PAKISTAN SOCIETY FOR HORTMICULTURAL SCIENCE

sa group

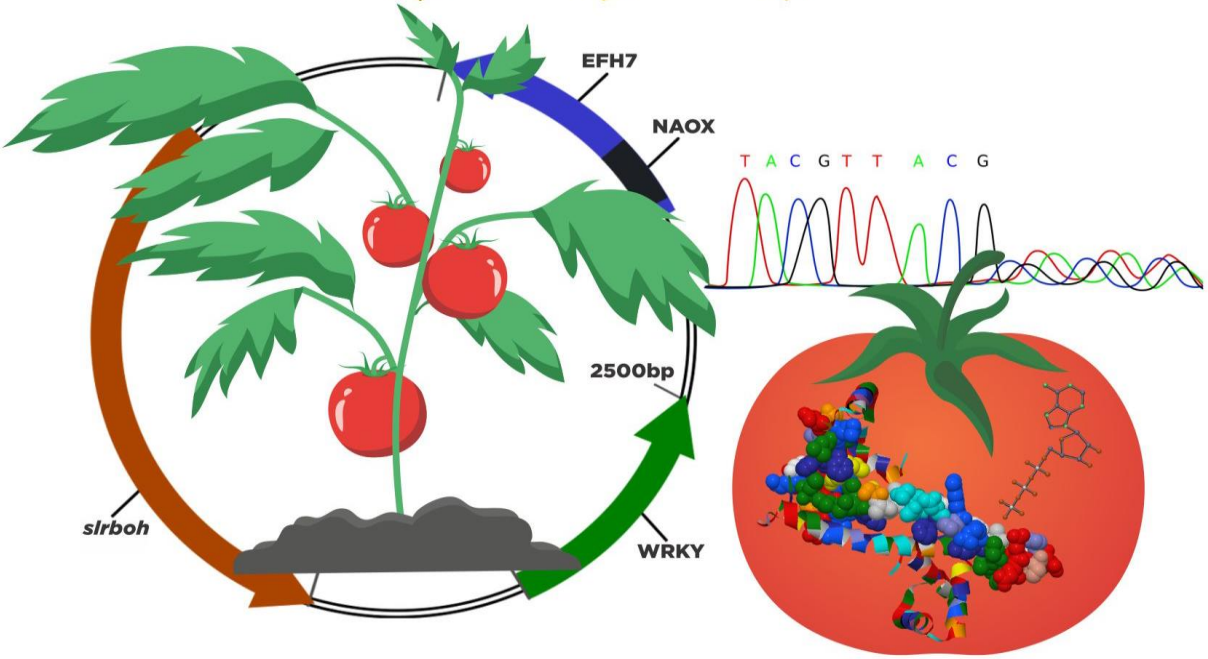
PSHS

International Horticulture Conference

(Revolutionizing Horticulture for secured future)

(IHC 2020)

Abstract Book



Organized by

Institute of Agricultural Sciences University of the Punjab Lahore and Pakistan Society for Horticultural Sciences(PSHS)

International Horticulture Conference (IHC2020)

(REVOLUTIONIZING HORTICULTURE FOR SECURED FUTURE)

February 26-28, 2020

Editorial Board

(Nong Lam University, Vietnam)

Dr. Nehdi Sabrine

(University of Jendouba, Tunisia)

Dr. Muhammad Adnan Shahid

(University of New Hampshire, USA)

Dr. Igor Mazurenko

(Prof. Hunan University of Humanities, Science and Technology, China)

Dr. Metoui Nebiha

(Assistant Director, Technical Center of Citrus, Tunisia)

Javed Shah

(Founder Tulip Garden, Srinagar, Jammu and Kashmir, India)

Ahmad Hassan

(Sichuan Agricultural University, China)

Dr. Waheed Akram

(Guandong Academy of Agricultural Sciences, Guangzhou, China)

Dr. Aqeel Ahmad

(Guandong Academy of Agricultural Sciences, Guangzhou, China)

Dr. Mumtaz A Cheema

(Boreal Ecosystem and Agricultural Sciences, Memorial University, Grenfell Campus, Canada)

Muhammad Tahir Rashid

(Principal Practice and Lead R&D Envirolead, Canada)

Dr. Muhammad Jamshed

(University of Calgary, Canada)

Farooq Ahmad

(Free University of BoZen-Bolzano, Italy)

(Nong Lam University, Vietnam)

Dr. Nehdi Sabrine

(University of Jendouba, Tunisia)

Dr. Tarlok Singh Sahota

(Director Lakehead University Agriculture Research Station Thunder Bay, Ontario, Canada)

NATIONAL KEY-NOTE SPEAKERS

Muhammad Akbar Anjum

(Department of Horticulture, Bahauddin Zakariya University, Multan, Pakistan)

Ishtiaq Ahmad Rajwana

(Pro-VC MNS University of Agriculture, Multan, Pakistan)

Chaudhary Muhammad Ayyub

(Institute of Horticultural Sciences, University of Agriculture Faisalabad, Pakistan)

Aamir Nawaz

(Chairman, Department of Horticulture, Bahauddin Zakariya University, Multan, Pakistan)

Nadeem Akhtar Abbasi

(Pro Vice Chancellor, Pir-Mehr Ali Shah Arid Agriculture University, Rawalpindi, Pakistan)

Aman Ullah Malik

(Professor Institute of Horticultural Sciences, University of Agriculture, Faisalabad, Pakistan)

Ishfaq Ahmed Hafiz

(Professor Department of Horticulture, Pir-Mehr Ali Shah Arid Agriculture University, Rawalpindi, Pakistan)

Muhammad Jafar Jaskani

(Professor, Institute of Horticultural Sciences, University of Agriculture, Faisalabad, Pakistan)

MANAGING EDITOR(S)

Muhammad Shafiq (Ph.D.), Sehrish Mushtaq (Ph.D.), and Mujahid Hussain (M. Sc.)

Poster Presentations

OFF-GRID SOLAR REFRIGERATION: TECHNICAL INNOVATIONS FOR THE STORAGE OF PERISHABLES FOR SMALLHOLDER FARMERS

***Randolph Beaudry**[1], Sangeeta Chopra[2], and Norbert Mueller[3]

[1]Department of Horticulture, Michigan State University, East Lansing, MI, 48824, USA
[2]Principal Scientist, Division of Agricultural Engineering, IARI, New Delhi, India
[3]Associate Professor, Department of Mechanical Engineering, Michigan State University, East Lansing, MI, 48824, USA
*Email: beaudry@msu.edu

ABSTRACT

Evaporative cooling is an ancient technique for removing heat in warm, dry climates and has been employed for the cooling of structures for the storage of perishables for the last three decades. However, at best, these evaporatively-cooled (EC) structures reduce temperatures only by 10 to 12°C below the ambient temperatures during the warmest part of the day and can have temperatures above ambient in the cooler evening hours. As a result, we have attempted to join evaporative cooling with solar-powered refrigeration to improve cooling performance. As part of a project supported by the Global Center for Food Security Innovation at Michigan State University and subsequently, the USAID PEER program, we have redesigned EC structures using novel inexpensive wall materials in a structure designed to be capable of accepting refrigeration at a later date. We compared the performance of a traditional brick-sand-brick (BSB) wall design with two new wall materials: pervious concrete (PC) and mesh-supported fabric (MSF) in 1/10th scale prototype structures at the Indian Agricultural Research Institute, Delhi. The low thermal mass and high heat transmittance of the PC and MSF walls permitted faster and more extensive cooling than BSB walls. This resulted in a 3-to 4°C reduction in the temperature of 100 kg of simulated 'produce' relative to a BSB structure during warm dry periods. During cool damp periods, however, the advantage of the MSF and PC structures was lost. The new wall materials and designs were less expensive and easier to construct than the traditional BSB design. We estimate that a full-sized structure made with PC or MSF would cost 30 to 50% less than the BSB design for EC storages. A full-scale MSF structure has been built and has been evaluated. Further, we have fitted this room with a solar-powered refrigeration system to achieve temperatures as much as 35°C below ambient. Modeled thermal properties of the room suggest that the evaporative cooling has reduced the size of the refrigeration system and associated solar array by 1/3 relative to a non-EC room. In 2019, we began construction of our first on-farm solar-refrigerated, evaporatively-cooled (SREC) room. Lessons from the construction and testing of our prototypes and on-farm systems will be discussed.

EFFECT OF MODIFIED ATMOSPHERE PACKAGING ON FRUIT QUALITY OF FRESH TOMATOES

***Raheel Anwar**[1], Maaz Fahim[1], Aman Ullah Malik[1], Mahmood Ul Hassan[1], Khurram Ziaf [1], and Hafiz Mahmood ur Rehman[2]

[1]Institute of Horticultural Sciences, University of Agriculture, Faisalabad, Pakistan
[2] CAB International (Central & West Asia), Rawalpindi, Pakistan
*Email: raheelanwar@uaf.edu.pk

ABSTRACT

The world is currently producing 182 million tonnes of fresh tomatoes out of which US$ 9 billion goes into the trade. Being a perishable crop, maintaining tomato quality for an extended period is quite challenging especially in developing countries where supply chain infrastructure still lacks basic postharvest management systems including a cool chain. Under such circumstances, the use of modified atmosphere packaging (MAP) holds great potential to prolong tomato shelf life by reducing deteriorative physiological changes and inhibiting fungal infection. The present study was part of an ACIAR-funded project aiming at evaluating the impact of MAP on fruit quality and storability of fresh tomatoes under ambient conditions. Tomato cv. 'Rubin' was harvested at breaker stage and packed in either open-top consumer-size polyvinyl boxes or first packed in the same box and then wrapped with polyethylene film (12 µm thickness) before storage under ambient conditions (25±1°C). Tomato fruits were evaluated for changes in fresh weight, firmness, shriveling, marketable fruit percentage, total titratable acidity, total

soluble solids, and ascorbic acid contents on alternate days. Use of MAP film significantly delayed pigmentation, reduced water loss (4.5% less than control), inhibited decay incidence and retained firmness (9 N higher than control) and visual quality. Though, MAP-packed fruits showed a 0.7% decrease in total soluble solids compared to tomatoes packed open-top polyvinyl boxes but changes in other biochemical and organoleptic attributes were statistically similar. Overall, MAP extended shelf life of tomatoes by at least 4 days which suggests that MAP can be employed as an economical technology to extend the marketable quality of fresh tomatoes.

EXOGENOUS APPLICATION OF SALICYLIC ACID (SA) DURING GROWTH STAGES INFLUENCES THE VEGETATIVE GROWTH, MARKETABLE YIELD AND QUALITY OF STRAWBERRY

***Sana Shahzad**[1], Saeed Ahmad[1], Raheel Anwar[1], Rashid Ahmad[2], and Sundas Shehzad[3]

[1]Institute of Horticultural Sciences, University of Agriculture, Faisalabad, (38000), Pakistan
[2]Department of Agronomy, University of Agriculture, Faisalabad, (38000), Pakistan
[3]Department of Plant Pathology, University of Agriculture, Faisalabad (38000), Pakistan
*Emails: sanashahzad247@gmail.com

ABSTRACT

Strawberry is an extremely perishable and economically important minor fruit crop. In Pakistan, its yield is very less and quality is poor as compared to other growing countries. Due to poor agronomic practices, its losses reach up to 40-50% which affects the economic status of growers. The present study was conducted to investigate the effects of exogenous application of salicylic acid on vegetative growth, yield and quality of strawberry. Different concentrations of SA (3, 6 and 9 mM) were applied on strawberry plants and these were compared with non- treated plants. The first foliar application was applied when strawberry plants were at 3-4 leaves stage and 2nd was applied at the fruit setting stage. Salicylic acid as signaling hormone improved the vegetative growth, marketable yield and qualitative characteristics of strawberry. Maximum leaf growth (19.25 plant -1), leaf area (51 cm 2) and marketable yield (414.25 g plant -^{1}) were observed from strawberry plants treated with 9 mM SA as compared to other treatments. A higher application of SA (9 mM) was found better for reducing unmarketable and small size yield. Strawberry quality attributes including firmness (0.94 kg-cm $^{-2}$), vitamin C contents (56.72 mg 100 g^{-1}) and TPC (191.50 mg GAE 100 g -^{1}) were improved with 9 mM SA while TSS (8.47 ºBrix) and TSS: Acid ratio (11.76) was found higher with 6 mM SA. Overall, it is concluded that foliar application of 9 mM SA is a highly effective strategy for improving the vegetative growth, marketable yield, fruit quality and extending the survival mechanism of strawberry plants during the growing season.

EFFECT OF POSTHARVEST CALCIUM CHLORIDE APPLICATION ON THE STORAGE LIFE AND QUALITY OF GUAVA FRUIT

Hafiz Musaab Minor, ***Ahmad Sattar Khan** Raheel Anwar, Aman Ullah Malik, Rashid Waseem Khan Qadri, Muhammad Azam, and Mahmood Ul Hassan

Institute of Horticultural Sciences, University of Agriculture Faisalabad, Pakistan
*Email: ahmad_khan157@yahoo.com

ABSTRACT

Guava is an important fruit crop of tropical and subtropical areas. Annually a large quantity of guava fruit is produced in Pakistan. The availability of fresh guava fruit in domestic as well as international markets is limited due to the short postharvest life of guava fruit. There is very little knowledge available about physiochemical changes and the effect of postharvest application of calcium on indigenous guava varieties. Hence, this experiment was conducted to evaluate the effect of postharvest application of calcium chloride on the storage life and quality of two commercial guava varieties *viz.* 'Gola' and 'Surahi' during cold storage. Fruits were treated with 1% and 2% calcium chloride solutions and were stored at 9 ±1°C with 75% RH for 0, 6, 12, 18 and 24 days. Physical parameters (fruit firmness, weight loss, palatability, and spoilage), as well as biochemical parameters (TSS, TA, TSS/TA,

Vitamin C contents and total sugars) of both varieties, were studied. Results revealed that in both varieties (Gola and Surahi), application of 2% $CaCl_2$ maintained the highest fruit firmness, and palatability score, while fruit weight loss and spoilage were lowest as compared to 1% $CaCl_2$ and control. The highest ascorbic acid contents and lowest value of TSS were recorded in fruits treated with 1% $CaCl_2$. In conclusion, postharvest application of calcium chloride significantly affected the physiochemical attributes and quality of both guava varieties, 'Gola' and 'Surahi' during cold storage.

POST-HARVEST TREATMENTS IMPROVE THE PHYSICOCHEMICAL CHARACTERISTICS OF GUAVA (*PSIDIUM GUAJAVA*) FRUIT CV. SURAHI

***Moazzam Anees**, Ali Zain Awan, Muhammad Tariq Manzoor, Sajid Ali, Shinawar Waseem Ali, Muhammad Rizwan Tariq, and Muhammad Shafiq

Institute of Agricultural Sciences, University of the Punjab, Lahore, Pakistan
*Email: moazzam.iags@pu.edu.pk

ABSTRACT

Guava is frequently advertised as "super-fruit" rich in dietary fiber, vitamins A, C, and riboflavin. Guava fruit is perishable and has a shortened life span. After harvesting, it's ripening starts due to its climacteric nature. A lot of fruit quantity spoils from harvesting to marketing and from market to consumers because of its short life span i.e. 2 to 4 days at room temperature. The present study was conducted to improve the biochemical characteristics and shelf life of guava cv. Surahi grown in Pakistan. There were a total of 6 treatments i.e. T_1 = 200 ppm chlorine, T_2 = 2 % H_2O_2, T_3 = 2 % $CaCl_2$, T_4 = 5 % Aloe Vera Gel, T_5 = 5 % Gum Arabic, T_6 = 5 % Aloe Vera Gel + 5% Gum Arabic and one Control (T_0). The fruits were kept at 15-17 ^oC and were carefully examined concerning different quality parameters like weight loss percentage, titratable acidity, pH, total soluble solids, firmness, ascorbic acid contents, and color. The recorded data was statically analyzed using LSD @ 5 % level of significance. T_6 (5 % aloe vera gel + 5 % Arabic gum) proved the best treatment to improve the biochemical characteristics and to increase the shelf life of guava up to two weeks, keeping the fruits at ambient temperature.

ASSESSMENT OF EXPORT QUALITY FRUIT OF MANGO CV SINDHRI AT HARVESTING STAGE FROM DIFFERENT ORCHARDS

***Samad Raza**, Inam Ullah, Sidra Kiran, Javed Iqbal, Hameed Ullah, Atif Iqbal, Ghulam Mustafa, Haider Karar, and Muhammad Imran

Mango Research Institute, Multan, Pakistan
*Email: samad.uaf@gmail.com

ABSTRACT

The research was conducted in the orchards of mango growers to investigate the percentage of exportable produce of mango cultivar Sindhri at the harvest stage. Generally, post-harvest losses in fruit and vegetables are believed to be in the range of 40% to 45% however it is not clear at which stage these losses are incurred. This attempt was made to gauge the quality of mango fruit cv Sindhri produced at the time of harvesting. Six Sindhri plants having the age of 10 to 12 years were selected from two different orchards applying the same kinds of inputs (fertilizers, pesticides, etc). The harvested fruit of each orchard (Three plants) was amassed into a stack to collect samples from it randomly. This fruit was ripened and subsequently divided into three categories i.e. A, B and C based on its color, weight, blemishes, and TSS. The fruit included in category A was yellow, free of blemishes, ideal in weight and TSS, hence, it can be exportable. Similarly, the fruit having pale yellow color, no blemishes, but more weight and high TSS was categorized in B Grade but can be exported in contradiction to fruit, exhibiting blemishes, green to yellow color, less weigh and TSS, and cannot be exported, that got its place in grade C. The quantification of this fruit revealed that the 26.02% of fruit demonstrated the traits of Grade A, while, 58.70% and 15.28% of Sindhri fruit

showed characters of Grade B and C respectively. It can be deduced from these results that 84.72% (A+B Grade) of the Sindhri fruit is exportable to foreign markets if transported delicately. Notwithstanding, the losses incurred in the shape of C grade fruit (15.28%) may be reduced by adhering to modern harvesting practices given the fact that most of the C grade fruit got injuries during the harvesting.

INDIGENOUS HYDROPONIC VEGETABLE CULTIVATION TECHNOLOGY IN PAKISTAN

Ishtiaq Ahmad Rajwana

Muhammad Nawaz Sharif University of Agriculture, Multan
Email: m.ismail@mnsuam.edu.pk

ABSTRACT

Food security and safety have become an urgent challenge of the millennium for a rapidly growing population (e.g. Pakistan @ 2% per year). Vegetable cultivation is under stress due to reducing arable land, changing climate (Pakistan, 7th most vulnerable country globally), depleting water resources, rising urbanization (4% annually in developing countries, 70% by 2030). The use of sewage and industrial wastewater for vegetable cultivation is another issue, thereby affecting growth, yield, and quality of harvested produce. Being perishable, vegetables are more susceptible to insect-pest and disease attack which require higher protection through chemical sprays, thus degrading the environment (soil and air) and human health. In this scenario, soilless farming is a potential climate-smart alternative for growing high-value vegetables. About 3.5% of the global protected vegetable area is under soilless farming and it is gaining in popularity due to efficient resource (water, nutrient, energy and plant protection) utilization, higher crop production, improved quality, and shelf life, thereby environment conservation and higher profitability. However, developing countries like Pakistan have several challenges for adapting this technology including higher infra-structural cost, energy cost, expensive imported inputs, pollinators and ICT based environment control (aerial and root temperature and relative humidity) systems, traditional supply chains, low market prices and lack of technical human resource. Therefore, region-specific R&D and policy support are required for successful implementation and demonstration of the technology. Accordingly, Pir Mehr Ali Shah Arid Agriculture University, Rawalpindi (PMAS- AAUR) developed and installed 12 low-cost hydroponic units in different locations of Punjab including MNS-University of Agriculture, Multan (MNS-UAM) during 2017 under a project funded by PARB. This study is based on the challenges faced during the operation of the indigenous hydroponic soilless unit due to structural issues along-with higher energy and input costs (seed, fertilizer, plant holding material, etc) and low market receptivity. The study also aimed for the development of crop calendars (Tomato, Bell Pepper, etc.) as per market trends, economical nutrient recipe, technical human resource development and testing high yielding cultivars to promote soilless cultivation.

CINNAMON BIODIVERSITY, MORPHOLOGY AND CHEMICAL COMPOSITION

Rumana Azad[1], MR Prathibhani[1]. S. Ranaweera[2], L. Jayasekera[3], Gamini Senanayake[4], R.A.A.K. Ranawake[5], K.L. Wasantha Kumara[4], and ***Sudarshanee Geekiyanage**[4]

[1]Board of Study in Agriculture, Faculty of Graduate Studies, University of Ruhuna, Matara, Sri Lanka
[2]Department of Chemistry, Faculty of Science, University of Ruhuna, Matara, Sri Lanka
[3]Department of Mathematics, Faculty of Science, University of Ruhuna, Matara, Sri Lanka
[4]Department of Agricultural Biology, Faculty of Agriculture, University of Ruhuna, Kamburupitiya, Sri Lanka
[5]Department of Export Agriculture, Peradeniya, Sri Lanka
*Email: sudarshanee@agbio.ruh.ac.lk

ABSTRACT

Cinnamomum verum is one of the most important species in Sri Lanka. A variety of chemical compositions in Sri Lankan cinnamon is an advantage for a range of uses as a spice, medicine, and pharmaceutical product. Morphological markers for chemical constituents are useful in selecting specific genotypes for the required product. An eco-geographic survey in major cinnamon growing areas was carried out and 269 distinct accessions were

explored. Due to cross-pollination nature, vegetative propagation of the collection was carried out to establish an ex-situ conservation garden at the Faculty of Agriculture, University of Ruhuna, Sri Lanka. A core collection of 33 accessions was developed for future work based on morphological and chemical characterization of the 269 accessions, which revealed the diversity among accessions. Leaf characters were highly variable among accessions, while cross-pollination would contribute to the leaf diversity. Inflorescence and flowers exhibited a variation in terms of branchlets, flower size, number of tepals and shape of the tepals. Gas Chromatography-Mass Spectrometry (GC-MS) of bark oil of the core collection revealed that Cinnamaldehyde was the major constituent in bark oil. Accessions of Kurunegala District produced higher Cinnamaldehyde (73.10% to 82.14%) and lower Cinnamyl acetate (1.62% to 4.68%). According to this study, Cinnamaldehyde is negatively correlated with Cinnamyl acetate, (-0.81) at 0.01% probability. The percentage of Eugenol and Benzyl benzoate was comparatively lower than the Cinnamaldehyde and Cinnamyl acetate. The correlation between Eugenol and Benzyl benzoate was significant (0.49) at 0.01% level. The morphological characters of the accessions also showed correlations with chemical constituents. Bark thickness (BT) indicated a correlation with Caryophyllene, (0.54) at 0.01%. Out of 146 chemical compounds in leaf oil, Eugenol was the major compound of 17 accessions (52.2% to 79.5%). Two accessions with zero eugenol contained 86.8% and 91.9% of benzyl benzoate, in contrast to that of 0%-0.65% from other accessions. One accession produced 16.6% Eugenol and 22.3% benzyl benzoate. Green flush color was associated with a higher benzyl benzoate percentage, which needs to be further investigated as a morphological marker. The present work would be an initial step in developing morphological markers for breeding cinnamon varieties with enhanced chemical profiles for specific industrial needs in the future.

VALUE CHAIN APPROACH FOR IMPROVING MARKET OPPORTUNITIES FOR SMALL LAND HOLDING VEGETABLE GROWERS: A CASE STUDY OF PAKISTAN

***Aman Ullah Malik**, Khurram Ziaf, Raheel Anwar, Mahmood ul Hassan, Muhammad Waseem, and Rehan Riaz

Postharvest Research and Training Centre, Institute of Horticultural Sciences, University of Agriculture, Faisalabad, Pakistan CABI, Pakistan
*Email: malikaman1@uaf.edu.pk

ABSTRACT

Globally, the vegetable industry is coming into the limelight due to its increasing role in food security. Pakistan is one of the major vegetables producing countries in the world. However, due to lack of awareness and access to new technology and resources, the small landholders are unable to get potential yield and quality of vegetables to get high market returns. Considering the issues, and to improve market opportunities for smallholders, youth and women, and ACIAR funded vegetable value chain project has been launched (2017-2021) in selected villages of Punjab and Sindh provinces to help improve supply chains of selected vegetable crops *i.e.* potato, tomato, onion, and chilies. During 2017-2019, significant R&D work on production and postharvest has been conducted. UAF team has developed nursery raising protocols to avoid insect pests and viral disease optimized local media with different proportions of coco-coir, rice hull ash and press mud compost comparable to existing commercial media (peat moss) and evaluated potential genotypes. For potato crop, selected villages were surveyed, and on-farm issues were assessed. Trials on improving fertilizer use efficiency and reducing the severity of devastating disease 'common scab' (which downgrades the tuber quality) are underway. The postharvest team monitored the quality of grower's produce at field and market-level in both provinces. Postharvest losses were monitored in supply chains and market quality standards were documented. Various indigenous and exotic cultivars were assessed for storage potential (ambient and cold) to explore their marketable window. Due to the high perishability of chilies and tomato, cling wrap film packaging has been tested which significantly enhanced its shelf life at ambient conditions during the winter season. Capacity building of growers has been done using participatory farmers' training sessions (PFTS) for better crop management (improving yield and quality), while walk the chain approach is being used for connecting them to markets. In conclusion, the value chain approach has demonstrated an enhanced yield of quality products with better market returns. This presentation provides details on the overall process and significant achievements of the project.

IDENTIFICATION OF PROMISING HORTICULTURE CROPS AND WATER EFFICIENT CROPPING PATTERN FOR IRRIGATED FARMING SYSTEM OF BALOCHISTAN

Muhammad Saeed

Freelance Consultant Horticulure / Agriculture, Quetta, Balochistan, Pakistan
*Email: cameos_saeed@yahoo.com

ABSTRACT

Horticulture will continue to be a mainstay of economy of Balochistan in spite of limitation of irrigation water, especially in the uplands, the main growing areas of deciduous fruits. The main sources of perennial irrigation were karezes and springs. Due to supply of electricity from the national grid system in mid70s, there wastremendous increase in the number of tube wells (electricity run) from 1980-81, 2000-01 over the previous decades. Consequently, the area under fruits and vegetables was also increased. An important factor related to selection of deciduous fruit was not recognized in the upland of the Province.High delta crops like apple was preferred over other low delta fruit crops in areas below altitude 1100 m which were not suitable for apples due to low chilling hours. Increase in the number of tube wells in the highland, resulted in decline of ground water in the Nari River, Pishin, Lora and partly in Zhob River basins, the maindeciduous fruit growing areas. Due to ground water depletion, the natural resources of irrigation like karezes and springs which were sustainable source were completely dried. The position was further aggravated due to continuous drought from 1997-2006. The present paper covers in detail the past and present issues related to Horticulture in Balochistan. In developing promising cropping pattern, the present climatic conditions, extreme events of drought, flood, its impact on water availability both surface and ground water were considered. Based on this, water efficient cropping pattern was developed for the entire agro-ecological zones of the Province. The proposed water efficient cropping pattern ranked the fruits/vegetables based on the water requirement of fruits/vegetables, yield/ hectare and comparative economic return ofthe fruits/ vegetables at Quetta market.

USING AMARANTH AS A MODEL PLANT FOR EVALUATING IMPERFECT STORAGES: EVALUATING THE FUNCTIONALITY OF SOLAR REFRIGERATED AND EVAPORATIVELY COOLED (SREC) STRUCTURES

Priyanka Sharad Mahangade[1], ***Sangeeta Chopra**[2], Randolph Beaudry[3], Indra Mani[4], and Norbert Mueller[5]

[1]Div. of Agricultural Engg., Indian Agricultural Research Institute (IARI), New Delhi

[2]Div. of Agricultural Eng., IARI, New Delhi, India
[3]Michigan State University, USA
[4]Indra Mani, Head, Div. of Agricultural Engineering, IARI, New Delhi, India
[5]Department of Mechanical Eng., Michigan State University, USA
*Email: dhingra.sangeeta@gmail.com

ABSTRACT

Some storages have limited control over their internal environment and undergo daily fluctuations in both temperature and humidity, which cause daily variation in the metabolic activities of stored products. As a result, it is difficult to assess and compare the performance of these imperfect storages. We propose using measures of plant senescence as a proxy for estimating storage performance based on the premise that these responses integrate changes temperature and/or humidity in a predictable, mathematically describable manner. We evaluated green (cv. Pusa Kiran) and red amaranth (cv. Pusa lal chaulai) amaranth (*Amaranthus* sp.), a leafy green vegetable grown worldwide, for its applicability as a model plant for evaluating imperfect storage structures. Amaranth is a tropical to subtropical leafy vegetable and is recommended to be stored between 0 to 5 °C and at a relative humidity between

80-90%. To link varying temperatures with the rate of metabolism, we developed a mathematical model using published values for the respiration of whole amaranth stems. The integrated respiratory activity (cumulative respiration) was regressed against the extent of leaf fall, chlorophyll loss, and leaf yellowing of amaranth for four storages having very different temperature profiles: Storages included: 1) solar refrigerated and evaporatively cooled (SREC) structure; 2) evaporatively cooled (EC) structure; 3) uncooled Laboratory (UL), and 4) household refrigerator. We found that the rate of leaf falls, chlorophyll loss, and leaf yellowing differed markedly for the four storages, however, these measures of senescence fell along the same curve when regressed against estimations of cumulative respiration. The ease of measuring leaf falls, chlorophyll loss, and leaf yellowing permit data collection even with minimal resources. We propose that amaranth would make an effective model plant for comparing the performance of storages differing dramatically in temperature control.

WORKING INNOVATIVELY FOR ENHANCING HORTICULTURAL R&D: EVOLUTIONN OF ACIAR WORK IN PAKISTAN

***Kazmi Munawar R** and Gerard McEvilly

ACIAR Country Manager Pakistan; AIK SAATH Coordinator ACIAR
*Email: munawar.kazmi@aciar.gov.au

ABSTRACT

The Australian Centre for International Agricultural Research (ACIAR) has been working with Pakistan since the mid-1980. Australian R& D institutes have been actively engaged with Pakistani partners in sharing their learnings and skills. This has enhanced research and capacity development across almost all areas of agriculture, including horticulture. The initial focus was on water and salinity management and has continued to this day. However, in 2005, a new era of collaboration started when the focus expanded to the development of the Horticulture sector using the value chain approach. The approach helps the horticulturist to work across disciplines to develop more robust solutions to low productivity and profitability. It incorporates water and other key inputs but also assesses the end consumers, market dynamics, policy and logistics. Crucially, the value chain approach requires thorough understanding of people and communities in all their diversity. As women empowerment is fundamental to economic growth and sustainable development so all these activities are done under the larger framework of gender inclusiveness in (i) research teams; (ii) research planning (iii) research implementation; and (iv) research results dissemination. ACIAR is trying to facilitate a major change in attitudes and approaches – instead of working in silos, bringing everybody on the same platform and the goal is to take a holistic approach and serve the industry more effectively.

FORMULATION AND QUALITY EVALUATION OF FLAVORED ALOE VERA READY TO SERVE (RTS) DRINK

***Shinawar Waseem Ali** and Asad Munir

Institute of Agricultural Sciences, University of the Punjab, Quid-i-Azam Campus, Lahore-54590, Pakistan
*Email: shinawar.iags@pu.edu.pk

ABSTRACT

Now a day's therapeutic ready to serve (RTS) drinks that are based on the blends of natural juices extracts *etc* are getting a great attention, which reflects the faster-growing awareness about these products in the market place. The objective of this study was to formulate and prepare the aloe vera flavored RTS drink. The product was analyzed for mineral contents, Vitamin-C, reducing sugars, pH, acidity, total soluble solids, and sensory attributes. Finally, the data were subjected to statistical analysis to evaluate the level of significance. Pure aloe vera juice at different concentrations was mixed with potable water, adding three different food flavors to prepare different treatments of flavored aloe vera RTS drink. The T1 was 14% aloe vera and 86% water, T2 comprised of 17% aloe vera and 83%

water, T3 was 20% aloe vera with the 80% water, T4 consisted of 23 aloe vera with 77% water and T5 had 26% aloe vera with 74% water. Results showed that with the increase of aloe vera content in the RTS drink, the acidity was increased from the 0.25 to 0.34, °Brix was increased from 2.49 to 2.60 and pH was decreased from 3.67 to 3.59. The level of pure Aloe vera juice in RTS profoundly affects the mineral contents of the RTS drink. There was no significant difference in reducing sugars content among the treatments. Total sugars were increased with the increase in Aloe vera contents of the RTS drink. Vitamin-C content was found in reasonable quantity i.e. 22.5-25.7 mg/100ml, in different treatments. It was concluded that T4 was the best RTS drink containing 23% aloe vera and 77% water, showing the highest organoleptic characteristics, while all of the flavors were equally liked by the panelists for sensory evaluation.

ACCUMULATION OF HEAVY METALS IN EDIBLE PARTS OF GREEN LEAFY VEGETABLES IRRIGATED WITH FRESH AND SEWAGE WATER

Ammara Fatima, Maryam Sadiqa Khan, Qaria Tariq, and Tahira Aziz Mughal
Department of Environmental Science, Lahore College for Women University, Lahore
Email:Ammara_sajid@yahoo.com

ABSTRACT

Vegetables comprise an important component of the human diet. Vegetables take up heavy metals and accumulate them in their edible parts and inedible parts in quantities high enough to cause several clinical and physiological problems both to animals and human beings consuming these metal-rich plants. Due to insufficient clean water resources wastewater is largely used for irrigation of vegetables in many developing countries, particularly in Pakistan. As a result, vegetables despite providing nutrients also accumulate toxic metals and causes health risks. Green vegetable crops irrigated with wastewater are highly contaminated with heavy metals and are the main source of human exposure to the contaminants. In this study accumulation of four heavy metals (Cu, Cr, Fe, and Co) in green vegetables like spinach, coriander, and fenugreek irrigated with wastewater grown in Okara are studied using Atomic Absorption spectrophotometer. The studied metals in vegetable grown on wastewater irrigated soil were significantly higher than those of tube well water irrigated soil and WHO/FAO permissible limits (P < 0.05). The most heavily contaminated vegetable was wastewater irrigated spinach leaves, where the accumulation of Cr (18.05 mg kg −1) in the edible parts was 20-fold greater than spinach leaves irrigated with tube well water irrigated soil. It may be concluded that both adults and children consuming these vegetables grown in wastewater irrigated soil ingest significant amount of these metals and thus can cause serious health problems.

CLIMATE CHANGE SEVERELY AFFECTS APPLE AND MANGO PRODUCTION IN PAKISTAN AND CHINA

***Adnan Arshad**[1], Faisal Hayat[2], Muhammad Nawaz Khan[3], and Hafiz Umer Javed[4]

[1]China Agricultural University, Beijing, 100193, China
[2]College of Horticulture, Nanjing Agricultural University, 210095, Nanjing, China
3 Citrus Research Institute, Sargodha, Pakistan.
[4]The School of Agriculture and Biology of Shanghai Jiaotong University
*Email: adnan.poda@gmail.com

ABSTRACT

Climatic changes have posed a serious challenge and leading to a decrease in total yield and fruit set productivity of apple and mango crops. The current studies indicated that climate simulation models with higher spatial resolution could be a way forward to future climate simulation for horticultural crops. Meanwhile, stochastic projections of more than one climate model showed that there is a need for necessary insights into model uncertainties as well as integrated adaptation and mitigation strategies. Model simulation projected that 7 to 10% decreases in the average number of freezing days would encourage plant productive growth and reduces reproductive growth. The model predicted that extreme temperatures with prolonging drought in summer would cause pollination damage. Results reveal that increasing temperatures are affecting bees to fly before flowers have bloomed, making pollination less

likely. However, already hot tropical regions of Pakistan could lose as many as 200 GDD/year. This paper summarizes the use of regional climate models and prediction scenarios to validate climate change impacts on physiology, phenology, and reproductivity of fruit plants to ensure high and quality fruits. A future climate model projected that by 2050 the annual mean temperature in China could rise by 2.3 °C to 3.3 °C, and the precipitation could increase by 5-7% that comparison of the regional model provided information about the change in cultural practices; improve resistance and future climate-adaptive plant production regions. This paper provides a comprehensive assessment of literature linked with the valuation of extreme climate change impacts on apple and mango crop pollination and production in China and Pakistan.

IDENTIFICATION AND MANAGEMENT OF *ALTERNARIA OCHROLEUCA* – A CAUSE OF LEAF NECROSIS IN MONEY PLANT

***Shazia Shafique** and Sobiya Shafique

Institute of Agricultural Sciences, University of the Punjab, Lahore, Pakistan.
*Email: shazia.iags@pu.edu.pk

ABSTRACT

Diseases caused by fungal pathogens are very common to occur worldwide. Biological control is an approach that provides a safe fungal management program and a substitute for reliance on chemical treatments. A survey was conducted in the vicinity of the Institute of Agricultural Sciences, University of the Punjab, Lahore and Money plant (*Epipremnum aureum*) was found to be infected with fungal leaf spots. The infected samples were collected for isolation, purification, and identification of the pathogen. The identification was carried out microscopically for morphological characterization and genetically from nucleotide sequencing of amplified ITS1-5.8S-ITS4 region of rDNA. *Alternaria ochroleuca* was identified as a leaf spot causing pathogen of the money plant. Afterward, pathogenicity aptitude of the identified pathogen was confirmed by the re-isolation of the same pathogen from the artificially inoculated leaves of the host plant using the detached leaf method. Further in this study, the biological control of *A. ochroleuca* was carried out using methanol extract of *Piper nigrum* L. (Black pepper) and *Amomum subulatum* Roxb (Cardamom). Both types of extracts presented varied results. However, all the employed concentrations of methanolic Cardamom extract suppressed the fungal growth except 1.5% concentration. Contrastingly, Black pepper extract didn't show any inhibition in fungal biomass production. Therefore, Cardamom extract was considered more effective in controlling *A. ochroleuca*. Further studies will be carried out to fractionate different compounds from Cardamom and to determine the efficacy of these compounds against the target pathogen.

BIOLOGICAL CONTROL OF LEAF SPOT CAUSING FUNGAL PATHOGENS IN RED-EDGE DRACAENA AND SOW THISTLE

***Sobiya Shafique** and Shazia Shafique

Institute of Agricultural Sciences, University of the Punjab, Lahore, Pakistan.
*Email: sobiya.iags@pu.edu.pk

ABSTRACT

Leaf necrosis is a common fungal problem of plants. During a survey of Lahore, Dracaena Red Edge (*Dracaena mariginata* Lam.) and Sow thistle (*Sonchus oleraceus* L.) were found to be infected with leaf spots. Pathogen isolation from the infected leaves of both plants was done followed by confirmation of Koch's pathogenicity postulates. Based on morphological and genetic characterization, *Alternaria arborescens* Simmons. and *Phyllosticta aristolochiicola* R.G. Shivas. were isolated from *D. mariginata* and *S. oleraceus*, respectively. In addition to isolation and identification, biological control of both pathogens was conducted using methanol extract of Cinnamon (*Cinnamomum verum* J. Presl.). All concentrations of extract suppressed the growth of both pathogens to a variable extent. In the case of *A. arborescens*, 0.5% concentration induced approximately 90% suppression in fungal growth. Contrastingly *P. aristolochiicola* was least affected at lower concentrations of extract as only 4–10% arrest in fungal biomass production was recorded at 0.5–1.5% concentrations. However, 2.0% or more of the extract was most potent as fungal pathogens failed to grow at these concentrations. Therefore, Cinnamon extract was considered more

effective in controlling A. arborescens than *P. aristolochiicola*. Further studies are required to identify active antifungal compounds in Cinnamon crude extract against the target pathogens.

EFFECT OF FOLIAR APPLICATION OF SILICON ON GROWTH, YIELD, QUALITY AND VASE LIFE OF TUBEROSE GROWN UNDER SALINE CONDITIONS

*__Muhammad Akbar Anjum__ and Sana Shahzad

Department of Horticulture, Bahauddin Zakariya University, Multan 60800, Pakistan
*Email: akbaranjum@bzu.edu.pk

ABSTRACT

Tuberose (*Polianthes tuberosa* L.) is one of the most important tropical ornamental bulbous flowering plants, extensively grown in Pakistan. It has valued in commercial floral crops due to its pleasant fragrance, longer vase-life of spikes and wide adaptability to varied soil and climatic conditions. Tuberose is sensitive to salinity stress. Salt stress is one of the most harmful environmental factors which affect plant health and yield. Many strategies are practiced to minimize the degree of damage and loss which occur due to salt stress. This research work was conducted during the years 2017-2019 to study the effect of silicon (as sodium metasilicate) on growth, yield, quality and postharvest life of tuberose grown under saline conditions. The present experiment was laid out by following a completely randomized design (CRD) with a factorial arrangement having 3 repeats. Bulbs of tuberose were planted on 13 March 2018 in pots that were filled with 2.5 kg of loam soil and each pot contained a single tuberose bulb. There were three levels of salinity (NaCl); 0 (control), 50 and 100 mM and four levels of sodium metasilicate (Na_2SiO_3); 0 (control), 50, 100 and 150 mg L^{-1}). Distilled water was used in the control level of silicon. Salinity was applied after 90 days of planting till harvesting and the first silicon spray was applied after one week of applying salinity. A total of five foliar sprays of sodium metasilicate were applied with a one-week interval. Data were collected on growth, physical and biochemical parameters. All physical parameters; i.e. total plant height, leaf number, leaf width, leaf fresh weight, leaf dry weight, stalk length, stalk fresh weight, stalk dry weight, spike length, floret number, floret length, floret fresh weight, floret dry weight, bulb fresh weight, total plant fresh weight, and total plant dry weight were decreased by salinity and not affected by silicon. Vase life was decreased by both salinity and silicon. Leaf length and root length were increased at 50 mM salinity level and then decreased. An interactive effect, floret length was increased by 50 mM salinity and control level of silicon. In-case of biochemical parameters, chlorophyll "a and b" content, superoxide dismutase (SOD) and catalase (CAT) were decreased by salinity. H_2O_2, proline, total soluble protein, antioxidant capacity and antioxidant activity were increased by salinity. SOD and proline were increased by silicon foliar sprays. Total phenols, malondialdehyde (MDA), glutathione reductase (GR), ascorbate peroxidase (APX), peroxidase dismutase (POD), relative leaf chlorophyll content, carotenoids and glycine betaine (GB) content were not affected by salinity and silicon. In light of the present study, it can be concluded that the foliar application of silicon as sodium metasilicatesalt is not effective to minimize the adverse effect of salt stress in tuberose.

IN VITRO REGENERATION OF PLANTLETS THROUGH FLORAL ORGANS CULTURE OF CLEMENTINE CASSAR (*CITRUS CLEMENTINA* HORT. EX TANAKA) AND TUNISIAN MALTESE 'MALTESE HALF-BLOOD' (*CITRUS SINENSIS*)

***Nebiha Metoui**[1], Malika Meziane[2], Fethia Dhaouadi[1], Dorsaf Yahiaoui[1], and Sabrine Nahdi[3]

[1]Centre Technique des Agrumes(CTA), B.P. N°318, ZaouiettJedidi 8099, Tunisia
[2]LaboratoireProduction et Protection des Cultures dans la région de Chlef. Université Hassiba Benbouali de Chlef, B.P 78C, OuledFaresChlef 02180 Algérie
[3]Ecole Supérieure d'Agriculture du Kef (ESAK), Boulifa, Le Kef
*Email: nabihabsaies@yahoo.fr

ABSTRACT

Somatic embryogenesis from floral organs *in vitro* culture is an excellent method for sanitation in most infected *Citrus* spp. (D'Onghia et al., 2000). While the shoot tip grafting remains the only technique for successful regeneration in Clementine because of its mono embryogeny (Meziane et al. 2012). In this context, *in vitro*

regeneration by floral organ culturing of Clementine Cassar and Tunisian Maltese were compared. Flowers were collected from both species maintained in the greenhouse of the Technical Center of Citrus (CTA) in Tunisia. Then, they were cultivated onto Murashige and Skoog (MS) media, supplied with 10 different hormonal combinations, composed of Naphthalene Acetic Acid (NAA), 2,4-Dichlorophenoxyacetic acid (2,4-D) and 6-Benzylaminopurine (BAP). Values corresponding to [number of calli/explant] were recorded monthly. First neo-formations were observed 50 to 60 days after culturing. No callogenesis has occurred in the case of 'Maltese'. Direct organogenesis has been ensured by the floral organ culture on the M5 medium (MS + 2mg / l BAP). Regeneration into rooted plantlets was successful with percentages of 17.64% for stigma/style and 13.33% for ovary. Indirect organogenesis was noted in the case of Clementine with M6 medium (MS+ 3 mg/l of BAP). In fact, ovaries culture produces 83.33% of organo-genic callus, regenerating 71.42% of rooted plantlets. Whereas, the culture of styles/stigmas on the same medium produces 63.33% of calluses without rooted plantlet regeneration. These rooted plantlets are acclimated *in vivo* under glasshouse in controlled conditions. The acclimatization of Maltese plantlets by grafting on *Citrus volkameriana* rootstock was achieved with a success rate of 50% in the case of style/stigma and 28% for ovary. While for Clementine, only 15% were successfully acclimated. These results can be used as a starting point for the establishment of the somatic embryogenesis technique for the regeneration and the sanitation of Tunisian local citrus genotypes.

INNOVATIVE APPROACHES FOR QUALITY FRUIT PRODUCTION TO ENHANCE KINNOW EXPORT

***Basharat Ali Saleem**[1], Aman Ullah Malik[2], Muhammad Azher Nawaz[3], Raheel Anwar[2], Ishtiaq Ahmed Rajwana[4], and Mahmood Ul Hassan[2]

[1]Department of Agriculture (Extension) Jail Road Sargodha, Pakistan
[2]Institute of Horticultural Sciences, Postharvest Research and Training Centre, University of Agriculture, Faisalabad, Pakistan
[3]Department of Horticulture, College of Agriculture, University of Sargodha, Sargodha, Pakistan
[4]Muhammad Nawaz Sharif University of Agriculture, Multan, Pakistan
*Email: basharatuaf@gmail.com

ABSTRACT

Citrus is grown on 500,000 acres in Pakistan producing over 2 million tonnes of fruit. During 2018-19,351,000 tonnes Kinnow fruit was exported and the rest was locally consumed. Though we have a large domestic market, export plays a vital role in the industry's viability and growers' economy. Pakistan citrus industry is dominated by the Kinnow mandarin (*Citrus nobilis* Lour × *Citrus deliciosa* Tenora) having more than 70% acreage. The reported average yield in Pakistan (11 tonnes/ha) is far less than the potential yield (25-30 tonnes/ha). Similarly, our citrus fruit is being marketed as grade B in international markets and fetching low prices compared with other citrus exporting countries. The main obstacle in boosting citrus export is poor fruit quality and harvest/postharvest losses (15-20%). The main quality issue is peel blemishes due to biotic and abiotic factors that deteriorate the cosmetic look of the fruit. At orchard level, poor nursery plants, lack of proper tree management and sanitation, low and imbalance use of nutrients, over and inappropriate irrigations, improper insect pests and disease management are the main issues. In the near past, different interventions in citrus production and postharvest management have been introduced to enhance quality fruit production to augment export targeting supermarkets. High-density plantation, lowering the size of trees, increasing organic matter in the soil, high-efficiency irrigation (drip, under head sprinkler), use of balanced fertilizer including micronutrients, effective control of insects and diseases with special focus on *citrus psylla*, fruit fly insects and citrus canker, citrus scab and melanose. The use of special non-chemical control of fruit fly and improved copper fungicides will also add to the correction of fruit quality. The number of plants per acre being grown is 175-250. The smaller size of plants will enhance the efficiency of insecticides, fungicides and scar-free good quality fruit will be produced that would facilitate export.

USAID PATTA PROJECT PROMOTING INNOVATIVE AND PRECISION AGRICULTURE TECHNOLOGIES TO IMPROVE YIELD AND QUALITY OF CROPS PRODUCED BY SMALL FARMERS IN PAKISTAN

Waqar Ahmad[1*], Rana Muhammad Wajid Khan[1,] and Muhammad Azher Nawaz[2]

[1]Pakistan Agriculture Technology Transfer Activity (PATTA), USAID, Lahore, Pakistan
[2]Department of Horticulture, College of Agriculture, University of Sargodha, Sargodha, Pakistan
*E-mail: wahmad@pakistan-patta.org

ABSTRACT

The four-year USAID-funded Pakistan Agricultural Technology Transfer Activity (PATTA) aims to identify, support and bring to scale private-sector solutions to improve agricultural productivity in Pakistan. Agricultural technologies will increase the competitiveness of small farmers and mobilize private sector investments in the agricultural technology sector. This partnership is providing Pakistani smallholder farmers broader access to affordable technologies leading to an increase in productivity. The project extends support by linking private sector agricultural technology partners with dealers to achieve sales through increased access to innovative agricultural technologies and improved business management practices. PATTA's technical assistance components are Business Development Marketing Services (BDMS) and Agriculture Technology. PATTA's Agricultural Technology component seeks to broaden and accelerate the use of modern and enhanced agricultural technologies. This includes quality seeds, fertilizers, improved water management, and other production practices to increase the yield and quality of small farmers' production. The project is working with Supply-Side Partners (SSPs) and Demand-Side Partners (DSPs) to bring to scale and promote appropriate, effective and affordable agricultural technologies. The component is collaborating with agricultural technology-related businesses to help them expand through increased capital investment by the private sector to scale-up and commercialize agricultural technologies. PATTA is providing pieces of training in areas of health, hygiene, and food safety concerning agricultural techniques. Besides, the project arranges exposure visits and demonstrations for farmers, DSP and SSPs to enhance their awareness of improved technologies. PATTA is working to ensure that farmers benefit from the improvements in agricultural technologies and practices by conducting a cost-benefit analysis (CBA) for selected agricultural technologies.

VEGETABLE GRAFTING: CURRENT PROGRESS AND FUTURE OUTLOOKS IN PAKISTAN

***Muhammad Azher Nawaz**[1], Fareeha Shireen[2], Hamza Sohail[2], Adeel Ahmed [2], Waqar Ahmed[3], Basharat Ali Saleem[4], Yuan Huang[2], and Zhilong Bie[2]

[1]Department of Horticulture, College of Agriculture, University of Sargodha, Sargodha, Pakistan
[2]Key Laboratory of Horticultural Plant Biology, Ministry of Education/College of Horticulture and Forestry Sciences, Huazhong Agricultural University, Wuhan 430070, PR China
[3]Pakistan Agriculture Technology Transfer Activity (PATTA), USAID, Lahore, Pakistan
[4]Department of Agriculture Extension, Government of Punjab, Sargodha, Pakistan.
*Email: azher.nawaz@uos.edu.pk

ABSTRACT

Cucurbitaceae and Solanaceae vegetables such as watermelon, melons, cucumber, chilies, tomato, and eggplant are cultivated on a commercial scale in Pakistan. These vegetables are grown in plastic tunnels during the winter season and field during the summer season. These vegetables experience restricted growth because of low and high temperatures during the winter and summer seasons, respectively. High temperature during the summer season often destroys growing plants leading towards reduced harvesting span. The average yield of vegetables in Pakistan is less compared with other vegetable producing countries. Biotic and abiotic stresses are the major reason for the reduced yields. Several approaches such as the use of disease and stress-tolerant cultivars, balanced nutrient supply, and use of growth regulators are employed to overcome stresses. Recently, we suggested vegetable grafting as an alternative approach that can be utilized to overcome biotic and abiotic stresses such as soil-borne diseases, nematodes, low and high temperatures, salinity, high and low light intensity, water scarcity, flooding, and heavy metals. The use of appropriate rootstocks (bottle gourd, pumpkin) can help improve the nutrient use efficiency, yield, fruit quality, postharvest life, and extend the harvesting window. The increasing trend of growing vegetables under protected cultivation system (plastic tunnels, greenhouses, and hydroponic cultivation) further necessitates the adoption of

vegetable grafting technique in Pakistan. We have started research work on vegetable grafting and developed a working model for the adoption of vegetable grafting in Pakistan. In our trials, we observed that the use of pumpkin and bottle gourd as rootstock improved the growth and quality of watermelon.

DEVELOPMENT OF INDIGENOUS SOILLESS SUBSTRATE FOR CONTAINERIZED NURSERY PRODUCTION OF ORNAMENTALS

*Iftikhar Ahmad, M. Aashir Sajjad and Shaiza Rasool

Institute of Horticultural Sciences, University of Agriculture, Faisalabad-38040, Pakistan
*Email: iftikharahmadhashmi@gmail.com; iahmad@uaf.edu.pk

ABSTRACT

Growing substrates are being used by ornamental plant industry since the 1950s in developed countries for quality production, but in developing countries including Pakistan, still, soil and/or silt is commercially used for nursery production of ornamental crops. Soil or silt poses many issues for quality plant production due to many soil-borne pathogens and poor air: water ratio in various soils along with quarantine issues for export. Moreover, imported products like peat moss are not only unsustainable but also are quite expansive and not feasible for local growers and nurserymen. Therefore, a study was conducted to evaluate local agriculture wastes for their suitability to be used in developing local sustainable soilless substrate for nursery raising of ornamentals. For this purpose, various agricultural by-products were collected from the local area, crushed to uniform particle size and composted where required, mixed in different ratios and evaluated for raising plug nursery, potted plant production and cut flower/cut foliage production on selected ornamental species. Results demonstrated a positive effect of some of the selected components when used in appropriate ratios and found at par with imported commercial substrates. Moreover, locally developed products were five times cheaper than imported products. Therefore, local agriculture waste-based soilless substrates are the best option to replace soil culture for quality ornamental production for local and export markets.

STERILANTS EFFECT AND MICRO-PROPAGATION OF TWO DIFFERENT CULTIVARS OF PEACH (PRUNUS PERSICA)

Gulley Wahab, Muhammad Imtiaz, Muhammad Ali, Fazal Jalal, Fazal Said, *Sayed Hussain

Department of Agriculture, Abdul Wali Khan University Mardan (AWKUM), KPK, Pakistan
*Email: sayedhussain@awkum.edu.pk

ABSTRACT

Peach (Prunus persica L.) belongs to the Rosaceae family mostly grown in temperate regions for their edible fruits and ornamental purposes. Conventional vegetative propagation methods of peach are generally time consuming and season bound with low multiplication rate. Therefore, it can also be propagated through tissue culture techniques. Surface sterilization is one of the critical steps in micro-propagation of peach because of giving quality planting materials for further process. The efficient protocol was established for sterilization and shoots multiplication of two peach cultivars i.e. Tarnab local and Swat local using shoot tips of healthy plants. Explants were cultured on B5 media after the treatment with 70% ethanol of different time exposure (1 and 5 minutes), while the same explants were treated with different concentrations of $HgCl_2$ (0.1% and 0.2%) of different time exposure (3 and 5 minutes). Different concentrations of BAP (0, 0.5 mgL^{-1}, 1 mgL^{-1}, 0.5 mgL^{-1}+Gln 200 mgL^{-1}, 1 mgL^{-1}+Gln 400 mgL^{-1}) were used to identify its effect on the growth of peach cultivars. The experiments were designed on Completely Randomized Design (CRD). The highest explants contamination (100% and 90%) and least explants survival (0% and 10%) were recorded when explants were treated first with 70% ethanol for 5 min and then with HgCl2 0.2% for 5 min. The minimum explants contamination (23.3% and 20%) and maximum explants survival (76.6% and 86.6%) were recorded when explants were treated with ethanol 70% for 1 min and then with HgCl2 0.1% for 3 min. The highest percentage of shoots development was recorded on B5 media supplemented with BAP 1 mgL-1 + Glutamine 400 mgL-1. The roots development was also observed when media was supplemented with BAP 0.5 mgL-1 + Glutamine 200 mgL-1. The lowest 31.6% and 35% shoots development were noted in Tarnab local and Swat locally

cultured on B5 control medium respectively. Furthermore, no roots formation was observed in both cultivars grown on the B5 control medium.

MICROPROPAGATION IN GERBERA (*GERBERA JAMSONII* L.)

***Monis Hussain Shah[1]**, Riaz-Ur-Rehman[1], Sehrish Somiya[1], Samia ikram[1], Muhammad Usman[2], and Sajida Bibi[3]

[1]Upgradation of plant Tissue Culture Project, Horticultural Research Institute for Floriculture and Landscaping, Plot No. 4, Orchard Scheme area, Murree Road, Islamabad

[2] Institutes of Horticultural Sciences, University of Agriculture, Faisalabad

[3] Plant Breeding and Genetics Division, Nuclear Institute of Agriculture and Biology, Jhang Road, Faisalabad

*Email: monishussain50@gmail.com

ABSTRACT

Gerbera (*Gerbera jamsonii* L.) is one of the most famous and beautiful cut-flower of tropical and subtropical climate. It is one of the most famous flowers known as Transvaal daisy or Barberton daisy. The plants are used for cut flower, bedding and corner planting for different landscaping schemes. Gerbera is important as a cut flower due to its attractive colors, stem length, petal shape, and extended vase life. These indices are the key quality attributes makes it famous in international cut-flower markets of Europe and America. China produces gerbera in open farming conditions in 6204 ha. followed by Netherlands 169, Turkey 116, Japan 92, Mexico 87and Taiwan 77 hectares in glasshouses. Generally, Gerbera is propagated through the division of rhizomes, seeds and shoot tips cutting in *in vivo* conditions. The division and cutting of rhizome have a low rate of success, required more time to complete the juvenility of plants with phytosanitary hazards. Commercial propagation of Gerbera through rhizomes is also not feasible due to slow and less amount of formation of rhizomes. *In vitro* plant propagation is the primary step to get a great achievement in biological sciences. Gene induction, novel species conservation, transgenic plant development against different biotic and abiotic stresses and the induction of autotetraploid are the most important objectives to achieve through the development of efficient *in vitro* protocol in gerbera. The efficacy of different explants (Clumps, callus, and embryo rescue) for multiple shoot induction for further research in Pakistan. The research was done in the plant tissue culture laboratory of Horticultural Institute, Directorate of Floriculture (T&R), Rawalpindi. The clumps were used for callus induction while seeds were sterilized for embryo rescue under the microscope. The variety subjected for both callus formation and embryo rescue was cv. Submarine. The clumps were washed with running tap water for an hour followed by the 30 minutes with 1g/L of Topsin M fungicide. The explant was further subjected to the washing of explants for 5 minutes with 10% NaOCl (Bleach) followed by rinsing in 70% ethanol followed by washing with autoclaved distilled water. The explants were further rinsed in 0.1% of $HgCl_2$. The seeds of cv. The submarine was washed with 0.1% of $HgCl_2$ followed by 99.9% Ethanol. The seeds were finally treated with 1g/L of Topsin M fungicide. The culture conditions for clumps were 16 hr. light and 8 hr. dark in the growth rooms of the laboratory while seeds were placed in the dark. The Clumps were cultured on MS-Medium modified with 2, 4-Dichlorophenoxy acetic acid (1, 2, 3, 4 and 5mg/L) while Callus through clumps were placed with on BA (1, 2, 3, 4, 5mg/L) while BA + IAA (1+2.5, 2+2.0, 3+1.5, 4+1.0 and 5+0.5 mg/L). The Sterilization protocol was successful for clumps and seeds. The culture sustainability rates in Clumps (95 %) and seeds (99%) were observed. The clumps were subjected in 2, 4-D for callus induction. The callus induction without 2, 4-D was also observed however the callus did not become soft and regenerative through plain MS-Medium. The best and friable callus was observed in 2mg/L of 2, 4-D. The callus maximum callus weight was (2.3g), with the leafy green color of with small globular embryos. The callus was then subjected to various doses of BA and BA+IAA (3+1.5mg/L) for shoot induction it was observed that no shoot regeneration was observed through callus. The Seeds were observed keenly in the MS-Medium. The seed was vulnerable as viable when its coat is burst and it became open. The seeds were picked and coats were removed followed by cultured again in the vertical position from the embryonic side. The seeds were then be sprouted and cotyledons were further excised. The multiple shoot induction was observed through embryo rescue. The best dose for multiple shoot induction in cv. Submarine is 2mg/L of BA. The plants were further shifted to the greenhouse after acclimatization in the lab.

EVALUATION OF VARIOUS AGRICULTURAL WASTES FOR DEVELOPING LOCAL SOILLESS SUBSTRATE FOR NURSERY PRODUCTION OF TAGETES ERECTA

*__Shaiza Rasool__, Iftikhar Ahmad, and Khurram Ziaf

Institute of Horticultural Sciences, University of Agriculture, Faisalabad-38040, Pakistan
*Email: shaiza4567@gmail.com

ABSTRACT

Nursery raising of floricultural crops can be a lucrative business if paid proper attention. Uniform germination and seedling growth are one of the prime factors in bedding annuals nursery production. A study was conducted at University of Agriculture, Faisalabad, to develop an economical and sustainable substrate by using agricultural wastes available locally viz., coco coir, sawdust, peanut hulls, rice hulls ash, sugarcane press mud, and fruit and vegetable waste along with negative control (silt: sand; 50:50) and positive control (coco coir: press mud; 50:50). The selected components were mixed volumetrically as coco coir: rice hulls ash: press mud, coco coir: peanut hulls: press mud, sawdust: rice hulls ash: press mud, sawdust: peanut hulls: press mud, coco coir: rice hulls ash: fruit and vegetable waste, coco coir: peanut hulls: fruit and vegetable waste, sawdust: rice hulls ash: fruit and vegetable waste and sawdust: peanut hulls: fruit and vegetable waste in different ratios, viz., 50:40:10, 60:30:10, 70:20:10, 40:40:20, 50:30:20, 60:20:20, 30:40:30, 40:30:30, 50:20:30, 20:40:40, 30:30:40 and 40:20:40 for all experiments. Results demonstrated that positive control treatment performed best for germination (final germination percentage, days to 50% germination, mean germination time and germination index) and growth (stem, root and seedling length, total leaf chlorophyll contents, seedling fresh and dry weight) attributes. Whereas best-performing ratios were varying for physicochemical attributes, viz., positive control and 50:30:20 ratio for highest EC (2900-3700 µSm -1), positive control and 40:20:40 ratio for lowest pH (6-6.3), 70:20:10 ratio for maximum water retention (270-340%) and positive control along with 70:20:10 for lowest bulk density (0.029-0.031 gcm^{-3}). This can be concluded from the studies that use of coco coir along with sugarcane press mud (50:50) proved best for nursery raising of marigold and may be used for commercial nursery production of marigold.

IN VITRO CALLUS INDUCTION AND REGENERATION OF CITRUS

***Mubasshir Hussain**[1], Muhammad Jafar Jaskani[1], Bilquees Fatima[1], Waqar Shafqat[1], and Muhammad Shafiq[2]

[1]Institute of Horticultural Sciences, University of Agriculture, Faisalabad, Pakistan
[2]Institute of Agricultural Sciences, University of the Punjab, Quaid-e-Azam Campus, Lahore, Pakistan
*Email: mubasshir.agrarian@gmail.com

ABSTRACT

Citrus mainly propagated asexually through budding or grafting at commercial level. Plant tissue culture is the best tool that regenerated the whole plant by callus induction for propagation and improvement of citrus varieties. The objective of the present study was to develop an efficient protocol for callus induction in Kinnow, Succari, and Grapefruit. The experiment was laid out according to factorial under CRD (completely randomized design) with three factors are treatments, citrus varieties and explants replicated three times. The experiment was divided into two parts. In the first part, seeds were grown on MS medium supplemented with three different concentrations of IBA and Kinetin. Data were analyzed based on growth parameters *i.e.*, days to induce roots, number of roots, root length, days to induce shoot, shoot length, number of shoots, plant height, survival, and mortality rate. In the second part of the experiment, callus was induced from leaf, stem and root explants of *in vitro* grown plantlets. Six different concentrations of 2,4-D and BAP were used for callus induction. Parameters studied were the number of days for callus initiation, callus induction percentage, callus quantity, callus type, callus color, growth habit and response for the somatic embryo. IBA (3 mg/L) showed best results for days to induce root, number of roots, root length, and plant height while Kinetin (2 mg/L) showed best results for days to induce shoot and shoot length from seed. In the case of callus induction low concentration of 2,4-D such as 2,4-D (1 mg/L) and 2,4-D (2.5 mg/L) showed a significant response. Only leaf explants showed embryogenic callus induction. Succari and Kinnow showed more

success in the development of somatic embryos *in vitro*. Minimum callus induction was observed from root explants.

NEW CAVEAT TO TOMATO CROP: POSSIBLE FUTURE THREAT TO WORLD TOMATO PRODUCTION

Muhammad Shafiq Shahid

Department of Crop Sciences, College of Agricultural and Marine Sciences, Sultan Qaboos University, Al-Khod 123, Oman
Email: mshahid@squ.edu.om

ABSTRACT

Next-generation sequencing (NGS) of DNAs amplified by rolling circle amplification from tomato (*Solanum lycopersicum*) plants with lead curl symptoms identified several monopartite begomoviruses, including Tomato yellow leaf curl virus (TYLCV), and a betasatellite (Tomato leaf curl betasatellite [ToLCB]) previously identified in tomato in Oman. The NGS results also suggested the presence of the bipartite legume-adapted begomovirus Mungbean yellow mosaic Indian virus (MYMIV), which was confirmed by cloning and Sanger sequencing from tomato plants. A wider analysis by PCR showed MYMIV infection of tomato in Oman to be widespread. Inoculation of plants with full-length clones showed the host range of MYMIV not to extend to *Nicotiana benthamiana* or tomato. Inoculation to *N. benthamiana* showed TYLCV to be capable of maintaining MYMIV in both the presence and absence of the betasatellite. In tomato, MYMIV was only maintained by TYLCV in the presence of the betasatellite and then only at low titer and efficiency. This is the first identification of TYLCV with ToLCB and the legume adapted bipartite begomovirus MYMIV co-infecting tomato. The findings here have far-reaching implications, suggesting that begomoviruses, such as MYMIV, could be spread as a passenger of TYLCV in tomato.

PROSPECTIVE STRATEGIES FOR ABIOTIC STRESS MANAGEMENT IN SUSTAINABLE HORTICULTURE PRODUCTION

Adnan Shahid

Department of Agriculture, Nutrition and Food Systems, University of New Hampshire, USA
Email: Muhammad.Shahid@unh.edu

Abstract

Abiotic stresses like heat, cold, drought, flooding, salinity, light, and heavy metal toxicity drastically affect crop production throughout the globe. These abiotic stresses cause average yield losses of greater than 50% in a majority of crop plants. It is estimated that the World's food requirements will become double by 2050. So, to feed this ever-growing population there is a dire need to improve our production by mitigating the growth and yield inhibition caused by various biotic and abiotic agents. Different kinds of strategies like breeding, and genetic modifications are being utilized to improve the abiotic stress tolerance of horticultural crops, but they very time taking. There is a need to work on efficient and environment-friendly shotgun approaches. Therefore, we have done work on nanoparticles, LED light, super sorbent polymers to address various abiotic stresses in citrus, grapes, peach, blueberries, blackberries potato, and tomato. Based on our findings, crop-wise application protocols for nanoparticles, LED lights and super sorbent polymers have been established.

EFFECT OF DROUGHT STRESS ON GROWTH, YIELD AND CAPSAICIN CONTENTS OF HOT PEPPER

*Chaudhry Muhammad Ayyub, Muhammad Wasim Haider, Saqib Ayyub, Karim Yar Abbasi, Adeel Shahid, and Abdul Rehman Munir

Vegetable Stress Physiology Lab, Institute of Horticultural Sciences, University of Agriculture Faisalabad, 38040, Pakistan.
*Email: cmayyub91@yahoo.com

ABSTRACT

The current research was conducted to identify the agronomic traits which can be used as descriptors of drought effect on hot pepper. The trial was conducted at the vegetable area, Institute of Horticultural Sciences, University of Agriculture Faisalabad. Seeds of ISH-54 genotype were sown in plastic pots containing soil, farmyard manure and leaf manure (4: 3: 3) as growth medium. After 40 days of sowing, potted plants were irrigated with 1000 mL (control), 800 mL, 600 mL, 400 mL, and 200 mL. The research was arranged in a completely randomized design. Maximum effect of drought on capsicum's plant height (39.4% reduction), number of leaves (48% reduction), branches (29.1% reduction) and fruits (49.8% reduction) per plant; seeds per fruit (40.3% reduction) and weight of fruits per plant (53.3 %) and endogenous capsaicinoids (34.2 %), dihydrocapsaicin (39.5%) and nonivamide contents (20%) were observed in the plants given the shortest volume of water in comparison with the control. Hence, the drought had a negative correlation with almost all the studied attributes.

DISTRIBUTIONAL VARIABILITY OF BACTERIAL WILT OF CHILI INCITED BY RALSTONIA SOLANACEARUM IN EIGHT AGRO-ECOLOGICAL ZONES OF PAKISTAN

*Tariq Mukhtar[1] and Muhammad Naveed Aslam[2]

[1]Department of Plant Pathology, Pir Mehr Ali Shah Arid Agriculture University, Rawalpindi, Pakistan
[2]University College of Agriculture and Environmental Sciences, The Islamia University of Bahawalpur, Pakistan
*Email: drtmukhtar@uaar.edu.pk

ABSTRACT

Bacterial wilt caused by Ralstonia solanacearum is one of the major constraints in the production of chilies in Pakistan. As the information regarding distribution and prevalence of R. solanacearum is exiguous, the present studies were conducted to determine the incidence and prevalence of R. solanacearum in the major chili growing areas from different agro-ecological zones of Pakistan. Variations in incidence and prevalence of R. solanacearum were recorded throughout the country. The overall incidence and prevalence of R. solanacearum in the country were found to be 10% and 76% respectively. Of the four provinces, maximum disease incidence of 16.4% was recorded in Sindh province followed by Punjab and Khyber Pakhtoonkhwa showing 11.4% and 7% disease incidences respectively and the minimum incidence of 4.9% was observed in the province of Baluchistan. As regards prevalence, the same pattern was observed. Out of 8 agro-ecological zones, the maximum disease incidence of 19.5% was observed in Indus delta followed by Sandy deserts (14.1%) while the minimum disease incidence of 5% was found in Western dry mountains. The disease incidence in other zones ranged between 5.4 and 14.1%. A similar trend was noticed regarding prevalence being the maximum in Indus delta (100%) followed by Southern irrigated plains (90%). Out of 114 R. solanacearum isolates, 92 (81%) were identified as Biovar 3 while the remaining 22 (19%) were recognized as Biovar 4. Biovar 3 was recorded from all the four provinces and was found to be predominant in all the provinces while Biovar 4 found in the Punjab and Sindh provinces only. Similarly, biovar 3 was observed from all the eight agro-ecological zones and found to be predominant. On the other hand, biovar 4 was recorded from four agro-ecological zones. It is concluded that bacterial wilt caused by R. solanacearum is prevalent

throughout the country in all the agro-ecological zones with varying intensities warranting stringent surveillance and control measures.

THERMOTHERAPY OF CITRUS BUDWOOD TO CONTROL *CANDIDATUS LIBERIBACTER* ASIATICUS TRANSMISSION FOR HUANGLONGBING MANAGEMENT

***Muhammad Sarwar Yaqub**[1], Iqrar Ahmad Khan[2], Rozina Aslam[1]

[1]The Islamia University of Bahawalpur, Bahawalpur, Pakistan
[2]Institute of Horticultural Sciences, University of Agriculture, Faisalabad, Pakistan
*Email: citsykk@yahoo.com

ABSTRACT

Citrus greening or huanglongbing (HLB) is the most destructive disease of the citrus. It arises from a bacterium that multiplies only in the phloem. Citrus trees infected by the *Candidatus liberibacter* asiaticus the causal organism of huanglongbing either by its natural host Diaphorina citri kuwayama (Hemiptera: Psyllidae) or during budding/grafting process are difficult to treat in the field, greenhouse, and nurseries by cultural practices. Thermotherapy of citrus budwood was conducted to control Candidatus Liberibacter asiaticus transmission for HLB management. Budwood was obtained from PCR tested HLB positive sweet orange trees and subjected to temperature treatment ranging from 56 ^{O}C to 68^{O}C. Temperature treated budwood was then grafted on citrus jambhiri lush rootstocks. Real-time PCR assays revealed that thermotherapy at 68^{O}C is effective to inhibit the transmission of Candidatus Liberibacter asiaticus from budwood to a rootstock.

EVALUATION OF SOME BOTANICALS AGAINST CITRUS BACTERIAL CANKER (XANTHOMONAS CITRI SUBSP. CITRI) AFFECTING LIME (CITRUS AURANTIFOLIA SWINGLE) IN SUDAN

Elshafia A. H. and Siddig M. E.

Agricultural Research Corporation (ARC)-Sudan
Email: elshafia.arc@gmail.com

ABSTRACT

Citrus Bacterial Canker Disease (CBCD) causes serious effects on lime orchards and nurseries in Sudan. The present study was conducted to evaluate the efficacy of four selected plant extracts under in vitro and in vivo conditions for the control of the CBCD. Although Roselle (Hibiscus subdariffa) and neem oil (Azadirachta indica) caused a significantly less inhibitory effect on canker severity compared to the fungicide Mancozeb, they were significantly ($P \geq 0.05$) more efficacious than the other plant diffusates. Cinnamon (*Cinnamomum verum*) and Clove (*Syzygium aromaticum*) showed little or no in vitro inhibitory activity. Under in vivo condition, the disease severity records on nursery lime seedlings declined by a proportion of 40.4% to 45.2% compared to the non-treated control. Roselle (2%) produced the greatest inhibitory effect in response to each of the three treatments. *Cinnamomum verum* and *Syzygium aromaticum* although had variable results after each of the first tow spray applications, but at last they attained the same final inhibitory effect.

METAGENOMICS STUDY LEAD TO TARGETED ISOLATION AND CHARACTERIZATION OF SERRATIA SPP. FROM THE ROOT NODULES OF CHICKPEA

***Ahmad Zaheer**[1,2], Babur S. Mirza[3], Joan E. Mclean[3], Kauser A. Malik[4], and M. Sajjad Mirza[2]

[1]Institute of Molecular Biology and Biotechnology, University of Lahore, Defence Road, Lahore, Pakistan
[2]National Institute for Biotechnology and Genetic Engineering (NIBGE), P.O. Box 577, Faisalabad, Pakistan
[3]Missouri State University, Biology Department, Springfield, MO 65897, USA
[4]Department of Biological Sciences, Forman Christian College University, Lahore 54600, Pakistan
*Email: ahmad.zaheer@imbb.uol.edu.pk

ABSTRACT

Chickpea is mainly cultivated in nutrient-deficient soils in rainfed areas where the application of phosphate (P) fertilizer is the main limitation for resource-poor farmers. Therefore, the present study was conducted to detect P-solubilizing bacteria from field-grown chickpea by DNA-based method, which followed their cultivation for use as bio-fertilizer. *Serratia* spp. known for their P-solubilizing ability were detected by pyrosequencing of DNA extracted from nodules of chickpea. Reddish colonies appearing on growth medium were purified and used to inoculate field-grown chickpea after confirmation of their P-solubilizing activity in pure culture of *Results Serratia* spp. affiliated DNA sequences were discovered in the root nodules of field-grown chickpea cultivars and two *Serratia* strains, 5D and RTL100 were obtained in pure culture. *In vitro*, strain 5D showed significantly higher P-solubilization as compared to RTL100. In the field experiments, the application of strain 5D inoculum resulted in up to 25.55 % and 30.85 % increase in grain yield of the crop grown on fertile soil in irrigated areas and nutrient-deficient soil in rainfed areas, respectively over non-inoculated control. These results indicated that *Serratia* sp. 5D and RTL100 can serve as effective microbial inoculants for chickpea, particularly in nutrient-deficient soils in rainfed areas where chickpea is the only major crop grown throughout the year.

DNA BARCODING, PHYLOGENETIC ANALYSIS AND BIOLOGICAL CONTROL OF YELLOW PEACH MOTH, CONOGETHES PUNCTIFERALIS (GUENEE) (LEPIDOPTERA: CRAMBIDAE) INFESTING GUAVA IN PUNJAB, PAKISTAN

***Jam Nazeer Ahmad**[1], Hajra Ghulam Ghaus[2], Ayesha Sattar[2], Annam Shahzadi[2], Samina Jam Nazeer Ahmad[1, 3], and Faisal Hafeez[4]

[1]Integrated Genomics, Cellular, Developmental and Biotechnology Laboratory, Department of Entomology, University of Agriculture, Faisalabad, Pakistan
[2]Department of Zoology and Fisheries, University of Agriculture Faisalabad, Pakistan
[3]Plant Molecular Biology and Biotechnology Laboratory, Department of Botany, University of Agriculture, Faisalabad, Pakistan
[4]Department of Entomology, Ayub Agriculture Research Institute, Faisalabad, Pakistan
[5]Department of Forestry, Wildlife and Range Management, University of Agriculture Faisalabad, Pakistan
*Email: jam.ahmad@uaf.edu.pk

ABSTRACT

Yellow peach moth, *Conogethes punctiferalis* Guenée (Lepidoptera: Crambidae) is an important pest of some fruit crops and vegetables worldwide. Recently, insect pest-infested guava fruits were collected from different Guava orchards in Punjab, Pakistan. The samples were placed in plastic jars for adult emergence and identification. The morphological study of adults under the microscope showed a similar pattern of black spots on the body as reported by taxonomists for *C. punctiferalis.* Molecular identification and phylogenetic analysis were also done through PCR, Sequencing, and Software (MEGA6). Mitochondrial cytochrome oxidase I (COI) gene-based primer pairs (LCO-1490/ HCO-2198) were used for DNA amplification and sequencing. From all collected *C. punctiferalis* samples, the PCR bands of 710bp were obtained in gel electrophoresis. The sequence analysis with sequences submitted at the NCBI database (Accession number MK301225.1) revealed that *C. punctiferalis* has 99-100% similarity with *C. punctiferalis* sequences. Further, the larvae of this pest were treated with entomopathogenic fungus (*Metarhizium anisopliae*) and 70-95% mortality was recorded under laboratory conditions. This is the first

report of infestation, identification and biological control of yellow peach moth, *C. punctiferalis* infesting Guava fruit in Pakistan.

PGPR INOCULATION RELIEVED PEA PLANTS FROM OXIDATIVE DAMAGE UNDER INDUCED SALINITY CONDITIONS

Muhammad Shahid[1*], Muhammad Sohail Akram [2], Muhammad Tariq Javed[2], and Muhammad Azeem[2]

[1]Department of Bioinformatics and Biotechnology, Government College University, Faisalabad 38000, Pakistan
[2]Department of Botany, Government College University, Faisalabad 38000, Pakistan
[*]Email: mshahid@gcuf.edu.pk

ABSTRACT

The study was planned to characterize and screen the PGPR strain(s) to evaluate the impact on the physiology of pea plants under different salinity levels. PGPR strain(s) were isolated from the pea rhizosphere and identified by the analysis of the 16S rRNA gene sequence. The Planomicrobium strain demonstrated phosphate solubilization and auxin production up to 2 mol l -1 NaCl and exhibited 1-aminocyclopropane-1-carboxylic acid deaminase activity up to 1.5 mol l -1 salt. In an inoculation experiment with the Planomicrobium under different salinity regimes, a significant increase in growth was observed associated with decreased levels of reactive oxygen species and enhanced anti-oxidative enzyme activities. The strain also promoted the translocation of nutrients in plants with a subsequent increase in chlorophyll and protein contents as compared to non-inoculated plants. It has been observed that rifampicin-resistant derivatives of the strain were able to survive for 30 days at optimum cell density with pea rhizosphere. The growth-stimulating effect of the strain on pea plants may be attributed to its rhizosphere competence, nutrient mobilization and modulation of plant oxidative damage repair mechanisms under saline environment.

GEOGRAPHICAL DISTRIBUTION AND DISEASE ASSESSMENT OF BACTERIAL CANKER IN STONE FRUIT GROWING AREAS OF PAKISTAN

***Muhammad Inam-ulHaq**, Raees Ahmed, G. Irshad, and MuhammadAshfaq

Department of Plant Pathology, PMAS-Arid Agriculture University Rawalpindi, Pakistan. Pakistan
*Email: dr.inam@uaar.edu.pk

ABSTRACT

The current study was carried out for the determination of disease incidence and prevalence of major stone fruits (Peach, Apricot and Plum) growing areas of Punjab (Districts Attock, Rawalpindi [Including Islamabad], Khushab) and Khyber Pakhtunkhwa (District Abbottabad, Mansehra, Haripur, Peshawar and Northern areas of KPK). For this purpose, during 2014-15, a comprehensive survey was conducted in stone fruit growing areas of Punjab and KPK provinces. A maximum of 100% disease prevalence was calculated in surveyed locations. In case of disease incidence, the highest was recorded in Attock (Punjab) that was 47.1%, 72.7% and 75% for peach, apricot, and plum respectively while lowest disease incidence was in Rawalpindi (Punjab) that was 16%, 21% and 13% for peach, apricot, and plum respectively. Similarly, the highest disease incidence was 86.6% recorded for peach in Abbottabad, 87.5% for apricot in Mansehra and 88.8% for plum in village LassanNawab (Mansehra), also 88.8% in village Bangnotar (Abbottabad). While lowest disease incidence was 33.3% and 28.5% in Mansehra for peach and apricot respectively, whereas 28% was recorded for plum in Tehsil Balakot. Pathogenicity tests and biochemical tests on healthy detached leaves of rose, Peach, Plum, and apricot were used for further confirmation. For molecular identification of local isolates, PCR assay was used to amplify *virB1* and *virD4* genes. The predicted 1453bp and 513bp PCR products were obtained for virD4 and virB1 genes, respectively. The results highlighted the alarming situation of a new threat in Pakistan, which must be further studied for its characterization and epidemiology for better management of bacterial canker of stone fruits in local environmental conditions.

FIRST REPORT OF *CURVULARIA LUNATA* CAUSING POSTHARVEST FRUIT ROT OF BANANA IN PAKISTAN

Arshad Javaid* and Iqra Haider Khan

Institute of Agricultural Sciences, University of the Punjab, Lahore, Pakistan.
*Email: arshad.iags@pu.edu.pk

ABSTRACT

In the present study, banana fruits (*Musa acuminate* Colla) infected with rot disease were collected from the local market of Lahore, Pakistan. The observed symptoms were dry, decayed, sunken lesions with dark grey to greenish, damaging the quality of the fruit. The pathogen was isolated on malt extract agar plate to obtain the pure colonies and for morphological examination such as colony size, shape, texture, exudates, and color. Pathogenicity test was performed by inoculating the pathogen artificially on an asymptomatic banana. The pathogen was observed under the light microscope and scanning electron microscope for morphological characterization and identified as Curvularia lunata. For more accuracy, the molecular studies of the isolated pathogen *C. lunata* were performed by sequencing its rDNA with two distinct markers ITS and GAPDH. The PCR products of ITS and GAPDH were then submitted to GenBank with MN752153 and MN787829 accession numbers, respectively. To the best of our knowledge, *C. lunata* infecting the banana fruit has not already been reported from Pakistan. Therefore, this is the first report of *C. lunata* responsible for banana rot in Pakistan.

EXOGENOUS APPLICATION OF SALICYLIC ACID FOR THE IMPROVEMENT OF TOMATO (*SOLANUM LYCOPERSICUM*) CROP UNDER ELEVATED TEMPERATURE STRESS

Muhammad Azam Khan* and Waqar Saleem

Department of horticulture, PMAS-Arid Agriculture University, Rawalpindi, 46300, Pakistan
*Email: drazam1980@uaar.edu.pk

ABSTRACT

Summer heat stress hinders tomato production in most areas of Pakistan resulting in an imbalance in demand and supply. Salicylic Acid (SA) has been reported to reduce the effect of heat stress on plants. This study was carried out to determine the effect of foliar application of salicylic acid (SA) on vegetative and reproductive growth of tomato plants (T-1359), grown as summer crop to expose it to the highest temperature month of June. Tomato seedlings were treated with foliar applications of different concentrations of SA viz., 0.0, 0.25, 0.75 and 1.25 mM to run off with two weeks' interval until final fruit harvesting. The physiological data (photosynthesis, transpiration, chlorophyll contents, and membrane integrity) was recorded after 15 days of first treatment. The yield data were pooled for multiple pickings as the crop matured. The SA treatments induced a significant rise in different vegetative, reproductive and physiological parameters. The maximum increase was observed in plant height, number of leaves, stem diameter, no. of flowers, no. of flower buds, total yield, fruit firmness, sub stomatal CO_2 conductance, transpiration rate, net photosynthesis rate, vapor pressure deficit, and leaf relative water contents in the plants treated with 0.25 mM SA compared to control plants. The heat stress also reduced the leaf relative contents (LRWC) (0.03%) whereas SA treatment (0.25mM) slightly raised LRWC (0.04%). These findings suggest that SA treatments help the tomato plants cope with the heat stress by mitigating the thermal damages and by improving plant physiological factors, consequently enhancing the growth and development of tomato crops.

APPLICATION OF ORGANIC COMPOST FOR RECLAMATION OF SOIL SALINITY FOR APPROPRIATE GROWTH OF *CUCUMBERS SATIVUS* SEEDLINGS

Sayed Jaleed Ahmad, **Maleeha Umber***, Rashida Sultana, Fareeha Iffat, Maryam Amin, Ayesha Khalid, Shanza Kiran

Department of Botany, Nusrat Jahan College Rabwah, Chenab Nagar, Pakistan
*Email: maleeha.umber@njc.edu.pk

ABSTRACT

The research was performed at the Botany department, Nusrat Jahan College Rabwah, Pakistan to determine the effect of different compositions of organic compost applied to reduce soil salinity. "Benazir" variety of *Cucumbers sativus* was taken from NARC Pakistan. The different compositions of compost applied in pots were 2%, 4%, 6%, 8%, and 10% and five replicates were made for each treatment. Five seeds of *Cucumbus sativus* were sown in each pot. The pots were placed in the completely randomized design and the moisture content was observed everyday and maintained. The plants were harvested after 21 days, roots, shoots and leaves were preserved in 50mM potassium phosphate buffer separately. The preserved samples were then ground, centrifuged and subjected to various biochemical tests. Results of our tests have shown than compost application more than 4% is more beneficial for overcoming salinity effects and growing healthy crops.

PLANT RESPONSES TO WATER STRESS IN GUAVA (PSIDIUM GUAJAVA L.)

***Muhammad Usman**[1], S.A.M. Bokhari[1], Bilquees Fatima[1], and Bushra Rashid[2]

[1]Plant Tissue Culture Cell, Institute of Horticultural Sciences, University of Agriculture, Faisalabad 38040, Pakistan
[2]National Center of Excellence in Molecular Biology, University of the Punjab, Lahore 53700, Pakistan
*Email: m.usman@uaf.edu.pk

ABSTRACT

In Pakistan, fruit crop productivity is being badly affected by major climatic changes including variable rainfall intensity and patterns. Global warming is leading to a higher frequency of hot days and nights and rising drought stress which is alarming. Guava is relatively more drought-tolerant among tree fruit crops. However, little is known about genotypic behavior, morpho-physiological and genetic responses towards water deficit (WD) in the indigenous material. Different studies were conducted in potted plants and mature trees to estimate varietal behavior against WD conditions and an overview is discussed. Mature bearing plants were subjected to WD for 15-45 days. Water deficit enhanced 70%-90% floral bud induction and enhanced fruit juice TSS up to 1.2 °Brix. No genotypic differences were noted for most of the plant morphological and fruit physicochemical traits. In potted plants, net plant height, leaf width, and chlorophyll contents were higher in 'Pyriform' compared with 'Round' shaped guava. In another study, guava cultivars were subjected to WD for four months and recovered. Morphological traits including net plant height, leaf area, and photosynthetic performance were better in 'Pyriform' compared with 'Round'. Better photosynthetic capacity, higher chlorophyll contents and water use efficiency (WUE) provided a base for early recovery and better growth in 'Pyriform'. Physiological responses were more variable and genotype independent. Among biochemical traits, SOD, POD, catalase and total flavonoids were higher in 'Pyriform'. Global differential gene expression analysis revealed a higher number of ESTs up and down-regulated in 'Pyriform' compared with 'Round' indicating its higher inherent potential towards WD stress tolerance. Further, extensive gene expression profiling is suggested to identify candidate genes regulating water stress tolerance in guava.

ISOLATION AND SCREENING OF DROUGHT AND SALT-TOLERANT IAA PRODUCING AND PHOSPHATE SOLUBILIZING PLANT GROWTH-PROMOTING RHIZOBACTERIA

Laraib Malik[1], ***Tanvir Shahzad**[1], Sabir Hussain[1,] Faisal Mahmood[1], and Muhammad Shahid[2]

[1]Department of Environmental Sciences & Engineering, Government College University Faisalabad
[2]Department of Bioinformatics & Biotechnology, Government College University Faisalabad
*Email: tanvirshahzad@gcuf.edu.pk

ABSTRACT

Drought and salinity are the major stressors for crop production. By 2050, it is estimated that most of the arable land will seriously come under drought and salinity stress thereby threatening world food security. Therefore, there is a need to find ways of enhancing crop production in the face of these stressors. Plant growth-promoting rhizobacteria (PGPR) have the potential for improving plant growth in stress environments like drought and salinity. PGPR is known for improving crop growth and yield for long. However, the studies on the efficiency of PGPR to enhance crop growth under drought and salt stress are rare. Two of the traits of PGPR is phosphate-solubilization and IAA production. Phosphorus and IAA are essential elements for plant growth and development. PGPR can solubilize insoluble phosphorus (P), produce IAA under water stress and salinity stress, and make it available for plant utilization. Herein, we isolated one hundred and forty-four bacterial strains from root rhizosphere of Barly (*Hordeum vulgare*), Gram (*Cicer arietinum*) drought-tolerant crops and Colocynth (*Citrullus colocynthis*) and Castor (*Ricinus communis*) grown in arid and semi-arid regions of Punjab Pakistan (Thal, Layyah, and Bhakkar). These strains of bacteria were tested for their survivability (Optical density at 600nm) phosphate solubilization and IAA production under different water stress (0%, 3%, 5%, and 10% PEG 6000) and salinity stress (0%, 3% NaCl) conditions. Sixteen isolates were initially selected for their ability to solubilize phosphorus. All of these drought-tolerant isolates were able to solubilize phosphorus at pikovskaya agar with two levels 3% and 5% of PEG 6000. C27 showed the highest level of PSI (Phosphorus solubilizing index) 8.5 and 6 at 3% and 5% PEG6000 respectively. This result shows that C27 is capable to solubilize phosphorus under water stress conditions (5%PEG 6000). From sixteen strains, two isolates BJK1 and C4 were able to solubilize phosphorus and produce IAA (5% PEG6000 and 5% NaCl)). The search for more such strains capable of tolerating and performing their PGP functions higher drought and salinity levels continues. Moreover, such strains will be tested in pot and field experiments for their potential to promote plant growth under drought and saline conditions.

POTENTIAL FOR THE USE OF ELICITORS IN INDUCING RESISTANCE AGAINST *ALTERNARIA SOLANI* CAUSED EARLY BLIGHT IN TOMATO

Ehsan Din, Mazhar Abbas, ***Rashid Iqbal Khan**, Waseem Iqbal

Institute of Horticultural Sciences, University of Agriculture, Faisalabad, Pakistan
*Email: rashid.khan3535@yahoo.com

ABSTRACT

Tomato is an important crop cultivated around all over the world for its fresh and value-added product. It is vulnerable to many diseases that are responsible for low yield and poor quality of produce. Among many diseases, devastating for the crop, early blight caused by *Alternaria solani* is the prominent one. Disease control mainly involves the application of agrochemicals but chemical control is posing certain economical and health risks for farmers and consumers respectively. Therefore, safer alternatives to control pathogens causing disease have become the top research priority area. Recently, the use of elicitors is trending in the market as a new option to be used as an antifungal agent due to the general assumption that they are less toxic and lethal than other artificially synthesized compounds. Therefore, a research trial was conducted to assess the effectiveness and potential of commercially available elicitors [Seaweed extract (SW), Imidacloprid, Azoxystrobin and Salicylic acid (SA)] against early blight under in-vitro conditions. Initially, *A. solani* was cultured on PDA plates amended with five different concentrations of each chemical. The results showed that SW and SA significantly inhibited the mycelial growth in vitro. Based on in-vitro trials, three selected concentrations of each product were tested against the fungal activity of pathogen under greenhouse conditions. Three weeks old tomato cv., “Rio-grande” plants raised in polystyrene trays on a mixture of peat moss and coconut coir were transplanted in pots followed by twice application of elicitors as drench treatment

particularly with the one-week interval before inoculation of the pathogen. The obtained results revealed that all applied chemicals have the potential to be used as elicitors to restrict the infection caused *A. solani* in tomato crops. However, seaweed extract (SW) at all available concentrations showed significant results by yielding healthy plants, higher plant fresh and dry weight. Moreover, certain other fields studied parameters like no. of leaves, stem diameter, and root length also showed significant differences in elicitor treated plants as compared to the control ones. Additionally, outcomes form antioxidant enzyme assay i.e. catalase, peroxidase, superoxide dismutase, and proline contents exhibited remarkable defense responses in elicitors treated plants. The higher enzymatic activity in treated plants indicates the possible role of listed enzymes to induce resistance against early blight in tomato. Thus, the introduction of elicitors into agricultural practice could reduce the scope of chemical control and thereby contribute to the development of sustainable agriculture.

MOLECULAR CHARACTERIZATION OF *PENICILLIUM EXPANSUM* ASSOCIATED WITH BLUE MOLD DISEASE OF APPLE IN PAKISTAN

[*]**Iqra Haider Khan** and Arshad Javaid

Institute of Agricultural Sciences, University of the Punjab, Lahore, Pakistan.
[*]Email: iqrahaider_khan@yahoo.com

ABSTRACT

The present study was carried out to identify the causal agent of blue mold decay in apple (*Malus domestica*). *Penicillium expansum* is a major post-harvest pathogen responsible for significant yield losses to the fruit industry. Specific detection of P. expansum is of prime importance for ensuring the safety and quality of food products. Therefore, traditional methods are labor-intensive and time-consuming. The infected apples with pale yellow to brown lesions were collected from the local market of Lahore, Pakistan. The obtained samples were cultured on malt extract agar to obtain the pure fungal colonies and confirmed their pathogenicity by inoculating the fungal mycelia on asymptomatic apples. After morphological confirmation, the isolated pathogen was observed under light microscopic and scanning electron microscope. For more accuracy, the isolated rDNA of the P. expansum was tested on the molecular level by using ITS, β-tubulin, calmodulin and CF specific primer sets. The obtained PCR products were subjected for sequencing and deposited in the GenBank with MN752156, MN787826, MN787827, and MN787828 respective accession numbers. As per our knowledge, studies regarding its molecular characterization in Pakistan has not already been reported. Therefore, the present study was aimed at the proper identification of the blue mold pathogen responsible for fruit decay at large scale in apple growing areas of Pakistan.

MOLECULAR CHARACTERIZATION OF ENDOPHYTIC BACTERIAL DIVERSITY FROM CITRUS IN PUNJAB PAKISTAN

Sehrish Mushtaq*, Muhammad Shafiq, and Muhammad Saleem Haider

Institute of Agricultural Sciences, University of the Punjab, Quaid-e-Azam Campus, Lahore.
*E-mail: sherry.a143@gmail.com

ABSTRACT

Culturable bacterial biodiversity from different cultivars of citrus leaves collected from Multan, Mian Channu, Sahiwal, Faisalabad, Sargodha, and Lahore, Pakistan were assessed. This study aimed to explore the diversity of culturable bacterial communities residing in citrus plants. Thirty-seven endophytic bacterial species or operational taxonomic units and fifteen different genera of bacteria were characterized from plant leaves, and their 16S rDNA sequences were amplified and sequenced. RDP base classification showed that class Bacilli has the highest percentage of isolates while class Alpha, Beta proteobacteria, and Gammaproteobacteria have less percentage. According to results most predominantly genera belonged to phylum Firmicutes contains genus (Bacillus, 60%; Enterococcus, 6%; Staphylococcus, 7%; *Brevibacterium*, 1%), respectively. Similarly, phylum Proteobacteria comprises of Alpha (Rhizobium) beta (*Comamonas terigena, Burkholderia cepacia)* gamma Proteobacteria (*Pseudomonas aeruginosa (5%), Enterobacter hermachei1%, Proteus mirabilis 8%, Yersinia molretti1%, Klebsiella*

pneumoniae 1%; and Psychrobacter pulmonis 1%). No such kind of study has been reported from Pakistan before so its first report of endophytic bacterial diversity from citrus orchards of Punjab Pakistan. This study could be helpful to know the diversity of bacterial endophytes of citrus and these isolates can be used as plant growth-promoting strains and also as biological control agents, for sustainable agriculture.

ANALYSIS OF THE RESPONSE OF THE SUNFLOWER (*HELIANTHUS ANNUUS* L.) GENOTYPES UNDER POLYETHYLENE GLYCOL MEDIATED DROUGHT STRESS IN LABORATORY CONDITIONS OF RAWALAKOT AZAD JAMMU &KASHMIR PAKISTAN

Uzma Ayaz

Department of Plant Breeding &Molecular Genetics, University of Poonch Rawalakot, AJK
Email: uzma_ayaz89@hotmail.com

ABSTRACT

Drought stress directly affects growth along with the productivity of plants by altering plant water status. The early effect of drought on plant growth is inhibition of shoot as well as root growth. Sunflower (*Helianthus annuus* L.) an oilseed crop, is adversely affected by abiotic stresses. The present study was carried out to characterize the genetic variability for seedling and morpho-physiological parameters in different sunflower genotypes under well-watered and water-stressed conditions. In this study, a total of twenty-seven genotypes including two hybrids, eight advanced lines and seventeen accessions of sunflower (*Helianthus annuus* L.) were tested against drought stress at germination and seedling stages. The material was sown within pots at the laboratory of Plant Breeding and Molecular Genetics, University of Poonch, Faculty of Agriculture Rawalakot. Five seeds of each genotype were planted in each pot. The experiment was laid out in a 2x2 factorial completely randomized design with three replications. Significant means were calculated among traits using analysis of variance (ANOVA) whereas, correlation and Principle component analysis also confirmed that germination percentage, root length, proline content, shoot length, chlorophyll content, stomatal frequency, and survival percentage are positively linked with each other hence these traits were responsible for most of the variation among genotypes. The cluster analysis verified Ausun, line-2, line-8, 17559, 17578, Hysun-33, 17555, and 17587 as more diverse among all the genotypes.

POTENTIAL OF NATIVE FLORA IN THE ORNAMENTAL HORTICULTURE INDUSTRY

K. Yakandawala

Department of Horticulture and Landscape Gardening, Faculty of Agriculture and Plantation Management, Wayamba University of Sri Lanka, Makandura, Gonawila (NWP), Sri Lanka
Email: kapilay@wyb.ac.lk

ABSTRACT

The ornamental horticulture industry is expanding rapidly and has been recognized as a profitable business all over the world. There is an increasing demand for new species, varieties or cultivars as the market is saturated with traditionally used species. New plants may be introduced via wild collections or from plant improvement programs. Irrespective of the source, most countries import these materials from other countries. Once escaped from gardens, some of these introduced plants have the potential to establish themselves and invade natural ecosystems. Ornamental horticulture has been recognized as the main pathway for plant invasions worldwide. Increasing international trade has been considered a major concern as it enables species to disperse across biographic barriers. At present, there is a trend toward introducing native flora as a source of new candidates from the wild. The diverse

floristic wealth of Sri Lanka could be tapped to select wild plants for the horticulture industry. Hence, studies have been conducted to investigate the landscape potential and to develop propagation techniques to promote selected native plants to the industry. Field surveys were conducted in the dry and intermediate zones of the country and potential species were identified. To determine the landscape potential, flowering phenology and animal visitation were monitored and the best maturity stage of stem cuttings was detected. The present study highlights the importance of introducing native plants in urban landscaping in Sri Lanka and recognizes the potential capability of *Helicteris isora*, *Lawsonia inermis*, *Woodfordia fruticosa* and *Osbeckia octandra* in the ornamental horticulture industry. Selected species attracted wildlife (bees, birds, and butterflies), survived under adverse conditions with minimum inputs. Hence, these plants could be promoted as energy and water-smart plants in the horticulture industry. Further, apart from aesthetic benefits, these plants can be promoted to get other functional and environmental benefits and also as multipurpose plants.

UN-CODING MOLECULAR SIGNALING BEHIND COMPATIBLE POLLINATION IN BRASSICACEAE (CABBAGE FAMILY)

***Muhammad Jamshed** [1,2,3], Subramanian Sankaranarayanan[1], Kumar Abhinandan[1], and Marcus A. Samuel[1],

[1]University of Calgary, BI 392, Department of Biological Sciences, 2500 University Dr. NW. Calgary, Alberta T2N 1N4, Canada
[2]OntarioTech University, Department of Science, 2000 Simcoe Street North Oshawa, Ontario, L1G 0C5, Canada
[3]Frontier Agri-Science, 98 Ontario Street, Port Hope, Ontario L1A 2V2, Canada
*****Email: mjamshed@ucalgary.ca

ABSTRACT

In Brassicaceae (Cabbage family), successful reproduction is dependent on the ability of the pollen (male) to germinate on the stigmas (female) to efficiently penetrate the stigmatic barrier, to access the ovules to fertilize them. The intricate process of pollination relies on complex molecular communication and signaling between two counterparts where the interplay of several pollen and stigma proteins decides the fate of successful pollination. In Brassicaceae, the stigmatic papillary cells control this process by releasing resources only to compatible pollen. Despite the identification of many stigmatic proteins that facilitate pollination responses, the signaling mechanisms that regulate the functions of these proteins have remained unknown. Here we show that, in Arabidopsis, an extremely functionally redundant mitogen-activated protein kinase (MAPK) cascade is required for maintaining stigma receptivity to accept compatible pollen. Our genetic analyses demonstrate that in stigmas, five MAPK kinases (MKKs), are required to transmit upstream signals to two MPKs to mediate compatible pollination. Compromised functions of these five MKKs in the quintuple mutant phenocopied pollination defects observed in the double mutant. We further show that this MAPK nexus converges on Exo70A1, a previously identified stigmatic compatibility factor. The phosphorylation of Exo70A1 at Ser328 by MAPK is a key regulatory mechanism to control pollination. Given the agricultural and economic importance of various crop plants that belong to Brassicaceae (canola, rapeseeds, kale, broccoli, etc.), understanding the signaling mechanism during compatible pollination responses could lead to identifying strategies to improve crop yield.

STUDY ON YIELD COMPARISON OF NEWLY REGISTERED AND EXOTIC SEED POTATO CULTIVARS UNDER DIFFERENT ECOLOGICAL ZONES OF GILGIT BALTISTAN

[*]**Fazal Rehman**, Muhammad Shah Zaman, Muhammad Khalid, Abdul Noor, and Muhammad Shaheen

Agriculture Research Department, Gilgit GB
[*]Email: drfazalrehman1963@ gmail.com

ABSTRACT

A study was conducted by the Department of Agriculture Research Gilgit-Baltistan (DAR-GB) at two different locations in Gilgit Baltistan to evaluate the performance of seven different potato cultivars. The cultivars were Sahiwal- 1, Sahiwal- 2, NARC- 1, NARC-2, Kuroda, Barna and Melanto. The crop was planted at Seed Potato Research Station Nalter and Babusar on 30th May and harvested on 18th September 2019. The experiment was laid out in Randomized Complete Block Design (RCBD) with three replications. Based on-field performance, the newly registered Seed Potato Cultivar Sahiwal-1 of the Potato Research Institute Sahiwal (PRIS) emerged as the highest yielding variety with a production of 24.46 MT/ha at Babusar and 22.83 MT/ha in Naltar. The cultivar Melanto emerged as 2nd highest with a yield of 16.98 MT/ha followed by the cultivar Sahiwal-2 with a yield of 15.92 MT/ha in Naltar. Both the cultivars introduced from the Potato Program, National Agriculture Research Center (NARC) i.e. NARC- 1 yielded 13.5 MT/ha and NARC- 2 yielded 12.9 MT/ha, also performed satisfactorily. The exotic cultivars Kuroda and Barna produced the least yield in the current study as compared to the newly registered cultivars of the Potato Research Institute Sahiwal.

USE OF ENZYMES: AN EMERGING TREND IN FRUITS AND VEGETABLE PROCESSING

Nasir Ahmad

School of Biological Sciences, University of the Punjab, Lahore.
Email: mna.sbs@pu.edu.pk; mna.pk1@gmail.com

ABSTRACT

Fruits and vegetables are an integral part of a healthy diet. They provide ample amounts of carbohydrates, fibers, essential vitamins and minerals. Also, they contain treasures of health-promoting bioactive components like polyphenols, flavonoids, and antioxidants. These natures gifted constituents are believed to provide a wide range of physiological benefits because of their antiallergic and anticarcinogenic properties. Juice products obtained from fruits and vegetables have gained wider acceptability by all age groups and are a convenient way to harness the health benefits of fruits and vegetables. Various techniques like mechanical, thermal, physicochemical, and enzymatic processing have been employed for juice extraction. The use of enzymatic treatments is an emerging trend in modern juice processing. Enzymes help in cost reduction by improving processing efficiency, maximizing product recovery and minimizing waste production. Various enzymes such as amylases, cellulases, pectinases, naringinase, tannase, and hemicellulose are suitable for the operations of juice processing. In terms of quality and food safety, the use of enzymes is greatly advantageous over traditional mechanical and thermal processes. We have produced several thermostable amylases having the potential to be employed in fruits and vegetable processing. Since these enzymes showed marvelous stability under extreme conditions, therefore, we anticipate that they will contribute a lot to the fruits and vegetable industry.

DEVELOPMENT OF LATE BLIGHT RESISTANCE IN POTATO THROUGH TRANSGENIC TECHNOLOGY

Shaheen Asad, Ali Rizwan, and Muhammad Arshad

Agricultural Biotechnology Division, National Institue for Biotechnology and Genetic Engineering, Faisalabad
Email: sasad@nibge.org

ABSTRACT

Potato, *Solanum tuberosum (S. tuberosum)* is one of the major vegetable food sources in Pakistan. Plant disease resistance is a prerequisite for the successful utilization of crop species in modern agriculture. Late blight is the most destructive disease in potato cultivation worldwide, causing billion-dollar losses every year. A wild diploid potato species, *Solanum bulbocastanum (S. bulbocastanum) (*2*n* =2*x*=24), is highly resistant to all known races of *Phytophthora infestans (P. infestan)*, even under intense disease pressure. Unfortunately, classic transfer of resistance from wild *Solanum* species to cultivated potato is not easy because of differences in ploidy and endosperm balance. Genetic engineering and molecular biology techniques have great potential to improve plant cultivars by introducing genes of interest without perturbing the commercially desirable traits. In the present study, the *S. bulbocastanum*-derived Rpi-blb2 gene was cloned and transformed into commercial potato cultivar via *Agrobacterium*-mediated method. Molecular analyses revealed the presence, integration and expression of the transgene in the transgenic potato. Late blight bioassay of transgenic potato indicated that some of the lines showed resistance/tolerance towards *P. infestans*.

TRANSCRIPTOME-ENABLED NETWORK INFERENCE REVEALED THE GMCOL1 FEED-FORWARD LOOP AND ITS ROLES IN PHOTOPERIODIC FLOWERING OF PLANT

Faqiang Wu[1], Xiaohan K. Kang[2], Minglei Wang[2], ***Waseem Haider**[3], William B. Price[2], Bruce Hajek[2], and Yoshie Hanzawa[1]

[1]California State University, Northridge, United States
[2]University of Illinois at Urbana-Champaign, United States
[3]COMSATS Institute of Information Technology, Pakistan
*Email: haider.waseem@gmail.com

ABSTRACT

Photoperiodic flowering, plant response to seasonal photoperiod changes in the control of reproductive transition, is an important agronomic trait that has been a central target of crop domestication and modern breeding programs. However, our understanding of the molecular mechanisms of photoperiodic flowering regulation in crop species is lagging. To better understand the regulatory gene networks controlling photoperiodic flowering of plants, we elucidated global gene expression patterns under different photoperiod regimes using the near-isogenic lines (NILs) of maturity loci (E loci). Transcriptome signatures identified the unique roles of the E loci in photoperiodic flowering and a set of genes controlled by these loci. To elucidate the regulatory gene networks underlying photoperiodic flowering regulation, we developed the network inference algorithmic package CausNet that integrates sparse linear regression and Granger causality heuristics, as well as Gaussian approximation of bootstrapping to provide reliability scores for predicted regulatory interactions. Using the transcriptome data, CausNet inferred regulatory interactions among plants flowering genes. A comparison with literature provided several inferred regulatory interactions with empirical verification. We further confirmed the inferred regulatory roles of the flowering suppressors GmCOL1a and GmCOL1b using GmCOL1 RNAi transgenic plants. Combinations of the alleles of GmCOL1 and the major maturity locus E1 demonstrated positive interaction between these genes, leading to enhanced suppression of flowering transition. Our work provides novel insights and testable hypotheses in the complex molecular mechanisms of photoperiodic flowering control in plants and lays a framework for de novo prediction of biological networks controlling important agronomic traits in crops.

ELUCIDATION OF GENE-REGULATORY-NETWORK FOR ORE1 TRANSCRIPTION FACTOR IN CONTROLLING SENESCENCE

***Mamoona Rauf** and Muhammad Arif

Department of Biotechnology, Abdul Wali Khan University Mardan
*Email: mamoona@awkum.edu.pk

ABSTRACT

Leaf senescence is a key physiological process in all plants. Its onset is tightly controlled by transcription factors, of which NAC factor *ORE1* is crucial in Arabidopsis thaliana. The major goal of this study was to explore the *ORE1* gene regulatory network by performing the evolutionary analysis of regulatory sequences, identifying downstream target genes and screening ORE1- interacting proteins. *ORE1* gene-regulatory-network exhibited that it interacts with the G2-like transcription factors *GLK1* and *GLK2*, which are important for chloroplast development and maintenance, and thereby for leaf maintenance. *ORE1* antagonizes *GLK* transcriptional activity, shifting the balance from chloroplast maintenance towards deterioration. These findings identify a new mechanism important for the control of senescence by *ORE1*. *ORE1* and *BFN1* expression patterns largely overlap, while *BFN1* expression in senescent leaves and the abscission zones of maturing flower organs were virtually absent in ore1 mutant background. A bipartite *ORE1* binding site is identified in the promoter of senescence-associated genes, namely *BFN1*, *SAG29*, and *SINA1*, supporting the central role of *ORE1* during senescence. Mutating the cis-element within the context of the full-length *BFN1*, *SAG29* and *SINA1* promoter drastically reduced ORE1-mediated transactivation capacity in transiently transfected Arabidopsis mesophyll cell protoplasts. Furthermore, chromatin immunoprecipitation (ChIP) demonstrates the in vivo binding of *ORE1* to the *BFN1*, *SAG29* and SINA1 promoter. Furthermore, comparative genome-wide bioinformatics analysis was performed for the identification of evolutionarily conserved non-coding sequences (CNSs) in the *SAG29* promoter. These newly discovered putative cis-regulatory elements might have a conserved role in controlling *SAG29* and its orthologues' biological role upon stress, senescence, and development of plants.

GENETIC DIVERSITY AND POPULATION STRUCTURE OF PAKISTANI BER GERMPLASM (*ZIZIPHUS MAURITITANA* LAMK.) BY USING SSR MARKERS

Naseem Sharif[1], *****Muhammad Jafar Jaskani[1], Summar Abbas Naqvi[1], Faisal Saeed Awan[2], Muhammad Kashif Raza[1]

[1]Institute of Horticultural Sciences, University of Agriculture, Faisalabad, Pakistan
[2]Centre of Agricultural Biochemistry & Biotechnology, University of Agriculture, Faisalabad, Pakistan
*Email: jjaskani@uaf.edu.pk

ABSTRACT

Ziziphus is a genus of spiny shrubs and small trees in the Rhamnaceae family. This group has a controversial taxonomy, with more than 200 species described, including Chinese jujube (*Ziziphus jujuba* Mill.) and Indian jujube (*Z. mauritiana*), as well as several other important cultivated fruit crops. Genetic characterization studies in *Ziziphus* species through SSR markers have been published in China and India but missing in Pakistan though its rich genetic resources are available. In this study, sixty Pakistani ber accessions were collected to explore the genetic diversity by using 12 SSR markers. Results showed average values for allelic frequency, genetic diversity, heterozygosity and Polymorphic Information Content (PIC) were 0.4830, 0.798, 0.7674 and 0.5063, respectively, from genomic DNA of selected ber accessions. The population subdivision was assessed by considering a model-based clustering scheme executed by STRUCTURE software and they revealed significant disparity within the studied ber gene pool. STRUCTURE results were further analyzed by STRUCTURE harvester and germplasm was distinguished in two groups i.e. wild and cultivated. The PCA plot generated showed similarities and dissimilarities between the selected phenotypes and further revealed that accessions near the axis were less diverse with each other as compared to the accessions which were away from the center. Dendrogram successfully divided the accessions into two clusters i.e.

C1 and C2. Cluster-1 was comprised of fourteen accessions i.e. BKR3, BKR8, BKR9, LYH13, BKR4, LYH12, LYH15, BKR5, BKR7, BKR6, LYH16, BKR2, LYH11 and LYH14, and Cluster-2 grouped forty-six accessions with further subdivision into two clusters i.e. C2A and C2B. This study showed a high potential for future breeding programs by revealing a broad genetic base of Pakistani ber germplasm. Products of this study will also prove helpful to improve breeding, conservation, and management of ber germplasm in Pakistan as well as to facilitate international collaborations for harboring innovative plant materials for scion and rootstocks.

STUDY OF VARIABILITY, HERITABILITY, AND GENETIC ADVANCE IN ONION (*ALLIUM CEPA* VAR. CEPAL.)

M.A. Chatto, *__Rizwan Rashid__, Mehrajuddin, J.I.Cheshti, and Faheema Mushtaq

Division of Vegetable Science-SKUAST-Kashmir
*Email:rizwan60@gmail.com

ABSTRACT

Thirty-two onion genotypes were evaluated for nine quantitative characters. The high genotypic and phenotypic coefficient of variation (>25%) was observed for double bulb percentage, split bulb percentage, and neck thickness. Moderate genotypic and phenotypic coefficient of variation (10-25%) was observed for polar diameter, equatorial diameter, and yield. However, plant height, no. of leaves, bolting percentage showed an only moderate phenotypic coefficient of variation (10-25%). High heritability (>60%) was observed for plant height, double bulb percentage, polar diameter, equatorial diameter, and yield. Moderate (30-60%) heritability was recorded for no. of leaves, split bulb percentage and neck thickness. Expected genetic advance expressed as a percentage of mean was observed high (> 20%) for double bulb percentage and yield. Low genetic advance as percent of the mean (<10%) was observed for all other characters viz., plant height, no. of leaves, bolting%, split bulb%, neck thickness, polar diameter, and equatorial diameter.

PRODUCTION OF POLYHYDROXY BUTYRATE BY AGRICULTURE WASTE USING SOLID-STATE FERMENTATION

*__Shagufta Saeed__, Sadia Nawaz, Muhammed Tayyab, and Sehrish Firyal

Institute of Biochemistry and Biotechnology, University of Veterinary and Animal Sciences, Lahore
*Email: shagufta.saeed@uvas.edu.pk

ABSTRACT

Polyhydroxybutyrate (PHB), a bioplastic, has attracted attention in recent years due to its ability to replace polyethylene, a non-biodegradable plastic. The present research work aimed to evaluate the potential of different agricultural wastes like wheat bran, rice polishings and corn cob for the synthesis of PHB by *Bacillus thuringiensis* FCBP-SB-0002 using solid-state fermentation. Optimization of different components of basal media and various physical parameters was also performed. Maximum PHB yield (420 mg/100g) was achieved on fermentation of rice polishing at a substrate water ratio of 10:36 at 72 hours of incubation time, pH 7, the temperature of 30^0C by addition of 1 mL inoculum. Addition of different optimum levels of ionic salts (1.5% of $KH_2PO_4.2H_2O$, 2% $MgSO_4$ and 2% NaCl) and nitrogen sources (0.75% urea and 1% corn steep liquor) increased the PHB production to 680 mg/100g respectively. The identification of PHB was done by FTIR analysis and was found to be 98% pure in comparison to standard by spectrophotometric method. The outcomes of the present study indicated that agricultural wastes can be used for the cheap production of bioplastic. This strategy will also help to reduce environmental pollution caused due to the disposal of this waste material.

FLORAL BIOLOGY, POLLEN VIABILITY AND HYBRIDIZATION IN POMEGRANATE (*PUNICA GRANATUM* L.) CULTIVARS

Sufian Ikram, M. Jafar Jaskani*, M. Ahsan Qureshi, Waqar Shafqat, Safeer ud Din, and Sami-Ur-Rehman

Institute of Horticultural Sciences, University of Agriculture, Faisalabad-38040, Pakistan
*Corresponding author: jjaskani@uaf.edu.pk

ABSTRACT

The production of pomegranate (*Punica granatum* L.) is decreased from 13.3 thousand hectares (2009-10) 7.3 thousand hectares (2017-18). Several factors are responsible for a decline in production such as unavailability of registered varieties, abiotic stresses, insect pests, and diseases. Lack of new varieties is the most important of all and it is the need of time to introduce new verities by using conventional and modern breeding tools. Keeping in view this problem present study was designed to explore hybridization potential in existing pomegranate germplasm along with a study on their floral biology, pollen viability. Crosses were attempted keeping in view the reported morphological markers. Fifteen pomegranate genotypes were selected and floral variation i.e. male, intermediate and hermaphrodite flowers among the genotypes were assessed based on their number, size, androecium and gynoecium structure. Data were analyzed using Statistics 8.1 and means were compared by Tukey's significant test. Results showed that maximum (72.8%) male flowers were found in Sandhora Khatta, intermediate (38%) in Sandhora and hermaphrodite (25.8%) in Chakwal. Hermaphrodite flowers in all genotypes showed the highest flower length followed by intermediate and male flowers. Maximum flower length (5.88 cm) was found in Kandhari red hermaphrodite flowers and minimum (2.72cm) in Takht-i-Babri male flowers. In *in-vitro* pollen germination studies revealed that germination media (12.5% sucrose + 0.2% agar) supplemented with 10 ppm boric acid gave the highest germination in all cultivars when kept for 24 hours. One month of stored pollen showed maximum germination (58.3%) in Desi and a minimum (16.3%) in Kandhari red. Among all reciprocal crosses, the overall fruit set percentage was 19.8%. Hybrid seed germination ranged from 82.5% (Kandhari Red × Qabili) to 15% (Ternab Ghulabi × Green Khushab; Kandhari White × Qabili). A total of 256 hybrid seedlings are being grown in the screen house and genetic studies are in progress.

GREEN IRON-NANOPARTICLES AS A DNA DELIVERY SYSTEM FOR THE PRODUCTION OF TRANSGENIC PLANTS

Naila Farooq[1], LaraibAther[1], *Muhammad Shafiq[2], Qamar Abbas[1], Mujahid Hussain[2]

[1]Department of Biotechnology, Lahore Garrison University, P.O BOX. 54000, Lahore, Pakistan
[2]Department of Horticulture, Institute of Agricultural Sciences, University of the Punjab, P.O BOX. 54590, Lahore, Pakistan
*Email: shafiq.iags@pu.edu.pk

ABSTRACT

Climate change, pesticide resistance, and the need for developing new plant-varieties have galvanized biotechnologists to find new solutions for producing transgenic plants. Since the last decade, around the globe, scientists are working on green metallic-nanoparticles to develop DNA delivery systems for plants. In the current study, we have synthesized green Iron-nanoparticles using leaf extract of *Camellia sinensis* (green tea) and Iron Chloride ($FeCl_3$). Using these nanoparticles, we have developed a novel method of gene transformation in plants with a combination of Magnetofection and centrifugation. In the presence of a magnetic field, the 1:20 DNA to Iron-nanoparticles ratio and rotation of mixture (Plasmid DNA, Iron-nanoparticles, and seed embryo) at 800rpm for 5h caused maximum gene transformation. Experimentally, applying this method, the transformation of the GFP (green fluorescent protein) gene was successfully done in *Abelmoschus esculentus* (Okra plant) and the fluorescence, in the result of the expression of the GFP gene, was confirmed using a Laser Scanning Confocal Microscope (LSCM). This method can be widely used in Agriculture to improve the yield and immunity of plants against pathogens.

ANALYSIS OF GENOTYPE X ENVIRONMENT INTERACTIONS IN TOMATO

Muhammad Yussouf Saleem, Khalid Pervaiz Akhtar, Muhammad Asghar, Abdul Rehman, Khan, and Najeeb Ullah

Nuclear Institute for Agriculture and Biology (NIAB), Jhang Road, Faisalabad
Email: Mysaleem1966@gmail.com

ABSTRACT

High yielding hybrids of tomato tolerant to blight and virus diseases were evaluated in multi-location yield trails in Punjab to adjudge their performance. Pooled analysis of variance indicated a significant impact of Genotype x Environment interactions over the yield. Stability analysis of individual hybrids estimated through simultaneous consideration of mean performance, deviation form regression line and regression co-efficient of unity pinpointed hybrid NBH-5 followed by hybrid NBH-149 as stable hybrids compared to the standard hybrid. Therefore, the prospect to release new hybrids for commercial cultivation is encouraging.

ORGANIC FARMING – FUTURE PROSPECTS AND CHALLENGES

Rhonda R. Janke

Department of Crop Sciences, College of Agricultural and Marine Sciences, Sultan Qaboos University
Email: rhonda@squ.edu.om

ABSTRACT

Organic farming has many proven benefits in most parts of the world where it has been implemented, including improved soil quality; more efficient water and nutrient cycling; and economic benefits to farmers in the form of higher prices, and social networking with other farmers and consumers. However, in many arid countries, certified organic farming has yet to thrive. Adding organic matter to the soil, a requirement for organic certification, increases the water holding capacity, rate of water infiltration, and provides buffering of nutrients. Certain organic amendments, such as biochar, also have the benefit of partially mitigating the effect of salinity. Current research in Oman on a range of soil amendments, some old, some new and novel will be discussed, as well as their potential impact on improving agricultural productivity and sustainability. Challenges to organic farming and possible solutions will also be addressed in this presentation, including; 1) current lack of local organic market demand, with the result that only the export markets bring price premiums, 2) freshwater sources are limited, but re-cycled wastewater is available to agriculture, but currently not allowed, following international organic standards, 3) organic certification is expensive, and the cost cannot be justified except for large, well-financed farms, 4) much local traditional agriculture is "almost organic," but is not recognized or labeled in the market-place, and 5) without a critical mass of local organic growers, supplies like organic seeds, biological pest control products, and animals feeds must be imported and are expensive and not sustainable. Less expensive certification options are possible, without losing the integrity of the organic label or consumer trust.

PHYSIOLOGICAL AND PSYCHOLOGICAL EFFECTS OF GARDENING ACTIVITY IN OLDER ADULTS

***Ahmad Hassan**, Chen Qibing, and Jiang Tao

College of Landscape Architecture, Sichuan Agricultural University
*Email: ahmaduaf1416@gmail.com

ABSTRACT

Gardening has long been one of the most enjoyable pastimes among older adults. Whether gardening activities contribute to the well-being of older adults is a major question. Therefore, the present study aimed to clarify the psychophysiological relaxing effects of gardening activities on older adults living in modern institutional care. The study participants were 40 older women aged 79.5 ± 8.09 years (mean ± SD). A cross-over study design was used to

investigate the physiological and psychological responses to environments with and without plants. Physiological evaluation was carried out using blood pressure and electroencephalography, and psychological evaluation was carried out using the State-Trait Anxiety Inventory and Semantic Differential method. Blood pressure was significantly lower, and changes in brainwaves were observed. Psychological responses showed that participants were more "comfortable and relaxed" after the plant task than after the control task. Besides, total anxiety levels were significantly lower after carrying out the plant task than after the control task. Our research suggests that gardening activities might enhance physiological and psychological relaxation in older adults.

LIQUIRITIN ELICITATION CAN INCREASE MEDICINALLY IMPORTANT GLUCOSINOLATES AND PHENOLIC COMPOUNDS IN CHINESE KALE PLANTS

Waheed Akram[1,2], Tehmina Anjum[3], Aqeel Ahmad[1,2], and Guihua Li[1,2]

[1]Guangdong Key Laboratory for New Technology Research of Vegetables, Guangdong Academy of Agricultural Sciences, Guangzhou, 510640, China
[2]Vegetable Research Institute, Guangdong Academy of Agricultural Sciences, Guangzhou, 510640, China
[3]Institute of Agricultural Sciences, University of the Punjab, Lahore, Pakistan
Email: meher_waheed@yahoo.com

ABSTRACT

Brassica oleracea var. alboglabra (Chinese kale) is an important vegetable crop grown in Southern China. This study was aimed at searching for an environmentally friendly and economically feasible approach to increase the production of medicinally important glucosinolates and phenolic compounds in Chinese kale plants. Accordingly, liquiritin was used as a foliar application at the concentrations of 0, 250, 500 and 750 ppm started from the four-leaf stage and done once every two weeks up till two months. Foliar application of liquiritn significantly increased glucosinolates and phenolic contents including glycosylated and acylated flavonoids and hydroxycinnamic acids, in Chinese kale plants in a dose-dependent manner. Compared with control, 2.34- and 1.96-fold increases in yields of total glucosinolates and phenolic contents were obtained in the Chinese kale plants treated by 750 ppm of liquiritin, respectively. Along with eight different types of glucosinolates, liquiritin elicitation effectively increased glycosylated and acylated flavonoids and hydroxycinnamic acids in Chinese kale plants. Besides, the expression patterns of the genes involved in glucosinolates and phenolics biosynthesis were significantly higher in liquiritin treated Chinese kale plants than those of control plants. Overall, the findings in this work highlight a feasible and environmentally friendly practice to increase the production of medicinally important glucosinolates and phenolic compounds for nutraceutical and food applications. This research work also contributes to understanding the molecular mechanisms in response to liquiritin elicitation. This is the first report of the use of liquiritin for elicitation purposes in plants.

A NON-PHARMACOLOGICAL AND NONINVASIVE TREATMENT APPROACH MEDICALLY BENEFICIAL TO THE WELLBEING OF PATIENTS

*__Muhammad Ali Khan__, Muhammad Imtiaz, Syed Hussain, and Fazal Said

Fazal Jalal Department of Horticulture, Abdul Wali Khan University Mardan, Khyber Pakhtoonkhwa, Pakistan
*Email: malikhan@awkum.edu.pk

ABSTRACT

Novelty statement: Plant therapy for hospitalized patients focused on the pure concept of utilizing a green environment using indoor foliage plants and flower arrangements for the health benefits of surgical patients. The cognitive and emotional responses of patients are immensely improved and optimized while attached to the green atmosphere in their surroundings. Green atmosphere and interaction with nature (plants and flowers) can considerably improve the human senses and sanity by decreasing the stress associated with anxiety, depression, neurotic impairment, and other psychological symptoms. Currant paper reports a therapeutic horticultural study's

findings concerning the effect of indoor foliage plants and flower arrangements on the health prospects of surgical patients. Two surgical wards naming ward A (with foliage plants and arranged flower) and ward B (without foliage plants and flowers) were selected under the study. A total of 270 patients were evaluated during the study, who were randomly assigned to both the wards making an equal lot of one hundred and thirty-five patients in each ward. Patients admitted in the ward A had significantly more optimistic and promising health improvements than those in the ward B. Provision of foliage plants and flowers arrangements to the patients in ward A resulted in shorter post-operation days, fewer intake of analgesics, experiencing less pain intensity and stress fatigue and were recorded with improved vital signs (Blood pressure, heart rate, respiration rate, and body temperature) as compared to patients in ward B. Moreover, patients in ward A were analyzed with a stronger psychological frame of mind regarding their surgery recoveries and had more positive emotions and feeling regarding their stay in the hospital. They also felt that the ward atmosphere was more calming, pleasant and satisfactory. Additionally, small group discussion and focal interviews with ward doctors and nurses confirmed the findings of the questionnaire that foliage plants & flower arrangements create a cherished environment in the ward, reduced patient's stress, improve the medical and psychological status of patients and also conveyed positive messages of the hospital. These findings confirm the therapeutic value of horticultural activities particularly in surgical patients in a stressed hospital setting.

MEDICINAL VALUE OF NEGLECTED HERBS: FAMERS' PERSPECTIVE

Sajid Ali[1]***,** Ammara Fatima[2,] Sohaib Afzaal[1], Hafiz Azhar Ali Khan[1], Moazzam Anees[1], and Muhammad Tariq Manzoor

[1]Institute of Agricultural Sciences, University of the Punjab, Lahore-54590, Pakistan
[2]Department of Environmental Science, Lahore College for Women University, Lahore
Email: sajid.iags@pu.edu.pk

ABSTRACT

Neglected and ignored or little utilized herbs are those to which only a little attention is paid or which are entirely ignored by agricultural researchers. Typically, these are not traded as commodities. They are wild or semi-domesticated varieties and non-timber forest species adapted to particular, often quite local, environments. Many of these varieties and species, along with a wealth of traditional knowledge about their cultivation and use, are being lost at an alarming rate. Yet neglected herbs present tremendous opportunities for fighting poverty, hunger, and malnutrition. And they can help make agricultural production systems more resilient to climate change. These neglected herbs may contain a wide variety of essential and precious biologically active compounds *i.e.*, polyphenolic compounds. These polyphenolics compounds or polyphenols impart a vital role as the first defense line in the mechanism of immunity in living organisms *e.g.*, in plants as well as in humans. Commonly neglected herbs including fennel, black seeds, oregano, rosemary, sage, anise, basil, etc., originate from the Mediterranean area are the crops which are grown by many farmers on small scale for their domestic use. However, these are not cultivated on a large scale as cash or commercial crops. They contain many biologically active compounds, mainly polyphenolics, which have been found to possess antimicrobial, antioxidant, antiparasitic, antiprotozoal, antifungal, and anti-inflammatory properties. The use of these neglected herbs as part of major meals may overall reduce malnutrition in Pakistani society which is becoming a serious threat nowadays. We have started research for devising the production technology of these neglected crops and optimization and extraction of these bioactive compounds from various herbs through agronomic/management practices and their application in food products is the prospect of our research.

ROLE OF LIVING GREEN WALLS IN COPING WITH ENVIRONMENTAL POLLUTION

Aamir Nawaz

Department of Horticulture Bahauddin Zakariya University Multan
Email: aamirnawaz@bzu.edu.pk

ABSTRACT

People living in the cities are aware of the day to day increasing the problem of environmental pollution. In big cities, every year the problem of smoke and smog is increasing which is a big threat to the life of the people. The major cause of these environmental issues is urbanization along with effluents of industry and the addition of more and more vehicles as required by increasing population. All these activities are increasing CO2 emissions in the air resulting in global warming. In this scenario, we need to educate people to increase the green spaces in the cities. Ultimately we need to promote the concept of Edible Landscape Garden (ELG), rooftop gardening and development of green walls technology. This green wall technology could be helpful in the production of leafy vegetables, like lettuce, spinach, coriander, mint, and mentha and fruit crops like strawberry, cherry tomato as well as ornamental plants like alternanthera, cholophytum, dark grass, ornamental cabbage and many other plants for aesthetic gratification. We can develop low-cost technology of green walls which can revolutionize the life of our urban population which is otherwise stressed due to so many problems of urbanization. These technologies can have far-reaching consequences to improve food safety as well as food security in urban life.

CONSTRUCTION OF ECO-FRIENDLY MOTORWAY SUKKUR – MULTAN MOTORWAY PROJECT (M-5)

Aslam Khan

National Highway Authority, Government of Pakistan
Email:rana21_pak@yahoo.com

ABSTRACT

The undertaken project is a monumental addition in the transportation structure of Pakistan with broad ramifications for the national economy. Keeping this in perspective, it was executed with keen planning and diligence. Apart from major structural concerns, minute aspects of its sustainability were covered. Horticulture and plantation were especially focused to render this project aesthetically pleasing and functional. During plantation, the design was strictly followed. Maintenance work has been undertaken with vigilance. With great pride, it can be concluded that the implementation of the project was achieved with distinction.

GENOME EDITING OF POTATO CULTIVARS (CARDINAL AND DESIREE) TO DEVELOP RESISTANCE AGAINST VIRAL CO-INFECTIONS

***Amir Hameed**[1], Muhammad Awais[1], and Muhammad Nouman Tahir[2]

[1]Akhuwat Faisalabad Institute of Research Science and Technology, Faisalabad, Pakistan
[2]Department of Plant Pathology, Bahaudin Zakariya University, Multan, Pakistan
*Email: amirhameed73@gmail.com

ABSTRACT

Potato (Solanum tuberosum L.), being a major food crop, has the potential for global food security. Unfortunately, potato cultivation in Pakistan is severely compromised due to viral diseases [dominantly; Potato virus X (PVX), and Potato Virus Y (PVY) attacks] causing considerable yield losses (10-60 %). Further, the prevalence of viral co-infections in potato has resulted in severe disease attacks rendering epidemics more devastating. Potato cultivars

(cv.) Cardinal and Desiree are the major red-skin varieties cultivated in Pakistan (on about 80% area under potato cultivation), however, both are highly susceptible to the RNA viral attacks. Several transgenic approaches have been employed in potato to engineer resistance against viruses. However, limited to the commercialization due to the transgenic tags, where the presence of transgene is a big question for society and legislation authorities. After infecting the plant cell, viruses interact and take over the functions of the host genes/factors like translation initiation factors (elF4E) for successful viral infection and proliferation. In this context, gene-editing technologies like CRISPR/Cas9 system [clustered regularly interspaced palindromic repeats (CRISPR)-associated 9] could be used for precisely targeting/editing the plant host genes/factors to engineer viral resistance in a transgene-free approach. The current research project is proposed to engineer virus resistance in potato cv. Cardinal and Desiree by using CRISPR/Cas9 gene knock-out technology. We propose to target the potato genes/factors like eukaryotic translation initiation factors [elF4E and isoform elF(iso)4E)] and eukaryotic translation elongation factors (elFB1) that have emerged as major susceptibility factors for interacting the RNA viruses. Host genome editing in potato to develop viral resistance will have more chances for approval and commercialization being marker and transgene-free. This is a novel approach to engineer the molecular resistance against the viral attacks and it will reduce the risks of yield losses caused by the dominating viruses in commercially important potato cultivars in Pakistan.

GREENING OF ROOFTOPS—FUTURE OF SUSTAINABLE COMMUNITY PLANNING: A REVIEW

Mehak Shehzad and Adnan Younis

Institute of Horticultural Sciences, Agriculture University, Faisalabad, Punjab-38000, Pakistan
Email: mehakiii3354@gmail.com

ABSTRACT

The expanded consciousness about nature degradation has gathered as an alarming issue among constructers and landscape architectures. Increase energy demands on high rise intensive buildings have led to recompile construction criteria based on energy-efficient designing ideas with vitality forms together with a pattern of the consistent sustainability concept. Greening of rooftops is a rising innovation that can counter the global climatic changes, space conjunction and population rise rendering an ecofriendly sustainable community. A green rooftop is a vegetative layer developed on a housetop with the diversity of plant arrangement and species collection that can provide a natural habitat for plants and another biodiversity by creating an ecologically rich area. While on other side vegetation on a green rooftop shades building surfaces expels excessive heat from the air by evapotranspiration and providing roof insulation. Shading and insulation are exceptional features of functional green roofs by which they not only decrease temperatures of the roof surface and encompassing air but also counter rainwater management and energy-efficient building by reducing cost for cooling and heating. Catering the ever-increasing population rendering space issues for home gardens an ancient green roof technology has been gaining tremendous attraction for ameliorating drastic climate changes on a sustainability basis. The outside of a vegetated housetop can be cooler than the surrounding air, through regular housetop surfaces that can surpass surrounding air temperatures by up to 90°F (50°C). This article aims to review the role of green roofs in creating sustainable urban communities. It includes the history of green roofs, their working mechanism, components, types of green roofs, role in urban sustainability, the functionality of green roofs against urban heat island, social aspects of urban farming on rooftops along with global market trend with demand and interest worldwide.

ENVIRONMENTALLY SMART NITROGEN (ESN) – POTENTIAL FOR IMPROVING MODERN CROP PRODUCTION AND N-USE EFFICIENCY

Tarlok Singh Sahota

Lakehead University Agricultural Research Station, 5790 Little Norway Road, Thunder Bay, Ontario, Canada P7B 5E1
Email: tssahota@lakeheadu.ca

ABSTRACT

ESN is polymer-coated urea that could release N matching with crop requirements. I was the first to initiate research on ESN in field crops in Ontario, Canada in 2006; initially, on timothy, spring wheat and winter wheat and later (till date) on bromegrass, grass mixtures (timothy, bromegrass, orchardgrass), other forages (barley, silage corn, oat, MasterGraze corn, and sorghum-sudangrass) feed barley and canola. In winter wheat, in 3 out of 6 years ESN gave ~0.6 MT/ha higher grain yield than urea. In spring wheat, in a relatively warmer year with well-spread rainfall, ESN produced 1 MT/ha higher grain yield than urea; averaged over 3 years, 2/3 rd N from urea and 1/3 rd N from ESN could be recommended. Two-Third N from urea and 1/3 rd N from ESN gave MT/ha extra seed yield than urea alone @ 180 kg N/ha in 2016 and 2017. Entire N from ESN in winter/spring wheat could be applied in seed rows at seeding without any detrimental effect. Highest barley grain and forage yields were recorded by urea @ 50 kg N/ha + ESN @ 20 kg N/ha; that recorded 1.2 MT/ha more forage yield than urea. Partial substitution of N from urea with ESN improved forage dry matter yield of timothy and MasterGraze corn (100 kg N/ha from urea + ESN (3:1 N) equaled that with urea @ 150 kg N/ha in yield, % protein and RFV!), but not that of winter cereals for forage, silage corn, and sorghum-sudangrass. At equal rates of N, single/fall application of ESN in timothy and bromegrass gave equal yield to urea applied in two splits in spring/summer. Spring wheat grain yields were the same as the fall/or spring application of ESN. ESN/or urea + ESN (3:1 N) increased the grain/forage protein content in almost all crops by 1-2 % points at an extra cost of only $ 6.0-10.5/ha. The results indicate that ESN could improve both crop yields and quality, make better use of N/and increase N-use efficiency. The presentation summarizes results from over 10 years and the results could be applicable globally under situations of high N losses from readily available N sources such as urea.

ORGANIC MEDIA AMENDMENTS ENHANCE SUPERIOR BIOACTIVE PHYTOCHEMICAL PROFILE IN VEGETABLES

Mumtaz Cheema

Boreal Ecosystems and Agricultural Sciences, School of Science and the Environment, Memorial University, NL. A2H 5G4, Canada
Email: mcheema@grenfell.mun.ca

ABSTRACT

Vegetables are increasingly recognized as essential for food and nutritional security. Vegetables are a rich and affordable source of micronutrients, minerals, vitamins, and phytochemicals needed for good health. Phytochemicals are naturally occurring plant chemicals, known to stimulate the human immune system, reduce oxidative damage to cells, cardiovascular diseases, Alzheimer's, macular degeneration and help to regulate hormones. Studies have shown that reduction in the risks for developing lifestyle-related illnesses (e.g. diabetes, arthritis, cancer, and cardiovascular diseases) is associated with diets high in vegetables. Particularly, green leafy vegetables are rich sources of carotenoids which help to alleviate vitamin A deficiency and age-related macular degeneration, which are considered serious public health concerns among children and adults in many developing countries. We used different organic media amendments (dairy digestate and rock dust) as a mineral source for the growth of lettuce (Lactuca sativa) and kale (*Brassica oleracea*) in hydroponic settings and pots experiments under controlled environment conditions. This presentation will explore the role of these organic amendments in enhancing nutritional composition and bioactive phytochemicals in vegetables.

IMPACT OF MODERN TECHNOLOGIES ON THE PRODUCTION OF HORTICULTURE FRUITS: A CASE STUDY OF CHINA

Maqsood Ahmed, Raja Tahir Mahmood, and Zeeshan Javaid

Department of Biotechnology, Mirpur University of Science and Technology (MUST), Mirpur-10250, (AJK) Pakistan
Email: dr.maqsood@must.edu.pk

ABSTRACT

Farmers aim to ensure that the safety and quality of their products will satisfy the highest expectations of the food industry and consumers. Besides, on-farm practices should ensure that arable and vegetable crops are produced under sustainable economic, social and environmental conditions. Good management of a farming system constitutes the grassroots of the system's economic, environmental and social sustainability. Farmers shall have taken into consideration applying the principles and practices to the whole farm system within the philosophy of continuous improvement. The application of modern farming techniques to fruit production will ensure good yield with quality products to the consumer. The current study includes a case study of the Republic of China for the production of various fruits, observed during training under the scholarship of Chinese Academy of Agriculture Sciences. Scientists and farmers employ modern farming and cultivating techniques which results in good yield with high-quality products. They ensure the freshness of fruits during ripening and produce many varieties of fruit keeping in mind the market demand. The varieties of pear observed include, Dangshansuli, yali, chili, Pingguoli, Quibaili, Nangouli, Jingbaili, Baozhuli, and Dongguoli. Further, they produce many products from these varieties like, juices, syrup and cane products which give more benefits to the producer. For the production of world-class apple varieties, they utilize the world six leading production system. They also control different diseases by various modern techniques to get disease-free fruits and to get more yields. The workers are properly trained to harvest fruits in the best possible way. The application of modern techniques not only ensure good quality products but also improve the living of poor farmers by more benefits.

AQUAPONICS: AN INNOVATIVE FARMING SOLUTION FOR THE PRODUCTION OF ORGANIC VEGETABLES

Ambreen Khadija Alvi[1], Naureen Aziz Qureshi[2], Safina Kausar[3], and Muhammad Tariq Tanveer[4]

[1] Department of Botany, Govt. College Women University Faisalabad
[2] Ex-Vice Chancellor, Govt. College Women University Faisalabad
[3] Department of Zoology, Govt. College Women University Faisalabad
[3] Agri- Tourism Development Corporation of Pakistan
Email: akalvi_uaf@yahoo.com

ABSTRACT

Vegetables are an important part of the human diet. With the increase in the use of pesticides to decrease yield loss and inorganic fertilizers to enhance productivity, the availability of chemical-free vegetables is becoming a global issue. Traditional hydroponic systems are expensive and require careful monitoring of pH and nutrients. Moreover, water in hydroponic systems needs to be discharged periodically causing environmental issues. In aquaponics microbial decomposition of fish excreta and excess feed provide nutrients in the system for plants. Moreover, in closed system aquaponics, water replacement is not required and water is simply topped it off as it evaporates. Tilapia are hardy freshwater fish farmed for their omega-3 fatty acid, nutrient and protein-rich meat and are favored in Aquaponic systems. A closed circulatory Aquaponic system was developed for the production of leafy vegetables including lettuce and celery with Tilapia. The growth and yield of plants cultivated in the system were compared with hydroponically cultivated (Water Culture pH 6 with half concentration Hoagland's Solution) and soil-grown plants. It was observed that both vegetables grown in Aquaponic systems showed better growth and gave more yield (7 to 10 % greater) in fresh weight per plant than soil-grown plants with no additional supply of fertilizer or

pesticide application. Moreover, the growth and fresh yield were statistically similar to those grown in the Hydroponic system. Net water usage in the Aquaponic system for vegetable cultivation was almost 59% less than soil-grown vegetables. Whereas, in hydroponically grown vegetables net water usage was approximately 46% less than in soil, thus concluding the potential of Aquaponics in organic farming.

PRODUCTION OF ANTIOXIDANT-ENRICHED VEGETABLES AND FRUITS

Muhammad Tahir Rashid

Research and Development, Envirolead Inc., Canada
Email: muhammadtahirr@gmail.com

ABSTRACT

For a long time, the increased consumption of fruits and vegetables was considered critical in protecting humans against several diseases, such as cancer, diabetes, neurodegenerative diseases, heart, and brain vascular diseases. Presently, it is thought that the protective properties of these foods result from the presence of antioxidants that protect the cells and their structures against oxidative damage. Fruits and vegetables have a beneficial effect on the human body related to anti-nutrients such as antioxidant substances, which are used in disease prevention and improving health and quality of life. Recent research has explained that plant chemicals, such as terpenes, flavonoids, and anthocyanins have much more powerful antioxidant properties than well-known antioxidant vitamins. Scientific literature commonly uses the term total antioxidant capacity, which determines the ability of tested material to neutralize oxygen-free radical specific form, irrespectively to the specific antioxidant activity of present antioxidants. Consumption of fruits and vegetables with a high value of antioxidant capacity increases the antioxidant capacity of tissues and body fluids, which acquire the same high ability to neutralize free radicals responsible for several diseases. We were able to develop a process to produce antioxidant-enriched vegetables which can be added to patients (cancer patients) food as a preventive and/or an alternate factor of recovery from the diseases.

VARIOUS LEVELS OF PRE AND POST-EMERGENCE HERBICIDES AFFECT WEED DENSITY, PLANT GROWTH, YIELD AND QUALITY OF *GLADIOLUS* L. HYBRIDS

Iftikhar Ahmad*, Hafiz Muhammad Kashif Ali, Aqsa Firdous, Mustaqeem Ali, and M. Qasim

Institute of Horticultural Sciences, University of Agriculture, Faisalabad-38040, Pakistan
*Email: iftikharahmadhashmi@gmail.com

ABSTRACT

A study was conducted to evaluate the effects of various herbicides applied at different concentrations on weed control and plant growth of gladiolus. In Expt. I, the efficacy of various pre and post-emergence herbicides were evaluated on *Gladiolus* cultivars, viz. 'Bangladesh' and 'Rosie Bee' during 1st year, while on 'Chanson' and 'Lemon Drop' during 2nd year for confirmation of results. There were five treatments including control (no herbicide application) with two pre-emergence herbicides, viz. S-Metolachlor (Dual Gold) and Pendimethalin (Stomp) and two post-emergence herbicides, viz. Paraquat ion and dimethyl sulfate salt (Paraquat) and Isopropylamine (Round Up). It was observed that pre-emergence herbicides were more effective than post-emergence herbicides, which had caused stress on plant growth. In Expt. II, different levels of herbicides were compared on weed control, growth, yield and quality of two gladiolus cultivars, viz., 'Magma' and 'Nova Zambla'. Pre-emergence herbicides included Stomp and Dual Gold, which were applied at 3.1 mL L^{-1}, 6.2 mL L^{-1} and 9.4 mL L^{-1}. While post-emergence herbicides included Paraquat and Round-Up, which were applied at 6.2 mL L^{-1}, 9.4 mL L^{-1} and 12.5 mL L^{-1} along with control (no herbicide) application. Both experiments were laid out according to Randomized Complete Block Design (RCBD) with factorial arrangements having three replications and 20 corms were planted in each replication. In Expt. I, significantly low weed density, better growth, and flowering characters were obtained with pre-emergence herbicide, viz. Stomp @ 5 mL L^{-1} application. Weed density was minimum in pre-emergence herbicides treated plots, while maximum in untreated (control) plots. Paraquat also performed well but caused stress on plants in plots where post-emergence herbicides were applied. However, corm weight, corm diameter and number of

cormels per clump were maximum in plots where no herbicide was applied. In Expt. II, a total of 10 weeds were identified and pre-emergence herbicide, Pendimethalin, showed the best results by controlling all weeds except *Stellaria media* followed by Glyphosate, which best controlled *Chenopodium album, Poa annua, Melilotus indica, Oxalis corniculata, Conyza stricta,* and *Coronopus didymus.* For best quality growth and yield, Pendimethalin reduced weed competition having minimal effect on plant growth and pre-emergence herbicides may be used by growers for controlling weeds in gladiolus fields and lower labor cost without hurting growth and yield of gladiolus.

STUDY OF THE RESPONSES OF ROADSIDE VEGETATION TO VEHICULAR EXHAUST POLLUTION- A PHYSIOCHEMICAL APPRAISAL

Sumreen Anjum*[1], Mubeen Sarwar[2], Mumtaz Hussain[1], and Hina Batool[1]

[1] Department of Botany, University of Agriculture, Faisalabad, (38040), Pakistan.
[2] Institute of Agricultural Sciences, University of the Punjab, Lahore, (54590), Pakistan.
*Email: sumreen38@gmail.com

ABSTRACT

The focus of the present study was to evaluate the effects of traffic pollutants on roadside vegetation. The most common roadside plant species i.e. *Cenchrus cilliaris*, *Cynodon dactylon*, *Datura alba*, *Parthenium hysterophorus* and *Xanthium strumarium* growing along two busy roads i.e. Faisalabad to Okara (FOR) and Okara to Lahore (N-5) in Punjab, Pakistan, were selected for the study. Control samples of selected plants were collected from 50m away from roads. Photosynthetic pigments, gas exchange attributes, total free amino acids, total soluble proteins, and total antioxidant activity were measured. Results revealed that chlorophyll a, b, total chlorophyll, and carotenoids contents were significantly lower in roadside plants than control plants. Photosynthetic rate, transpiration rates, and stomatal conductance were also lower in roadside plants than control site plants. The average decrease in the photosynthetic rate of *C. cilliaris*, *C. dactylon*, *D. alba*, *P. hysterophorus*, and *X. strumarium* was 37.21%, 35.89%, 41.64%, 31.26% and 27.79% along FOR and 41.90%, 37.42%, 44.83%, 32.48% and 28.32% along N-5 road, respectively. The decreased photosynthesis in roadside plants resulted in more substomatal CO_2 concentration and higher water use efficiency. The least total soluble proteins and higher free amino acid content and antioxidant activity were noted and that might be due to the defensive response of plants to the traffic pollutants. The significant correlations between traffic density and various plant attributes imply that the impact was directly caused by vehicular emissions. Among plants, *D. alba* was found to be most affected by vehicular pollutants. While *P. hysterophorus* and *X. strumarium* showed the least variation in all parameters compared to control. Hence, the results suggest *P. hysterophorus* and *X. strumarium* are more resistant to vehicular pollution than *D. alba, C. cilliaris,* and *C. dactylon*. These would be a good choice as phytoremediator of vehicular pollutants, whereas, *D. alba* could be used for biomonitoring purpose.

EVALUATION OF HOUSEHOLD FOOD SECURITY IN PERI-URBAN AREAS OF GILGIT CITY

Sadat sher khan[1], Sobia Rehman, and ***Saleem Rasheed**

[1]Karakoram International University, Department of Agriculture and Food Technology
*Email: saleem.rasheed345@gmail.com

ABSTRACT

Peri-urban household food security is gradually being recognized as a developmental challenge in the peri-urban areas of Gilgit-Baltistan. The increase in the prices of food and high unemployment in peri-urban areas of Gilgit city has made it difficult for the population, particularly for the rural poor, to meet their food requirements. To some extent, it has affected the livelihood patterns of the people staying in urban and peri-urban areas. There are many complex reasons which make households food insecure. The insecurity of food is mainly the driving factor due to the remoteness of the area and lack of transportation facilities to other cities. Socio-economic and political problems are creating food insecurity problems in urban and peri-urban areas. This study aimed to contribute to a better understanding of the nature and dynamics of urban and peri-urban household food security in the peri-urban areas of Gilgit city. The first objective of this study explored peri-urban household livelihoods in Gilgit city, by describing

livelihood patterns, coping strategies and distinguishing between food secure and insecure households, using descriptive statistics. The second objective investigated the determinants of household food security among urban and peri-urban households. Third, the study evaluated the extent of urban and peri-urban household food security, by looking into their nutritional security and how this affects their welfare. Purposive sampling technique was employed to select 62 households in the peri-urban areas of Gilgit city (Jutial and Danyore). A structured questionnaire using multiple household food security measurement tools were used in this study.

IMPACT OF PGPB FROM BOVINE MANURE ON VEGETABLE FARMING FOR A GREEN AND SUSTAINABLE ENVIRONMENT

***Dalaq Aiysha** and Zakia Latif

Department of Microbiology and Molecular Genetics, University of the Punjab, Lahore, Pakistan
*Email: daleq.phd.mmg@pu.edu.pk

ABSTRACT

Plant growth promotion is central dogma in every agricultural practice related to fertilizer development and use. A complete randomized block designed study was conducted using isolated bacterial strains of bovine manure for plant growth promotion in the turnip. The isolated strains were *Brevibacillus parabrevis* (MK493196), *Stenotrophomonas pavanii* (MK488056), *Stenotrophomonas maltophilia* (MK489413), *Achromobacter spanius* (MK487768), *Achromobacter deleyi* (MK487818), *Achromobacter piechaudii* (MK493193), *Achromobacter xylosoxidans* (MK493195), *Achromobacter kerstersii* (MK493305) and *Pseudomonas hibiscicola* (MK493407). Five treatments as, positive control (manure mixed soil), three combinations of isolated bacterial strains as a cocktail for experimental purpose and negative control (no fertilizer) were designed for testing the aforementioned ability of bovine manure isolates. Treated seeds were sown, harvested after sixty days and statistically analyzed for plant growth promotion parameters. The highest yield 32.6 Kg was observed in bacterial mix.2 as compared to rest other bacterial mixtures whereas, positive control and negative control have yield 13.3 Kg and 8.4 Kg, respectively. Statistical evaluation using Duncan's Multiple Regression Analysis (DMRT) revealed a significant ($p < 0.05$) effect of bacterial treatment for plant growth promotion. This study affirms that isolated bacterial strains have the potentials to be used as plant growth-promoting biofertilizers for sustainable agriculture.

URBAN AND PERI-URBAN AGRICULTURE AS A STRIP TO FOOD SANCTUARY IN LAHORE

Faiza Mazhar

Government College University Faisalabad, Pakistan
Email: faizamzhr@yahoo.com

ABSTRACT

Assimilated awareness in the node between sustainability and food sanctuary has directed to increasing dialogues on the use of food control values in agricultural practice. As an outcome of the conversion of the urban and socioeconomic countryside in Lahore, urban and peri-urban agriculture has been flaunted as a prospective reaction to growing food uncertainty. Beyond the essential idea that the urban landscape is unfit for food production, literature has demonstrated that urban households have embedded urban and peri-urban agriculture into their occupations. Irrespective, institutional activities governing the exercise persist unsure of the practice, getting to question the capability of families to exploit the paybacks of the practice. This assessment highlights that failure to comprise of all patrons weakens urban and peri-urban agriculture, subsequently leading to discriminating food uncertainty and the use of unsanctionable practices. By investigating the administrative economy of food, we hope to motivate debate focused on food control within and urban spaces and outside.

BIOCHAR AND MINERAL FERTILIZER ENHANCED RADISH (*RAPHANUS RAPHANISTRUM*) BIOMASS, SOIL ORGANIC CARBON AND AVAILABLE NUTRIENTS IN ALKALINE CALCAREOUS SOIL

Muhammad Riaz[1*], Muhammad Adnan[1], Iqra Rehman[1], Sajid Ali[2], Rashid Mahmood[2], Muhammad Saleem Arif[1], and Tahira Yasmeen[1]

[1]Department of Environmental Sciences & Engineering, Government College University Faisalabad, Allama Iqbal Road, Pakistan
[2]Institute of Agricultural Sciences, The University of Punjab Lahore, Pakistan
*Email: mr548@ymail.com

ABSTRACT

Biochar is recalcitrant carbon (C) rich material developed from pyrolyzing the biomass waste under no or limited supply of oxygen. Biochar generally imparts multiple benefits to soil-plant systems; however, these benefits vary across soils and climatic conditions and depend on feedstock type and pyrolysis conditions. In the light of this discussion, a pot experiment was used to investigate the effects of corncob-derived biochar on radish (*Raphanus raphanistrum*) biomass production and soil biochemical properties in the presence of chemical fertilizer in nutrient-poor alkaline aridisol. Biochar was applied at 0, 1.5 and 3% w/w basis whereas recommended chemical fertilizer (RCF) was applied at 0, 50 and 100% RCF rates following completely randomized design (CRD) using three replicates per treatment. The experiment was conducted for 12 weeks and changes in plant parameters and soil biochemical properties were recorded. Biochar and mineral fertilizer enhanced radish biomass and significantly improved soil biochemical and nutrient properties including soil mineral N, phosphorus and potassium contents whereas mineralizable C was the lowest at higher biochar application rates. The results also demonstrated that biochar increased nutrient use efficiency of chemical fertilizer. We concluded that biochar has the potential of increasing soil fertility, organic C contents and plant biomass in organic matter deficient alkaline soils of arid and semi-arid regions.

OLIVE GROWING IN THE WORLD: CURRENT SITUATION AND FUTURE PERSPECTIVES

Kostas Chartzoulakis

Irrigation and Olive Growing Expert, Ex-director of the Institute for Olive Tree & Subtropical Plants, ZenAgroPC, 4 Irinis Str., 73400 Kissamos, Greece
Email: kchartz@nagref-cha.gr

ABSTRACT

Olive is an indigenous tree of the Mediterranean Basin, where it is grown for more than 5000-6000 years. After the 2nd World War, the olive growing is expanding to other regions out of the Mediterranean basin, with more or less suitable climatic conditions in Asia, Latin America, California, and South Africa. Its cultivation is increased by 4-fold since 1960, and today olive is cultivated in more than 45 countries, covering more than 10.6 million ha with a total production of more than 3 million tons/year of olive oil and 2.9 million tons/year of table olives. Some countries promote ambitious projects to create new plantations for a) to cover the increasing internal demand (Algeria, Morocco, Albania, Croatia, Australia, California, China) and b) to increase their share in the international markets (Spain, Turkey, Egypt, Tunisia, Syria). During the last 25 years (1992-2017) the olive oil production increased by 77,5%, while the same period the olive oil consumption increased by 76,7% (IOC). The potential of olive growing worldwide is increasing due to its multifunctional functions. It contributes to economic development (olive products, olive industry, new jobs), has a positive impact on the environment (forest, protect from erosion, no susceptible to fires) and has an important social role (keep the population in marginal and mountainous areas, especially the young people). The increasing scarcity of water in many countries, the relatively low water requirements of the olive tree and the rapid increase in demand for olive products, due to their benefits in human

health, will contribute to even more rapid growth in olive production and trade in the coming decades. However, key issues for a successful olive industry, especially in new areas, is the detailed study of climatic conditions of each area, the use of proper genetic material, the application of proper cultivation practices and the capacity building of the personnel.

DRYING OLIVE LEAF FOR GREEN TEA BUSINESS: ENTREPRENEURSHIP IN HORTICULTURE

Muhammad Nafees[1], ***Muhammad Samsam Raza[1],** Imran Khalid[2], Ayesha Siddiqa[1], Kashif Raza[1]

[1]Department of Horticulture, Islamia University of Bahawalpur
[2]University College of Agriculture and Environmental Sciences, Islamia University of Bahawalpur
Email: samsam.raza@gmail.com

ABSTRACT

The olive tree (*Olea europaea L.*) have been used widely as a medicinal plant from ancient time in Mediterranean and European countries like Spain, Italy, France, Morocco, and Tunisia. Its fruit, oil, and leaves have been used in the daily diet throughout the world. Olive fruit, 100 g in weight contains 115 kcal, 6.3g Carbs, and 3.2 g fiber. It also contains Iron, which is an important part of hemoglobin, Vitamin E a good source of antioxidants and Calcium which is important for bone health. Olive leaves contain beneficial compounds like Oleuropein 0.88±0.09 mmol/L which is a strong antioxidant, Tyrosol 0.35±0.05 mmol/L, which helps in the prevention of heart diseases. Oleanolic acid and antioxidants prevent lever damage and inflammation and Quercetin lowers blood pressure and improves cardiac health. Olive leaf dried power can be used as a tea to attain the mentioned health benefits and can be commercialized. Keeping in consideration of olive nutritional study, In the Agri-Business Exhibition in the Islamia University of Bahawalpur in 2017, olive tea from olive leaves was prepared and displayed in the exhibition. The fresh olive healthy leaves of variety arbequina were collected from a farm at Chak 13BC Bahawalpur and rinsed in distilled water to remove dust. Leaves were kept in shade for overnight. They lose their medicinal value if dried under the sun, therefore, they were dried in the dry oven in the laboratory of soil science, department of Soil Science at 65ºC for 48 hours. Ground and packed in tea bags, tagged and displayed. The taste and quality of tea were surveyed with a good result as 30/31 positives feedbacks from university students, faculty and visitors. This is a good idea for horticulture business if olive leaf green tea is produced and to market in Pakistan. Nutritional value and other drying methods need to be highlighted in the future to promote this business in Bahawalpur.

OLIVE PRODUCTION AND VALUE CHAIN DEVELOPMENT INITIATIVES IN PUNJAB

Muhammad Ramzan Anser*, Muhammad Azhar Iqbal, and Muhammad Ashraf Sumrah
Barani Agricultural Research Institute, Chakwal
*Email: ramzan.anser@gmail.com

ABSTRACT

Olive is being cultivated as a commercial crop on marginal lands in Pothwar. Punjab Agriculture Department been providing various incentives and has facilitated more than 749 farmers to plant 1069545 true to type olive saplings on 7939 acres. Some of the earlier olive plantations made under the PIDSA project has also started bearing fruit. During the last harvest, the estimated olive crop was 125 tons. This harvest is expected to increase exponentially at a rate of 30% per annum during the next 5 to 7 years. On the value chain side, there are few players; however, the olive value chain is virtually non-existent. Recognizing the national importance and potential of olives for profitable rehabilitation of marginal lands as a climate change adaptation intervention and the need for value chain development, the department initiated a consultative process. During the last eleven sessions since June 2016, several value chain development initiatives viz a viz olive oil standards, development of SOPs for certified olive nursery development, Installation of a state of the art olive extraction unit, strengthening olive R&D in Punjab have been taken on the demand of the private sector. This paper shall share the recent developments in Punjab for olive

promotion and value chain development with the strategy the department adopted to ensure private sector inclusion in the process.

PROSPECTS OF RAPID AND NON-DESTRUCTIVE TECHNIQUES IN OLIVE OIL PROCESSING INDUSTRIES

Muhammad Haseeb Ahmad

Institute of Home and Food Sciences, Faculty of Life Sciences, Government College University, Faisalabad, Pakistan
E.mail: haseeb.ahmad@gcuf.edu.pk

ABSTRACT

Olive oil is considered to be an essential part of the diet due to its higher nutritional profile and disease prevention properties. However, it is one of the costliest edible oil whose quality and safety must be ensured to provide the consumer with authentic and pure oil. As it is very costly, therefore, fraudulent practices are prevailing especially in developing countries like Pakistan which can be mitigated by the use of smart, rapid and nondestructive technologies. There are various rapid and non-invasive techniques in which fluorescence spectroscopy has been considered better as compared to other similar methodologies due to its sensitivity and accuracy. The fluorophores (tocopherol, polyphenols, and chlorophyll, etc.) in the different grades of olive oil give peaks in specific excitation and emission wavelengths which can be used for classification into pomace, virgin, and extra virgin oil. The spectral data can not only be used to predict the different parameters for compositional analysis but also employed for detection of adulterants, determination of geographical origin as well as the authenticity of the different grades of olive oil using various chemometric tools for data analysis. Different compound develops during the processing of olive oils due to the heat treatment which can also be monitored out of spectral fingerprints using different multivariate data analysis like PCA and PLSR models. Hence, it can be concluded that fluorescence spectroscopy coupled with multivariate data analysis is a fast and non-destructive tool for characterization and to combat the fraudulent practices in olive oil processing industries.

EFFECT OF DIFFERENT AGRO-WASTES, CASING MATERIALS AND SUPPLEMENTS ON THE GROWTH, YIELD, AND NUTRITION OF MILKY MUSHROOM (*CALOCYBE INDICA*)

Hasan Sardar[*], Muhammad Akbar Anjum, Aamir Nawaz, and Safina Naz

Department of Horticulture, Bahauddin Zakariya University, Multan, Pakistan
*Email: hasan.sardar@bzu.edu.pk

ABSTRACT

Agricultural waste disposal is one of the main concerns in today's world which can cause environmental pollution. The utilization of agro-waste materials to grow mushrooms is an eco-friendly method to reduce pollution. Therefore, various agricultural waste materials such as wheat straw, rice straw, and cotton waste were utilized for the production of milky mushroom. The results indicated that wheat straw is the best substrate for the cultivation of milky mushroom. The highest yield, biological efficiency, number of fruiting bodies, the maximum diameter of pileus and stalk length, protein contents, phosphorous and potassium contents were observed on the wheat straw substrate. Peat moss, loam soil and spent mushroom substrate were used as casing materials. Among the casing materials used, the highest yield and biological efficiency were observed on peat moss casing material. The results also indicated that the addition of supplements with the substrate improved yield and yield contributing

characteristics. Among the tested supplements (wheat bran and rice bran), wheat bran was the better supplement for the wheat straw substrate to cultivate milky white mushroom.

EFFECT OF DIFFERENT LEVELS OF FUNGICIDE AND STORAGE INTERVALS ON *IN VITRO* SYNTHETIC SEED PRODUCTION OF POTATO

Tahira Kalsoom, **Ishfaq Ahmed Hafiz**, Touqeer Ahmad and *Nadeem Akhtar Abbasi

Department of Horticulture, Pir Mehr Ali Shah Arid Agriculture University Rawalpindi, Pakistan
*Email: nadeemabbasi65@yahoo.com

ABSTRACT

The research work is on the way to develop artificial seed in tissue culture labs as an alternative to the nature of the seed. Shoot tips obtained from *in vitro* grown plantlets of potato were encapsulated in sodium alginate mixed with different concentrations of fungicides to produce synthetic seeds. Sodium alginate mixed with 150 mg l^{-1} of fungicide was found most suitable and considered as an optimum dose for the formation of ideal beads and protection from contamination. Furthermore, theses prepared uni nodal cuttings coated with sodium alginate mixed with optimum concentration of fungicide were placed for different storage intervals to evaluate maximum percent survival for the conservation of synthetic seeds. This study leads to a conclusion that encapsulated unimodal cuttings could be stored at a temperature of 4 °C up to 45 days with a survival rate of 63.33 %. After 60 days of storage, about 43.03 % encapsulated shoot tips converted into plantlets showing poor viability percentage.

SEED PRIMING WITH SELENIUM IMPROVES GROWTH OF *CORIANDRUM SATIVUM* THROUGH MODULATION OF PHOTOSYNTHETIC AND ANTIOXIDATIVE SYSTEM

***Rehana Sardar**[1], Shakil Ahmed[1], Nasim Ahmad Yasin[2]

[1]Department of Botany, University of the Punjab
[2]University Gardens, University of the Punjab
*Email: rehana.phd.botany@pu.edu.pk

ABSTRACT

Selenium (Se) improves the growth of plants subjected to various stresses. The current study was performed to evaluate the cadmium (Cd) stress alleviation potential of Se in *Coriandrum sativum.* Plants affected by Cd toxicity (2.5 Mm as $CdCl_2$) showed decreased root length, shoot length, besides the lower level of photosynthetic pigments and soluble protein contents. Moreover, Cd stress reduced chlorophyll content (Chl, Chl*a*, and Chl*b*), photosynthetic activity and net photosynthetic rate (Pn). Similarly, Cd toxicity increased electrolyte leakage (EL) in addition to the biosynthesis of reactive oxygen species (ROS) and malondialdehyde (MDA) contents. Pre-sowing seed treatment (seeds priming) with Se (0, 5, 10 µm/L as Na_2SeO_3) for 15 hours reduced Cd toxicity causing oxidative stress and improved root and shoot growth in developed seedlings. Significantly reduced Cd concentrations were observed in root and shoot tissues of Se treated *C. sativum* plants. Nevertheless, Se augmented biosynthesis of soluble protein and photosynthetic contents. Furthermore, the activity of stress-responsive enzymes such as *Superoxide dismutase* (SOD) and catalase (CAT) was improved in Se treated plants. These results advocate that seed priming with Se improves plant tolerance and mitigates Cd toxicity by modulation of photosynthetic and enzymatic activity in *C. sativum* plants.

EVALUATION OF HEAT TOLERANCE POTENTIAL IN BELL PEPPER GENOTYPES UNDER HEAT STRESS

Muhammad Imran Lodhi[1], C.M. Ayyub[1], *__Mujahid Ali__[2], Zahoor Hussain[2], and Bilal Akram[2]

[1]Institute of Horticultural Sciences, University of Agriculture, Faisalabad
[2]Department of Horticulture, College of Agriculture, University of Sargodha, Sargodha
*Email: mujahidali2263@gmail.com

ABSTRACT

Summer vegetables are severely affected by high temperatures above threshold level which ultimately results in serious losses of their production. To cope with these economic losses different strategies had been adopted. The present study was designed to screen out heat-tolerant genotypes of bell pepper. For this purpose, an experiment was conducted in a plant growth room in the Institute of Horticultural Sciences, University of Agriculture Faisalabad. Ten genotypes of bell pepper (C1G3, C3G5, C7G4, V6G4, C2-E, C5G4, C43-D, C4G3, C43-A, C2G3) were brought from Ayyub Agriculture Research Institute Faisalabad (AARI) and were grown. Heat treatment up to 40℃ was given. Data regarding agronomic traits (number of leaves, root length, shoot length, seedling dry weight, seedling fresh weight, electrolyte leakage, chlorophyll contents) and leaf water-related attributes (leaf water potential, leaf turgor potential, leaf osmotic potential, relative water contents) was collected. Proper statistical designs were used to analyze the data. The research findings proved that heat stress significantly affected physiology, morphology, and mechanisms of screened genotypes which followed the order for the heat stress as C5G4, C1G3, C2G3, C43-A, C3G5, C43-D, V6G4, C4G3, C43-A, and C2G3, respectively. The collective effects of all these changes under high-temperature stress resulted in poor plant growth and productivity. Based on physical and physiological parameters, genotypes C5G4, C1G3 and C43-A were among the most tolerant group and the most resistant genotypes.

BIOLOGICAL CONTROL OF CORYNESPORA LEAF FALL DISEASE (CLFD) IN THE RUBBER TREE BY *BACILLUS AMYLOLIQUEFACIENS* T3

Nguyen Bao Quoc

Research Institute for Biotechnology and Environment, Nong Lam University, Ho Chi Minh City, Vietnam
Email: baoquoc@hcmuaf.edu.vn

ABSTRACT

Corynespora cassiicola is the causal agent of Corynespora Leaf Fall Disease (CLFD) resulting in the yield reduction of natural rubber cultivation. Currently, the use of antagonism bacteria against the fungal pathogenicity has been considered as one of the environmentally friendly approaches to control plant diseases. Herein, identification of the gene encoding cassiicolin (cas) known as an important fungal effector involved in the CLFD was conducted and the fungal pathogenicity of *C. cassiicola* isolates containing cas gene was evaluated on the detached leaves. Additionally, the biological control of *Bacillus amyloliquefaciens* (T3) against CLFD was also carried out to understand the expression profile of cassicolin toxin. The results indicated that 6 of 40 *C. cassiicola* isolates contained cassiicolin gene encoding cas2 and the other 24 isolates were classified as cas0 due to no detection of cas genes. For controlling CLFD in-vitro and in-planta, *Bacillus amyloliquefaciens* (T3) showed significant inhibition zones and reduction of infected areas in the detached leaves respectively. Interestingly, the expression of gene encoding cassiicolin 2 (cas2) was down-regulated under the treatment with *Bacillus amyloliquefaciens* (T3) in contrast to the up-regulation of genes encoding bacterial lipopeptides such as iturin, fengycin known as antifungal and antibacterial agents. The findings obtained in this study confirmed the important role of lipopeptides secreted by *Bacillus amyloliquefaciens* in the control of CLFD in the rubber trees.

MOUNTAIN PAPAYA; (*VASCONCELLEA CUNDINAMARCENSIS*), A POTENTIAL RESOURCE FOR THE IMPROVEMENT OF *CARICA PAPAYA* FOR PAPAYA RINGSPOT VIRUS RESISTANCE AND FUNCTIONAL FOODS

N S. Kottearachchi[1], W.A.D.L.R**.** Warnakula[1], B. N. Rajapakshe[1], and A. Chandrasekhara[2]

[1]Department of Biotechnology, Wayamba University of Sri Lanka, Makandura, Gonawila (60170), Sri Lanka
[2]Department of Applied Nutrition, Wayamba University of Sri Lanka, Makandura, Gonawila (60170), Sri Lanka
Email: kottearachchins@yahoo.com

ABSTRACT

Vasconsellea cundinamarcensis is generally referred to as the mountain papaya due to its morphological similarity to papaya and ecological preference to high altitudes. In Sri Lanka, this plant has not been exploited at commercial levels, although the plant is reported to be possessing important agronomic and industrially valuable traits. The objective of this research was to expose the genetic diversity of mountain papaya in comparison with *Carica papaya*, evaluate potential resistance for papaya ringspot virus and reveal its' superior antioxidant properties. In this regard, SSR and ISSR marker-based characterization and barcoding analysis were performed in comparison with *Carica papaya*. Mountain papaya was inoculated with PRSV and symptoms were evaluated morphologically and using an RTPCR based method. RTPCR amplicon was sequenced to confirm the identity of PRSV and the functional ability of the cDNA was examined using the SAND family protein gene (*Sand*) as the reference gene in the comparison. Phenolic content and antioxidant activities of matured unripe fruit, peel, seeds and latex extracts of mountain papaya and two popular cultivars of *Carica papaya*, were compared. Results of the DNA markers revealed that mountain papaya and *Carica papaya* cultivars are genetically distantly related. Also, the taxonomy of the mountain papaya was declared by DNA barcodes and the results proved that mountain papaya belongs to *Vasconsellea cundinamarcensis.* Visual symptoms related to PRSV did not appear in mountain papaya even seven weeks after the inoculation of PRSV and RTPCR also did not produce any of the expected amplification. According to this study, mountain papaya is resistant to PRSV in the geographic region where the experiment was conducted. The results of the antioxidant assay revealed that mountain papaya is a better source of natural antioxidants than *Carica papaya* cultivars, although it has low food value. The finding of this research would be useful as there are no PRSV resistant germplasms reported for *Carica papaya* in the world. Also to exploit the use of mountain papaya as a nutraceutical and a functional food ingredient, further research on mountain papaya fruit-based product development by value addition needs to be focused.

APHID BORNE VIRUSES IN POTATO WITH PARTICULAR INTEREST TO *PVY* AND *PLRV*

Sabrine NAHDI[1], Wafa khaled[2], Arij Bedoui[2], Rabha Souissi[2], and Sonia Bouhachem[2]

[1] Higher School of Agriculture of Kef (ESAK),
[2] National Institute of Agriculture Research of Tunisia (INRAT)
Email: nehdimah@yahoo.fr

ABSTRACT

In Seed Potato Production, four viruses are the most important in the field: Potato virus Y (PVY), Potato virus S (PVS), Potato virus M (PVM) are non-persistent viruses and Potato leaf roll virus (PLRV) a persistent one. Aphids of several species are responsible for the spreading of these viruses from plant to plant. The purpose of this study is to understand some epidemiological aspects of the most important potato viruses. Surveys from 2011 to 2019, showed that potato crops in many regions of Tunisia were infected by PVY (two strains PVY O, PVY N) and PLRV which were consistently the most prevalent and harmful ones then followed by PVS, PVM, and PVX. Four aphid species: Myzus persicae, Macrosiphum euphorbiae, Aphis fabae, and Aphis gossypii were the most predominant on potatoes; they can transmit PLRV and PVY. Furthermore, many aphids were also captured in yellow water traps and suction trap (more than 200 species) and can carry PVY and spread it more than 2 hours. The vectors of PVY are optimally infective when they have fed for only a few minutes on the infected plants after a

period of fasting. After infection feeding, infectivity is very rapidly lost when the vectors feed on healthy plants, but while it remains a single vector can infect several plants. The transmission efficiency of PVY and PLRV by potato colonizing and non-colonizing aphid species were assessed. Serological techniques were performed to detect the presence of PVY and PLRV in the most abundant species of aphids. They revealed that Aphis spiraecola has the highest concentration of PVY virus particles while the highest potential for PLRV transmission was recorded for M. persicae and M. euphorbiae, at 90 and 80% respectively. Managing the aphids appears important to control the spreading of the potato viruses. More attention should be given for breeding virus-resistant cultivars that would lead to decreased insecticide use and thus promote more environment-friendly strategies for control.

CONTENDING CHARCOAL ROT DISEASE OF MUNG BEAN BY EMPLOYING BIOCONTROL *OCHROBACTRUM CICERI* AND ZINC

Amna Shoaib* and Haider Ali
Institute of Agricultural Sciences, University of the Punjab, Lahore, Pakistan
*Email: amna.iags@pu.edu.pk

ABSTRACT

Role of rhizobacteria and zinc (Zn) was investigated in the management of charcoal rot disease in mung bean [Vigna radiata (L.) Wilczek] caused by *Macrophomina phaseolina* (Tassi) Goid. In vitro, screening tests with eight rhizobacteria [Bacillus subtilis (FCBP-0324), Bacillus subtilis (FCBP-0189), *Rhizobacter daucus* (FCBP- 0450), *Azospirillum brasilense* (FCBP-0025), *Azospirillum lipoferum* (FCBP-0022), *Pseudomonas malophilia* (FCBP-0099), *Pseudomonas fluorescence* (FCBP-0083) and *Ochrobactrum ciceri* (FCBP-0727)] were conducted against *M. phaseolina* and FCBP-0727 were found as the most effective biocontrol agent. Molecular analyses of 16S rDNA combined with cultural and biochemical analyses confirmed FCBP-0727 identification (GeneBank Accession No. LC415039). Cell-free culture filtrate (CFCF) and cell culture (CC) of *O. ciceri* were separated and antifungal trials of both substrates indicated inhibition in mycelial growth and suppression in sclerotia formation, although the CFCF appeared to be more destructive against the pathogen. Ethyl-acetate and chloroform extracts of bacterial secondary metabolites completely halted the growth of *M. phaseolina*. The GC- MS analysis of CFCF of chloroform extract proved to be rich sources of bioactive fungicide like phthalates, adipic acid, propanoic acid, and linoleic acid. Likewise, CFCF of ethyl acetate also exhibited important organic compounds like phthalates, diisopropyl glycol, and octasiloxan. Pot experiment revealed that soil inoculation with *O. ciceri* in combination with Zn (2.5 ppm) protected mung bean plants against *M. phaseolina* through improving photosynthetic pigment, total protein content, and activities of antioxidant enzymes (catalase, peroxidase, and polyphenol oxidase). The present study will open new vistas for biological management of charcoal rot disease of mung bean using a combination of rhizobacteria and Zn.

MOLECULAR GENETIC VARIABILITY OF THE CHESTNUT BLIGHT FUNGUS (CRYPHONECTRIA PARASITICA) IN SOUTH TYROL (ITALY) AND THE INCIDENCE OF HYPOVIRUS INFECTION

Farooq Ahmad* and Sanja Baric

Free University of Bozen-Bolzano, 39100, Bolzano, Italy
Email: fahmad@unibz.it

ABSTRACT

Chestnut trees (Castanea spp.) grow in several countries of Asia, America, and Europe. One of their most important pathogens is the fungus Cryphonectria parasitica, which causes chestnut blight. The pathogen has devastated American chestnut (Castanea dentata) with a mortality rate of 99%. Although European chestnut (Castanea sativa) is also affected by the pathogen, it continues to remain an economically important species, mainly because of the occurrence of a group of mycoviruses that decreases the virulence of the fungus. Hypovirulence can naturally spread

through hyphal anastomosis among vegetatively compatible (VC) strains and hence is widely used as a biocontrol strategy. High genetic variability of C. parasitica, especially the occurrence of different VC types as well as the presence of both mating types in a population can hamper the success of biocontrol. In this study, the molecular genetic characterization of C. parasitica was performed in the sub-populations of South Tyrol (Northern Italy). Extensive sampling was done from several chestnut farms and one forest population of South Tyrol and C. parasitica was isolated from the diseased samples. Genetic variability was assessed using vegetative incompatibility (VIC) loci. Also, mating type ratios were determined and DNA sequencing of amplicons of the internal transcribed spacer region (ITS) was performed. A simple protocol based on an antigen-antibody reaction was implemented to determine the presence-absence of double-stranded viral DNA, which is characteristic of the Cryphonectria hypovirus 1. Results showed a high degree of genetic variability of C. parasitica in South Tyrol based on VIC loci, mating-type loci and ITS. This study will contribute to a better understanding of the genetic variability of C. parasitica and its mycovirus, and help optimizing biocontrol strategies in the region. The immunology-based method of hypovirus detection could further be transformed into a commercial test kit that would allow detecting the presence of fungal viruses in the field.

FALL ARMYWORM, *SPODOPTERA FRUGIPERDA* (LEPIDOPTERA: NOCTUIDAE) IMPACTS AND IMPLICATIONS

***Shahbaz Ahmad**, Muhammad Arslan Ibrahim, and Muhammad Zahid Anwar

Institute of Agricultural Sciences, University of the Punjab Lahore, 545900
*Email: Shahbaz.iags@pu.edu.pk

ABSTRACT

The fall armyworm, *Spodoptera frugiperda* (J. E. Smith), is a voracious lepidopteran pest preferably feeds on the leaves, stems and reproductive parts of almost 350 species of host plants, responsible to cause economic damage to nearly all-important cash crops including maize, rice, sorghum, sugarcane, cotton, wheat and most of the vegetables. Originally pest is associated with the Americas and has been problematic there for several years. In African countries it was first reported in 2016 where it caused vast devastation to maize crop; posed a threat to European countries as well being a quarantine pest and later on, in 2018, the presence of *S. frugiperda* was also recorded in the Indian subcontinent. Since then it has invaded Bangladesh, Myanmar, China, Sri Lanka, Thailand and this time to Pakistan. Ability to reproduce at a much faster pace, availability of host, migration and diverse host range let this genius pest to survive in various circumstances. A survey was conducted to examine the presence and absence of FAW in different localities of Lahore, Pakistan. A total of 160 cornfields were inspected from north to south Lahore and found FAW at 5 locations. The monitoring was carried out to assess whorls of maize for egg masses, larvae, damaging signs including windowing, lumps of frass, shot holes, ragged and torn leaves. For confirmation, the collected larvae were brought to IPM Lab, University of the Punjab and reared. Larval characteristics; four spots on posterior end and an inverted Y shaped marking on head, were exactly matched with that of *S. frugiperda*.

MONITORING RESISTANCE TO INSECTICIDES IN THE FRUIT FLY, *BACTROCERA DORSALIS*, IN PUNJAB, PAKISTAN

Hafiz Azhar Ali Khan

Institute of Agricultural Sciences, University of the Punjab, Lahore.
Email: azhar.iags@pu.edu.pk

ABSTRACT

The use of insecticides has been a primary tool to manage *Bactrocera dorsalis* in Pakistan; however, recent reports of field control failures necessitate mapping out the insecticide resistance problem. Therefore, eight field strains from Pakistan were evaluated for their resistance against trichlorfon and spinosad. Compared with a reference strain, six field strains showed high levels of resistance to trichlorfon, while two field strains expressed intermediate resistance. In the case of spinosad, five field strains fell in the susceptible range, whereas, the rest of the strains

represented minor resistance. Correlation analysis between LD_{50} values of trichlorfon and spinosad of all the field strains revealed a non-significant association, suggesting the possibility of a lack of cross-resistance between both insecticides. Synergism bioassays implementing *S, S, S*-tributylphosphorotrithioate (DEF) and piperonyl butoxide (PBO) revealed that the LD_{50} values of trichlorfon in the presence of either DEF or PBO in seven field strains were significantly reduced. However, DEF and PBO had a non-significant effect on synergizing spinosad toxicity. The results revealed resistance to trichlorfon in field strains of *B. dorsalis*, which might be metabolic-based. Absence or minor resistance to spinosad and lack of cross-resistance to trichlorfon, suggest that spinosad could be a potential candidate for managing *B. dorsalis*.

SONOLYTIC OZONATION TECHNIQUE IN DECONTAMINATES FRESH CUCUMBER, WITHOUT IMPACTING ITS QUALITY

***Zarghona Siddique**[1], Aman Ullah Malik[1], Raheel Anwar[1], Muhammad Inam-ur-Raheem[2], and Muhammad Rafique Asi[3]

[1]Postharvest Research and Training Centre, Institute of Horticultural Sciences, University of Agriculture Faisalabad,
[2]Department of Food Science and Technology, University of Agriculture, Faisalabad
[3]Nuclear Institute for Agriculture and Biology, Faisalabad
*Email: zarghonachaudhary@yahoo.com

ABSTRACT

Microbial and chemical contamination of fresh fruits and vegetables poses serious risks to human health. Fresh fruits and vegetables can be potentially contaminated during production and postharvest supply chain due to inappropriate practices and negligence of workers. This study was aimed at testing an eco-friendly hybrid technology for microbial and chemical decontamination of fresh cucumbers at the kitchen level. Combined treatment of ozone + ultrasound was applied with different time levels (5, 10 and 15 min). Different food safety and quality parameters were studied. Microbial contaminants (Log 10 CFU/g) were studied by plate count method and pesticide residues (thiamethoxam, imidacloprid, acetamiprid, thiacloprid, and carbendazim) were estimated by using HPLC. A combined treatment of ozone + ultrasound for 10-minute reduced total plate counts 1.74 Log 10 CFU/g along with slight to no effect on quality parameters (TSS, TA, ascorbic acid content, firmness), up to two weeks under refrigerator storage conditions (5±2◦C). Best performing treatment was selected to detect sonolytic ozonation treatment impact on chemical residues reduction. Treated fruits were compared with control and residues reduction of ˜45% in Imedacloprid, ˜28% in Acetamiprid and ˜16% in Carbendazim was observed. In conclusion, the sonolytic ozonation technique was effective in microbial as well as pesticide contaminant reduction in cucumber.

BIOLOGICAL CONTROL OF BACTERIAL BLIGHT OF POMEGRANATE THROUGH PLANT EXTRACTS AND ESSENTIAL OILS

***Muhammad Abid**[1*], Shehla Gul[1], Sobia Chohan[1], Muhammad Sajid[1], Muhammad Azeem[2], and Rashida Perveen[1],

[1] Department of Plant Pathology, Faculty of Agricultural Sciences and Technology, Bahauddin Zakariya University, 60800 Multan, Pakistan
[2] Department of Chemistry, COMSATS University Islamabad, Abbottabad Campus, Abbottabad 22060, Pakistan
*Email: muhammad.abid@bzu.edu.pk; abiduvb@gmail.com

ABSTRACT

Bacterial blight of pomegranate caused by *Xanthomonas axonopodis* pv. *punicae* is causing severe damage all around the world. In current study plant extracts i.e. Amaltas, eucalyptus, Ulta Ashok, citrus and Bakain, and essential oils of various plants i.e. *Lepidium* spp., Artemisia sp., *Artemisia indica*, *Eucalyptus* sp. and *Conyza* sp. were tested against the pathogen under *in vitro* conditions by agar well diffusion method and on fruit to control the disease. Plant extracts and essential oils were used in three concentrations i.e. 1%, 5% and 10%. Plant extract of

Amaltas sp. proved as the best among all other extracts at all concentrations, while *Lepidium* sp. proved best essential at all concentrations against *X. axonopodis* pv. *punicae*. The efficacy of these plant extracts and essential oils were tested on fruit. The disease severity was recorded as 66.66% when treated with *Amaltas* extract and 33.33% when *Lepidium* sp. oil was applied. Our data expresses that *Amaltas* extract and *Lepidium* sp. oil can be potential biological control and suitable alternate of chemical control.

EXPLOITING THE ANTIFUNGAL POTENTIAL OF LEAF EXTRACT OF *DATURA METEL* FOR MANAGEMENT OF *SCLEROTIUM ROLFII*

[*]**Nadia Jabeen[1],** Arshad Javaid[1], Ejaz Ahmed[2], and Muhammad Zahid Qureshi[3]

[1]School of Botany, Minhaj University Lahore
[1]Institute of Agricultural Sciences, University of the Punjab, Lahore, Pakistan.
[2]Institute of Chemistry, University of the Punjab, Lahore, Pakistan.
[3]Department of Chemistry, GC University, Lahore, Pakistan.
E-mail: drnadia.bot@mul.edu.pk

ABSTRACT

Sclerotium rolfii causes collar rot disease in bell pepper (*Capsicum annuum* L.) and causes significant yield losses. Synthetic fungicides used to combat the problem cause environmental pollution and health hazards. In the present study, an alternative environmental friendly strategy was used to control the pathogen. Methanolic leaf extract of a solanaceous weed *Datura metel* was evaluated for its efficacy in controlling the *in vitro* growth of *S. rolfii.* Extract concentrations ranging from 0.5% to 4.0% significantly controlled fungal growth by 29-88% over control. The study was extended to separate the various constituents of methanolic leaf extract on the bases of their polarity by partitioning the extract with *n*-hexane, chloroform, ethyl acetate, and *n*-butanol. Bioassays with different concentrations of the extract revealed that chloroform fraction was the highest antifungal followed by ethyl acetate fraction causing 36–47% and 5–43% reduction in fungal biomass, respectively. The chloroform fraction was subjected to GC-MS analysis for the identification of possible antifungal constituents in this fraction. A total of 21 compounds were identified in this fraction. The most abundant compound was 1,2-benzene dicarboxylic acid, bis (2-methyl propyl) ester (24.86%) followed by 1-hexacosanol (9.64%), 1-octadecene (8.08%), 2-methyl, 3-phenyl, 2-propenal (6.53%) and 1-Eicosanol (5.09%).

ASSESSMENT OF PARTIAL RESISTANCE IN CARROT AGAINST *ALTERNARIA ALTERNATA* EXTRACTS

***Zill-e-Huma Aftab** and Adeeba Mehboob Qureshi

Institute of Agricultural Sciences, University of the Punjab, Lahore, Pakistan
*Email: huma.iags@pu.edu.pk

ABSTRACT

Partial Resistance was examined in *Daucus carota* against *Alternaria alternata* extracts in field conditions as well as in in-vitro conditions. Five varieties of carrots cultivated in the field were treated with *Alternaria alternata* extracts to examine the Partial resistance / Durable resistance. Based on disease severity and disease incidence durable resistance was examined. Deep red: Origin Thailand (Desi) (V1), Karri red: (Desi) (V3), Hybrid: Pink (treated) (V5) showed strong resistance while Deep red: Origin India (Desi) (V2) and Hybrid: Red (untreated) (V4) showed week resistance towards the *Alternaria alternata* extract. Besides the evaluation of partial resistance in the field, partial resistance in carrot through the in-vitro propagation technique was also assessed. For that purpose, calli were raised from all the varieties of the carrot planted in the field, MS medium with different concentrations were tested for best callogenesis. MS medium with 1.5M NAA and 1M BAP showed excellent callogenesis. Those calli were treated with fungal exudates to screen out the calli resisting the fungal exudates, in the light of results it was concluded that

callus of Deep red: Origin Thailand (Desi) (V1), Karri red: (Desi) (V3) and Hybrid: Pink (treated) (V5) have strong partial resistance while Deep red: Origin India (Desi) (V2) and Hybrid: Red (untreated) (V4) were susceptible to exudates and show week partial resistance against the organic extract of *Alternaria alternata.*

USE OF TETRACYCLINE TO CONTROL CITRUS HUANGLONGBING DISEASE

***Muhammad Kashif**[1], Sarwar Yaqoob[2], Shahbaz Shafiq[3], Muhammad Saad Rafique[4], Sharaz Ud Din[4], Azka Sabeeh[2], Amara Akhter Choudhry[2], Hafiz Muhammad Sharif[1]

[1]Institute of Horticultural Sciences, University of Agriculture Faisalabad, Pakistan
[2]Department of Horticultural Sciences, the Islamia University of Bahawalpur, Pakistan
[3]Department of Plant Pathology, University of Agriculture Faisalabad, Pakistan
[4]Department of Plant Breeding and Genetics, the Islamia University of Bahawalpur, Pakistan
Email: kashifchand13@gmail.com

ABSTRACT

Huanglongbing (HLB) is the most devastating disease of citrus, caused by phloem inhabited fastidious bacterium *Candidatus Liberibacter spp*., which results in great economic losses to the citrus industry worldwide. Antibiotics are considered effective to control citrus HLB. This experiment was conducted in a randomized complete block design with four replications of citrus plants in the spring season, at the Department of Horticultural Sciences, The Islamia University of Bahawalpur. The main purpose was to study the effect of tetracycline to control citrus HLB and to evaluate which doses of tetracycline are better and effective against HLB. Rough lemon was used as rootstock and sweet orange cultivar (Musambi) bud wood was treated with different doses of tetracycline. A total of 63 plants were grafted. In T_3 By treating diseased buds (with 250ppm tetracycline; after 2 and 4-hour scion dipping), an ideal result was obtained with 83% buds sprouting (10 buds out of 12 sprouted) from the treated buds grafted on the rootstock that no symptoms were found in the young shoots when analyzed by conducting Iodine starch test. T_5 (850ppm tetracycline) gave minimum results at 6 and 8-hour scion dipping, with only 16 % buds sprouting (2 out of 12 buds sprouted). Other treatments as T_1 (control), T_2 (Distilled water), T_4 (500ppm tetracycline), and T_6 (1000ppm tetracycline) gave negative results as some not sprouted and the sprouted ones were also died after sprouting in these treatments. The non-phytotoxic and effective antibiotic tetracycline could be used for control of citrus HLB, either for the rescue of infected citrus germplasm or for restricted field application.

EFFECTIVENESS OF CHEMICALS MODULES FOR THE MANAGEMENT OF DIFFERENT MANGO HOPPERS

Haider Karar, Abid Hameed Khan, Syed Inam Ullah Shah Bukhari, Samad Raza, Sidra Kiran, Hameed Ullah, Atif Iqbal, Ghulam Mustafa, and Muhammad Imran

Mango Research Institute, Multan, Pakistan
Email: haider853@gmail.com

ABSTRACT

Mango hopper is one of the most destructive pests of mango crop. Mostly it attacks the mango during the flowering stage, which deteriorates the flowers. The hoppers cause a loss of 20-100% of flowers. To overcome this pest, the present study was undertaken to study the efficacy of different insecticidal modules for the management of mango hoppers during 2017-18 and 2018-19 at Mango Research Institute, Multan, Punjab-Pakistan. Three modules i.e. Module-I (One spray in Feb.), Module-II (Two sprays in Feb. and April) and Module-III (Three sprays in Feb. April and August). Among these three modules, the third proved to be the best and control the pest successfully throughout the year. The module-III consists of three sprays with Imidacloprid @ 250ml, Clothianidin @ 200ml and Thiomethaxam @10g each of these insecticides were sprayed in February, April and August proved to be the most effective against mango hoppers management exhibited 1.17 hoppers on the trunk and 0.00 population per fluorescence followed by module-II with two sprays i.e. Imidacloprid, Clothianidin in February and April with 40.33 and 2.08 individuals on trunk and inflorescence. So it is concluded that module-III is one of the best insecticidal management modules for the management of mango hoppers. By the use of three sprays during the whole year

control the mango hoppers successfully and hence the pollinators fauna can be saved from the deleterious effects of insecticides which play a key role in fruit-setting.

CHARACTERIZATION AND CONTROL OF ENDOPHYTIC BACTERIA GROWTH DURING IN VITRO GERMINATION OF PEA (*PISUM SATIVUM*) SEEDS

Suliman Khan1, Jalal ud din[1], Mubarak Ali[1], Mamoona Rauf[2], Muhammad Arif[1]

[1]Department of Biotechnology;
[2]Department of Botany, Abdul Wali Khan University Mardan
Email: arif@awkum.edu.pk

ABSTRACT

To control bacterial contamination during in vitro culture is the key to success for micropropagation of all plant tissue culture. Several factors influenced the efficiency of their yield and seeds germination caused by bacterial contamination. The present study was designed to characterize and eradicate endophytic bacterial strain from in vitro cultures of economically important Peas (*Pisum sativum*) plants. Five distinct endophytic bacteria from in vitro grown plantlets of peas were selected based on color colony and morphology. The endophytic bacterial contaminants were diagnosed at the species level by using 16S rRNA PCR analysis. It became obvious that nearly 60% of seedlings have been infected with Bacillus sp where *Bacillus tequelensis* contributed to maximum infections (70% out of the Bacillus infections). The other most often occurring microorganisms were *Staphylococcus saprophyticus*, *Leifsonia shinshuensis*, *Stenotrophomonas rhizophiliaand*, *Acetobacter sicerae*. The use of commercial antibiotic ceftriaxone has significantly reduced the growth of endophytic microorganisms compared to other antibiotics used (Kanamycin, Cefotaxime). Furthermore, ceftriaxone was tested with a combination of silver nanoparticles for their activity against the identified endophytes. Five different media, antibiotic and nanoparticle combinations were tested for their response against the selected endophytes. The media containing 5mg/l ceftriaxone and 20ppm/l silver nanoparticles concentration showed a good response to growth inhibition of all the bacteria isolates from seed germination in vitro pea plant tissue culture. Furthermore, these findings can be helpful in the in-vitro culturing of other plant species in the future.

LOCUST'S DEVELOPMENT AND THEIR MOVEMENT FROM REGION TO REGION

***Muhammad Umar Javed**[1] and Faryal Fatima[2]

[1]Department of Entomology, University of Agriculture, Faisalabad, Pakistan
[2]Department of Botany, University of Agriculture, Faisalabad, Pakistan
*Email: umarjaved14ag4816@gmail.com

ABSTRACT

Locust is a serious pest of field crops, fruits, and vegetables. Since 2003-2005, locust caused severe damage to the crops in winter and dry season in Africa. 13 million hectors of the area sprayed by manually, machinery and by Air plan. Around about 500 million dollar investments done by Africa to save crops. The larger the population, the harder it is to control. Its population must be finished at one time. Locust is a migratory pest that has 20 species in the world. Just only 3 locusts can make a large population in a few weeks. Within two weeks' locust eggs hatch and larva come out. Every female locust lay eggs in 3-5 pods, each pod has 30-50 eggs. Each female lay eggs every week till her death. Locust has 5 molting stages, the 5th molting stage is called fledging. Fledging stage is that stage in which locust cannot fly, it just crawls and feeding on leaves and make his body hard within two weeks the wings are emerged out from the body and become sexually matured for mating. If the environment is suitable, locust can fly 3000KM, it can pass through via sea and ground way. It can fly 2KM above from the ground. One large population can spread in large hector area. Locust can eat more than his weight. I can damage crop 100%. It can be by biological eating by birds and crawling animals. Biochemical pesticides have been made by Africa, which controlled his population. Chemical pesticides that can be used for locust control that's are (Fipronil 0.3-1g a.i/ha, Diazinon 450-500g. a.i/ha (1L/ha), Fenitrothion 400-500g. a.i/ha (500g/ha). By air spray UV-light formulation used without dissolving in water.

INTRODUCTION OF METHYL JASMONATE, SALICYLIC ACID, AND BIOLOGICAL CONTROL AGENT (BCA) AND INDUCED RESISTANCE IN OILSEED RAPE (*BRASSICA NAPUS L*) AGAINST CABBAGE APHID

Samina Jam Nazeer Ahmad [1,2,] Jam Nazeer Ahmad[1,2], Muhammad Aslam[1], Mubasher Ahmad Malik[1,2], Ishita Ahuja[3], and Atle Bones[3]

[1]Plant Stress Physiology and Molecular Biology Lab, Department of Botany, University of Agriculture Faisalabad, Pakistan
[2]Intergrated Genomics Cellular Developmental and Biotechnology Lab, Department of Entomology, University of Agriculture Faisalabad, Pakistan
[3]Department of Biology, Norwegian University of Science and Technology (NTNU), NO-7491 Trondheim, Norway
Email: saminatmalik@yahoo.com

ABSTRACT

The study was carried out to determine the effect of induced resistance caused by Methyl Jasmonate, Salicylic acid and biological control agent (*Diaretiella rapae*). Methyl Jasmonate, MeJA (MeJA: 50µM, 100µM, 300µM) and Salicylic acid, SA (SA: 0.25 mM, 0.5 mM, 1 mM) were used to determine the most effective concentration by studying the expression pattern of SA and MeJA dependent markers genes. The cross-talk of MeJA and SA dependent genes was also elaborated by studying the defense-related genes expression. The expression pattern was analyzed through RT-PCR. The pathogenesis-related protein 1 (PR1) and proteinase inhibitor (PIN2) were shown to be activated against aphid's infestation. Upon treatment of SA, PR1 was activated but PIN2 was down-regulated whereas the application of MeJA activated the PIN2 but down-regulated PR1 genes. Phytohormones and biological control agents alone and in combination particularly had proved their worth by controlling aphid population on *brassica napus* L. plants. Thus the study revealed that the strategy to use of plant defense elicitors and biocontrol agents simultaneously is best at aphids control on brassica crop rather than indiscriminate use of synthetic insecticides.

EARLY DETECTION AND MANAGEMENT OF THE RED PALM WEEVIL (RHYNCHOPHORUS FERRUGINEUS) (COLEOPTERA: CURCULIONIDAE)

Muhammad Zubair[1], ***Mudssar Ali**[1], Shahid Iqbal[1], Muhammad Talha Ahmad[1], Muhammad Awais Ahmad[1], Shafqat Saeed[1], and Asif Sajjad[2]

[1]Institute of Plant Protection, Muhammad Nawaz Shareef University of Agriculture Multan, Pakistan
[2]Department of Entomology, University College of Agriculture and Enviernamenal Sciences, Islamia University Bahawalpur
*Email: mudssar.ali@mnsuam.edu.pk

ABSTRACT

Red Palm Weevil (RPW) Rhynchophorus ferrugineus (Coleoptera: Curculionidae) is a potential pest of palms originating from South Asian and African Countries and also significantly distributed to the geographical area of Pakistan. At present, date palm production is prominently affected by this pest. So its effective management is key to reduce its population under the economic level. The larval phase of this pest is very dangerous because it directly damages the trees of date palm. Pest infestation increased 75-80% have been observed in the base of the palm trunk. Owing to manage this pest, many control tactics were used in past but inadequate knowledge, lack of coordinated efforts and low financial condition of farmers were unable to combat this quarantine pest. So, early detection of this pest is important to monitor its population under the economic level. Recent advances in information technology added a significant management tool in early detection and monitoring this pest under field conditions. Many pheromones trap and sensors are used, which are embedded in the plant body for visual movement of the pest, especially seen in the offshoots and the trunk of the date palm. Quarantine measures help to improve the post-

infection strategies for this pest. We conclude that by using different techniques we can control the red palm weevil at a possible level.

BIOGENIC SILVER NANOPARTICLES MEDIATED STRESS ON DEVELOPMENTAL PERIOD AND GUT PHYSIOLOGY OF PINK BOLLWORM, (*PECTINOPHORA GOSSYPIELLA* LEPIDOPTERA: GELECHIDAE) AN ECO-FRIENDLY APPROACH OF INSECT PEST CONTROL''

Ayesha zulfiqar[1], Anam Shahzadi[1,] Hajra[1], Tahir Raza[4], Jam Nazeer Ahmed[2], Samina Jam Nazeer Ahmed[3], and Kiran Maqsood[1]

[1]Department of zoology, Wildlife and Fisheries, university of Agriculture Faisalabad
[2]Integrated Genomic, Cellular Developmental and Biotechnology laboratory, Department of Entomology University of Agriculture, Faisalabad
[3]Department of Botany, University of Agriculture, Faisalabad
[4]Department of Zoology, University of the Punjab, Lahore
Email: zulafiqarayesha@gmail.com

ABSTRACT

Cotton is one of the most significant crops responsible for the production of natural fiber and is used for various domestic purposes. Pakistan is the fourth cotton producing country in the world. Cotton production is badly affected due to the attack of various sucking and chewing insect species. Among chewing pests, Pink bollworm, (*Pectinophora gossypiella*) is the major damaging pest of this crop and is destroying the crop at the larval stage because of chewing mouthparts. The main objective of this study is to manage the pink bollworm, (*P.gossypiella*) population to prevent cotton loss through the use of silver nanoparticles. A laboratory trial was carried out to determine the cytotoxicity of nanoparticles on developmental influence and gut physiology like the efficiency of conversion ingested and digested food, gut enzymes, gut microbiota against pink bollworm. Silver nanoparticles synthesized from Pomegranate peel extract. Different levels of silver nanoparticles were used. These nanoparticles were incorporated into the artificial diet for feeding. Results revealed that the nanoparticles were highly effective against all the tested parameters as dose-dependent manner by showing larval and pupal mortality, least lethal concentration 50 (LC50), lethal time 50 (LT50), reduced larval, pupal period, reduced adult emergence and adult longevity. Gut physiology study on the third instar of pink bollworm showed a distinct reduction effect on all the tested parameters.

CREASING IN SWEET ORANGES: THE ROLE OF PUTRESCINE

Zahoor Hussain[1, 2], and Zora Singh[1]

[1]urtin Horticulture Research Laboratory, Curtin University, Perth, Australia
[2]College of Agriculture, University of Sargodha Punjab, Pakistan.
Email: zahoor.hussain@uos.edu.pk

ABSTRACT

Creasing (albedo breakdown) is a serious physiological disorder in many orange producing countries in the world. It affects the cosmetic look of fruit and fruit become unfit for fresh market. However, creasing did not affect on the internal fruit quality of sweet oranges. Creasing is more common in different cultivars of sweet oranges cv. Navelina, Washington Navel, Lane Late and Valencia Late. In the current study, the effects of different concentrations (0, 100, 250, 500,1000 µM) of putrescine (PUT) on the incidence of creasing, rheological properties of the rind and fruit quality in sweet orange cv. Washington Navel and Lane Late were investigated. Thirty-five ripe fruit per tree were harvested randomly around the tree canopy to determine the incidence of creasing, textural properties of the rind and fruit quality. The exogenous spray application of PUT (1000 µM) at the golf ball stage substantially reduced the incidence of creasing (22.10 and 24.29%) in cv. Washington Navel and (23.57 and 22.86%) in Lane Late during both harvesting seasons, respectively. All the treatments of the PUT improved the rheological properties of the rind, individual sugars, ascorbic acids and antioxidants in sweet orange fruit, irrespective of the stage of PUT application. In conclusion, the exogenous application of PUT (1000 µM) at the gold

ball stage substantially reduces creasing incidence and improves fruit quality in sweet orange cv. Washington Navel and Lane Late.

PHYSICOCHEMICAL AND NUTRITIONAL COMPOSITION OF DIFFERENT QUINCE ACCESSIONS GROWN IN RAWALAKOT, AZAD JAMMU & KASHMIR

N. Zahid[*,1], M. Maqbool[1], S.Z.A. Shah[1], J.R. Khan[1], and M. M, Tahir[2]

[1]Department of Horticulture, Faculty of Agriculture, The University of Poonch, Rawalakot, Azad Jammu and Kashmir
[2]Department of Soil and Environmental Sciences, Faculty of Agriculture, The University of Poonch, Rawalakot, Azad Jammu and Kashmir
Email:* noosheen.zahid@upr.edu.pk

ABSTRACT

Consumption of fresh vegetables and fruits is getting attention throughout the world. These fresh fruits and vegetables are full of nutritious elements. But the nutritional status of these fruits and vegetables varies among accessions. Quince (*Cydonia oblonga* Miller) fruit is attracting interest globally due to its health-promoting properties. It grows successfully in temperate regions of Azad Jammu and Kashmir. Fruit of quince is mostly used to produce functional products. Recently, researches interest has been increased on nutritional properties of quince due to its demand as an industrial raw material. However, in Rawalakot most of the fruit is wasted every year due to lack of awareness and attention towards its proper harvesting, storage, and utilization. Therefore, the present study aimed to evaluate two different accessions of quince (Apple shaped and Pear shaped) grown in Rawalakot. Fruit of these two accessions were analyzed for titratable acidity, total flavonoids, total phenols, and total antioxidants activity. Titratable acidity for pear-shaped quince (1.31%) was higher as compared to apple-shaped quince (1.29%). Similarly, the results showed that both the accessions possessed high antioxidants activity (4.84 and 4.69 activity of $FeSO_4$ mg/g FW) for apple and pear-shaped quince, respectively. However, pear-shaped quince showed better yield and resistance against fruit fly attack. Based on these results it can be concluded that pear-shaped quince has better prospects when grown under Rawalakot conditions. Moreover, detailed studied are needed to explore their market potential and multiplication scope for distribution to the local growers.

TOMATO FRUIT QUALITY IMPROVEMENT THROUGH ASCORBIC ACID BIOSYNTHESIS PATHWAY

Shoaib Munir,
Key Laboratory of Horticultural Plant Biology, Ministry of Education, Huazhong Agricultural University, Wuhan 430070, China

ABSTRACT

Tomato fruit is an important source of vitamins and nutrients in the human diet and is a significant model for the study of fruit biology. Ascorbic acid (Vitamin C, AsA) is an important antioxidant metabolite essential for human health and obtained from tomato fruit. Myo-inositol oxygenase (MIOX) is a critical enzyme that is involved in plants AsA biosynthesis. Therefore, MIOX gene involvement in AsA biosynthesis would be significant to investigate. Our study revealed MIOX genes uneven distributed on tomato chromosomes and all the MIOX genes showed remarkable expression in various examined tissues throughout the plant growth and development. The MIOX overexpression transgenic plants exhibited a significant increase in total ascorbate compared to control. This enhanced accumulation of AsA in overexpression plants could be possibly due to multiple genes involved in AsA biosynthesis. Furthermore, Myo inositol (MI) feeding indicated improved AsA biosynthesis, which strengthens the MIOX role in ascorbic acid biosynthesis. These findings directed that MIOX transgenic lines are involved in AsA biosynthesis, through improved light response. Our study postulates the first comprehensive analysis of the MIOX genes and their involvement in ascorbate biosynthesis to improve the tomato fruit quality.

A SUCCESSFUL TECHNIQUE FOR ROOT INITIATION IN AERIAL SUCKERS OF THE DATE PALM WITH GOTTI LAYERING AND ROOTING HORMONES

***Saeed Ahmad** and Muhammad Tayyab

Institute of Horticultural Sciences, University of Agriculture Faisalabad, Pakistan
*Email: saeedsandhu@uaf.edu.pk

ABSTRACT

Date palm is a dioecious fruit plant and can be propagated through sexual and asexual methods. It is different than other fruit plants regarding their growth, reproduction and propagation methods. Among the cultivars "Hillawi" is a popular cultivar of Punjab which can produce 20-30 suckers up to 20years age. Two types of suckers are generally produced i.e. root suckers and aerial suckers. Aerial suckers are not used for propagation because these cannot develop a proper root system due to the unavailability of proper substrate, so these are useless for growers and removed in early-stage and throughout which is a wastage of true to type plants. Aerial offshoots of date palm contained lower levels of carbohydrates as compared to ground suckers, therefore root initiation is difficult in aerial offshoots. A few workers have tried to initiate the roots in detached aerial suckers with rooting hormones but could not succeed properly. It is because the absorption of hormonal solution through tissues is difficult due to permeability of the cell membrane. Therefore, this study was carried out and different hormones were injected by making the holes in the basal portion of offshoot and plugged with cotton. Different concentrations of NAA, IAA and their combinations were injected in the base of attached suckers and covered with mud and gunny bags adopting the Gotti layer method. The data was collected after 90 days of treatment. It was observed that all treatments significantly promoted the rooting percentage and the highest (84.66%) rooting was recorded in NAA @500PPM treatment followed by NAA + IAA, IAA alone and control where rooting percentages were 45.5%, 27.33%, and 7.66 % respectively. A maximum number of roots per sucker also showed the same pattern. It is concluded that the injection of rooting hormones into cotton plugged holes gave rapid and more root initiation and NAA @500PPM is the most constructive dose for rooting in aerial offshoots and this method can be adopted as commercial practice in date palm orchard. The study will help to increase the availability of true to type date palm suckers for the establishment of new orchards.

ESTABLISHMENT OF PCR BASED DIAGNOSTIC PROTOCOLS OF CITRUS DISEASES IN PAKISTAN

Zahir Abbas, Muhammad Shah Nawaz ul Rehman, and ***Muhammad Mubin**

Virology Lab, Centre of Agricultural Biochemistry and Biotechnology, University of Agriculture, Faisalabad
*Email: mmubin@uaf.edu.pk

ABSTRACT

Citrus fruit quality and production are greatly affected by pests and diseases i.e. fungal, bacterial and viral diseases. In Pakistan bacterial diseases like citrus greening i.e., Huanglongbing (HLB), and citrus bacterial canker (CBC), while fungal diseases like citrus black spot (CBS) pose a severe risk to the citrus economy. Timely, diagnoses of these diseases could be helpful to encompass the epidemics in nurseries or orchids. The present study was designed for the establishment of PCR-based diagnostic protocols for these diseases. Leaves and fruits samples with characteristics symptoms were collected from main citrus growing areas. Healthy samples were taken as negative control. DNA was isolated and universal as well as pathogen-specific primers were used to detect the pathogen. In the case of CBC, pathogenic bacteria were successfully isolated and cultured *in-vitro*. Using universal primers for 16S rDNA, a fragment of 1.4 kb was amplified while using specific primers for the Asiatic form of CBC (Xac01 and Xac02) a fragment of 581 bp was amplified. Thus the Asiatic form of citrus canker was prevailing in the region. Similarly, disease-specific primer pairs ITS 1F and 5.8S 2R was used for detection of citrus black spot. A fragment of 400 bp of ITS region of CBS pathogen, *Guignardia citricarpa* was amplified through PCR. Earlier CBS was

reported from America and Africa was not reported from Asian countries like Pakistan. Huanglongbing was diagnosed by the amplification of 16S rDNA. Thus PCR-based diagnostic protocols were established in Pakistan, which will helpful for rapid detection and then eradication of these dangerous diseases.

NANO EMULSION-BASED EDIBLE COATING OF ALGINATE AND MARGOSA SEED OIL MODULATES BIOCHEMICAL CHANGES IN PAPAYA FRUIT BY UPREGULATING ANTIOXIDANT SYSTEM

*__Ghulam Khaliq__, Muhammad Waseem, Intazar Ali, and Azhar Iqbal,

Faculty of Agriculture, Lasbela University of Agriculture, Water and Marine Sciences, Uthal, Balochistan, Pakistan
*Email: ghulam-khan@live.com

ABSTRACT

Papaya (*Carica papaya* L.) fruit is a good source of bioactive compounds like polyphenol, flavonoids, vitamin C, thiamine, riboflavin, and carotene. Papaya fruit is consumed worldwide due to its excellent flavor and nutritional properties. As a tropical fruit, storage has serious limitations that result in their rapid deterioration and high incidence of rots during handling and storage. Postharvest losses in papaya may reach from 30 to 40% and losses due to diseases account for almost 93% depending upon climatic conditions. The effect of sodium alginate (SA) at 1, 2 and 3% combined with margosa oil (MO) 0.1% on biochemical and postharvest quality of papaya during storage at 20 °C for 15 days were investigated. Significant differences were observed between the treated and untreated fruit. The combined treatment of SA 2% and MO 0.1% significantly mitigated weight loss and soluble solids concentration. Papaya fruit treated with SA 2% + MO 0.1% maintained higher fruit texture, titratable acidity, ascorbic acid, total phenolic and DPPH radical scavenging activity as compared to the control. These results suggest that SA 2% added to MO 0.1% could be a simple and innovative technique for extending the shelf and retaining the postharvest quality of papaya fruit during storage.

EFFECT OF THE SPRAY OF PLANT GROWTH REGULATORS ON MORPHOLOGICAL AND PHYSIOLOGICAL ATTRIBUTES OF PHALSA

***Muhammad Nafees**, Ishtiaq Ahmad, Muhammad Rashid Shaheen, Muhammad Ahsan, Muhammad Yasir, Zakia Rafiq, Muhammad Junaid, Hassan Mukhtar, and Aamir Manzoor

Department of Horticultural Sciences, University College of Agriculture & Environmental Sciences,
The Islamia University of Bahawalpur
Email: muhammad.nafees@iub.edu.pk

ABSTRACT

Phalsa (*Grewia asiatica L.*) known as Star Apple, is a subtropical berry fruit in the family Tiliaceae with 140 species in this genera. It is a hardy shrub, can thrive in salt-affected wasteland condition and commercially produced in arid regions of the world to use in traditional medication. There is massive fruit drop and low-quality fruit with less pulp to stone ratio could be addressed through the application of plant growth regulators. It is, therefore, an experiment was planned to observe the effect of GA_3 and NAA (100, 150 and 200mM each) foliar spray singly and in combination on Phalsa shrubs at pre-bloom and after fruit set, commercially grown in an experimental area of the Department of Horticultural Sciences, Bagdad-Ul- Jadid Campus, The Islamia University of Bahawalpur during 2018-19. Statistically, there was a significant effect of different concentrations of GA3 and NAA (individual and combined) on vegetative growth of Phalsa in all directions for the emergence of new shoots and leaves with highest shoots (6.66) with NAA (150mM) in Northside of plants, however, the highest number of leaves (80.22) were recorded in East side of plants received 150mM gibberellic acid. There was an increasing amount of fruit set (885.33) on Northside shoots sprayed with 150mM NAA and the highest average fruit weight (50.33g) was recorded in the same type of shoots which was at par with East and Westside shoots received 150mM spray of GA and NAA. Fruit

dimensions were also highly significantly vary for GA and NAA spray compared with plants received only distilled water (control). There was a significant effect of GA3 (100mM) and 150, 200mM NAA (individual and combined spray) on the pulp to stone ratio regardless of the direction of shoots compared to control. The optimum dose of plant growth regulars had a good effect on fruit set, growth, and quality as compared to control regardless of the plant direction.

CHANGES IN PHYSICO-CHEMICAL FRUIT QUALITY CHARACTERISTICS OF PEACH DURING RIPENING

* **A.S. Khan[1]**, M.A. Khan[1], M.H. Almas[2], A.U. Malik[1], R. Anwar[1], M.U. Hassan[1], T. Shaheen[3], and R.N.U. Rehman[1]

[1]Institute of Horticultural Sciences, University of Agriculture, Faisalabad, 38040, Pakistan
[2]Directorate of Floriculture (T&R), Punjab, Lahore, Pakistan
[3]Department of Bioinformatics and Biotechnology, GC University, Faisalabad Pakistan
*Email: ahmad_khan157@yahoo.com

ABSTRACT

Peach is a popular summer fruit crop being cultivated in the temperate and subtropical regions of the world and Pakistan. Less attention has been paid to peach fruit because of high perishability and short postharvest life. Therefore, very little information is available about various changes in the physicochemical quality of peach during fruit ripening. So, the purpose study was carried out to analyze the ripening behavior of different peach cultivars during ripening by evaluating their physiological and biochemical fruit quality. Results revealed that significant variations occur in the fruit quality of all cultivars during ripening at ambient conditions. At day-5 of ripening, cultivar '8-A' exhibited maximum SSC; whereas, the lowest SSC was measured in 'Flordaking'. Maximum ascorbic acid content and total sugar were observed in '5-A' fruit at ripening day 5; while, maximum total antioxidant, total phenolic content and total carotenoids content were noted in cultivar 'Tex-6A'. Maximum fruit firmness was recorded in cultivars '5-A'. Percent physiological loss in fruit weight was lower in cv. '8-A' and maximum weight loss was recorded in 'Tex-6A' from day 1 to 5. Results revealed that cultivars '8-A' and 'Tex-6A' had the best physicochemical properties and better eating quality after 4 days ripening at ambient conditions and these cultivars showed by grown and marketed for better consumption.

24-EPIBRASSINOLIDE MITIGATES CADMIUM STRESS IN *CUCUMIS SATIVUS* SEEDLINGS: MODULATION OF ANTIOXIDANT ENZYMES AND POLYAMINES

***Anis Ali Shah**, Shakil Ahmed, and Nasim Ahmad Yasin

Department of Botany, University of the Punjab, Lahore, Pakistan
*Email: anisalibot@gmail.com

ABSTRACT

The current research was conducted to explore the potential of 24-epibrassinolide (24-EBL) in cadmium (Cd) stress alleviation in *Cucumis sativus* L. 24-EBL pre-treated seeds (1 µM, 5 µM, and 10 µM) were grown in soil contaminated with 50 mg kg^{-1} cadmium. Cadmium stress significantly reduced the growth of cucumber plants. Exogenous treatment of 24-EBL enhanced growth characteristics along with an increase in leaf relative water content (LRWC), net photosynthetic rate and raised gas exchange characteristics in treated seedlings. Application of 24-EBL resulted in the incrimination of polyamines (PAs) synthesizing enzymes (spermine, spermidine, putrescine) in conjunction with the decrease in the activity of polyamine oxidase (PAO). 24-EBL mitigated Cd stress through up-regulation in expression of stress-related *CS-ERS* gene along with the amplified activity of superoxide dismutase (SOD), catalase (CAT) and ascorbate peroxidase (APX) in treated seedlings. The improved activity of *antioxidant scavengers* played a central role in the reduction of hydrogen peroxide (H_2O_2), electrolyte leakage (EL) and malondialdehyde (MDA) in plants under Cd stress. Recent findings also advocate the positive correlation between

PAs and ethylene, as both possess a common precursor. The current study reveals that priming seeds with 24-EBL reduces Cd-toxicity and makes it possible to cultivate cucumber in Cd-contaminated sites. Future experiments will perhaps help in elucidation of 24-EBL intervened stress mitigation procedure in *C. sativus* crop. Furthermore, research regarding the potential of 24-EBL for stress alleviation in other horticultural crops to increase crop productivity.

COMPARATIVE STUDY ON MORPHOLOGICAL, PHYSIOLOGICAL AND BIOCHEMICAL INDICES FOR EVALUATING DWARFING POTENTIAL IN APPLE ROOTSTOCKS

***Faisal Hayat**[1,2], Summera Asghar[2], Shahid Iqbal[1], Han Zhenhai[2]

[1]College of Horticulture, Nanjing Agricultural University, 210095, Nanjing, China
[2]Key Laboratory of Biology and Genetic Improvement of Horticultural (Nutrition and Physiology) in the Ministry of Agriculture, China Agricultural University, Beijing, 100193, China; College of Horticulture, China Agricultural University, Beijing, 100193, China
*Email: maken_faisal@yahoo.com

ABSTRACT

The utilization of dwarfing rootstocks has triggered high-density plantations to get maximum yield production. Therefore, screening of dwarf indicators is necessary for the early selection of dwarfing apple rootstocks. The influence of four rootstocks ('M-9', M-26', 'Chistock-1', and 'Baleng' rootstocks) affects the growth morphology, hormonal levels, photosynthesis and hydraulic conductance of 'Red Fuji' scion cultivar were significant at 45, 90 and 180 days after grafting (DAG). 'Red Fuji' plants grafted with 'M-9' rootstock appears to induce lower scion growth based on the lower node number, internodal length, and reduced trunk diameter of the scion. The root system of 'Red Fuji'/'M-9' rootstock was smaller with lower root volume, root surface area, root length, projected area, number of forks, and number of tips grafted with 'Red Fuji' apple trees compared with more vigorous rootstocks. Further, we observed that 'Red Fuji' grafted onto 'M-9' rootstock had a lower hydraulic conductance (K_{leaf}), and photosynthesis rate (P_n) compared with other rootstocks. Plants grafted onto 'M-9' had a lower concentration of indole-3-acetic acid (IAA) and zeatin riboside (ZR) and higher abscisic acid (ABA) concentration in the roots compared with 'Red Fuji' grafted onto 'M-26', 'Chistock-1' and 'Baleng' rootstocks that likely reduced the growth rate. The hormonal ratio (IAA+ZR+GA_3)/ABA was also lower for 'M-9' rootstock, whereas the higher ratio was observed for more vigorous rootstocks. These indicators can be useful in apple breeding programs to evaluate the dwarfing potential of rootstocks.

DIFFERENTIAL PH-INDUCED BIOSYNTHESIS OF STEVIOL GLYCOSIDES AND BIOCHEMICAL PARAMETERS IN SUBMERGE ROOT CULTURES OF *STEVIA REBAUDIANA* (BERT.)

Naveed Ahmad[1], ***Shah Zeb**[2], Abdur Rab[1], and Nisar Ahmad[1]

[1]The University of Agriculture, Peshawar
[2]Agricultural Research Institute, Tarnab, Peshawar
*Email: shahzebhorticon@gmial.com

ABSTRACT

The major objective of the current study was to investigate the potential effects of different pH levels on culture development and production of steviol glycosides and other polyphenolics content in submerge root cultures of Stevia rebaudiana. In vitro grown cultures require an optimum pH level for rapid growth and uniform production of secondary metabolites. Herein, varying media pH levels (5.0, 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.7, 5.8, 5.9 and 6.0)

significantly influenced fresh and dry biomasses of adventitious root cultures. Among tested levels, adventitious root cultures favored high media pH (6.0) for the accumulation of maximum fresh biomass (112.86 g l -1) and dry biomass (8.29 g l -1). In this study, we observed that lower pH levels (5.1) strongly supported the production of stevioside (79.48 mg/g-DW) and Rebaudioside-A (13.10 mg/g-DW) contents but reduced the polyphenolics content in adventitious cultures. However, dulcoside contents (2.57 mg/g-DW) in adventitious root cultures were found in higher quantities at pH level 5.8. Similarly, maximum total phenolics (70.06 mg/g-DW) and flavonoids (50.19 mg/g-DW) were observed on media having a 5.8-pH level. The same pH level also improved DPPH-radical scavenging activities (92.67%). This study will offer an approach to enhance medicinal products in the in vitro tissues, rather than to over-exploit the wild plants and ultimately putting them on the brink of being endangered. Furthermore, the consistent production of secondary metabolites in these cultures could be scaled-up on the bioreactor level, which will ultimately affect society by the potential introduction of cost-effective and biologically stable medicinal drugs.

ELUCIDATION OF PHYTOCHEMICAL PROFILE AND ANTIMICROBIAL ACTIVITY OF ZINGIBER ZERUMBET

***Javed Iqbal Wattoo**[1], Sana Ahsan[1], and Muhammad Ashfaq[2]

[1]Department of Biotechnology, Faculty of Life Sciences, University of Central Punjab, Lahore.
[2]Institute of Agricultural Sciences, University of the Punjab, Lahore.
*Email: javed.nibge@gmail.com

ABSTRACT

Medicinal plants have long been used for the treatment and prevention of many diseases around the globe. The current study was designed to elucidate phytochemical profiling and antimicrobial activity of Zingiber zerumbet. Different extracts were separated based on the polarity of solvents like Chloroform, n-hexane, Butanol, Methanol, Ethyl acetate, and Distilled water. Extracts were further subjected to phytochemical screening to break down the nearness of Flavonoids, Coumarine, Quinone, Tannins, Terpenoids, and Saponins. The extracts were tested for antifungal properties by deploying against different contagious strains like *Aspergillus niger*, *Aspergillus fumigates* and *Aspergillus flavors*. HPLC analysis revealed a higher concentration of Kaempferol with distinctive absorbance at the assorted wavelength (nm). Radical scavenging activity was checked by utilizing the DPPH compound at various fixations. At each concentration, Zingiber extracts showed distinct activity. Phytochemical screening demonstrated that flavonoids, saponins, tannins, and quinone were available in the least way while terpenoids and coumarine were exceptionally identified in each weakened concentrate. The antioxidant activity demonstrated that every enzyme (SOD, POD, alpha-amylase, and protease) indicated distinctive action at various concentrations. In DPPH radical scavenging activity, general outcomes demonstrated that maximum activity exposed by diluted extract at 60 µL while the least action showed at 90 µL. In conclusion, the results of the current study showed the potential of Zingiber zerumbet to be used as an antimicrobial agent and further showed its importance as a medicinal plant for drug development underlying diverse medical targets.

PGPR ENHANCED THE GROWTH OF LEAD-STRESSED *HELIANTHUS ANNUS* L. BY MODULATING THE ANTIOXIDATIVE HOMEOSTASIS.

***Azeem M**[1], Munawar K[1], Akram M. S[1], Nawaz M[1], and Shahid M[2]

[1]Department of Botany, Government College University, Faisalabad
[2]Department of Information and Biotechnology, Government College University Faisalabad
*Email: azeemsultan75@gmail.com

ABSTRACT

A pot experiment was conducted to determine the changes in growth, physiological and biochemical attributes of sunflower after being treated with Plant growth-promoting bacteria (PGPR) in response to heavy metal stress. Seeds

of two varieties of sunflowers were primed with PGPR for 2 hours and seeds were sown in plastic pots in a completely randomized design with five replicates per treatment. Three levels of Lead Nitrate (0 ppm, 250 ppm, 500 ppm) were applied to the soil after 20 days of germination and 20 days application of the heavy metal treatment data were recorded for growth, physiological and biochemical attributes. Without inoculation of PGPR, Pb stress significantly reduced the plant biomass as well as the number of amino acids, total soluble proteins and photosynthetic pigments due to enhanced H2O2, malondialdehyde (MDA) contents, and impaired antioxidant homeostasis. Subsequently, PGPR inoculation increased the plant fresh and dry biomass whereas it decreased the lipid peroxidation under Pb stress. In parallel, inoculation with plant growth-promoting rhizobacteria promoted the ascorbate peroxidase, catalase, superoxide dismutase, glutathione reductase and proline contents in the Pb stressed plants.

PROTEOMIC AND PHYSIOLOGICAL ASSESSMENT OF STRESS-SENSITIVE AND TOLERANT VARIETY OF TOMATO TREATED WITH BRASSINOSTEROIDS AND HYDROGEN PEROXIDE UNDER LOW-TEMPERATURE STRESS

*__Zoobia Bashir__ [1], Aqeel Ahmad[2], Tanveer Alam Khan [2,3], Taiba Saeed [2,3], Iqra Shahzadi [4], and Tingquan Wu[2]

[1]National Laboratory of Solid State Microstructures, Department of Physics, Nanjing University, 22 Hankou Road, Nanjing 210093, Jiangsu, PR China
[2]Vegetable Research Institute, Guangdong Academy of Agricultural Sciences/Guangdong Key Laboratory for New Technology Research of Vegetables, Guangzhou 510640, PR China
[3]Department of Physiology and Cell Biology, Leibniz Institute for Plant Genetics and Crop Plant Research, Corrensstraße 3, D-06466 Gatersleben, Germany
[4]School of resource and environmental science, Wuhan University, Wuhan-430072, Hubei, China.
*Email: zoobiabashir@gmail.com

ABSTRACT

The current investigation aimed to perform proteomics and physio-chemical studies to dissect the changes in contrasting varieties (S-22 and PKM-1) of *Lycopersicon esculentum* under low-temperature stress. The plant grown under variable low-temperature stress were analyzed for their growth biomarkers, antioxidant enzyme activities, and other physiological parameters, which headed toward the determination of protein species responding to low-temperature and 24-epibrassinolide (EBL) concentrations. The plants grown under temperatures, 20/14, 12/7, and 10/3 °C recorded significantly lower growth biomarkers, SPAD chlorophyll, net photosynthetic rate and carbonic anhydrase activity in S-22 and PKM-1. Moreover, the combined effect of EBL and hydrogen peroxide (H_2O_2) significantly improved the parameters mentioned above and consecutively upgraded the different antioxidant enzymes (CAT and SOD) with higher accumulation of proline under stress and stress-free environments. Furthermore, proteomics study revealed that the maximum number of differentially expressed proteins was detected in S-22 (EBL+H_2O_2); while treatment with EBL+H_2O_2+low temperature lost expression of 20 proteins. Overall, three proteins (O80577, Q9FJQ8, and Q9SKL2) took a substantial part in the biosynthesis of the citrate pathway and enhanced the growth and photosynthetic efficiency of tomato plants under low-temperature stress.

FUNCTIONAL ANALYSIS OF TERMINAL FLOWER 1 HOMOLOG CMTFL1A IN CHRYSANTHEMUM CULTIVAR 'JINBA' VIA CRISPR CAS-9 SYSTEM

SABA HAIDER

Beijing Forestry University, Beijing, China
Email: saba_haider04@yahoo.com

ABSTRACT

Chrysanthemum (Chrysanthemum x morifolium Ramat) holds the largest floriculture commodity with a growing demand for the best quality cut flowers. 'Jinba' is a distinctive short-day chrysanthemum, which can be exploited as a model research material for the molecular mechanism of flowering in short-day chrysanthemum. Time of flowering is one of the most important traits of chrysanthemum. Numerous interrelated pathways are responsible to synchronize flowering time with environmental conditions to promote plant adaptability and success in reproduction; namely photoperiodism, vernalization, plant hormones, and flowering pathways. Phosphatidyl-ethanolamine binding protein (PEBP) family comprises several genes that are responsible for the regulation of meristem growth and flowering time. To investigate the role of these genes in chrysanthemum (dicotyledonous plant), the TFL1 (TERMINAL FLOWER 1) gene, designated as CmTFL1a was cloned and then further analyzed. Role of TFL1 (TERMINAL FLOWER 1) gene in flowering time regulation has been studied previously. Sequence analysis exhibited a high similarity of CmTFL1a to its homologous PEBP family genes CEN/TFL1 and FT. Phylogenetic analysis of the CmTFL1a amino acid sequence showed that it belongs to the CEN/TFL1 clade of the PEBP family. The expression level of the CmTFL1a gene was relatively higher in vegetative stems as compared to the flower buds and leaves. Transgenic chrysanthemum overexpressing CmTFL1a exhibited delayed flowering. The genetic function of CmTFL1a was further analyzed in 'Jinba' through Agrobacterium-mediated transformation that confirmed the role of CmTFL1a in promoting inflorescence formation. The results showed that CmTFL1a plays a key role in flowering repression as well as inflorescence architecture in chrysanthemum.

IDENTIFICATION OF GENES RELATED TO FLOWER SENESCENCE IN CUT ROSE

***Nisar Hussain**, Ma Nan, Ma Chao, Changqing Zhang, and Gao Junping

Beijing Key Laboratory of Development and Quality Control of Ornamental Crops, Department of Ornamental Horticulture, China Agricultural University, Beijing, China
*Email: nisarhussain@cau.edu.cn; gaojp@cau.edu.cn

ABSTRACT

Rose is the most important ornamental crop around the globe, leading in cut flower production. Owing to serious challenges in postharvest management especially dehydration and ethylene which severely damaging the vase life. Flower is unable to open properly and start wilting, which also disturbs marketing and causes a 30-40% loss in total production. However, the mechanism regulating flower senescence is largely unclear, here we aimed to explore the transcription regulation network of senescence especially linked with ethylene and dehydration. 1), we observed that flowers are sensitive to ethylene; at the transcription level, there is positive feedback in ethylene receptor, but no feedback in ethylene biosynthesis and *RhETR3* is a key receptor gene of ethylene. Then we identified aquaporin in response to ethylene-induced petal expansion in which ethylene promotes flower opening and decreases flower fresh weight. *RhPIP2;1* having close contact with flower opening and inhibited by ethylene. Further, we explored regulatory proteins affecting petal expansion in response to ethylene. We observed that *RhNAC100* is involved in the regulation of petal expansion by directly affecting genes involved in cell expansion, such as *RhCesA2, RhPIP2,1*. Moreover, we studied genes regulated by ethylene and other hormones in flower senescence and identified that *RhHB1* mediates the regulation of GAs and ethylene during petal senescence. We also identified an ethylene-induced *RhHB6-RhPR10.1* regulatory module that functions as a brake of ethylene promoted senescence by increasing the CTK contents. **2),** we tried to find how the loss of water blocks the opening of the flowers? For this purpose, we observed that antioxidants significantly improve flower water loss stress resistance. Likewise, we Identified that *RhNAC2* and *RhNAC3* silencing decreased petal water loss tolerance and rehydrating capacity. We also examined the effect of dehydration and rehydration on ethylene production in different floral organs and found rehydration rapidly and specifically induced ethylene production in gynoecia. Recently we found that Water loss-induced *RhPIP2;1* membrane-bound transcription factor that phosphorylates *RhPTM*, which enter the nucleus to regulate its action against dehydration and inhibit petal and leaf expansion.

SCREENING OF BIOACTIVE COMPOUNDS AND BIOLOGICAL ACTIVITIES OF LEAF EXTRACT OF *MORINGA OLEIFERA* ON CAPSICUM ANNUM

*Sadaf Anwaar[1], Nyla Jabeen[1], and Ateeq Tahir[3]

[1]Department of Biological Sciences, International Islamic Univerity, Islamabad
[3]Institute of Agricultural Sciences University of the Punjab, Lahore
*Email: xdf.anwaar111@gmail.com

ABSTRACT

Medicinal plant *Moringa oleifera* is traditionally used for the treatment of various diseases due to its antifungal activity. In the present study, medicinal plant *Moringa oleifera* is screened for antifungal activity against two strains of fungi which are well known for plant infections. *Capsicum annum* is commonly known as chilies and grown as spices in Pakistan, belonging to family Solanaceae. *C. annum* is prone to many fungal pathogens. In the present study, it was checked whether the petrochemicals present in Moringa are responsible for the antifungal activity or not. The leaf extract of *Moringa oleifera* was obtained by mixing the powdered leaves with two different solvents methanol and ethanol. The presence of various chemical constituents was checked by phytochemical analysis: Quantitative and Qualitative. The presence of antioxidants is also confirmed by performing antioxidant tests. Antifungal activity on the capsicum plant is checked by using the diffusion method. The fungal attack was reduced within 3 weeks after the spray from the plant leaves. The current results supported the antifungal potential of *M. oleifera* against phytopathogens thus it is justified to say that Moringa can be utilized as a raw material for the production of medicines against fungal infections that are common in plants specifically the attack of *Fusarium oxysporum* and *Alternaria alternata* on capsicum.

EVALUATION/CHARACTERIZATION OF PERENNIAL PLANT SPECIES FOR URBAN GREEN SPACE AGAINST DIFFERENT STRESSES

ALEEM AHMED

George-August-University of Goettingen, Germany
Email: aleem062@gmail.com

ABSTRACT

With the growing population of the globe and rapid urbanization, the climatic changes are hitting their peaks which is diverting the attention of many plants and environmental scientists to look into the fate of present plant species in the more congested environment i.e. big cities. Despite the plant's ability to adapt to the changing climate, the genetic potential, or more precisely genetic limitations, of a plant to adapt to unknown conditions cannot be neglected. It may take years for a plant to develop resistance against extremes of climate. The project should be designed to understand the tolerance limits of these species in the changing temperature, CO2 and different water regimes. Species that are nearing their limits shell be identified and recommended for better redistribution, especially to the professionals working with urban landscaping projects, to avoid extirpation.

EFFECT OF DIFFERENT EDIBLE COATINGS ON THE QUALITY AND SHELF LIFE OF CHINESE MEYER LEMON (*CITRUS MEYERI* L)

Danish Ahmad

Institute of Agriculture Sciences, University of the Punjab Lahore

Email: danish.ahmad12555@gmail.com

ABSTRACT

Advanced technological antimicrobial coatings applied to food may help in extending the shelf life of perishable fruit, and reduction in packaging layers to enhance the food safety and food security standards. Researches have shown that several edible coatings such as aloe vera gel solution, sugarcane wax solution, and honeybee wax solution, and garlic extract (diluted 30%) have high food preserving potential. This research is aimed to find out the highly effective bio-edible coating solution for vegetables and fruit. All the above-mentioned solutions are used for coating lemon variety *Chinese meyeri* L. and lemons were placed at room temperature in a fumigated room. In the case of lemon fruit preservation, aloe vera gel solution has been proved to be the best suitable and biologically safe coating material as it has several properties i.e. antimicrobial actions, biodegradability, film-forming, and biochemical properties. Its coating is composed of polysaccharides that act as a natural barrier against oxygen and moisture that are the main deteriorating agents of fruit and vegetables. It is proved by the research work that aloe vera gel solution among all has the highest potential of reducing respiration rate while maintaining quality attributes i.e. color, weight, flavor, etc. The following are the garlic extract (diluted 30%), sugarcane wax solution and honeybee wax solution as compared to the control treatment. The present review has described the properties, potential, and preparation of the coating materials to further the postharvest life and quality attributes of lemon fruit

EFFECT OF GROWING MEDIA ON SEED GERMINATION AND SEEDLINGS GROWTH OF PUMPKIN (*CUCURBITA MOSCHATA* L.)

***Erum Rashid[1]**, Shahla Rashid[1], and Sheerin Gul Raza Mirrani[2]

[1]Department of Horticulture, College of the Agriculture University of Sargodha.
[2]Department of Soil and Environmental Sciences, University of Agriculture Faisalabad.
*Email: erumrashid91@gmail.com

ABSTRACT

Potting media is of great importance in vegetable nursery raising, plant health, and yield. The present study was carried out to check the effect of different growing media on seed germination and growth of Pumpkin at the horticultural lab, Department of Horticulture, College of the Agriculture University of Sargodha. Seedlings trays were filled with different media (Sand, Peat Moss, and Coconut Husk). Seed soaking for 6 hours was done and 50 seeds were sown in each media. From the results, we concluded that the best media for Pumpkin growing was Peat Moss, as seedlings showed best in Peat Moss followed by Coconut Husk and Sand keeping in view the growth parameters like plant fresh weight, dry weight, root length, and seedlings vigor index. Hence peat moss is recommended.

MYC2 TRANSCRIPTION FACTOR MEDIATES BY JASMONATES SIGNALING PATHWAY STIMULATE THE TOLERANCE MECHANISM AGAINST THE ABIOTIC STRESS IN PLANTS

***Faiza Shafique Khan[1,2,3]**, Chugen Hu[1,2], Muhammad Shafiq[3], Muhammad Sajid Ali[3], and Moazzam Ali Anees[3]

[1]Key Laboratory of Horticultural Plant Biology (Ministry of Education), Huazhong Agricultural University, Wuhan, P.R. China
[2]College of Horticulture & Forestry Sciences, Huazhong Agricultural University, Wuhan, P.R. China
[3]Institute of Agricultural Sciences, University of Punjab, Quaid-e-Azam Campus, Lahore, Pakistan
*Email: Faiza_khan6665@yahoo.com

ABSTRACT

Unfavorable environmental conditions constrain crop growth and development, ultimately decreasing agricultural crop production. Jasmonates (JAs) trigger a specific mechanism in plants against abiotic stresses. These stresses trigger specific transcription factors and proteins in the JA signaling pathway. The core JA signaling pathway

modifies the transcriptional ailment of hormone receptive gene binding to basic helix-loop-helix (bHLH) transcription factor MYC. MYC2 is the vital MYC transcript of signal transduction of the JA pathway. During JA signaling, the JAZ family is repressed through coronatine insensitive 1 (COI1) by the bHLH transcription factor MYC2 involved in the response of climate-induced stressors. MYC2 is involved in distinct molecular mechanisms mediating the JA responsive genes, stimulating the tolerance mechanism in plants.

EFFECT OF PRE-STORAGE TREATMENTS ON SHELF LIFE AND DISEASE MANAGEMENT OF CHILLI

***Hafiza Hadiqa Anum** and Nasar Amjad

Institute of Horticultural Science, University of Agriculture, Faisalabad, Pakistan
*Email: nasramjad@gmail.com

ABSTRACT

Green chili (*Capsicum annuum* L.) has limited storage potential being susceptible to chilling injury (CI) and postharvest diseases. This study was aimed to enhance storage and shelf-life and quality maintenance of chilies by hot water treatment (HWT). Fruits were dipped in hot water at different temperatures i.e. control, 50°C for 30 sec, 50°C for 60 sec, 52°C for 30 sec and 52°C for 60 sec, stored in cold storage at 10 ± 2°C for 28 days. Weekly interval of data was collected for a different physical parameter like fruit weight loss (%), firmness (score), color (score), disease incidence (score), decay (%); biochemical parameters i.e. TSS (ºBrix), TA (%), TSS: TA ratio, pH, vitamin C (mg/100gm), electrical conductivity (%) and phytochemical parameters including total phenolic (mg GAE g-1) and antioxidant (mg GAE g-1) contents. Standard statistical techniques were used for data analysis. In this experiment, hot water treatment at 52ºC for 60 sec showed best and highly significant results for maintaining fruit color (2.02) and firmness (1.53), red chili percentage (8.27%) and reduced wrinkling (2.06), disease incidence (1.35), decay percentage (0.00%), chilling injury (1.02), TSS (4.20ºBrix), TA (0.52%), TSS: TA (15.02) EC (6.77 %), pH (5.32), Vitamin C (83.64 mg/100gm), total antioxidant contents (60.59 mg GAE g-1) and total phenolic content (144.51 mg GAE g-1) as compared to control. However, fruit weight loss (14.01%) showed a non-significant result. Statistically non-significant result in fruit weight loss (%) showed that hot water treatment (HWT) had no negative effect on fruit quality. In conclusion, hot water treatment (HWT) at 52ºC for 60 sec improved storage potential and fruit quality of green chili.

EVALUATION OF DIFFERENT DRYING TECHNIQUES ON BIOCHEMICAL AND QUALITY PARAMETERS OF JUJUBE

Nasar Amjad, and Hafiza Hadiqa Anum

Institute of Horticultural Science, University of Agriculture, Faisalabad, Pakistan
Email: nasramjad@gmail.com

ABSTRACT

Ber is a highly nutritious and important minor fruit of Pakistan having significant nutritive and medicinal value. Extending fruit shelf life has been a major concern to minimize post-harvest losses worldwide. Dehydration or drying is among the most commonly used methods to enhance the product shelf life. An experiment was conducted in the Post-Harvest laboratory, Institute of Horticultural Sciences (IHS), University of Agriculture Faisalabad to determine the efficiency of common drying methods on the quality of ber fruits on drying. Completely randomized design (CRD) was used for the experiment with three treatments viz., shade drying, sun drying, and oven drying and 3 replicates each. In this experiment response of 4 varieties of ber i.e., Anokhi, Delhi White, Dilbahar and Karela were studied. Data were recorded regarding following parameters, viz., fruit length (cm), fruit diameter (cm), drying time (min), fresh weight of fruit (g), dry weight of fruit (g), fresh and dry weight ratio, initial moisture content (%), Final moisture content (%), pH, TSS (Brix), TTA (%), vitamin C (mg/100g), total sugars (%), reducing sugars (%), Cu contents (mg/0.5g), Fe contents (mg/0.5g), Mn contents (mg/0.5g) and Mg contents (mg/0.5g). Collected data were analyzed using CRD under a factorial experiment and treatment means were compared using the Least Significant Difference (LSD) test at 5% significant level. Among all treatments, drying in dehydrator proved more

effective as compared to all other drying methods applied. While in comparison of cultivars, 'Anokhi' gave the best results.

EFFECT OF PLANT SPACING ON VIGOR AND PRODUCTIVITY OF CUT MARIGOLD

Jawad Hassan

Email: awadmajoka1122@gmail.com

ABSTRACT

Marigold (Tagetes Erecta) is among popular ornamental cut flower and has great potential in Pakistan. However, for the enhancement of its productivity, various techniques have been used. The present study is designed to improve the productivity of marigold variety (Lnca 2) by using three different plant to plant and row to row distances i.e., 6*18, 9*18, 12*18 inches with all other cultural practices and nutritional requirements will be used as per recommendation. various morphological (shoot length, root length, shoot fresh weight, total fresh plant weight, total plant dry weight, total plant height) and reproductive attributes (days to initiation of flower, number of buds per plant, number of flowers per plant, plant health) will be studied. Data will be collected with five replications of each treatment at maturity. The data will be analyzed with suitable statistical packages.

DETERMINING OPTIMAL PLANTING TIME THROUGH STAGGERED PLANTING OF COMMERCIAL GLADIOLUS CULTIVARS IN FAISALABAD

Nasar Amjad and Hafiza Hadiqa Anum

Institute of Horticultural Science, University of Agriculture, Faisalabad, Pakistan
Email: nasramjad@gmail.com

ABSTRACT

A field experiment was conducted at Floriculture Research Area, Institute of Horticultural Sciences, University of Agriculture, Faisalabad, in the year 2017-2018 to evaluate optimum planting time for quality production of gladiolus. Six commercial gladiolus cultivars, i.e., 'Advance', 'Amsterdam', 'Essential', 'Grand Prix', 'Rose Supreme' and 'White Prosperity' were trailed in the experiment. There were 5 different planting times from September to November at the interval of 14-15 days. Data regarding vegetative growth, development and quality parameters were collected. Early sprouting, best vegetative growth, and higher quality gladiolus stems were obtained for September sowing in all six cultivars, while in the comparison of all six cultivars, 'Rose Supreme' proved to be the best cultivar for all sowing dates in the agro-climatic region of Faisalabad. Early sowing of gladiolus crop in the season with favorable temperature and photoperiod produced strong growth response as compared to late sowing when the temperature dropped below 20oC with shorter photoperiods during winter. Minimum time to 50% sprouting (7.0 days), maximum sprouting percentage (95%), the highest number of leaves per plant (9.6), leaf area (67.6 cm2), plant height (96.4 cm), production time (96.1 days), spike length (72.97 cm), vase life (11.9 days), fresh weight (58.8 g), dry weight (3.52 g), spike quality (8.3) and numbers of cormels per clump (30.48) were highest obtained in September plantation.

EFFECT OF ORGANIC AND INORGANIC FERTILIZER ON GROWTH, YIELD, AND QUALITY OF CARROT (*DAUCUS CAROTA* L.)

***Muhammad Irfan Ashraf**[1], Rashid Iqbal[1], Bakhatawar Liaqat[2], Munawar Almas[3], Tahir Saeed[4], and Nazar Hussain[1]

[1]Institute of Horticultural Sciences, University of Agriculture, Faisalabad. Pakistan.
[2]Department of Botany, University of Agriculture, Faisalabad. Pakistan.
[3]Governor House Lahore
[4]Ayyub Agriculture Research Institute Faisalabad, Pakistan
*Email: irfanflorist199@yahoo.com

ABSTRACT

The current experiment was undergone at Vegetable Experimental Area, Institute of Horticultural Sciences, and the University of Agriculture Faisalabad during 2011-2012, to find the effect of organic (FYM and poultry manure) and inorganic fertilizer (NPK, SOP, and Urea) on the growth, yield, and quality of carrot variety "T-29. The experiment has undergone according to Randomized Complete Block Design (RCBD), comprising ten treatments and three replications. The parameters on vegetative growth, yield and quality were recorded and statistically analyzed at a 5% level of significance. The treatment means were compared by the LSD test. Different doses of organic and inorganic fertilizers were applied, the plants showed variations in vegetative and reproductive parameters like plant height, number of leaves per plant, root length (cm), root diameter (mm), root volume (cm^3), core diameter (mm), root fresh weight (g), root dry weight (g), foliage fresh weight (g), foliage dry weight (g), foliage dry matter percentage (%), root dry matter percentage (%), total plant weight (g), harvest index (%), yield (tonnes per hectare), number of forked roots (%), root color, Juice content percentage (%), pH of juice, total soluble solids (Brix) and Chlorophyll contents (CCi). The treatment T_4 (50% Farm Yard Manure + 50% poultry manure) showed the highest value in yield and quality parameters followed by T_6 (25% Poultry Manure + 75% Chemical Fertilizer), T_9 (33.33% FYM + 33.33% Poultry Manure + 33.33% Chemical Fertilizer) and T_1 (100% FYM). From the above experiment, it is concluded that T_4 (50% Farm Yard Manure + 50% poultry manure) is observed as the best combination of organic and inorganic fertilizer for carrot crop.

EFFECT OF FOLIAR APPLICATION OF ZINC AND BORON ON GROWTH AND YIELD OF CHILLI (*CAPSICUM ANNUM* L.)

***Muhammad Irfan Ashraf**[1], Rashid Iqbal[1,] Bakhatawar Liaqat[2], Munawar Almas[3], Tahir Saeed[4], and Nazar Hussain[1]

[1]Institute of Horticultural Sciences, University of Agriculture, Faisalabad. Pakistan
[2]Department of Botany, University of Agriculture, Faisalabad. Pakistan
[3]Governor House Lahore
[4]Ayyub Agriculture Research Institute Faisalabad, Pakistan
*Email: irfanflorist199@yahoo.com

ABSTRACT

The experimental trial was undergone to find the impact of foliar feeding of Zinc and Boron on the flourishment and production of green chili (*Capsicum annum* L.). The experiment was designed according to Randomized Complete Block Design (RCBD). Moreover, ten treatments and four replications were considered. Each treatment contained ten plants. Vegetative and reproductive parameters of chili hybrid cultivar BSS-410 were observed for data collection. Results revealed that the highest plant height (76.18 cm), stem thickness (1.78 cm), highest fruit weight (5.39 g), the maximum number of seeds per fruit (158.25), the maximum TSS value (10.63 Brix°) and highest pH value (5.68) was achieved in T_9 while T_8 had the maximum number of branches (36), the maximum fruit pedicel length (3.17 cm), the highest value of fruit length (12.49 cm), the maximum fruit yield per plant (1113 g), the maximum fruit yield per hectare (51.15 tons), the highest value of 100 seeds weight (0.3250 g), Hence, it was concluded that foliar application

of Zinc and Boron @ $ZnSO_4$ + B_2O_3 (0.75 + 0.6 g) per liter of water increased yield characters up to maximum and this dose can be recommended to farmers to get more yield and profit.

EFFECT OF COLD STORAGE ON POSTHARVEST QUALITY OF SWEET CHERRY FRUIT

Taqdees Ali, **Ahmad Sattar Khan***, Aman Ullah Malik, Abdul Rehman, Raheel Anwar, Mahmood Ul Hassan, and Aqsa Zafar

Postharvest Research and Training Centre, Institute of Horticultural Sciences, University of Agriculture, Faisalabad, 38040, Pakistan
*Email: ahmad_khan157@yahoo.com

ABSTRACT

Cherry is a sweet temperate fruit that is high in nutrition. It exhibits short postharvest life because of high perishability; therefore, this experiment was conducted to investigate the effect of cold storage on postharvest life and quality of cherry fruit. Uniform-sized, physiologically mature, and healthy cherry cvs. 'Local' and 'France' fruits were randomly harvested from a commercial cherry orchard located in the Gilgit region, while, 'Black' cultivar was harvested from a commercial cherry orchard located in Baluchistan. Storage behavior and fruit quality were tested every 3 days during storage, for 9 days, and results from these different species cultivars were compared. During cold storage fruit of cherry cultivar 'Black' showed weight loss (165.6-54.5 g) and firmness loss (20.0 N- 0.0 N) than 'France' and 'Desi' fruit. The fruit of cv. 'Black' showed better TSS (32.4 °Brix), total sugars (63.3%), reducing sugars (41.3%), TA (0.1%) results than 'Desi' and 'France'. The pH of fruit juice showed a slight increase trend during the whole span of storage. While EC (0.9-0.2 dSm^{-1}) and ascorbic acid (63.3-49.2 mg/100g) showed a decreasing trend in 'Desi' fruit. It can be concluded that cold storage positively influenced postharvest life and quality of cherry and fruit of cherry cv. 'Black' showed better results for TSS, total sugars, reducing sugars and TA.

RECENT ADVANCES IN THE MANAGEMENT OF FRUIT FLY INFESTATION: AN OVERVIEW

***A.S. Khan R.** Anwar, A.U. Malik, C.M. Ayyub, and R.N.U. Rehman, and M.U. Hassan

Institute of Horticultural Sciences, University of Agriculture Faisalabad, Pakistan
*Email: ahmad_khan157@yahoo.com

ABSTRACT

At present fruit fly infestation is the most dangerous pest species causing a huge economic loss of the fruits and vegetable growers throughout the world. Attack of fruit flies (Diptera: Tephritidae) especially at the preharvest stage limit marketing of fruits and vegetables both in the domestic as well as export markets. In past various pre- and postharvest strategies such as mechanical, cultural, chemical, biotechnological, biological have been tested and reported in the literature to combat these devastating pest species with varying success. One of the most effective ways to manage these pests mechanically includes bagging of fruits, trapping of adult insects to reduce their multiplication. The use of improved field sanitation practices and resistant varieties have also proved effective for fruit fly management. In certain parts of the world, a scientist has introduced the use of male annihilation techniques and the introduction of sterilized adults to reduce their population. The use of parasitoids as biological control of various fruit fly species is also becoming popular in certain developed countries to manage this insect in organic farming. The fruit fly is one of the major threats to the postharvest industry worldwide. Use of hot water treatment forced hot air treatment, microwave vapor heat treatment, vapor heat treatment, irradiation, cold air treatment are major postharvest quarantine protocols being implemented in various importing countries. The use of all the above non-chemical approaches has reduced the use of chemicals for insecticidal control of this pest. However, the

application of integrated pest management initiated from the preharvest stage in the field and continue to various postharvest approaches is still considered the most effective method to manage fruit fly infestation for various fruit and vegetable crops.

RECENT ADVANCES IN THE FOLIAR APPLICATION OF MINERAL NUTRIENTS FOR FRUIT CROPS: AN OVERVIEW

Anam Waheed, *__Ahmad Sattar Khan__, Saeed Ahmad, Aman Ullah Malik, Raheel Anwar, and Mahmood Ul Hassan

Institute of Horticultural Sciences, University of Agriculture, Faisalabad, 38040, Pakistan
*Email: ahmad_khan157@yahoo.com

ABSTRACT

Foliar application of mineral nutrients has been found very effective to fulfill nutrient requirements for various fruit crops during their most critical phonological stages. In pomology, the most important source to increase yield is the application of fertilizers is nutrient management. Mineral nutrients are essential for plant growth, productivity, and premium fruit quality. Along with the appropriate amount and time, the method of fertilizer application is also equally important for their effective utilization. Among fertilizer or mineral nutrients application the most important method is foliar application as it is much easier and quicker than other methods of application. Foliar application of nutrients gives more extravagant results as compare to soil nutrient application especially for trace elements and as supplemental nutrition for macronutrients. Nutrients play a vital role in the reduction of biotic and abiotic stress. This paper describes the recent advances in the application of foliar nutrition being utilized for optimum plant growth, higher yield and best eating quality of various fruit crops.

EFFECT OF FOLIAR APPLICATION OF WATER SOLUBLE FERTILIZER ON FLOWERING, YIELD AND QUALITY ATTRIBUTES OF TOMATO (*SOLANUM LYCOPERSICUM* L.)

***Muhammad Irfan Ashraf**[1], Waqar Khalid[1] Bakhatawar Liaqat[2], Tahir Saeed[3,] Munawar Almas[4], Bilal Saeed[5,] M. Saqib Ali[1]

[1]Institute of Horticultural Sciences, University of Agriculture, Faisalabad. Pakistan.
[2]Department of Botany, University of Agriculture, Faisalabad. Pakistan.
[3]Ayyub Agricultural Research Institute, Faisalabad. Pakistan.
[4]Governer House Lahore. Pakistan.
[5]Department of Entomology, University of Agriculture, Faisalabad. Pakistan.
*Email: irfanflorist199@yahoo.com

ABSTRACT

The tomato is one of the most famous crops in Pakistan. It is used and consumed as fresh as well in processed form. The yield of tomato in Pakistan is low as compared to the global yield. The application of fertilizers has been designed to improve the yield of the crop. The water-soluble fertilizer application is the most efficient way of supplying nutrients to the plants. The proposed study had been conducted in the year 2017-2018 to find the best combination of water-soluble NPK fertilizers as compared to control. Five different types of water-soluble fertilizers were collected from different sources and were applied at 5% concentration during the entire growing period of the tomato crop. The experiment was designed using Randomized Complete Block Design (RCBD) with five treatments and four replications of each. Different vegetative, reproductive and biochemical parameters were recorded and analyzed statistically at a 5 % level of significance. The treatments were compared using the LSD test. After the statistical analysis, it was concluded that different NPK water-soluble fertilizers showed variation in physical and biochemical parameters in tomato plants as compared to control. The plants showed variation in plant height, No. of fruit per plant, fruit yield per hectare, Individual fruit weight, fruit weight per plant, No. of diseased fruit per plant,

date of the first harvest, Fruit color Fruit length (cm), fruit size (cm), fruit firmness, total NPK contents, vitamin C mg Chlorophyll concentration, pH, (TSS), Electricity conductivity (EC) and Titratable acidity. Among all the water-soluble treatments, the T_3 treatment (Water Soluble Fertilizer 20:20:20) yielded the comparatively better results as compared to other Water Soluble Fertilizer treatments. So this it was concluded that T_3 was the recommended water-soluble fertilizer for tomato.

OPTIMIZING PLANTING TIME, CALLUS INDUCTION TECHNIQUES, CUTTINGS WOOD AGE AND THEIR PREPARATION METHOD FOR ENHANCING SURVIVAL RATE, ROOT INITIATION, AND GROWTH OF *ROSA CENTIFOLIA*-UAF CUTTINGS

Iftikhar Ahmad*, **H. Atta-Ur-Rehman Saeed*,** Muhammad Shahid and H. Muhammad Amir

Institute of Horticultural Sciences, University of Agriculture, Faisalabad-38040, Pakistan
*Email: rehman.5253303@gmail.com

ABSTRACT

A study was conducted to optimize planting time, callus induction techniques, cuttings wood age and preparation method for cuttings of *Rosa centifolia*-UAF in agro-climatic conditions of Faisalabad. In Expt.1 cuttings were prepared using the standard method and planted fortnightly from November 24 to February 10, using different callus induction methods, viz. no callusing, traditional callusing by dumping in moist soil for 15 days or dipping in 2000 mg L^{-1} indole-3 butyric acid solution for 5-10 sec. In Expt. II, cuttings were prepared using straight cut on both ends, straight cut on the upper end with slanting cut on the lower end, slanting cut on the upper end with a straight cut on the the lower end and slanting cut on both ends with three callusing treatments, viz. no callusing, traditional callusing for 15 days, or dipping in 2000 mg L^{-1} naphthalene acetic acid for 5-10 sec. In Expt. III, softwood cuttings, semi-hardwood cuttings and hardwood cuttings with traditional callusing, dipping in 2000 mg L^{-1} NAA for 5-10 sec. and without callusing, as treatments were compared to select optimized cutting wood age. Data were recorded on sprouting percentage, length of shoots after 90 days, number of leaves per branch, number of branches per plant, number of shoots per cutting, root length (cm), fresh weight of shoot (g) and dry weight of shoot (g). Experiments were set up using a split-plot design and data were analyzed using Fisher's analysis of variance technique while treatment means were compared using LSD test at a 5% significance level. In Expt.1, cuttings planted on 24th Nov. and treated with IBA @ 2000 mg L^{-1} produced highest survival percentage (83%), many leaves per branch (20) and several branches per cutting (4). In Expt. II, cuttings with a straight cut on the upper end and a slanting cut on lower-end treated with NAA had better results for sprouting percentage (68.0%), length of shoots after 90 days (6.5 cm), number of branches per plant (2.9) and root length (17.7 cm), while straight cut on upper ends with slanting cut on lower ends with callusing had a better number of roots per cutting (6.9 g). In Expt. III, hardwood cuttings callused with 2000 mg L^{-1} NAA were best for the length of shoots after 90 days, number of leaves per branch (33.5), plant diameter (13.3 cm), leaf area (3.38 cm^2), fresh weight of shoot (3.0 g) and dry weight of a shoot (1.3 g), while semi-hardwood cuttings callused with 2000 mg L^{-1} NAA had better sprouting percentage (40.7%). In summary, cuttings prepared on Nov. 24 and dipped in 2000 mg L^{-1} in synthetic auxin solution for 5-10 sec. proved the best time with hardwood being best-cutting wood age, while among callusing method, synthetic auxins, viz. IBA or NAA dipping proved better than traditional callusing in moist soil for 15 days.

HEAT STRESS ALLEVIATION IN DIFFERENT GENOTYPES OF SPINACH THROUGH THE USE OF CHITOSAN

Muhammad Nazar[1], Choudhary Muhammad Ayyub[1*], *__Mujahid Ali__[2], Zahoor Hussain[2], and Bilal Akram[2]

Institute of Horticultural Sciences, University of Agriculture, Faisalabad
College of Agriculture, University of Sargodha, Sargodha
*Email: mujahidali2263@gmail.com

ABSTRACT

Spinach is a famous edible plant, commonly eaten as a vegetable due to its nutritive value of iron. Spinach is found in moderate climatic conditions and grows best at 60 to 65ºF range of temperature in fall or spring seasons. Spinach faces different types of stress; heat stress is one of those stresses which causes deleterious effects on its growth. There are many methods to cope with these stresses but chitosan is a very useful tool. In this experiment, three genotypes of spinach were selected (All Pure green, Desi Local and Lahori Palak). While, four treatments of chitosan were applied on spinach genotypes i.e. 25, 50, 75, 100 ppm in comparison to control. After the application of chitosan, data for different parameters were collected like, several leaves, leaf area (cm^2), along with root and shoot length (cm), root to shoot ratio, seedling fresh weight (g), seedling dry weight (g) and plant height (m). Besides these parameters, chlorophyll contents and electrolyte leakage (%) were also observed. The research findings proved that foliar application of chitosan responded better against heat stress and significantly affected attributes under the scrutiny of genotypes which followed the order for the heat stress as All pure green, Desi local and Lahori palak, respectively. The concentration of chitosan at 100 ppm gave the best results. The collective effect of chitosan against high temperature enhanced plant growth and productivity.

EFFECT OF ROOTING HORMONES TO PROMOTE GROWTH CHARACTERISTICS IN FICUS CUTTINGS

Adnan Younis, Fahad Ramzan *****, Sabir Aziz, and Muhammad Muzamil Ijaz

Institute of Horticultural Sciences, University of Agriculture, Faisalabad, 38040, Pakistan
*Email: fahidflorist@yahoo.com

ABSTRACT

Plant growth regulators are an excellent source to be used as rooting hormones. Therefore, three commercial synthetic rooting hormones, viz. Indolebutyric acid (IBA), 1-Naphthaleneacetic acid (NAA) and Salicylic acid (SA) were utilized. Terminal cuttings with uniform diameter were treated with 100 mg/l, 300 mg/l and 500 mg/l concentrations of IBA and NAA individually and 100 ml/l, 300 ml/l and 500 ml/l concentrations of Salicylic Acid (SA) for 5-10 seconds. In our results, higher concentrations of NAA ($500mgL^1$), IBA ($500mgL^1$) and SA ($500mlL^1$) showed significant survival percentage particularly in Golden Ficus, Black Ficus, King Ficus, and Panda Ficus. The lowest survival rate was observed in 100mg L^{-1} IBA treated cuttings of King Ficus i.e. 10.67 %. Higher concentrations of rooting hormones increased the number of leaves of most of the plant species except Panda Ficus in which 300 mlL^1 SA treated cuttings showed better results than 500 mlL^1 SA treatment. Besides, in the case of plant height parameter, $500mgL^1$ applications of NAA, as well as IBA, improved the plant height of golden ficus and black ficus cuttings than other ficus cuttings. Overall, higher concentrations of NAA and IBA rooting hormones significantly improved the growth parameters in ficus cuttings.

IMPACT OF FOLIAR APPLICATION OF ORGANIC GROWTH PROMOTERS ON VEGETATIVE AND FLORAL GROWTH OF PETUNIA HYBRIDS

***Fahad Ramzan**, Adnan Younis, Muhammad Muzamil Ijaz, and Sabir Aziz

Institute of Horticultural Sciences, University of Agriculture, Faisalabad, 38040, Pakistan
Email: fahidflorist@yahoo.com

ABSTRACT

Organic growth promoters (Moringa leaf extract and Neem leaf extract) utilization in the form of foliar application is an excellent practice to enhance morphological growth in many plant species. Therefore, an experiment was conducted on five petunia hybrids. Five treatments, T_0=0 %, T_1= 3% Moringa leaf extract, T_2= 5% Moringa leaf extract, T_3= 3% Neem leaf extract, T_4= 5% Neem leaf extract were used in this experiment. Results indicated that 5% concentrations of moringa leaf extract, as well as neem leaf extract, increased plant height, several flowers, and petal area significantly. In contrast, the increase in several leaves and leaf areas was observed in lower concentrations (3%) of moringa leaf extract and neem leaf extract in most of the petunia hybrids respectively. Also, stem diameter did not show any significant variation due to foliar application of moringa leaf extract and neem leaf extract. In conclusion, a higher concentration of organic growth promoters improved most of the floral characteristics while lower concentrations increased most of the vegetative characteristics.

TO CATEGORIZE THE ANTIBIOSIS RESISTANCE COMPONENT IN EIGHT DIFFERENT POTATO CULTIVARS AGAINST *MYZUS PERSICAE* (SULZER) (HOMOPTERA: APHIDIDAE)

Zafrullah Khan and Shah Alam Khan

Email:mzafar@aup.edu.pk

ABSTRACT

The resistant ability of potato crop plants can be determined by the genetic character avoid the attack of *M. persicae* and to reduce the plant's damages. The category of resistance as antibiosis influences the growth and development of insect pests caused by the presence of some chemical and physical features of the plant. In antibiosis, the single adult *M. persicae* mother (P1) were caged on a potato plant leaf and were put on observance for twice a day till the production of first nymph (F1). The mother aphid was shifted on the same plant to new leaf until the nymph F1 produced its first progeny. The time and date were recorded. The potato cultivar Sahiwal Red showed a delay of the first nymph production of *M. persicae* in both repeated experiments and took 15.1 and 15.2 days while SH -5 took the shortest time i.e. 10.3 and 10.5 during spring and autumn seasons of 2016 respectively. The maximum numbers of progenies were produced on the cultivars FD – 70 (14.3 and 14.0) while cultivar Sahiwal Red exhibited the minimum progenies (11.1 and 10.8) during the same period. The lowest intrinsic rate of natural increase r_m values was recorded on cultivar Sahiwal Red (0.13 and 0.16) and the highest r_m values were noted on potato cultivar FD-70 (0.26 and 0.21) during spring and autumn seasons of 2016. This new heritable resistance in potato cultivars may serve further breeding and research purposes.

COMPARATIVE EFFECT OF SOAKING AND PRIMING OF THE SEEDS ON GERMINATION AND GROWTH OF THE NASTURTIUM (*TROPAEOLUM MAJUS*)

Faiza Soomro[1], *Noor-un-Nisa Memon[1], Niaz Ahmed Wahocho[1], Muhammad Nawaz Kandhro[2], and Shabroze Hussain[1]

[1]Department of Horticulture, Sindh Agriculture University, Tandojam, Sindh, Pakistan
[2]Department of Agronomy, Sindh Agriculture University, Tandojam, Sindh, Pakistan
*Email: norimemon@gmail.com

ABSTRACT

The experiment was conducted to assess the comparative effect of soaking and priming of the seeds on germination and growth of the nasturtium. The seeds of three varieties viz. Double Giant mixed, Double Dwarf mixed and Double Aleska mixed were planted in pots. The treatments included P_1-Unprimed seeds, P_2-soaking of seeds in distilled water, P_3-priming of seeds in distilled water, P_4-soaking of seeds in boric acid solution and P_5-priming of seeds in boric acid solution. The results revealed that all growth parameters were significantly affected by an interactive effect of varieties and seed soaking/priming. The better results for seed germination (92%), days to germination (3.67), seedling vigor index (2528), fresh shoot biomass (3.57 g), fresh root biomass (2.35g), dry root biomass (1143.3 mg), rooting (92%), fresh flower biomass (553.33 mg), dry flower biomass (290 mg), flowers plant^{-1} (18.67) and electrolytes leakage (6%) were observed in Double Dwarf mixed in response to the priming of the seeds in distilled water. To compare seed soaking/priming as an independent factor, hydro primed seeds responded better for germination (82.44%), days to germination (3.89), germination index (6.44), seedling vigor index (2262.67), fresh shoot biomass (2.82g), dry shoot biomass (846.67 mg), fresh root biomass (1.73 g), dry root biomass (967.76 mg), rooting (82.44%), fresh flower biomass (383.33 mg), dry flower biomass (206.67 mg), days to flowering (39.44), flowers plant^{-1} (16.78) and electrolytes leakage (8.33%). For varieties, Double Dwarf mixed had better results for germination (67.87%), germination index (6.00), seedling vigor index (1756.1), fresh shoot biomass (2.38 g), dry shoot biomass (586 mg), dry root biomass (724.67 mg), rooting (66.13%) fresh flower biomass (377.34 mg) and dry flower biomass (208.66 mg). It is concluded that priming of the seeds in distilled water had better results for most of the germination and growth of the Double Dwarf mixed extract, T_4= 5% Neem leaf extract was used in this experiment. Results indicated that 5% concentrations of moringa leaf extract, as well as neem leaf extract, increased plant height, several flowers, and petal area significantly. In contrast, the increase in many leaves and leaf area was observed in lower concentration (3%) of moringa leaf extract and neem leaf extract in most of the petunia hybrids respectively. Besides, stem diameter did not show any significant variation due to foliar application of moringa leaf extract and neem leaf extract. In conclusion, a higher concentration of organic growth promoters improved most of the floral characteristics while lower concentrations increased most of the vegetative characteristics.

GROWTH, YIELD AND QUALITY OF STRAWBERRY UNDER DIFFERENT PHOTOPERIODS (NATURAL LIGHT) AND SOIL MEDIA

***S.A.Memon**, A.J.Roonjho, M.A.Baloch, M.I.Keerio, Muzummil Jamali, Asif Hajano, M. N. Kandhro, and M. Usman Gujjar

Sindh Agriculture University, Tando Jam, Pakistan
*Email: sabamemonjee@gmail.com

ABSTRACT

Majority cultivars of strawberry (*F.* x *ananassa*) are short day (SD) plants that, under a critical limit, are induced to flowering by photoperiods; but interactions of different photoperiods x temperature can be found. Soil plays an important role as a reservoir on which balance nutrients; and inorganic and organic substances act better for nutrient uptake to produce effective growth and development because of oxygen and water holding. Meanwhile, different materials such as peat moss, vermiculite, perlite and their properties used as a growing media affect growth and

yield, directly and indirectly. The experiment was conducted during the year 2015-16 to examine the photoperiodic effects on growth, yield and quality of strawberry at the Dept of Hort. T. Jam in a four replicated CRD design. The strawberry plants cv, "Chandler" were grown under three photoperiod treatments which included 10h photoperiod (under open), 2-4h photoperiod (under open), under net house and three soil media viz., M_1 (Garden soil (control), M_2 (garden soil + peat Moss + vermiculate (9:1:1)), M_3 (garden soil + compost manure+ perlite (9:1:1). The interactive effects (10h photoperiod (under open) + soil media (garden soil + compost manure + perlite (9:1:1) ranked 1st in all growth and quality traits of strawberry with 16.17 plant^{-1} number of leaves, 2.78 plant^{-1} number of flowers, 4.28 plant^{-1} number of fruits, 9.89 g weight of fruits, 2.52 cm diameter of fruits, 3.50 cm length of fruits, 6.19% total soluble solids and 22.87% vitamin C, respectively. It is suggested that the 10h photoperiod (under open) and M_3 (garden soil + compost manure + perlite (9:1:1) strongly influenced all the development and yield parameters as well as vitamin C and TSS.

EFFECT OF NAPHTHALENE ACETIC ACID (NAA) ON ROOTING IN STEM CUTTINGS OF FIG (FICUS CARICA L.)

***S.A.Memon**, N. A. Kashani, M.A.Baloch, M.I.Keerio, Asif Hajano, Muzummil Jamali, M.Usman, Gujjar, and M.N.Kandhro

Sindh Agriculture University, Tando Jam, Pakistan
*Email: sabamemonjee@gmail.com

ABSTRACT

Propagation by hard-wood cuttings is the cheapest and easiest method of vegetative propagation, which is used in many fruit trees as well as ornamental plants. Different treatments are used to increase the successful propagation of plants by cutting, which external application of plant growth regulators is one of the most common methods. Auxin effects on rate and enhancement of rooting percentage in the cuttings. Plants produce natural auxin in the young shoots and leaves, but for successful rooting artificial auxin must be used to prevent cuttings dead. The study was carried out during the year 2015-2016 to study the effect of naphthalene acetic acid (NAA) on rooting in stem cuttings of fig. The treatments included T1= Control, T2= Distilled water, T3= 0.10 g/100 ml (quick dip), T4= 0.30 g/100 ml, (quick dip), T5= 0.10 g/100 ml (20 hours) and T6=0.30 g/100 ml (20 hours). The result was determined number of shoot cutting^{-1} was 6.53, shoot length was 14.80 cm, number of leaves cutting^{-1}was 13.57, several primary roots cutting^{-1} was 48.76, percentage of rooted cuttings was 83.33, root length (cm) was 52.33, many secondary roots cutting^{-1} was 61.83, fresh root weight was 39.13 treated with (T3) 0.10 g/100 ml (quick dip) respectively. It was concluded that all the studied parameters were considerably higher when fig cuttings treated with T3 = 0.10 g/100 ml (quick dip).

ALLEVIATION OF SALT STRESS IN TRIGONELLA (*FOENUM-GRAECUM* L.) THROUGH DIFFERENT SEED PRIMING TECHNIQUES

***Sajjad Hussain**, Hafiza Muzamil Asif, Muhammad Akbar Anjum, Farrukh Naveed, Aamir, Nawaz, Safina Naz, Khalid Masood Ahmad, Shaghef Ejaz, Sakeena Tul-Ain Haider, Hassan, Sardar, and Sajid Ali

Department of Horticulture, Faculty of Agricultural Sciences and Technology, Bahauddin Zakariya University Multan Pakistan
*Email: sajjad.hussain@bzu.edu.pk

ABSTRACT

Salinity is globally considered as a widespread problem of the irrigated soils in arid and semi-arid areas and seed priming is proved as a useful technique to mitigate the salt stress. The current study was conducted to evaluate the effect of different priming techniques on two fenugreek cultivars under saline conditions. There were five priming treatments (i.e. T 1 = Potassium nitrate (KNO 3), T 2 = Polyethylene glycol (PEG), T 3 = Gibberellic acid (GA 3), T 4 = Hydrogen peroxide (H 2 O 2), T 5 = Salicylic acid (SA) and T 6 = Distilled water) and two fenugreek cultivars (i.e. Kasuri methi (V 1) and Local methi (V 2)). Slat stress plants were irrigated with 100 mM of NaCl while control plants were irrigated with normal tap water. Seed priming of V 1 enhanced germination index

(37.52%) with GA 3 and energy of emergence (98.33%) with PEG as compared with other treatments. Final emergence percentage (100%) was increased in control plants of both cultivars when treated with SA. Morphological characteristics such as several leaves, number of branches, shoot length, root length, plant fresh and dry biomass were increased in control plants of V 1 when primed with SA. The leaves chlorophyll "a" and "b" were significantly increased in control plants of V 2 primed with SA. The antioxidant activity and capacity and proline content in leaves as well as in roots were also increased when treated with SA under salt stress. It is concluded that seeds of Kasuri methi should be treated with SA to reduce the effect of salinity by improving the germination, morphological and chemical properties.

VARIOUS AGRICULTURAL WASTES BASED SOILLESS SUBSTRATES AFFECT GROWTH, YIELD, AND QUALITY OF *ANTIRRHINUM MAJUS*

Samina Iqbal* and Iftikhar Ahmad
Institute of Horticultural Sciences, University of Agriculture, Faisalabad-38040, Pakistan
Email: saminaiqbal222@gmail.com, iftikharahmadhashmi@gmail.com

ABSTRACT

Antirrhinum majus (snapdragon) is a commercially important specialty cut flower, which belongs to family Scrophulariaceae. A study was conducted to evaluate various agricultural wastes-based soilless substrates, viz. date palm coir, peanut hulls, rice hulls and sugarcane press mud in different combinations on growth, yield and quality of *Antirrhinum majus* in agro-climatic conditions of Faisalabad, Punjab, Pakistan. Two experiments were conducted having seven substrate treatments with traditionally used silt (control) having three replications. Experiments were laid out according to Randomized Complete Block Design (RCBD) with three replications. In Expt.1, plants are grown in substrate combinations consisted of 50:40:10 date palm coir, peanut hulls, and sugarcane press mud performed best with greatest plant height, number of leaves, leaf total chlorophyll content, stem length, number of florets, stem diameter, flower quality, fresh weight and spike length followed by 40:40:20 date palm coir, peanut hulls, and sugarcane press mud, which resulted in longest vase life and highest number of marketable stems per plant. In Expt. 2, growing substrates having 40:40:20 date palm coir, rice hulls, sugarcane press mud, and 50:40:10 date palm coir, rice hulls, sugarcane press mud produced best results regarding all the parameters studied. Whereas, plants grown in silt had minimum plant height, number of leaves, leaf total chlorophyll contents, number of florets, spike length, shortest vase life and minimum marketable stems per plant followed by 30:60:10 date palm coir, peanut hulls, and sugarcane press mud, which showed 100% mortality. Physico-chemical analysis of the substrate exhibited significant differences among pH, electrical conductivity, bulk density, and porosity, water holding capacity, total available nitrogen, and available phosphorus and available potassium. It can be concluded that date palm coir, rice hulls, sugarcane press mud (50:40:10) and date palm coir, peanut hulls, sugarcane press mud (50:40:10) are best growing substrate combinations for tested cut antirrhinum flower production, followed by date palm coir, rice hulls, sugarcane press mud (40:40:20) and date palm coir, peanut hulls and sugarcane press mud (40:40:20). Moreover, use of growing substrates in the combination of (30:60:10) date palm coir, peanut hulls, and sugarcane press mud did not prove suitable for antirrhinum production due to highest bulk density, less porosity, maximum water holding capacity, which led to fungal attack, highly acidic pH and EC, which restricted the availability of nitrogen.

EFFECT OF PLANT GROWTH REGULATORS ON MORPHOLOGICAL CHARACTERISTICS OF *BEGONIA* PLANT

***Hafza Mahek Hamid**, Adnan Younis, Fahad Ramzan, Muhammad Muzamil Ijaz, and Sabir Aziz

Institute of Horticultural Sciences, University of Agriculture, Faisalabad, 38040, Pakistan
*Email: hafzamahekhamid75@gmail.com

ABSTRACT

Begonia semperflorens, belonging to the family "Begoniaceae" is an indoor plant widely distributed in the tropics and subtropics of South America, Africa, and Asia. This experiment was conducted at Gardening Wing, University of Agriculture, Faisalabad. Two varieties of *Begonia semperflorens* plant and two growth regulators, Naphthalene acetic acid (NAA) and Indole Butyric acid (IBA) were selected for this experiment. The concentration of Naphthalene acetic acid (100ppm, 200ppm, 300ppm) and Indole Butyric acid (50mg/L, 100mg/L, 150mg/L) was

applied for the fast growth and to check the growth rate and morphological characteristics on both varieties. A total of seven treatments were used in this experiment, each replicated three times with Complete Randomize Design (CRD). Data were collected on various parameters i.e. plant height, number of leaves per plant, leaf area, root length, number of flowers, flower diameter, and petal length. Results conceded that higher concentrations of growth regulators especially NAA improved the leaf area, several flowers and flower diameter significantly. In conclusion, the utilization of plant growth regulators enhanced the growth of the begonia plant.

VARIATIONS IN POLLEN ATTRIBUTES OF DATE PALM MALE ACCESSIONS

Muhammad Kashif Raza, Muhammad Jafar Jaskani*, Summar Abbas Naqvi, and Naseem Sharif

Institute of Horticultural Sciences, University of Agriculture, Faisalabad, Pakistan
*Email: jjaskani@uaf.edu.pk

ABSTRACT

Date palm (*Phoenix dactylifera* L., 2n=2x=36) is an evergreen, mono-cotyledonous and dioecious (2n=36) fruit plant of Arecaceae family which has a momentous share in the social and financial position for the inhabitants of date growing areas. It is highly nutritious, energy-producing and assimilative fruit among natural foods available to a human being. Naturally, date palm is a dioecious fruit tree in which male and female reproductive organs are present on different trees. Pollen grains are present in the flowers of the male tree whereas female plants fetch fruit only. Attention driven phenomena i.e. "metaxenia" exist in date palm which is the effect of pollen grain on the maternal tissues of fruit. Pollen morphology is a genetically controlled trait. So, a study on variations in pollen traits is imperative to discriminate male accessions of the date palm. The objective of this investigation was to determine the variations in pollen morphology of different date palm male trees. Pollen of nineteen date palm male accessions was collected. The scanning electron microscopic (SEM) results revealed that pollen grains of all studied accessions were elliptical-oblate in shape having one deep germinal furrow on the entire surface. Results revealed a significant difference among the length of different pollen grains. Maximum pollen length (38.40 µm) was found in M7 but minimum pollen length i.e. 12.46 µm was exhibited by accession M5. Pollen width varied from 5.80 to 14.86 µm for accessions M18 and M7, respectively. Similarly, a maximum number of pores of 172.33/µm^2 was found in the pollen grain of accession M7. Maximum pollen weight per spathe (29.16 g) was exhibited by the accession M17. These findings are helpful in the identification and characterization of date palm male accessions.

EVALUATION OF KINNOW MANDARIN FOR ENDOGENOUS HORMONES, GROWTH PHYSIOLOGY AND YIELD GRAFTED ON NINE ROOTSTOCKS

Muhammad Ahsan Qureshi, *Muhammad Jafar Jaskani, Ahmad Sattar Khan, Safeer ud Din, and Waqar Shafqat

Institute of Horticultural Sciences, University of Agriculture, Faisalabad, Pakistan
*Email: jjaskani@uaf.edu.pk

ABSTRACT

The citrus industry is very important to the economy of Pakistan. Worldwide, Pakistan ranks at 13 positions with an annual production of 2.39 thousand tons from an area of 192.8 thousand hectares. In Pakistan, citrus is grafted on two rootstocks; rough lemon in Punjab and sour orange in Khyber Pakhtunkhwa. This dependence just on two rootstocks results in low production, disease infestation, and short orchard life. An experiment was conducted to evaluate the endogenous plant hormones, leaf gas exchange, photosynthetic pigments, vegetative performance and yield of Kinnow mandarin grafted on nine rootstocks (Rough lemon, cox mandarin, Fraser hybrid, Troyer Citrange, Cleopatra mandarin, *Poncirus trifoliata*, Benton, C-35 and Carrizo Citrange). Maximum Indole acetic acid (IAA), gibberellic acid (GA_3) and zeatin (ZT) levels were recorded in scion and rootstock of *Poncirus trifoliata* followed by Fraser hybrid. Troyer citrange rootstock depicted maximum amount of abscisic acid in scion and rootstock. Maximum leaf gas exchange in Kinnow mandarin was recorded on Fraser hybrid rootstock followed by *Poncirus trifoliata*. Kinnow grafted on Troyer citrange rootstock had minimum stomatal conductance and photosynthetic activity because of a high ABA level. Photosynthetic pigments of Kinnow mandarin were maximum on *Poncirus trifoliata* and minimum on Troyer citrange. A positive correlation was observed among levels of IAA, GA, ZT and vegetative growth of Kinnow mandarin. *Poncirus trifoliata* and Fraser hybrid were the most vigorous rootstocks and had high tree height, canopy volume, and yield. It is concluded that endogenous hormones modulated the growth of

Kinnow mandarin. *Poncirus trifoliata* and Fraser hybrid rootstocks could be an alternate rootstock of traditional Rough lemon for Kinnow mandarin.

EXPLOITATION OF DIVERSITY IN JAMUN (*SYZYGIUM CUMINI*) GERMPLASM

Safeer ud Din[1], Muhammad Jafar Jaskani[1,*], Rizwana Maqbool[2], Waqar Shafqat[1], and Ahsan Qureshi[1]

[1]Institute of Horticultural Sciences, University of Agriculture Faisalabad.
[2]Department of Plant Breeding and Genetics, University of Agriculture Faisalabad.
[*]Email: jjaskani@uaf.edu.pk

Jamun (*Syzygium cumini*) belongs to family *Myrtaceae* and is well known for its high nutritional and medicinal value. Jamun is a cross-pollinated plant, that ensures high variability. In Pakistan, it is distributed throughout the tropical and subtropical areas. It is treated as a minor fruit crop and data regarding its diversity is completely missing. The present study was focused on the morphogenetic characterization of fifty Jamun accessions collected from different districts of Punjab. Evaluation of qualitative and quantitative characters revealed high variability among accessions. Tree shape varied from upright to drooping and spreading. For fruit length and width data varied among 2.20 - 4.17 cm and 1.40-2.97 cm. Weight of fruit varied between 2.67 g (SKUK-02) to 12.63 g (TUK-03). Pulp percentage varied from 50-90%, approximately. Variation was also found in the case of biochemical characters. In CSP-25, maximum phenolic content was observed (20.57 mg GAE/100 g) and minimum in KDC-01 (8.36 mg GAE/100 g). TSS (13.7-25.4%), TA (0.38-1.15%) and antioxidants (19.81-251.47 mg/g) were found diverse among accessions. PCA biplot exhibited the highest phenotypic variability in SFM-08, SFS-02, TUK-03, and KDC-04. Random amplified polymorphic DNA markers were used for fingerprints and genetic diversity analysis among accessions. A total of 220 amplification products were scored of which 87% were polymorphic. Dendrogram constructed through UPGMA depicted genetic relatedness among accessions and grouped them into clusters. Accessions like SPJ-05, SFM-08, and TUK-02 showed clear distinctive features that can be helpful in the future for crop improvement

DIVERSITY OF PLANT GROWTH PROMOTING RHIZOBACTERIA IN THE RHIZOSPHERE OF QUINOA (*CHENOPODIUM QUINOA* WILLD)

Ejaz Rafique[1], Arif Malik[1], and *Ahmad Zaheer[1]

[1]Institute of Molecular Biology and Biotechnology, University of Lahore, Defence Road, Lahore, Pakistan.
*Email: ahmad.zaheer@imbb.uol.edu.pk

ABSTRACT

Chenopodium quinoa Willd commonly known as Quinoa belongs to family Chenopodiaceae. Rhizospheric soil is one of the largest reservoirs of microbial genetic diversity. In this study, we analyzed the bacterial diversity associated with the rhizosphere of *the* quinoa plant by culture-dependent techniques. The bacterial strains were also characterized by morphological, physiological, biochemical tests. A field experiment was conducted to determine the inoculation effect of bacterial strain on growth, yield, and quality of quinoa crop. About 30 bacterial isolates isolated and chemical characterized. The identification of bacterial isolates is in progress.

INVESTIGATING THE IN VITRO REGENERATION POTENTIAL OF COMMERCIAL CULTIVARS OF BRASSICA

Nisma Farooq, Muhammad Asif Nawaz, Zahid Mukhtar, Iftikhar Ali, Penny Hundleby, and Niaz Ahmad

Department of Microbiology & Molecular Genetics (MMG), The Women University, Multan
Email: nismaansari@yahoo.com

ABSTRACT

In vitro regeneration is a pre-requisite for developing transgenic plants through tissue culture-based genetic engineering approaches. Huge variations among different genotypes of the genus Brassica necessitate the identification of a set of regeneration conditions for a genotype, which can be reliably used in transformation experiments. In this study, we evaluated the morphogenesis potential of four commercial cultivars (Faisal canola, Punjab canola, Aari canola, Nifa Gold) and one model, Westar, from four different explants namely cotyledons, hypocotyls, petioles and roots on three different Brassica regeneration protocols, BRP-I, -II and -III. The regeneration efficiency was observed in the range of 6–73%, 4–79.3%, 0–50.6%, and 0–42.6% from cotyledons, petioles, hypocotyls, and roots, respectively, whereas, the regeneration response in terms of average shoots per explant was found to be 0.76–10.9, 0.2–3.2, 0–3.4 and 0–2.7 from these explants. Of the commercial varieties tested, almost all varieties showed poorer regeneration than Westar except Aari canola. In comparison to Westar, its regeneration frequency from cotyledons was up to 7.5-fold higher on BRP-I, while it produced up to 21.9-fold more shoots per explant. Our data show that the explant has a strong influence on the regeneration response, ranging from 24% to 92%. While the growth of commercial cultivars was least affected by the regeneration conditions provided, the effect on Westar was twice that of the commercial cultivars. After determining the optimal explant type and regeneration conditions, we also determined the minimum kanamycin concentration levels required to selectively inhibit the growth of untransformed cells for these cultivars. Regenerated shoots of Aari canola could be successfully grown to maturity within 16–18 weeks, with no altered phenotype, noted and normal seed yields obtained. Therefore, the commercial variety, Aari canola, could be a good candidate for future genetic transformation studies.

MARKET DEMAND, SUPPLY AND CONSUMPTION PATTERN ANALYSIS OF WHOLESALE FLOWER MARKETS OF PUNJAB, PAKISTAN

Iftikhar Ahmad*, Zafar Iqbal, **Kainat Fatima***, and Muhammad Abdul Salam Khan

Institute of Horticultural Sciences, University of Agriculture, Faisalabad-38040, Pakistan
*Email: iftikharahmadhashmi@gmail.com; kainatfatima272@gmail.com

ABSTRACT

A study was conducted to analyze the supply, demand and consumption patterns of cut flowers in wholesale flower markets of Punjab, Pakistan, from March 2015 to March 2016. Two wholesale flower markets Pattoki (Kasur) and Saggian (Sheikhupura) were selected. Data were collected on a questionnaire along with the record registers of wholesalers in the markets. Results demonstrated that wholesalers were marketing different cut flowers, viz. cut roses, gladioli, tuberoses, statice, and marigolds but the majority of wholesalers were marketing only cut roses, which had the greatest demand during the whole year. The maximum supply of cut roses was recorded (376.56 million stems) in the last week of October, followed by 11.48 million stems of gladiolus in last week of December, 5.40 million stems of tuberose in the first week of September and 0.35 million stems of statice in Pattoki (Kasur) flower market. But, in Saggian (Sheikhupura) flower market, the maximum supply of cut roses was 276.45 million stems in last week of September, followed by 23.18 million stems of gladiolus in the third week of December, 11.63 million stems of tuberose in the third week of September and 38.83 million stems of statice in last week of March. The average price of cut roses were Rs. 585.71 in Pattoki market, followed by Rs. 700 in the Saggian market per 100 stems of cut roses. The average price of the gladiolus was Rs. 18 per stem in Pattoki market, followed by Rs. 22 per

stem in the Saggian market, however, it varied from time to time from Rs. 8 to 40. The average price of tuberose was Rs. 9.50 per stem in the Pattoki market, followed by Rs. 10 per stem in the Saggian market, when demand was highest, while during summer months, the tuberose rate was Rs. 3-4 per stem. The average price of statice was Rs. 6.5 per 10 stems in the Pattoki market, followed by Rs. 6.0 per 10 stems in the Saggian market. On average, 20-40 thousand stems were supplied to each wholesaler daily in each market mainly by local growers in the region, while 21-30 percent of cut flowers were being wasted every day due to the non-availability of refrigerated containers for storage and transportation. Results also highlighted some problems faced by wholesalers such as lack of capital investment and non-existence of cooperatives, insufficient training institutions, improper market infrastructure, less producer's share in marketing of cut flowers, post-harvest losses during harsh weather conditions, less knowledge of marketing and lack of quality standards. Therefore, public and private sectors need to collaborate to overcome these issues for maintaining product quality after harvest and promotion of the floriculture industry in Pakistan.

COMPARISON OF NATURAL VS SYNTHETIC ROOTING HORMONES, CUTTING SIZES, PLANTING TIMES AND SOILLESS SUBSTRATES ON GROWTH AND FLOWERING OF *DENDRANTHEMA GRANDIFLORUM*

Iftikhar Ahmad*, Hassan Razzaq, and **Muhammad Zain Ali***

Institute of Horticultural Sciences, University of Agriculture, Faisalabad
*Email: iftikharahmadhashmi@gmail.com; zainali5605@gmail.com

ABSTRACT

Chrysanthemum (*Dendranthema grandiflorum*) is the leading commercial flower crop all over the world, which is used for making bouquets, floral arrangements and loose flowers. A study was conducted to compare organic homemade and synthetic rooting hormones for enhancing the rooting of chrysanthemum cuttings. Indole Butyric Acid (IBA) at 500 mg L^{-1}, Naphthalene Acetic Acid (NAA) at 500 mg L^{-1}, Salicylic Acid (SA) at 500 mg L^{-1}, Willow water 1 kg L^{-1}; w/v, Aspirin 2 tablets in 100 mL distilled water, honey and cinnamon powder were compared. Cuttings treated with IBA (500 mg L^{-1}) had the highest survival percentage (95.0%). Honey syrup produced tallest shoots (18.8 cm), greatest shoot diameter (5.6 mm), leaf number (14.6), shoot fresh weight (1.56 g), shoot dry weight (0.25 g), root fresh weight (0.51 g) and root dry weight (0.10 g), while cinnamon powder produced longest roots (14.6 cm). Another experiment was conducted on the evaluation of the best cutting size for chrysanthemum propagation. Treatments included control (terminal cuttings with five leaves), terminal cuttings with three leaves, terminal cuttings with one leaf, lateral cuttings with three leaves and lateral cuttings with one leaf. Results depicted that terminal cuttings with 3 leaves had a maximum survival rate. Experiment III was conducted to optimize the planting time of chrysanthemum cuttings in agro-climatic conditions of Faisalab ad, Punjab, Pakistan. Cuttings were planted on July 01, July 15, August 01, August 15 and September 01, 2018. Cuttings planted on July 01 produced maximum height (67.7 cm) and flowered in the least time (138.7 d). Cuttings planted on August 01 took the longest time (157.2 d) to produce flowers, while cuttings planted on August 15 and September 01 did not flower. Experiment IV was conducted to evaluate various local soilless growing substrate for cut chrysanthemum production. Ratios of substrates included coco coir + peanut hulls + press mud (60%:30%:10%; v/v/v), coco coir + peanut hulls + press mud (40%:40%:20%; v/v/v), coco coir + peanut hulls + press mud (30%:40%:30%; v/v/v), coco coir + rice hulls + press mud (60%:30%:10%; v/v/v), coco coir + rice hulls + press mud (40%:40%:20%; v/v/v), coco coir + rice hulls+ press mud (30%:40%:30%; v/v/v) and silt as control. Coco coir + peanut hulls + press mud (30%:40%:30%; v/v/v) took least time (121 d) to produce flowers. Plants were grown in coco coir + peanut hulls + press mud and coco coir+ rice hulls + press mud took a relatively similar time to flower. In summary, homemade natural or synthetic rooting hormone (IBA) is best suited to enhance rooting and terminal cuttings with three leaves should be planted during July for better growth and flowering. Moreover, soilless substrates proved better than soil or silt for quality chrysanthemum production.

AGRICULTURAL WASTES-BASED SUBSTRATES AFFECT THE GROWTH AND FLOWERING OF GERANIUM (*PELARGONIUM BICOLOR*)

*Iftikhar Ahmad, Muhammad Aashir Sajjad, Asees Ahmad, and **Afira Bilal**

Institute of Horticultural Sciences, University of Agriculture, Faisalabad.
*Email: iftikharahmadhashmi@gmail.com; iahmad@uaf.edu.pk

ABSTRACT

A study was conducted to evaluate the effects of various ratios of indigenous agricultural wastes-based growing substrates, which consisted of date palm coir, coco coir, pine bark, rice hulls ash, peanut hulls and sugarcane press mud on growth and flowering of geranium (*Pelargonium bicolor*). Coco coir and sugarcane press mud were used in all substrate combinations along with mixing with either pine bark (Expt. 1), peanut hulls (Expt. 2) or rice hulls ash (Expt. 3) having four different ratios as 30%:60%:10%, 40%:50%:10%, 50%:40%:10% or 60%:30%:10%, which were mixed v/v/v. In a separate experiment, coco coir was replaced by date palm coir and similar ratios of date palm coir: peanut hulls: sugarcane press mud was also compared. In expt. 1, plants are grown in coco-coir: pine bark: press mud (30%:60%:10%; v/v/v) performed best, while in expt. 2, plants are grown in coco-coir: peanut hulls: sugarcane press mud (40%:50%:10%; v/v/v) had the best growth and early flowering as compared to other tested ratios. In expt. 3, highest quality plants were produced when grown in coco-coir: rice hulls ash: sugarcane press mud (50%:40%:10%; v/v/v). In expt. 4, plants are grown in palm coir: peanut hulls: press mud (60%30%10%; v/v/v) produced the best quality plants. Overall, plants grown in date palm coir: peanut hulls: sugarcane press mud (60%:30%:10%; v/v/v) performed best and produced best quality plants with the greater number of leaves, highest plant height, number of flower branches, stem diameter, number of flowers, floret diameter, blooming period and plant canopy diameter as compared to all other substrate combinations and ratios and may be used for quality geranium production.

ISOLATION AND FUNCTIONAL CHARACTERIZATION OF AN ETHYLENE RESPONSE FACTOR (RHERF092) FROM ROSE (*ROSA HYBRIDA*)

*__Muhammad Ali Khan__, Muhammad Imtiaz, Syed Hussain, and Fazal Said

Fazal Jalal Department of Horticulture, Abdul Wali Khan University Mardan, Khyber Pakhtoonkhwa, Pakistan
*Email: malikhan@awkum.edu.pk

ABSTRACT

The rose Ethylene Response Factor RhERF092 is a transcription factor that regulates essential ethylene-related development of rose flowers and mediates abiotic stress responses in Arabidopsis. Improper post-harvest handling results in significant losses to cut rose flowers. The phytohormone ethylene plays a key role in the growth of rose and flower opening. In this study, we isolated and characterized an Ethylene Response Factor (RhERF092) from rose (*Rosa hybrida*) cv. “Samantha” and investigated its role in flower opening and development. RhERF092 was originally detected in a microarray experiment with a significant increase in its expression in rose petals after 1 h of ethylene treatment. Sequence analysis showed the presence of a canonical AP2/EREBP domain and a C-terminus trans-activation domain. Phylogenetic analysis showed that RhERF092 is an orthologue of the Arabidopsis ERF1 (AT3G23240) belonging to subgroup IX of the ERF gene family. Confocal laser scanning microscopy showed RhERF092: GFP expression in the nucleus. Basal expression of RhERF092 is the highest expression at stage 0 of flower opening which gradually decreases and remains constant till senescence. Ectopic expression of RhERF092 in Arabidopsis caused various ethylene-related aberrations in plant development including stunted growth, abortion of apical dominance, production of lateral tillers from rosette nodes, branches from the aerial nodes, and sterile inflorescence. Arabidopsis 35SRhERF092 plants were found to be sensitive to the ethylene precursor ACC with significantly reduced hypocotyl and root system with a significant reduction in the expression of genes involved in cell proliferation, cell expansion and cell cycles such as ARGOS, ARGOS-LIKE, SIM, JAGGED, AN3, CYCD3-1, and CYCD3-2as compared to WT plants. Taken together these results indicate that RhERF092 regulates ethylene-specific responses in rose and Arabidopsis.

EFFECT OF SODIUM CHLORIDE ON GROWTH, MORPHOLOGY, PHYSIOLOGY, AND ANATOMY OF BISMARCKIA PALM (*BISMARCKIA NOBILIS*)

Iqra Hanif [1,2], Adnan Younis [2], Fahad Ramzan[2]*, and Iram Naz [1,2]

[1]Department of Botany, University of Agriculture, Faisalabad, 38040, Pakistan
[2]Institute of Horticultural Sciences, University of Agriculture, Faisalabad, 38040, Pakistan
*Email: fahidflorist@yahoo.com

ABSTRACT

Salinity is a major issue that causes the accumulation of excess salts. An experiment was conducted in pots at Old Botanical Garden, University of Agriculture, Faisalabad, to examine the effects of sodium chloride (NaCl) on the growth, morphology, and physiology of bismarckia palm *(Bismarckia nobilis*). The NaCl of different concentrations was supplied to observe the above-mentioned aspects. Seedlings of bismarckia palm were established in pots and treatments were started with the 50mM of NaCl and then higher concentrations like 100 and 150mM of NaCl periodically. All the data was recorded at regular intervals. Statistical completely randomized design (CRD) was used. Results showed the reduction in plant height, no. of leaves, area of leaves, fresh and dry biomass, chlorophyll contents, stomatal conductance and net CO_2 assimilation; and increased in antioxidants like superoxide dismutase (SOD), peroxidases (POD), catalases (CAT) and other phenolic compounds. Bismarckia seedlings were affected by various applications of sodium chloride significantly.

EFFECT OF DROUGHT STRESS ON GROWTH, MORPHOLOGY AND PHYSIOLOGICAL RESPONSES IN BISMARCKIA PALM (*BISMARCKIA NOBILIS*)

Iram Naz [1,2], Adnan Younis [2], Fahad Ramzan[2]*, and Iqra Hanif [1,2]

[1] Department of Botany, University of Agriculture, Faisalabad, 38040, Pakistan
[2]Institute of Horticultural Sciences, University of Agriculture, Faisalabad, 38040, Pakistan
Email: fahidflorist@yahoo.com

ABSTRACT

Drought stress is multi-dimensional environmental stress caused due to several factors like salinity, low rainfall, and temperature fluctuations. It affects plant morphological and anatomical characters to a degree depending upon the level of drought stress faced. This research aimed to study the effect of different levels of water deficit on plant growth, morphology and physiological responses in *Bismarckia* palm. The experiment is conducted at Gardening Wing, University of Agriculture, Faisalabad. Four treatments (40%, 60%, 80% and 100% field capacity (control) with five replicates each was applied on *Bismarckia* palm and the experiment was designed in a completely randomized design. By inducing drought stress, a decrease in plant fresh weight, dry weight, growth, chlorophyll contents and an increase in the root-to-shoot ratio and root length were observed in *Bismarckia* palm seedlings. A significant increase in Reactive oxygen species was also observed. *Bismarckia* seedlings were affected by various applications of drought stress significantly.

EFFECT OF HYDROGEN PEROXIDE ON GROWTH ATTRIBUTES OF *HAMELIA PATENS* AND *HIBISCUS ROSASINENSIS*

Muhammad Muzamil Ijaz[1], Adnan Younis[1], Fahad Ramzan [1]*, Muhammad Umair Shafique[1], Tahira Naseem[1], and Mehak Shehzad[1]

[1]Institute of Horticultural Sciences, University of Agriculture, Faisalabad, 38040, Pakistan
*Email: fahidflorist@yahoo.com

ABSTRACT

Ornamental shrub's growth characteristics can be affected by the applications of growth-related inorganic chemicals. In this regard, an experiment was conducted to find out the effect of hydrogen peroxide as a foliar application on the morphological characteristics of *Hamelia patens* and *Hibiscus rosasinensis* young plants. Five treatments of hydrogen peroxide i.e. T_0=0 mg/L T_1= 30 mg/L, T_2= 50 mg/L, T_3= 70mg/L, T_4= 90mg/L were used in this

experiment. Results indicated that higher concentrations of hydrogen peroxide i.e. T_4= 90mg/L showed improvement in floral characteristics (number of flowers, flower diameter) of *Hibiscus rosasinensis* significantly while T_3= 70mg/L improved the vegetative characteristics plant height, number of leaves and leaf area significantly. Besides, *Hamelia patens* vegetative growth was significantly increased by the applications of T_4= 90mg/L hydrogen peroxide. In conclusion, foliar applications of higher concentrations of hydrogen peroxide significantly increased the morphological parameters of young plants of *Hamelia patens* and *Hibiscus rosasinensis*.

INFLUENCE OF OIL EMULSION ON FRUIT QUALITY AND SHELF LIFE OF CHINA LIME

Ehtesham Jamil, Shah Zeb, Qazi Shoaib Ali, and Naveed Ahmad

Department of Horticulture, Faculty of Crop Production Sciences, The University of Agriculture Peshawar, Pakistan.
Email: ehteshamjamil47@gmail.com

ABSTRACT

An experiment 'Influence of oil emulsion on fruit quality and shelf life of China lime' was conducted at Post Harvest Laboratory, Department of Horticulture, The University of Agriculture Peshawar during 2016. The experiment was laid out using a Completely Randomized Design (CRD) with three repeats. China lime was treated with different edible oils (Control O_1, Coconut oil O_2, Mustard oil O_3, Castor oil O_4, and Sesame oil O_5) stored at room temperature for about 40 days, at 10 days of intervals. The experimental results showed that Oil emulsion and storage durations significantly influenced all the quality and sensory attributes of China lime fruit during 40 days of storage. The highest fruit firmness (3.22 kg-cm^2), fruit juice content (37.21%), titratable acidity (3.82%), ascorbic acid content (14.89 mg.100ml^{-1}), taste score (9.62), appearance score (9.46) with minimum weight loss (13.09%), total soluble solids (8.70 ^{0}Brix), fruit juice pH (3.05) and disease incidence (2.21%) were recorded in fruits treated with coconut oil. The least fruit firmness (2.22 $\underline{kg.cm}^2$), fruit juice content (30.65%), titratable acidity (3.16%), ascorbic acid (12.15 mg.100ml^{-1}), taste score (6.70), appearance score (6.41) with highest weight loss (44.80%), total soluble solids (10.61^{0}Brix), fruit juice pH (3.12) and disease incidence (8.88%) were recorded in untreated fruits. These quality attributes were also significantly influenced by storage duration. The highest taste score (10.00), appearance score (10.00), fruit firmness (3.79 $\underline{kg.cm}^2$), fruit juice content (38.32%), titratable acidity (4.52%) and ascorbic acid content (20.58 mg.100ml^{-1}) with least fruit juice pH (3.00) and total soluble solids (8.05 ^{0}Brix) was found in freshly harvested fruits. However, the least taste score (5.78), appearance score (4.2), fruit firmness (0.99 $\underline{kg.cm}^2$), fruit juice content (28.34%), titratable acidity (2.84%) and ascorbic acid content (8.42 mg.100ml^{-1}) with maximum fruit juice pH (3.16) and total soluble solids (12.93^{0}Brix) were found in fruits stored for 40 days. As concerned about the interactive effects, a significant variation was observed for the qualities and sensory attributes including appearance, taste, fruit firmness and weight loss %. The highest appearance score (8.93), taste score (9.13), fruit firmness (2.41 $\underline{kg.cm}^2$) with least weight loss (25.08%) were recorded in fruits treated with coconut oil stored for 40 days of storage. However, the least appearance score (2.00), taste score (3.26), with maximum weight loss (73.19%) were recorded in untreated fruits stored for 40 days. It is concluded that coconut oil considerably maintained the quality parameter of lime fruit up to 40 days of storage at room temperature (20±1 ^{0}C with a relative humidity of 45-50%).

MODERN AGRICULTURE, FUTURE PROSPECTS AND CHALLENGES IN PAKISTAN

Aamir Nawaz, ***Muhammad Adnan Sadique**, Muhammad Umer Farooq, and Riaz Ahmad

Department of Horticulture, Bahauddin Zakariya University Multan, Pakistan
*Email: adnansadique094@gmail.com

ABSTRACT

Modern agriculture is the key to get a good profit in Agriculture. To understand modern agriculture's importance, we must understand the importance of agriculture economic and Pakistan land. Agriculture, as a primary field of activity including plant cultivation and horticultural crops, is a major source of the national and global economy.

Therefore, in agriculture, we have to give up traditional farming and adopt non-traditional farming. Traditional Agriculture begins in a research station, where scientists have access to the necessary supplies, expertise, and corresponding time. But, when the package is awarded to farmers, even the best farms cannot compare with the results we get as researchers. The basic challenge for modern agriculture is to sustain a better use of internal resources available in Pakistan. Presently, the information in agriculture at the decision-making level comes from suppliers, researchers, and private entrepreneurs rather than from local sources. However, the use of local information can minimize the use of external inputs, lead to more effective regenerating, or combine both. Modernization of agriculture presumes to be sustainable, economically viable, and socially responsible, protect resources, and serve as a basis for future generations. For this work, we have shared some of the most important practical experience. Modern agriculture includes tunnel farming, vertical gardening, Hydroponic system, and flower production, medicinal and high-density plantation.

TRICHODERMA HARZIANUM INDUCED STRESS TOLERANCE AGAINST CADMIUM CONTAMINATION IN WHEAT SEEDLINGS

Faiza Nasir

Nusrat Jahan College, Chenab Nagar, Punjab, Pakistan
Email:faizanasir079@gmail.com

ABSTRACT

The research activity was conducted at Nusrat Jahan College Rabwah Pakistan to overcome cadmium stress in wheat seedlings namely Punjab-11 and Shafaq-06 through *Trichoderma harzianum* seed coating method. Seeds of mentioned wheat cultivars and *Trichoderma* fungus were taken from NARC Pakistan. Wheat seeds after surface sterilization through mercuric chloride were coated with *Trichoderma harzianum* at the rate of $2x10^7$ CFU using pledge for twenty-four hours and then they were air-dried for twelve hours. At the end of the air-drying period, seeds were sown in sand cups. Cadmium nitrate (Cd1:20mM and Cd2:40mM) stress was applied at the two-leaf stage. Seedlings were harvested after 30 days of sowing and were preserved in 50mM potassium phosphate buffer. Roots and shoots were separately preserved. The preserved samples were subjected to different biochemical tests. This study has found *Trichoderma* seed coating a very effective method to overcome cadmium nitrate contamination by generating reactive oxygen species (ROS) damaging proteins.

PRESERVATION OF FIG (*FICUS CARICA* LINN.) FRUIT ACCESSIONS: A COMPARATIVE STUDY OF CONVENTIONAL AND MECHANICAL PROCEDURES

***Saba Sattar**[1*], Zarghona Siddique[1*], Urva Siddique[2], Zartasha Siddique [2], Saira Sattar[3], and Razia Sultana[3]

[1]Institute of Horticultural Sciences, University of Agriculture, Faisalabad
[2]Department of Food Science and Technology, University of Agriculture, Faisalabad
[3]Department of Plant Breeding and Genetics, University of Agriculture, Faisalabad
*Email: zarghonachaudhary@yahoo.com; sabasattar44@yahoo.com

ABSTRACT

Fig (*Ficus carica* Linn.) is one of the perishable minor fruits. The highly nutritive fruit is neglected by the researchers. Drying of fruits is becoming a commercial method of preservation, to overcome delicacy and perishability issues. There is a need to compare different accessions and different drying methods to ensure safety issues with remarkable economic value. So, the study was aimed to evaluate the best drying method to elicit quality dried figs production. Whole fruit and fresh-cut fruits of two accessions (Accession 1 and Accession 2) were processed through the two drying methods: sun-drying (Conventional method) and oven drying (Mechanical method). In the conventional method, fruits were dried in ˜15 days when placed as whole fruit, while ˜7 days were required for fresh-cut fig fruits. While in case of mechanical method, fresh fig fruits dry as whole fruit at 60◦C for 72 hours and as fresh-cut fruit at 60◦C for 7 hours. All fruits were almost dry and became able to preserve but whole

fruit oven drying was found the best method for commercialization as it proves as economic and values able in concerning with fruit safety aspects as well. The conventional method was found good but proved limited for local consumption or local market and was the unhygienic method. Accession 1 was performing well as a whole dried fruit for a hygienic commercial product.

PHYSIOLOGICAL AND BIOCHEMICAL STUDY OF EXOTIC AND LOCAL CULTIVARS OF HOT PEPPER (*CAPSICUM FRUTESCENS* L.)

*Abubakar Khalil Awan, Muhammad Amjad, Khurram Ziaf, and Rashid Iqbal

Institute of Horticultural Sciences, University of Agriculture, Faisalabad, Pakistan
*Email: malikabubakar2780@gmail.com

ABSTRACT

Depending upon different environmental conditions among different regions, it's necessary to check the performance of each foreign cultivar of chili, if one is going to introduce the new exotic cultivar in a region. Hot pepper (Capsicum frutescens L.) is a prominent member of family Solanaceae. The present study was conducted to evaluate the different exotic and local genotypes of hot pepper for their performance under Faisalabad environmental conditions. Randomized Complete Block Design was applied with eleven treatments replicated thrice. Ten hot-pepper cultivars (Demre-8, Doru-16, Dugel Carliston, Llica-256, Syrneh, Uraz-98, Yalova Cordaci, Yalova Carliston, Yalova Tatlisivri, Yalova Yaglix) and one local cultivar (BSS-410) were grown to select the best variety adapted in agro-climatic conditions of Faisalabad. Maximum fruit diameter (3.5 cm), maximum pedicle length (3.5 cm) and highest nitrogen percentage (4.3%) were observed in Doru-16 while Demre-8 had the highest fruit length (9.6 cm) and maximum titratable acidity (0.5). BSS-410 was observed as early maturing variety as first fruit picking was done after 43 days of transplanting at Faisalabad conditions. Maximum total phenolic contents (189.2 mg 100 g -1), maximum super oxidase dismutase activity (1.03%), highest total soluble solids (9.6 Brixo), maximum fruit yield per plant (0.8268 kg) and highest fruit yield per plot (5.7 kg) was recorded in BSS-410 while maximum fruit weight was observed in Yalova Carliston. On the other hand, the highest vitamin C contents (80.9 mg 100 g -1), maximum potassium percentage (1.7%) and highest pH value of fruit (6.6) were found in cultivar Yalova Tatlisivri. Yalova Cordaci had maximum peroxidase activity (17.3 U kg-1 protein) and the highest phosphorus contents (0.4%) was observed in Yalova Carliston while Yalova Cordaci showed minimum phosphorus contents (0.1%). Hence, it was concluded that great variation existed among the studied cultivars in all physiological and biochemical parameters which would be very beneficial for plant breeders to conduct an operative research and breeding program.

BIOFUNGICIDE POTENTIAL OF PENNISETUM FLACCIDUM GRISEB. EXTRACTS AGAINST BLUE MOLD DISEASE

Tehzeeb Zubairi

***Tehzeeb Zubairi**[1], Khajista Jabeen[1], Sana Khalid[2], and Sumera Iqbal[1]

[1]Department of Botany, Lahore College for Women University, Lahore
[2]Institute of Agricultural Sciences, University of the Punjab, Lahore
*Email: tehzeeb_zubairi26@hotmail.com

ABSTRACT

Blue mold disease caused by various species of genus Penicillium is responsible for deteriorating a huge amount of food items, especially during storage and transportation. The study evaluated various extracts of *Pennisetum flaccidum* Griseb. For bio fungicide potential to control the disease. Blue mold pathogen was isolated from the infected onion and was identified by microscopic and macroscopic studies. Five methanolic concentrations viz., 0.5%, 1%, 1.5%, 2% and 2.5% of each part of *P. flaccidum* (leaves, spikelets, and roots) were tested against the fungus through poisoned food method. The extracts in lower concentrations were found to be more potent as

compared to higher concentrations, and the least concentration (0.5%) for each part was found beyond 65% efficient. But, the root extracts produced the most pronounced results, i.e. up to 89% of the fungal growth has been retarded. Therefore, it was further subjected to fractionation guided bioassays by partitioning it with n-hexane, n-butanol, chloroform, and ethyl acetate. Concentrations for each fraction were evaluated against the fungus, and ethyl acetate fraction was found to be the most effective one. The study was validated by the phytochemical screening of the plant which confirmed the presence of different secondary metabolites in it. Moreover, the novelty of the study lies in the fact that *P. flaccidum* has been screened for the first time against any pest, and is introduced as a bio fungicide.

THE RESPONSE OF CHILI VARIETIES UNDER DIFFERENT SOWING SEASONS

***Ramsha Mehmood**[1], Najma Yousaf Zahid[1], Nadeem Akhter Abbasi[1], and Tanveer Iqbal[2]

[1]Department of Horticulture, PMAS-Arid Agriculture University Rawalpindi, Pakistan
[2]Department of Soil Science, PMAS-Arid Agriculture University Rawalpindi, Pakistan
*Email: ramshamehmood863@gmail.com

ABSTRACT

Chilli is the world's second most important vegetable after tomato. Pakistan ranks 5th in its production worldwide, with an estimated increase of 3.7% during the year 2015-16. Nutritionally, chili pepper is an excellent source of vitamins (A, B2, B6, C, and K) and essential minerals (potassium, phosphorus, calcium, iron, and zinc) besides this, it also contains a mixture of antioxidants notably carotenoids, ascorbic acid, flavonoids, and polyphenols. Considering its high nutritive value and export potentiality in Pakistan it is imperative to take attempts for successful cultivation which depends on several factors like sowing time and plant spacing. It ensures proper growth and development of plants resulting in more yield with economic use of land. Chilli fruits fetch higher premium during early winter or late winter as off-season crops. So, the present study aimed to witness the yield and quality of off-season produce as winter cultivation of chilies in protected conditions is important to fulfill demand all year round and increases the yield of chilies in Pakistan. The research was designed to check the best comparison of varieties in different growing conditions throughout the year and to clarify the optimum sowing/planting time for maximum yield and better quality. The trial was laid out in Complete Randomized Block Design with 3 replications. Observations for three varieties of chilies (Local& Hybrid) were recorded which revealed that in morphological parameters P6 performed best for number of branches, number of fruits per plant, number of seeds and yield during summer due to favorable climatic conditions while on the other hand long and hi fly was found significantly similar and highest in biochemical content like ascorbic acid during the winter season. Similarly, for quality of the produce P6 variety can be stored for a maximum number of days up to 20 days due to thick pericarp which can retain plenty of water.

BORON TOXICITY TOLERANCE IN HOT PEPPER THROUGH GRAFTING ON DIFFERENT ROOTSTOCK

Muhammad Zakaria[1], **Najma Yousaf Zahid**[1], Abdul Ahad Qureshi[1], Ishfaq Ahmad Hafiz*, and Muhammad Akmal[2]

[1]Department of Horticulture, PMAS-Arid Agriculture University Rawalpindi, Pakistan
[2]Department of Soil Science, PMAS-Arid Agriculture University Rawalpindi, Pakistan
*Email: honey_neema@yahoo.com

ABSTRACT

Grafting is a vegetative plant propagation technique. In a grafted plant, the upward supply of water and mineral nutrients, as well as the downward flow of photosynthesis, is modified. The objectives of the study were to find out

whether the grafting of hot pepper plants (*Capsicum annuum* L. family Solanaceae) lowers the leaf boron concentration of some commercial cultivars under boron toxicity and to examine the effects of grafting and different rootstocks on the levels of antioxidant capacity. Un grafted plants of the cultivars P6 and Longi as well as grafted P 6 and Longi scion was used. The plants were treated with 0.7 and 0.9 mg L^{-1} boron. After 21 and 28 days of treatment, grafting significantly reduced the boron concentration in the leaves of the scion-cultivars while it was increased by 80% in the non-grafted plants. After 21 days of boron treatment, it was found that grafting reduced the concentration of leaf phenol to 60-70% in ungrafted plants. There was a significant difference in the average yield of fruit per plant of the varieties Varietal difference causes a significant difference in the average yield of fruit number per plant. The GV2 variety produced more average yield of fruit per plants 15.4, and followed by GV1 14.3 of fruits and data was statistically superior from the others. UNGV1 produced less number 13.0 of fruits and statistically inferior than the othersGrafting increased the number of seed per fruit. The maximum number of seeds per fruit was observed in the grafted GV2101. The minimum number of seeds per fruit was recorded from ungrafted UNGV1 95.33. Was shown by grafted variety GV1 54.91 % and GV2 52.57 % with the increasing trend of 40 % antioxidant capacity concerning ungrafted varieties. Antioxidant capacity for most of the plant significantly resulted in DPPH antioxidant activity for both varieties and treatment interaction. The best result for both varieties for grafting showed a significant result in terms of antioxidants with slight variation (1.87 % in GV1 and 11% UNGV.Varieties between grafting and un grafting showed significant results for total phenol content for both varieties and treatment interaction. The best result was shown by grafted variety GV1 1.16) and GV2 0.84 UNGV1 and (0.83) UNGV2 0.91.

EFFECT OF PHYSICAL ENERGIES ON GERMINATION AND GROWTH BEHAVIOR OF *CELOSIA CRISTATA* (COCK'S COMB)

Sumiya Yaseen[1]**, Adnan Younis[1]**, Fahad Ramzan[1], Urwa Irshad[1], Muhammad Kashif[1], and Muhammad Muzammil Ijaz[1]

[1]Institute of Horticultural Sciences, University of Agriculture, Faisalabad, 38040, Pakistan
*Email**:** sumiya2728@gamil.com; adnanyounis@uaf.edu.pk

ABSTRACT

Celosia cristata (Cock's comb) is a common garden plant of the amaranth family (*Amaranthaceae*). *Celosia* is a versatile plant that has been used as herbal remedies, ornamental annuals in the garden and cut flowers. To become a more sustainable and energy-efficient crop in the future, one potential change in production is an overall increase in growth efficiency. In this research, the effect of physical energies was studied to check germination and growth behavior of cock's comb by using Gamma irradiations (25rad,50rad &75rad) and magnetic field doses (30mT,60mT & 90mT). This study was conducted at Gardening Wing Nursey Area, University of Agriculture, Faisalabad. The experiment was laid out in Randomized Complete Block Design with seven treatments and four replications. Data were evaluated based on morphological characteristics. Data on plant germination and growth was recorded from the initial stage to maturity. No. of leaves, plant height, chlorophyll contents uniform seed emergence, stem anatomy, and root anatomy were observed higher in T3 and T5 (50rad and 30mT) regarding gamma irradiation and magnetic field. Leaf area, stem diameter and fresh weight of plant were highest in T3 and T6 (50rad and 60mT). T1 (Control) and T7 (90mT) showed fewer growth results in an experiment. Overall T3, T5 & T6 showed significant growth performance. In conclusion, gamma irradiations and magnetic fields both can be used to enhance uniform and rapid seed germination and quality of cock's comb plant.

POST-HARVEST FUNGAL PATHOGENS ISOLATED FROM APPLE, PEACH, BANANA, TOMATO, MANGO, ONION, GARLIC, CUCUMBER, BITTER GUARD AND GINGER COLLECTED FROM NAROWAL AND ZAFARWAL, PAKISTAN

***Ayesha Shafqat** and Sundus Akhtar

Department of Bothay, Minhaj University, Lahore
*Email: ayeshashafqat234@gmail.com

ABSTRACT

In the present study, various vegetable and fruits markets were selected from different areas of Narowal and Zafarwal, Pakistan. Various fruits and vegetables like apple, peach, banana, tomato, mango, onion, garlic, cucumber, bitter guard and ginger were collected from the selected areas. The intensely damaged and rotted selected samples were inoculated on malt extract agar (MEA) medium and studied under a microscope for morphological characteristics. MEA medium was firstly prepared by adding 20, 20 g of malt extract and agar in 1000 mL of distilled water. The medium was further autoclaved followed by pouring in pre-sterilized Petri plates in aseptic conditions. After seven days of the incubation period, the different isolated fungus was purified in a 2% MEA medium and further studied under a microscope for identification characteristic. The results revealed various fungi isolated from the selected samples. *Mucor* sp. and *Rhizopus* sp. were isolated from bitter guard; *Alternaria solani from* garlic and ginger; *Aspergillus flavus* and *A. fumigatus* were isolated from cucumber *Fusarium oxysporum* and *A. solani* were isolated from onion. Moreover, *Mucor* sp. and *A. flavus* were isolated from mango; tomato: *Penicillium* and *A. fumigatus;* apple: *Botrytis cinerea* and *Rhizopus* sp.; Banana: *Mucor* sp. and peach revealed *F. oxysporum* and *Rhizopus* sp. So far, packing material of soppy fruits ought to be perpetually soft and sterile. unfold of postharvest fungi is additionally attributable to poor hygienical techniques followed by the godown house owners. Fruits and vegetable sales in markets ought to be beneath a clean-safe setting that will be unfavorable settings for the expansion of such fungi. The regarding bodies ought to hold their responsibilities in following-up fruit, vegetable-sales markets to make sure high-quality and toxic-free.

ANTIFUNGAL ACTIVITY OF DIFFERENT PLANT EXTRACTS ON SHEESHAM (DALBERGIA SISSOO) TREE TO PROMOTE THE USE OF BIOPESTICIDE FOR THE ENHANCEMENT OF SUSTAINABILITY

***Ramsha Basit,** Anam Rashid, Waqar Aslam, and Aneeza Nasrullah

Institute of Agricultural Sciences, University of Punjab.
*Email: ramshabasit001@gmail.com

ABSTRACT

The seed is an embryonic plant that can spread disease and pathogen in the new crop by providing a medium of inoculum to transfer pathogen. Seed-borne fungi are one of the most important biotic constrains in seed production worldwide. Therefore, this experiment evaluates the use of plant extracts as an antifungal activity on the seed. Extracts of four plants; garlic (*Aluim sativum*), Akk (*Calotropis acia*), Kortunba (*Citrullus colocynthis*), Moongray (*canabsis indica*) were used by soaking seeds in these extracts for five hours and then placed in moist chamber as an incubation method. After 4 weeks, *Canabsis indica* extracts treated seeds survived, out of 10 seedlings 8 were sustained with a significant reduction in associated fungi and improved root and shoot length. However, *Citrullus colocynthis* did not only resist fungus to grow on seeds but also cause of death of seedlings. The other two also delineated the same results as *C. indica* with no significant change in values. The identified seed-borne and associated fungi were *Fusaruim oxysporum* and *Aspergillus niger*. The results showed that plant extracts not only manage fungus but increase the growth of the seedling.

EVALUATION OF THE EFFECT OF BIOCHAR AND COMPOST AS SOIL ORGANIC AMENDMENT AGAINST EARLY BLIGHT OF TOMATO

***Muhammad Taqqi Abbas**, Muhammad Hafeez ul Haq, Muhammad Saleem Haider, Waheed Anwar, and Adnan Akhter

Institute of Agricultural Sciences, University of the Punjab, Lahore.
*Email: muhammadtaqqi52@gmail.com

ABSTRACT

Sustainable agriculture deals with the efficient use of resources for the benefit of humans and their environment. By this, we can fulfill the requirement of food, feed, and fiber efficiently. The use of heavy doses of chemicals like fertilizers or pesticides is not suitable for sustainable agriculture. This study emphasis the effective use of different concentrations of biochars and composts to promote the growth of plant biomass and nutrients availability like N, P and K in the presence and absence of *Alternaria solani*. Two types of biochars (Wood biochar and Green Green waste biochar in 3% and 6% concentrations) and compost were used as a soil amendment. All of the different concentrations have very effective control on disease reduction and enhancement of plant biomass but 6% Wood biochar has a better effect from all of them. It also enhanced the growth of stem and root. Biochar also reduced the disease incidence and severity in plants. Under stress conditions, Nitrogen and Phosphorus contents were increased in tomato. It was observed that Nitrogen contents were increased to 12.44% and Phosphorus contents were increased to 55.17%. Disease incidence was 90% in tomato plants when they were grown in soil only, while reduced to 40% when grown into soil containing 6% Wood biochar combination. However, the disease severity was reduced to 47% in 6% wood biochar containing treatment. In conclusion, Biochar has a positive impact on the reduction of early blight in tomato by reducing the incidence of disease and enhancing the plant growth parameters. Thus, Biochar usage is an alternative way to control diseases and enhance the growth of plants.

DETERMINING THE SET PRODUCTION POTENTIAL OF FOUR CULTIVARS AND COMPARISON OF PHOSPHATIC FERTILIZERS IN ONION

Muhammad Wasim Haider, ***Khurram Ziaf**, Aman Ullah Malik, Raheel Anwar, Chaudhary Muhammad Ayyub, and Muhammad Awais Ghani

Institute of Horticultural Sciences, University of Agriculture Faisalabad
*Email: khurramziaf@uaf.edu.pk

ABSTRACT

Onion's prices are usually low during April-June, the time when Sindh and Punjab crop is available in the market. Due to the surplus supply of the commodity in the market during this period, the growers of Punjab cannot get a good return from their seasonal crop (May). However, market demand and therefore the price is high during November and December. Production and availability of Kharif onion crop through sets during this period can pay a good profit. Therefore, studies regarding the set production potential of currently available superior cultivars are necessary to get the benefit of the high yielding potential of these cultivars. Moreover, the optimization of fertilizer application rates is necessary for obtaining good quality sets. This study consisted of two experiments carried out at vegetable area, UAF; Experiment 1: comparison of the set production potential of two hybrids (Red Bone and TI-172) and onion cv. Phulkara from two different sources (Magnus Kahl Seeds) (MKS) and Government (Govt). Experiment 2: comparative effect of two phosphatic fertilizers, diammonium phosphate (DAP) and nitrophos (NP), applied five times at a two-week interval. The experiment was replicated thrice. The sets were harvested after four months. Phulkara (MKS) produced the highest number of sets, followed by Phulkara (Govt), while hybrids TI-172 and Red Bone produced the lowest number of sets. Similarly, the set formation index was also observed maximum in Phulkara (MKS) and minimum in Red Bone. Moreover, the cultivar Phulkara (MKS) also had the largest individual and total set weight than that of all experimental cultivars. The application of DAP produced the highest number of sets and individual set weight, followed by those of NP and control. Our results indicate that the cultivar Phulkara (MKS) showed strong potential in terms of producing a good number and healthier sets. While DAP applied Phulkara (Govt) seedlings produced the highest number of sets having high mean set weight.

THE EFFICIENCY OF VARIOUS RATIOS OF SOILLESS SUBSTRATES AND PGPR INOCULATION ON GROWTH AND QUALITY OF *RUSCUS HYPOPHYLLUM*

***Hafiz Muhammad Kashif** and Iftikhar Ahmad

Institute of Horticultural Sciences, University of Agriculture Faisalabad
*Email: iftikharahmadhashmi@gmail.com

ABSTRACT

A Research study was conducted at Floriculture Research Area, Institute of Horticultural Sciences, the University of Agriculture Faisalabad on *Ruscus hypophyllum* to evaluate the efficiency of various soilless substrates and plant growth-promoting rhizobacterial *strain Bacillus* sp. (MN-54) inoculation to develop optimal substrate composition for better growth and quality of *Ruscus hypophyllum*. Nursery plants were purchased from a commercial nursery at Pattoki, Qasur, transported to Floriculture Research Area and shifted into 25 cm earthen pots having different ratios of selected soilless substrates. The substrates components included coco-coir (CC), composted peanut hulls (CPH) and sugarcane press mud (SPM) in various proportions while silt (S) was used as a control treatment. Substrate compositions were contained [on a % (v/v) basis]: CC (60%) + CPH (30%) + SPM (10%); CC (50%) + CPH (40%) + SPM (10%); CC (40%) + CPH (50%) + SPM (10%); CC (40%) + CPH (40%) + SPM (20%); CC (33%) + CPH (33%) + SPM (33%) and CC (30%) + CPH (60%) + SPM (10%). Substrate ratio(s) were inoculated with bacterial strain *Bacillus sp*., MN-54 to half of the plants in each treatment. Among all substrate compositions CC (50%) + CPH (40%) + SPM (10%) produced maximum plant height, suckers per plant, fresh and dry weight of shoot, leaf per stem and comparatively less production time to produce marketable items, CC (40%) + CPH (40%) + SPM (20%) produced maximum leaf area and CC (33%) + CPH (33%) + SPM (33%) produced maximum stem diameter and foliage quality. Inoculation of plant growth-promoting rhizobacterial strain *Bacillus sp*. (MN-54) extended stem longevity and produced better quality. Moreover, inoculation of bacterial strain *Bacillus sp*. (MN-54) lowered pH, maintained optimum EC and increased organic matter of substrate compositions that helped improve nutrient uptake by the plants.

COMPARATIVE ANALYSES OF SPORES OF SOME GILLED AND NON-GILLED MUSHROOM

***Hanza Ahmad**, Sobia Ilyas, and Samina Sarwar

Department of Botany, Lahore College for Women University
*Email: h03354346504@hotmail.com

ABSTRACT

Fungal spore morphology has been used as a taxonomic tool for mushrooms identification. In this work 6 families, 10 genera and 18 species of fungi analyzed. Out of 18, only 2 species are new in science study. This study include one species of Amanita (*Amanita crocea*), four species of Boletus (*Caloboletus rubripes*, *Hortiboletus rubellus*, *Rubroboletus lupinus*, *Rubroboletus rhodoxanthus*, and *Rubroboletus satanas*), one species of Clitocybula (*Clitocybula pakistanica*), four species of Cortinarius (*Cortinarius bolaris*, *Cortinarius brunneus*, *Cortinarius erythrinus*, and *Cortinarius semisanguineus*), one species of Hebeloma (*Hebeloma mesophaeum*), one species of Hygrophorus (Hygrophorus pakistanica), one species of Russula (*Russula postiana*), Two species of Suillus (*Suillus americanus* and *Suillus himalayensis)*, one species of Tylopilus *(Tylopilus sultanii)*, and one species of *Xerocome*llus (*Xerocomellus chrysenteron*). Out of these 18 species, 16 were previously and 2 as new records for Pakistan. Mycoflora's new record from this report includes one (1) species of Clitocybula and one (1) species of Hygrophorus has been collected first time from Pakistan. Spore morphology and ultrastructure of different species of mushrooms analyzed by using light and scanning electron microscopes have carried out for mushrooms growing in Pakistan to segregate species within the genus and between genera. The proposed study aims to analyze the size, shape, color and surface pattern of spores of different gilled and non-gilled mushrooms. The spores' surface patterns such as reticulate, verrucate, psilate, gemmate, regulate, cristate, echinate and tuberculate have been studied and the size varies from family to family in µm. The size of the spore measured in micrometers and its range varies from family to family. Spores may be smooth, elliptical, and oval or lemon-shaped.

THE RESPONSE OF EUCALYPTUS CAMALDULENSIS PLANTATION TO EXPERIMENTAL DROUGHT

***Waqar Zafar** and Aamir Saleem

Department of Forestry, Range Management, Pir Mehr Ali Shah Arid Agriculture University Rawalpindi
*Email: w.hunjra@gmail.com

ABSTRACT

This study summarized research and field observations of the work that was conducted in 2015 to 2016 at the field area of village Kolo Tarar, district Hafizabad to evaluate the growth of *eucalyptus camaldulensis* in experimental drought. Overall, these results have suggested that eucalyptus have great adaptability against any climatic conditions. For the current research, we give two different treatments to Eucalyptus camaldulensis trees. In the first treatment 20, Eucalyptus camaldulensis trees were remained open to rainfall. In other treatments, experimental drought was provided to 20 Eucalyptus camaldulensis trees. For this purpose, trees were covered in such a way that no water penetration occurred under the canopy. Trees were covered by plastic sheets by setting 2 feet above the ground in such a way that no harmful effect was imposed on trees. However, it is recommended that screening of genotypes for drought tolerance is important for successful plantation for contrasting environments. More studies need to be planned for Eucalyptus plantation to check long term drought effects on biomass production. Keeping in view our results can help for future selection of Eucalyptus genotypes under rainfed conditions.

INTERACTION EFFECT OF CHEMICAL FERTILIZERS AND A BIOFERTILIZER ON GROWTH AND YIELD OF POTATO UNDER BIOTIC STRESS OF *NEOCOSMOSPORA RUBICOLA*

Muhammad Riaz, ***Rashid Mahmood**, Salik Nawaz Khan, Naureen Akhtar, and Muhammad Ashfaq Anjum

Institute of Agricultural Sciences, University of the Punjab, Lahore
*Email:rashid.iags@pu.edu.pk

ABSTRACT

A biofertilizer enriched with strains of *Azotobacter chroococcum*, *Azospirillum lipoferum*, and *Pseudomonas putida* was tested in interaction with nitrogen (N) and Phosphorus (P) fertilizers against stem and tuber rot of potato caused by *Neocosmospora rubicola*. In the presence of half and full recommended dose of N and P, the soil under potato plants was inoculated with *N. rubicola* separately and in combination with the biofertilizer. *N. rubicola* increased stem and tuber rot and decreased tuber yield by 11% in comparison to control. On the other hand, a sole inoculation of the biofertilizer increased tuber yield by 41%. A combined inoculation of both or *N. rubicola* inoculation a week before the biofertilizer did not affect tuber yield in either direction. However, biofertilizer inoculation a week before *N. rubicola* controlled rot symptoms and increased tuber yield by 32%. An increase in P application favored the biofertilizer in controlling rot in tubers. The interaction effect of N with biological treatment of biofertilizer and the pathogen was non-significant; however, in its main effect N increased rot in tubers and decreased in stems. A prerequisite application of the biofertilizer can better control *N. rubicola* infestations with maximum yield benefits.

EVALUATION OF STORAGE POTENTIAL OF COMMERCIAL TOMATO CULTIVARS

*Raheel Anwar[1], Atiqa Ishtiaq[1], Aman Ullah Malik[1], Mahmood Ul Hasan[1], Khurram Ziaf[1], and Hafiz Mehmood ur Rehman[2]

[1]Institute of Horticultural Sciences, University of Agriculture, Faisalabad, Pakistan
[2]CAB International (Central & West Asia), Rawalpindi, Pakistan
*Email: raheelanwar@uaf.edu.pk

ABSTRACT

Tomato (*Solanum lycopersicum*) is the second most important vegetable crop of Pakistan. Even though the demand for better yielding tomato varieties in the farming business is appreciated but the characterization of commercial varieties for better quality and high shelf life has not yet been explored. In this ACIAR-funded project study, the storage potential of five commercially grown tomato cvs. Eureka, Carmine, Rubin, CKD-1 and Baby Red were evaluated. Tomato fruits harvested at breaker stage were stored under ambient conditions (25±1°C) and evaluated for changes in fresh weight, firmness, shriveling, marketable fruit percentage, total titratable acidity, total soluble solids, and ascorbic acid contents on alternate days. After 14 days, Carmine exhibited least fruit weight loss (12.1%) followed by Eureka (14.2%), Rubin (15.8%), CKD-(16.6%) and Baby Red (18.8%). Skin shriveling is attributed as a major indication of the visual quality of tomato fruit. Rubin, followed by CKD-1, were scored least for shriveling whereas the rate of shriveling in cv. Carmine was found highest. When compared with pre-storage status, tomato cv. Eureka showed only a 16% decline in ascorbic acid while Eureka, Carmine, Baby Red, and CKD-1 exhibited 21%, 28%, 27% and 41% decline in ascorbic acid content, respectively. Studied cultivars did not show much variation in sugar: acid ratio but significant variation in loss of marketable fruits during storage was observed. Tomato cvs. Rubin and CKD-1 showed a 20% loss in marketable fruits after 12 days whereas cvs. Eureka, Carmine, and Baby Red reached the same loss percentage in 10, 8 and 4 days, respectively. Overall, results suggested that among the five commercial tomato cultivars studied, cvs. 'Eureka' and 'Rubin' retained better quality attributes during 14 days of storage under ambient conditions.

EVALUATION OF GROWTH PARAMETERS AND GERMINATION BEHAVIOR OF DIFFERENT TOMATO (*LYCOPERSICON ESCULENTUM* L.) CULTIVARS UNDER THE HYDROPONIC CONDITION

***Mehwish Liaquat[1]**, Arshad Mahmood Malik[1], Muhammad Ishaq[1], Saeed Ahmad[2], Hafiz Muhammad Qasim Ashraf[2], Imtaiz Ahmad[1], Ismara Naseem[1], Aliya Hanif[2], and Zarghona Siddique[2]

[1]Institute of Hydroponic Agriculture, PMAS Arid Agriculture University, Rawalpindi, Pakistan;
[2]Institute of Horticultural Sciences, University of Agriculture Faisalabad, Pakistan
*Email: mehwish2454@yahoo.com

ABSTRACT

Tomato (*Lycopersicon esculentum* L.) is an important vegetable crop of Pakistan. Tomato is the most edible and nutritious vegetable crop. The experiment was conducted at the Institute of Hydroponic Agriculture PMAS Arid Agriculture University Rawalpindi to evaluate selected tomato (*Lycopersicon esculentum* L.) varieties for their growth and germination behavior grown under hydroponic conditions. Five different tomato varieties (Berberana F1, Lezaforta F1, Elipida F1, Premium Ruby, and Cherry Tomato) were used for the experiment. Germination and several seedling quality variables like shoot length, root length; stem diameter and no. of leaves were observed at 30 days aged seedlings in coco peat media. A completely randomized design (CRD) with four repetitions was used. Data were subjected to analysis of variance (ANOVA). Results revealed significant differences ($P \leq 0.05$) in seedling growth parameters among different tomato varieties. Data were collected on germination percentage after two days' interval. The results revealed that the germination percentage (100%) was higher in Cherry Tomato. The seedling root length (37.62 mm), seedlings shoot length (89 mm), number of leaves (6), Stem diameter (1.74 mm) were observed in Berberana tomato variety as compared to the other varieties and hence it is found that Cherry and Berberana tomato variety in hydroponics can use for good seedling quality and germination behavior.

EFFECT OF GIBBERELLIC ACID (GA3) ON ONION CULTIVAR (*ALLIUM CEPA* L.) UNDER SALINE CONDITIONS

***Muhammad Mehran Abbas[1]**, Muhammad Awais Ghani[1], Amina Mushtaq[2], Muhammad Basharat Ali[3], and Romana Anjum[4]

Institute of Horticultural Sciences, University of Agriculture Faisalabad, Faisalabad.
*Email: mehranabbas2074@gmail.com

ABSTRACT

Salinity is a very serious factor which affects the productivity of crops now a day. In the world, about 45Mhac of irrigated land has been destructed by salinity. Due to the high level of salinity in the soil about 1.5Mhac agriculture land taken down each year. For this instance, this study was conducted in which PGR (Plant Growth Regulator) GA3 (Gibberellic Acid) was used by the foliar application on Onion (Allium cepa L.) To investigate the effect of GA3 on onion two different levels of salinity and one level of GA3 was applied. Applications were applied as (Control, GA3, Salinity 2 ds/m, Salinity 2ds/m + GA3, Salinity 4ds/m, Salinity 4 ds/m +GA3) foliar spray of GA3 by 100ppm was applied. Results showed that the growth parameters TSP increased to maximum when GA3 was applied but antioxidants activities have an antagonistic effect. In the growth parameters maximum (Survival percentage 94.2%, plant height 50.4cm, leaf blade length 47.7cm, root length 14.3cm, bulb diameter 5.5cm and plant yield/acre 1013.4kg) was observed by the foliar application of GA3. The saline stress results of antioxidants showed that (POD 13.2 at 4ds/m, SOD 41.0 at 4ds/m, CAT 42.1 at 4ds/m and TSP 7.3 at 100ppm GA3) was maximum. Results also showed that on the growth parameters the combined effect of GA3 + Saline stress of 2ds/m and 4ds/m significantly high with the comparison of saline stress. The overall investigation showed that the growth was found maximum where GA3 was applied by the concentration of 100ppm under saline stress.

EFFECT OF FERTILIZER, COMPOST, AND THIOUREA ON GROWTH AND PRODUCTIVITY OF ONION CULTIVARS

Muhammad Arsalan Manzoor, ***Muhammad Mehran Abbas**, Arzoo Rubab, Muhammad Danish, Muhammad Mudassar Iqbal, Muhammad Arsalan, and Adnan Akram

Institute of Horticultural Sciences, University of Agriculture Faisalabad, Faisalabad
*Email: mehranabbas2074@gmail.com

ABSTRACT

Onion is an economically important winter vegetable in Pakistan but its productivity is low. Yield can be enhanced by using high yielding cultivars, optimizing cultural practices, organic and inorganic fertilizers, or by using growth-enhancing chemicals such as thiourea. This research work was conducted to ascertain the best dose of thiourea and NPK alone or in combination with compost for high yield. The first experiment comprised four treatments viz., control, RDF + FYM, 2 × RDF, RDF + compost, which was applied to onion cultivar Phulkara and Nasrpuri. In the second experiment, five concentrations of thiourea (0, 5, 10, 15 and 20 mM) were applied as a foliar spray on two onion cultivars (Phulkara and Nasrpuri). Data were subjected to statistical analysis and treatment means was compared using Tukey's test at 5 % probability level. Results of organic and inorganic fertilizers on growth and yield of onion showed that Phulkara cultivar exhibited better results than Nasrpuri and the plants treated with compost in combination with the recommended dose of fertilizer showed the best results. Phulkara cultivar responded better than Nasrpuri to thiourea application regarding growth and productivity. Plants treated with 15 mM treatment of thiourea showed best results for (yield per pot 1.56 kg, plant height 52.2 cm, plant biomass 911.2 g, number of leaves19.8, leaf blade length 41.6 cm, pseudostem height 11.4 cm, bulb diameter Nasrpuri (63.3 mm) and Phulkara (60.5 mm) and bulb neck diameter 16.0 mm) in Phukara then Nasar puri. It can be concluded that the foliar application of 15 mM Thiourea can improve growth and yield of onion; Phulkara responded better than Nasrpuri to this treatment.

EFFECT OF POLLEN SOURCES ON FRUIT SIZE AND QUALITY ATTRIBUTES IN PINK FLESH GRAPEFRUIT

M. Awais Rana[1], *Muhammad Usman[1], Bilquees Fatima[1], M. Salman[1], M. Shahid[2], and Arooge Fatima[1]

[1]Plant Tissue Culture Cell, Institute of Horticultural Sciences, University of Agriculture, Faisalabad, Pakistan
[2]Department of Biochemistry, University of Agriculture, Faisalabad, Pakistan
*Email: m.usman@uaf.edu.pk

ABSTRACT

Grapefruit (*Citrus paradisi* Macf.) is a natural hybrid of *C. maxima* x *C. sinensis* and *a* rich source of vitamin C, phytonutrients and secondary metabolites. Three varieties of pink flesh grapefruit including Shamber 'S', Star Ruby 'SR' and Marsh Early 'ME' were crossed in diallel pattern to observe the effect of pollen parent on fruit development and quality. The significant impact of pollen parent was observed on most of the fruit quality attributes in all the crosses when compared with open-pollinated and self-pollinated crosses of the same variety as controls. Fruit weight (238 g to 512 g), fruit size (85 mm to 106 mm diameter), TSS (8.1 to 8.4 °Brix), and TSS: TA (4.65 to 5.84) and total sugars (5.2% to 5.4%) were markedly enhanced in S x ME cross while in reciprocal crosses most of the parameters showed decline indicating the higher potential of ME as pollen parent than the seed parent. Similar fruit size and quality enhancements were also observed in SR x ME cross-compared with controls (open and self-pollinated crosses) and reciprocal cross (ME x SR). The number of segments was reduced in all the crosses. The number of developed seeds was reduced, and shriveled seeds were enhanced in most of the crosses. Total sugars (4.84% to 5.43%) and anthocyanins (1.05% to 1.67%) were significantly enhanced in reciprocal crosses of SR x ME. Inbreeding depression s also observed in most of the selfed crosses of the parents. These findings provide evidence of metaxenial effect and inbreeding depression in the selected parental crosses for utilization for fruit quality enhancement and in breeding programs.

EFFECT OF GIBBERELLIC ACID, NAPHTHALENEACETIC ACID AND ETHREL ON THE YIELD OF CAULIFLOWER (*BRASSICA OLERACEAE VAR. BOTRYTIS* L.)

Muhammad Mehran Abbas, ***Muhammad Awais Ghani**, Rashid Waseem, Khurram Ziaf, and Muhammad Azam

Institute of Horticultural Sciences, University of Agriculture, Faisalabad, Pakistan
*Email: awais.ghani@uaf.edu.pk

ABSTRACT

The cauliflower (*Brassica olareceae*) is one of the horticultural crops of most consumption in Pakistan. In Pakistan, it has many problems i.e. at nursery stage, immaturity and disease during growth periods which ultimately affect the yield. An investigation was carried out to overcome these issues by using different growth-promoting agents i.e. Gibbrerelic Acid (GA_3), Naphthaleneacetic acid (NAA) and Ethrel. The effect was directly related to the concentration (GA_3 50ppm, 100pm, NAA 50ppm, 100ppm and Ethrel 100ppm, 200ppm). The effect of all treatments was pronounced when plant height was found maximum (26.72cm) in Ethrel by 200ppm as compared to other and control. Results showed that earliness which was observed in plants were due to GA_3 at 100ppm. Results showed that the effect of NAA at 100ppm was maximum in Leaf length (47.21cm) and leaf width (24.66cm). NAA also showed a maximum number of leaves (7) by the application of a 100ppm solution. Early maturity in Plants was observed in the treatment of the NAA 50ppm solution. Results showed that curd fresh weight was maximum after the application of NAA at the concentration of 100ppm solution. The formation of curd from translating to end-stage was found more prominent in the treatment of (23.2days) GA_3 at 50ppm solution. Curd Diameter was maximum (24.66cm) in the NAA at 100ppm solution. Plant yield was found maximum (0.86g) in the treatment of NAA at 100ppm These all morphological parameters showed significant results as compared to control conditions. The genre conclusion was found that the earliness in the cauliflower was induced by the application of GA_3 by 100ppm solution and the Effect of NAA by the concentration of 100ppm may induce more curd size and high yield.

DETERMINATION OF THE EFFECTIVENESS OF DIFFERENT APPLICATION METHODS OF *TRICHODERMA HARZIANUM* FOR THE HEALTHY GROWTH OF WHEAT

***Maleeha Umber**, Rashida Sultana, Faiza Nasir, Rizwana Mubasher, and Ragheeba Sehar

Department of Botany, Nusrat Jahan College Rabwah, Chenab Nagar, Pakistan.
*Email: maleeha.umber@njc.edu.pk

ABSTRACT

An experiment was conducted at Botany department, NUSRAT JAHAN COLLEGE RABWAH PAKISTAN to determine which method of application among seed coat, sand mix and foliar spray of *Trichoderma harzianum* is most effective for the healthy growth of wheat. Seeds of wheat variety "SHAFAQ" and *T. harzianum* fungus taken from NARC PAKISTAN. The seed coating treatment was performed by inoculation of the *Triticum aestivum L.* seeds with *Trichoderma harzianum* at the rate of $2x10^6$ CFU using pledge before implanting the seeds into the soil. The foliar spray treatment was done by spraying the solution of *Trichoderma harzianum* with water on germinated seedlings and in sand mix treatment, the *Trichoderma harzianum* solution was incorporated into the sand. Each treatment contained 3 replicates with a control group. The wheat crop was harvested when fully matured, dried and gained golden yellow colored setas. Different biochemical tests including malondialdehyde content, ascorbate peroxide activity, hydrogen peroxide concentration, and catalase activity were performed along with different morphological parameters that involved a number of seeds, spikes, and stem height and their weight and germination rate. Our results have revealed that the seed coating method is most effective.

PROSPECTS FOR THE USE OF PLANT ALLELOCHEMICALS IN INTEGRATED PEST MANAGEMENT

***Rashid Iqbal Khan**, Mazhar Abbas, Muhammad Muzammil Jahangir, Waseem Iqbal, and Muhammad Ahsan Khatana

Institute of Horticultural Sciences, University of Agriculture, Faisalabad, Pakistan
*Email: rashid.khan3535@yahoo.com

ABSTRACT

In recent decades, to maximize the food production of rapidly growing populations, the use of agrochemicals around the world has increased significantly. However, excessive use of these substances, especially pesticides, has led to the accumulation of toxic residues in food, soil, air, and water has developed resistance to pests. Besides, pesticides also affect soil enzymes, which are important catalysts for controlling soil quality. To meet food security, more food must be produced sustainably and securely, reducing available arable land and reducing water resources. In this regard, there is growing interest in alternatives to synthetic pesticides because synthetic pesticides have lower risks to the environment and human health, while also increasing food safety. The compounds extracted from aromatic plants have been used in the control of agricultural pests and have achieved good results. Such plant-derived compounds have a high-efficiency, multi-action mechanism and low toxicity to non-target organisms. However, the poor stability of these substances and other technical problems have limited their large-scale application in pest control. Therefore, all of these alternatives based on plant allelopathic substances aim to reduce the number of synthetic pesticides thus reduces environmental harm and promote sustainable agriculture. This technology will strengthen the prospects for environmentally friendly agriculture and sustainable development necessary for human survival.

QUALITATIVE CHARACTERS OF COMMON BUCKWHEAT (*FAGOPYRUM ESCULENTUM* MOENCH) GENOTYPES FROM GILGIT-BALTISTAN, PAKISTAN

***Ishtiaq Hussain**[1], Asghari Bano[2], Fazal Rehman[1], Faizan Ullah[3], Ghulam Raza[4], M. Ayub[5], and Mohammad Ali[4]

[1]Department of Agriculture Research Skardu, Gilgit-Baltistan, Pakistan
[2] Department of Biosciences, Wah Uni. Pakistan
[3]Department of Botany UST, Bannu, KPK
[4] Department of Biological Sciences, University of Baltistan, Skardu, Gilgit-Baltistan, Pakistan
[5] PARC Station Skardu, Gilgit-Baltistan, Pakistan
*Email: drishtiaq.mondoq@gmail.com

ABSTRACT

Common buckwheat (*Fagopyrum esculentum*) is a traditional crop in Asia and mostly grown in the Northern and Eastern parts of Gilgit-Baltistan. Diversity among common buckwheat populations was evaluated from different field-grown crops in the buckwheat growing regions of Karakorum Mountains Baltistan. Qualitative traits of local common buckwheat genotypes were evaluated by using IPGRI descriptors. Among these white flowers were dominant (58%) and genotypes with pink color flowers were least (17%). Similarly, the majority of genotypes possessed green stem color (67%) than that of green-pink stems (8%). Most genotypes (67%) were found in the category of larger seed size. Based on three main traits (seed color, flower color, and stem color) analyzed by the multivariate approach differentiated the genotypes into three major groups. The observed diversity of the population showed a geographical relationship with a variation of the traits investigated. Factors like heterogeneity, the genetic architecture of population, history of selection and/or developmental traits would be more influenced among genotypes. Diversity in seed colors, traits, and other traits enable better varietal selection and for development of local gene pool by classical breeding as well as advanced methods like hybridization.

ASSESSING THE PRIMARY AND SECONDARY RESPONSES OF SUNFLOWER (*HELIANTHUS ANNUUS* L.) UNDER LIMITED WATER VIA UV-B SEED ELICITATION

Beenish Afzal

Government College University, Faisalabad
Email: beenishafzal123@yahoo.com

ABSTRACT

The constant rise in the global population demands more food and medicinal sources. Sunflower with its nutraceutical metabolites and healthy oil quality is one of the good candidates. Limited water is one of the environmental hurdles faced by growing plants. For level optimization, a screening experiment was conducted. Seeds were subjected to UV-B (0, 20, 40 and 60 minutes). Growth and biochemical attributes showed that the used treatment level was not growth retarding. Therefore, the final experiment was conducted with all levels in the same season (next year). The experiment was designed with a split block in RCBD with five replicates, two blocks (100 & 50 % irrigation), parted into subplots for treatment UV-B and their levels (as in screening experiment) with the same size and seed number. Data was collected for growth, yield, primary metabolites, secondary metabolites, and catalase enzyme. For expensive metabolomics studies, best performing levels were selected like UV-B 20 minutes. Limited water reduced growth, yield and oil quality with minor variations per plot. Primed plants with better phenolic composition & oil quality supported the plant under limited water conditions. The best performing level was found UV-B (20 minutes). Based upon availability, all the above-mentioned treatment levels recommended to farmers for growing sunflowers in areas with water limitations.

ISOLATION AND CHARACTERIZATION OF *CERCOSPORA CALOTROPIDIS* FROM LEAVES OF *CALOTROPIS PROCERA*

*__Iffat Fizza__, Najam ul Sehar Afshan, and Abdul Rehman Niazi

Department of Botany, University of the Punjab, Lahore.
Email: iffatfizza123@gmail.com

ABSTRACT

Genus *Cercospora* Ellis and Everh are comprised of more than 300 species of which 659 presently are recognized. This genus is categorized by the existence of fertile hyphae bearing conidia, may be either simple or branched, and include the indigenous cells. The present study is based on a collection of *Calotropis procera* leaves infected by a pathogenic fungus that was identified on the morpho-anatomical basis and confirmation was done by culturing the infected plant material on Malt Extract Agar (MEA) medium and again the morphological and anatomical study of grown mycelium was done. The infection appears to be on leaves as white powdery mass. This fungus is newly reported on *Calotropis procera* from the Mianwali district, Punjab, Pakistan. The plant has a wide range of medicinal uses and is the source of various materials, especially fiber. *Calotropis procera* latex has been used in leprosy, eczema, inflammation, cutaneous infections and leaves are used as an anti-inflammatory, analgesic, antimalarial and antimicrobial. Growth of *Calotropis procera* retarded due to this pathogenic fungus.

OPTIMIZING GROWING MEDIA FOR HEALTHY TOMATO SEEDLING PRODUCTION

Arsalan Mehmood[1], Ishtiaq A. Rajwana[1], ***Hafiz Nazar Faried[1]**, Kashif Razzaq[1], Muhammad Amin[1], Mohsin Bashir[2], Gulzar Akhtar[1], Sami Ullah[1], and Zeeshan Haider[1],

[1]Department of Horticulture, MNS University of Agriculture, Multan
[2]Institute of Horticultural Sciences, University of Agriculture, Faisalabad
*Email: nazar.farid@mnsuam.edu.pk

ABSTRACT

Nursery production in traditional growing media leads to poor germination along with inadequate growth and development. Therefore, healthy vegetable nursery production of expensive hybrid seeds especially for protected cultivation requires an appropriate mixture of growing media for optimum nutrients, water and anchorage provision. The present study was, therefore, carried out to explore an appropriate growing media combination for healthy tomato nursery production. Various media substrates i.e. Peat moss (PM), Coconut coir (CC), Vermiculite (Vr), Perlite (Pr), Sawdust (SD), Nutri-compost and Saula were used with different combinations (T_0 = PM, T_1 = 75% PM + 25% CC, T_2 = 50% PM + 50% CC, T_3 = 75% (PM 75% + CC 25%) + 25% SD, T_4 = 90% (PM 75% + CC 25%) + 10% Vr., T_5 = 90% (PM 50% + CC 50%) + Vr. 10%, T_6 = 90% (PM 75% + CC 25%) + Pr. 10%, T_7 = 90% (PM 50% + CC 50%) + Pr. 10%, T_8 = Nutri Compost, T_9 = Saula) to evaluate their performances for healthy tomato nursery production. The seeds of two tomato cultivars (CKD-1 and the Rio Grande) were sown in plug trays under-protected tunnel. The plants were harvested at the 4th leave stage to record different morpho-physio-chemical parameters. 100% germination was observed in all combinations of growing media mixes. T_7 (90% (PM 50% + CC 50%) + Pr 10%) treatment conferred maximum chlorophyll contents (Chlorophyll a and b), gaseous exchange (photosynthetic rate, stomatal conductance, substomatal CO_2, transpiration rate and water use efficiency), basic nutrient (NPK) assimilation and biomass accumulation, thereby healthy tomato seedling. In conclusion, peat moss and coconut coir in 50% ratio together-with 10% perlite may be used for healthy tomato nursery production.

EFFECT OF DIFFERENT FACTORS OF GROWTH MEDIA AND LIGHT ON THE GERMINATION RATES OF *GOMPHRENA, NEMESIA,* AND *IMPATIENS*

Madiha Ashfaq, *__Maryam Nawaz__, and Sana Saeed

[1]Institute of Agricultural Sciences, University of the Punjab, Lahore, Pakistan.
*Email: maryamnawaz97@hotmail.com

ABSTRACT

Three ground flowers namely *Gomphrena globosa, Nemesia strumosa* and *Impatiens balsamina* belonging to the families Amaranthaceae, Scrophulariaceae and Balsaminacaea were studied based on vegetative growth, the effect of light interception, and the type of growing media in which the crop was grown. The light factors included the full sun, partial shade and full shade, while the growth media comprised of the cocopeat, a mixture of 50% leaf manure (LM) and 50% farmyard manure (FYM), and a mixture of 50% cocopeat, 25% LM and 25% FYM, that were used for the germination of the seeds of ground covers. The respective pots with different concentrations of growth media were placed in different factors of light and the data collection was started 10 days after the seeds were sown in pots when they started emerging according to the specific treatments. The daily survey was calculated and the results were deduced that *Gomphrena* showed the best germination rate of 92% in partial shade with the mixture of LM and FYM while least germination of 20% was in the cocopeat, *Nemesia* showed the best germination rate of 98% in the light of the full sun in the mixture of all components i.e., cocopeat, LM and FYM, while the minimum germination was 60% in cocopeat, and for *Impatiens*, the factor of light didn't have a significant role but the media that it was grown best in was the same as for *Nemesia*, which was 95% and the minimum rate was 42% in the mixture of LM and FYM. This study was helpful for the germination rates of different ground covers and how they interacted with the different media of the environment. This research can be conducted on other ground covers as well to minimize the complications and to better understand the germination rates.

ROLE OF NATIVE POLLINATORS IN CUCUMBER SEED PRODUCTION

Mariam Zahid and *__Mudssar Ali__

Department of Entomology, Muhammad Nawaz Shareef University of Agriculture Multan, Pakistan1
*Email: mudssar.ali@mnsuam.edu.pk

ABSTRACT

Pollination is an important process for the reproduction of flowers. Without pollination, fruits cannot be formed. Insect pollinators play a vital role in the reproduction of cucumbers. Cucumbers are grown all over the world and are a good source of vitamin C, iron, phosphorus, thiamine, calcium, iron and dietary fiber. Cucumbers are cross-pollinated plants. In cucurbits, insects and wind are important sources for cross-pollination. The pollen grains of cucumber are sticky so they are highly dependent upon insect pollinators and very less on the wind. It has been previously reported that insect pollinators from different groups (Lepidopteron 10%, Hymenopterans 50%, Coleopterans 15%, Dipterans 20%, and other orders 5%) are involved in visiting cucurbits but out of these bees are the most frequently visiting (95%) and efficient pollinators. The presence of beehives in cucumber farms increases fruit setting of cucumbers about 81% in open-pollinated plants and about 75% in caged plants. It has also been reported that they help in increasing cucumber yield about 60% and provide high-quality fruit. When grown in a greenhouse, the cucumber plants produce less fruit and yield is low but the yield is 25 % high in those greenhouses where beehives are placed. Honeybee, *Apis mellifera* is the most effective pollinator of cucumber. Bumblebees are also reported as the supplemental pollinators of cucumbers. Hence, the presence of bees in the cucumber farms is essential to increase the seed quality and quantity of cucumbers.

PHYTO-HORMONES MEDIATED DEFENSE AGAINST INSECT PEST IN TOMATO

Muhammad Awais Ahmad and ***Mudssar Ali**

Department of Entomology, Muhammad Nawaz Shareef University of Agriculture
Multan, Pakistan
*Email: mudssar.ali@mnsuam.edu.pk

ABSTRACT

Tomato is an important vegetable grown throughout the world. It is one of the most susceptible crops to insect pests. The tomato plant has evolved several defense mechanisms to overcome the attack of pests such as trichomes, hormones, and allelochemicals. Activation of these Phyto-hormone pathways controls the biosynthesis of defense metabolites that increase a plant's defense to herbivore insects. Previous studies have reported that plant produces volatiles i.e., ethylene (Me) salicylic acid (SA) and jasmonic acid (JA) induce defense against many phytophagous insects. In tomato, defense by plant volatiles against Spodoptera exigua, *S. litura*, *Helicoverpa zea*, *Bemicia tabaci*, *Tuta absoluta* and tomato aphid have been reported. SA slows down the nymphal development of *B. tabaci* and inhibits the activity of *S. exigua*. Tomato aphid and *B. tabaci* nymph didn't prefer to feed on JA accumulated plant. Moreover, exogenous application of these volatile enhances the capability of the plant to defense against pests. The exogenous application of JA prevents *H. zea* attack on the plant. These plant volatiles are also responsible for attracting natural enemies in the tomato field. Therefore, plant volatile should be used instead of pesticides for the control of insect pests and could be integrated into the IPM program for pests control.

MANAGEMENT OF ASIAN CITRUS PSYLLA BY USING INSECTICIDES

***Anam Shahzadi**[1], Ayesha Zulfiqar[1], Jam Nazeer Ahmed[2], Samina Jam Nazeer Ahmed[3], Hajra[1], and Kiran Maqsood[1]

[1]Department of Zoology, Wildlife and Fisheries, University of Agriculture Faisalabad
[2]Integrated Genomic, Cellular Developmental and Biotechnology Laboratory, Department of the Entomology, University of Agriculture Faisalabad
[3]Department of the Botany, University of Agriculture Faisalabad
*Email: shahzadianam143@gmail.com

ABSTRACT

Diaphorina citri (Asian Citrus Psyllid, ACP) is an insect vector of bacterium *Candidatus Liberibacter asiaticus* which deteriorates the citrus trees, causing Citrus Greening disease also called huanglongbing in Chinese, leading to serious economic losses not only within Pakistan but in the whole world. The Psyllid injects saliva in leaves and inoculates the bacteria into its body when it feeds on bacteria-infected plants. The disease spreads when a bacteria-carrying psyllid flies to a healthy plant and injects bacteria into it as it feeds. The purpose of this study is to manage the population of Citrus Psylla using pesticides. Different concentrations (500,400,300 ppm) of Knock out and Imidacloprid have applied alone and in combination along with two controlled conditions, to check their efficacy against Citrus Psylla. Citrus Psylla was collected from Kinnow and Orange trees. Mortality data were recorded and analyzed on Minitab-13statistical software. Results indicated that combination of the recommended dose of Knock out (15ml/100L of water/acre) low dose of Imidacloprid (50ml/acre) yielded maximum mortality (96.34%) followed recommended dose of Knock out alone (87.21%) while a low dose of Imidacloprid showed the lowest mortality (34.64%). It is concluded that Knock out having Pyriproxifen (active ingredient), alone and in combination with Imidacloprid is best for the management of Asian Citrus Psylla with lethal times (LT50s) of 5 and 4 hours, respectively, at a concentration of 500 ppm.

ROLE OF COLD TEMPERATURE IN THE BREAKING OF BUD-DORMANCY OF PEAR (*PYRUS PYRIFOLIA*) CULTIVAR CUIGUAN

***Sayed Hussain**, Fazal Said, Muhammad Ali Khan, Fazal Jalal, and Muhammad Imtiaz

Department of Agriculture, Abdul Wali Khan University Mardan, Khyber Pakhtunkhwa, Pakistan
*Email: sayedhussain@awkum.edu.pk

ABSTRACT

The role of cold temperature in bud dormancy release and biochemical changes in different organs was evaluated in stem cuttings of pear (*Pyrus pyrifolia*) cv. Cuiguan selected at the leaf fall. The cuttings were exposed to 5°C for 0, 100, 200, 300, 400, 500, 600, and 700 chilling hours (named positive chill units; PCU). A 50 % bud break was observed in floral and vegetative bud cuttings at 300 and 600 PCU, respectively. Meantime to bud break was inversely proportional to the chilling treatment. The low-temperature stimulated starch hydrolysis accompanied by sucrose accumulation in all organs. Sucrose and sorbitol content increased substantially peaking at 100, 400, and 100 PCU in floral buds, vegetative buds, and bark, respectively, thereafter decreased when buds approached chilling satisfaction (300 and 600 PCU for the floral and vegetative buds, respectively), and then increased again up to 700 PCU. Hexoses (glucose and fructose) accumulated constantly in the buds from 0 to 700 PCU. In bark, glucose and fructose content increased up to 400 PCU, and then gradually decreased. Total amylolytic and α-amylase activities increased in all organs, especially in the floral and vegetative buds up to 100 PCU and then decreased in the floral and vegetative buds before increasing again after endo-dormancy release. Invertase activity remained high in the buds during chilling satisfaction possibly because of translocation of sucrose to the buds which functioned as a strong sink. The results suggest that low availability of hexoses may be the cause of limited bud breaks due to a lack of chilling. Chilling satisfaction of the buds may increase the content of soluble sugars and acid invertase activity, and decrease the starch content, which may correlate with improved bud breaks.

EFFECT OF ALOE VERA ON PHYSICOCHEMICAL PROPERTIES AND QUALITY ATTRIBUTES OF GUAVA (*PSIDIUM GUAJAVA* L.) CV. GOLLA DURING AMBIENT CONDITIONS

***Muhammad Azam**, Haddi Abbas, M. Arsalan Khan, Rashad Qadri, Muhammad Awais Ghani, M.M Jhangeer, Raheel Anwar, Muhammad Awais, and M. Hussnain

Pomology Labortray, Institute of Horticultural Sciences, University of Agriculture, Faisalabad, 38040
*Email: muhammad.azam@uaf.edu.pk

ABSTRACT

Guava is an important fruit crop of different tropical and subtropical areas. Guava is 4th leading fruit of Pakistan. It is climacteric fruit and thus deteriorates quickly under ambient conditions. Various types of edible coatings and natural plant extracts are being used for shelf life enhancement and quality maintenance of fruits. The objective of the present study is to enhance the shelf life of guava by applying an edible coating of Aloe vera gel. Guava fruit was treated with a different coating of Aloe vera along with untreated fruit and keep at ambient conditions for 12 days. Data were collected and analyzed after 3 days' interval for different Physico-chemical parameters and enzymatic activities. Aloe vera treated fruits showed a positive impact on quality maintenance and shelf life enhancement of guava fruit up to 12 days during ambient conditions. Postharvest Aloe vera application on guava fruit retained high fruit weight, soluble solids, sugars, acidity as well as significantly enhanced the enzyme activities. Therefore, Aloe vera could be used for commercial applications on guava during storage.

IMPACT OF FOLIAR APPLICATION TIME AND A DOSE OF CALCIUM, ZINC, AND BORON ON GROWTH, YIELD, AND FRUIT QUALITY OF STRAWBERRY CV. CHANDLER

Muhammad Salman[1], ***Sami Ullah**[1], Kashif Razzaq[1], Ishtiaq Ahmad Rajwana[1], Muhammad Amin[1], Hafiz Nazar Faried[1], Gulzar Akhtar[1], Ali Asad Bahar[1], Ahsan Kamal[1], and Abid Hussain[2]

[1]Department of Horticulture, MNS-University of Agriculture, Multan.
[2]Department of Soil and Environmental Sciences, MNS-University of Agriculture, Multan
*Email: sami.ullah1@mnsuam.edu.pk

ABSTRACT

Nutrients play a key role in improving the growth, yield, and quality of many fruits including the Strawberry. Therefore, a study was conducted to investigate the effects of foliar application of calcium (Ca), Boron (B) and Zinc (Zn) alone and in combination with different time of application (Mid-Dec, Mid-Jan, and combined application) on the plant growth, yield and quality of strawberry fruit. Foliar application of Ca alone and combined with Zn and B were applied [T 1 (Control), T 2 ($CaCl_2$ @ 2%), T 3 ($CaCl_2$ @ 2% + Boric acid @ 0.4%), T 4 ($CaCl_2$@ 2% + $ZnSO^4$ @ 0.4%), T 5 ($CaCl_2$ @ 2% + Boric acid @ 0.4% + $ZnSO^4$ @ 0.4%) at different fruit development stages. This experiment was laid out under a randomized complete block design (RCBD) with a split-plot arrangement and three replications. Regardless of the time of application, foliar combine application of Ca with Zn significantly increased fruit weight (80.62g), total soluble solids (8.05 ℃Brix) and vitamin-C contents (343%); while fruit sprayed with combined Ca with Zn + B exhibited significant higher juice percentage (57.56%) and anti-oxidative scavenging activity (0.37%) than control. Irrespective to nutrients application, time of application at Mid-Dec + Mid-Jan significantly enhanced the juice percentage (58.72), fruit weight (80.62g), total soluble solids (8.46 ℃Brix), titratable acidity (0.37%), POD activity (4.22 Umg -1 protein) and catalase (CAT) (4.86 U mg -1 protein) enzymes activities as compared to other application time. Foliar application of Ca combined with Zn + B at both times Mid-Dec andMid-Jan enhanced higher average fruit weight, antioxidant scavenging activity, and catalase CAT enzyme activity. Conclusively, combined application foliar application of macro and micro-nutrients resulted in better yield and fruit quality attributes.

EFFECT OF MICRONUTRIENTS ON FRUIT QUALITY OF MANDARIN'S CV. KINNOW

***Adnan Sajid**, Zahoor Hussain, Faheem Khadija, Muhammad Umer Naseer, Mujahid Ali, Bilal Akram, and Muhammad Zia Saleem

Faculty of Agriculture, Department of Horticulture, University of Sargodha, Sargodha, Pakistan
*Email: Zahoor.hussain@uos.edu.pk

ABSTRACT

Kinnow is a very prominent and exportable cultivar of citrus in Pakistan. Micronutrient deficiency in soil and plants is a worldwide nutritional problem and very severe in many countries. Plants vary in their demand for micronutrients, as these are involved in almost all physiological functions. In Pakistan, nutrient deficiency particularly micronutrients are common due to low organic matter, alkaline pH and calcareous nature of soil so the present study was conducted to find the response of micronutrients on kinnow fruit. Micronutrients $ZnSO_4$ (0, 0.3 g/L, 0.6 g/L) and H_3BO_3 (0, 0.2g/L,0.4 g/L) are applied at golf ball stage alone and with combinations. The result showed that the application of micronutrients was significantly improved the physical and chemical parameters of kinnow. Result also showed significantly improved the result of $ZnSO_4$ and boric acid on ascorbic acid, TSS, reducing and total sugars. Maximum ascorbic acid (49.06 mg/100g) and TSS (12.11 ° Brix) were observed when combined utilization of $ZnSO^4$ (0.6 g/L) and boric acid (0.4 g/L) were applied. Minimum acidity (0.60%) was noticed when $ZnSO_4$ was applied at a rate of 0.6 g/L. Higher concentrations of zinc sulfate (0.6 g/L) alone increased

the total sugars and reducing sugars as compared to control and other treatments. From this study, it was concluded that kinnow mandarin trees that received a foliar application of zinc sulfate and boric acid at the golf ball stage indicated a high fruit quality than the untreated ones.

EFFECT OF EDIBLE COATINGS ON QUALITY MAINTENANCE AND SHELF- LIFE OF GUAVA

*__Muhammad Azam__, Muhammad Awais, M. Arsalan Khan, Rashad Qadri, M. Awais Ghani, Ahmad Sattar, M.M Jhangeer, and Raheel Anwar

Pomology Labortray, Institute of Horticultural Sciences, University of Agriculture, Faisalabad, 38040
*Email: muhammad.azam@uaf.edu.pk

ABSTRACT

Guava (*Psidium guajava* L.) known as the apple of tropics is an important fruit crop of tropical and subtropical regions. It is a perishable fruit having short shelf life due to high metabolic activities and ethylene production. It deteriorates rapidly as it undergoes a rapid post-harvest ripening. Various types of edible coatings and botanical extracts are being used for shelf life enhancement and quality maintenance of fruits. The present investigation aimed to enhance shelf life and maintain quality attributes of guava fruit at ambient conditions with combined application of Persian gum and neem leaf extract. Fruits after harvest were dipped in a solution for 5 minutes as follows, T 0 = Control (washed with distilled water), T 1 = 2% PG +10%NLE, T 2 =2% PG +20% NLE, T 3 =2% PG +30% NLE. Each treatment was replicated thrice and 12 fruits were taken as one treatment unit. Data were collected after 3 days interval to analyze the changes in fruit decay, weight loss, ascorbic acid content, soluble solid contents, titrable acidity, sugars (total, reducing and non-reducing), total phenolic content, total soluble proteins, H 2 O 2 and malondialdehyde content were studied during storage. Coated fruits showed a significant delay in weight loss as well as decay percentage. Coating delayed the enzyme activities of peroxidase and polyphenol oxidase of the fruit. Results suggest that the overall quality of fruits coated with 2% PG+10%NLE was maintained up to 12 days with considerable enhancement of shelf life.

EFFECT OF GIBBERELLIC ACID AND SALICYLIC ACID ON SHELF-LIFE OF TOMATO

Fateen Haider[1], *Zahoor Hussain[1], Faheem Khadija[1], Muhammad Umer Naseer[1], Mujahid Ali[1], Raheel Anwar[2], and Ghulam Mustafa[3]

[1]College of Agriculture, University of Sargodha
[2]Institute of Horticultural Sciences, Sargodha
[3]Mango Research Institute, Multan
*Email: zahoor.hussain@uos.edu.pk

ABSTRACT

Tomato (*Lycopersicon esculentum* Mill.) belongs to family Solanaceae. Tomato is an important source of Vitamin A and Vitamin C. Tomato crop is a very popular and widely cultivated crop all over the world and used as an edible fruit portion. The tomato crop is included in the top three horticultural important crops. Despite its prime importance these crop faces the problem of post-harvest losses and have a low shelf life. So, keeping in view this study was designed to check the effect of GA 3 and SA on the postharvest life of two cultivars Sahil and Salar of tomato and standardize dose of GA 3 (0, 20, 40 and 60 ppm) and SA (0, 40, 80 and 160 ppm) for the enhancement of postharvest life enhance. The results showed significant differences for all the studied traits. On the average, it was recorded that the Sahil variety under the application of GA 3 80 ppm showed the best performance for fruit weight, titratable acidity, total soluble solids, decaying %, sugar accumulation %, chlorophyll degradation, pH, viral effect,

fruit deformation, fruit diameter, juice %, and maturity index. The variety Salar was also performed better under both GA 3 and SA applications but its performance was lower as compared to the Sahil.

ROLE OF MICRONUTRIENTS ON GROWTH AND SEED PRODUCTION OF OKRA

Muhammad Umer Naseer, *Zahoor Hussain, Ijaz Rasool Norka, and Mujahid Ali

College of Agriculture, University of Sargodha
*Email: zahoor.hussain@uos.edu.pk

ABSTRACT

Okra is an important vegetable crop all over the world for cooking of its pods. Various nutrient techniques have been used for enhancing its production and quality. The present research trials were conducted to find the response of the micro-nutrients such as Zinc and Manganese on the seed production of four different cultivars of okra. The different concentrations of $ZnSO^4$ and $MnSO^4$ @ (0, 40 and 80 ppm) were applied through foliar application in two different experiments in the first experiment these treatments are applied after @45 day of sowing and in the second experiment same treatments are applied @45 and 60 days of sowing. In the first experiment, it was observed that the treatment $ZnSO^4$ (40 ppm) combination with $MnSO^4$ (40 ppm) significantly affect on the seed production of the okra when applied after 45 days of sowing than the treatment $ZnSO^4$ (80 ppm) with $MnSO^4$ (80 ppm) and the control. However, the maximum number of seeds/pod was observed in Bhindi Sanwali (52.49) in treatment $ZnSO^4$ (40 ppm) + $MnSO^4$ (40 ppm) followed by OH-595 (53.77), RT-130 (53.77) and Okra-555 (56.77). The highest number of seeds per pod was observed in Bhindi Sanwali (50.83) in treatment ZnSO 4 (80ppm) + $MnSO^4$ (80 ppm) as followed by OH-597 (49.267), RT-130 (48.477) and Okra-555 (47.903). While the minimum number of seeds was recorded in control. Similar, findings were observed in the second experiment. The result showed that the cultivar Bhindi Sanwali were also performed well in plant growth and development in both experiments at 80 ppm.

IMPACT OF CHITOSAN FOLIAR APPLICATION ON GROWTH AND FLOWERING OF ROSE (Gruss a Teplitz)

Muhammad Adeel Arshad[1], *Gulzar Akhtar[1], Kashif Razzaq[1], Muhammad Amin[1], Sami Ullah[1], Nazar Farid[1], and Muhammad Baqir Hussain[2]

[1]Department of Horticulture, Muhammad Nawaz Shareef University of Agriculture, Multan, Pakistan;
[2]Department of Soil Science, Muhammad Nawaz Shareef University of Agriculture, Multan, Pakistan;
*Email: gulzar.akhtar@mnsuam.edu.pk

ABSTRACT

Chitosan is an important plant growth regulator known to have a positive impact on plant growth and flowering. The present study was conducted to investigate the impact of chitosan foliar application on the growth and flowering of Gruss-an-Taplitz. Different chitosan concentrations (Control, 2.5, 5, 7.5, 10 mg L^{-1}) were applied through the foliar application at 15 days interval. The experiment was laid out under Randomized Complete Block Design (RCBD) with three replications. Different growth (Number of bud, number of flowers/plant, Plant height, Flower fresh weight, Flower diameter, Pedicle weight) and physiological parameters (chlorophyll and carotenoid, anthocyanins content) were recorded. It was observed that the foliar application of chitosan significantly improved plant vegetative, reproductive and physiological attributes. It was concluded that foliar chitosan application has a positive role in the growth and yield of Gruss a Teplitz. Keeping in view the growing demand roses, future research work should be considered this aspect on other Rosa species.

EFFICACY OF HUMIC ACID IN COMBINATION WITH MULTIPLE NITROGEN LEVELS ON THE GROWTH AND YIELD OF TOMATO

***Kashif Waseem**, Shafqat Ullah, Muhammad Sohail Khan, Mehwish Kiran, Muhammad Amjad Nadim, and Ghazanfar Ullah Muhammad Salman

Department of Horticulture, Gomal University, Dera Ismail Khan, Pakistan
*Email: waseemhort@gmail.com

ABSTRACT

An experiment was conducted to check the efficacy of humic acid in combination with multiple nitrogen levels on the growth & yield of tomato (Lycopersicon esculentum Mill), at the research of Horticulture department, Faculty of Agriculture, Gomal University, D.I. Khan. This research work was carried out in Randomized Complete Block Design (RCBD) with split plot arrangement and every treatment was replicated thrice. Five different humic acid rates (00, 25, 50, 75 & 100 kg ha -1) were assigned as main plots whereas three various nitrogen rates (00, 75 & 150 kg ha -1) were assigned as sub-plots. Amongst various humic acid rates, statistically maximum results were obtained in plots where humic acid was applied @50 kg ha -^{1}, for all the vegetative & fruiting parameters studied, followed by 75 kg ha -1 humic acid. For multiple nitrogen levels statistically maximum results were obtained in plots where maximum nitrogen (150 kg ha -1) was applied, followed by 75 kg N ha -1, for all the vegetative & fruiting parameters studied. Combined application of intermediate humic acid rate (50 kg ha -1) along with the highest nitrogen rate (150 kg ha -1) showed it's supremacy for almost all vegetative growth and fruiting traits as compared to all the other treatments. This combination produced maximum values regarding plant height (53.90 cm), leaf length (12.90 cm), leaf width (11.87 cm), leaves plant -1 (27.27), stem diameter (16.73 mm), flowers cluster -1 (23.17), fruits plant -1 (43.44), fruit fresh weight (58.60 g), fruit length (58.28 mm), fruit diameter (50.01 mm), fruit dried weight (4.34 g), fruit yield plant -1 (2.94 kg), fruit yield plot (25.40 kg), fruit yield (63.17 t ha -1). Least response was noted in control treatments in almost all the parameters under study.

THE POTENTIAL APPLICATION OF NANOTECHNOLOGY IN THE FIELD OF HORTICULTURE

Muhammad Farooq Haider[1], ***Zohaib Ahmad**[1], Muhammad Nabeel Afzal[1], Hamza Ali Khan, Shahbaz Shafiq[1], and Muhammad Abdul Qadir Hassan Kharal[2]

[1]Department of Plant Pathology, University of Agriculture Faisalabad, Pakistan
[2]Department of Horticulture, UCA& ES, The Islamia University of Bahawalpur, Pakistan
*Email:zohaibahmad088@gmail.com

ABSTRACT

The recent advancements in the field of nanotechnology have opened a gateway towards remarkable opportunities to address the issues related to the food supply chain. The inability to grasp this opportunity will render us unable to achieve goals towards better food quality, food safety, and related economic advantages. Due to variation and diversity in the specific characteristics of agricultural and mainly horticultural products it becomes difficult to address the complex issues related to food supply chain management. There are many perishable horticultural products and crops. The management and standardization of some types of fruit and fruit products are still not very high. Under such circumstances the implementation of nanotechnology in the field of horticulture becomes crucial. Review of data confirms that the practical application of nanotechnology firstly in the packaging process and later in other aspects such as tracing, tracking, storage, distribution is potentially increasing. In the current situation, most of the applications of nanotechnology are mainly in the field of packaging, and for the improvement of materials used in packaging, enhancing product quality and safety. Considering the supply chain management, the potential application of nano-sensors in the development of intelligent packaging in addition to keeping in view the promotion of information and management of all the factors involved in the agricultural food supply chain. When we compare

nano-sensors with traditional sensors with their less efficiency, nano-sensors have certainly an edge over traditional sensors mainly due to their ability to be highly sensitive and selective in addition to their portability, low cost and near to real-time detection. The cost-effectiveness of nanotechnology in the field of horticulture is also not any different when compared to the cost-effectiveness of other new technologies.

DEVELOPMENT OF ROOT SYSTEM IN HORTICULTURAL CROPS UNDER THE CONDITIONS OF ABIOTIC STRESS

***Muhammad Farooq Haider**[1], Qaiser Shakeel[2], Muhammad Raheel[2], Zohaib Ahmad[1], Muhammad Abdul Qadir Hassan Kharal[3], Muhammad Qasim Kamal[3], and Hamza Ali Khan[1],

[1]Department of Plant Pathology, University of Agriculture Faisalabad, Pakistan
[2]The discipline of Plant Pathology, University College of Agriculture, The Islamia University of Bahawalpur, Pakistan
[3]Department of Horticulture University College of Agriculture, The Islamia University of Bahawalpur, Pakistan
*Email: farooqhaiderm96@gmail.com

ABSTRACT

The exposure of roots to adverse abiotic stress conditions is much higher as compared to the shoot system. Roots, therefore, suffer severely as compared to the aboveground parts of the plants under abiotic stress conditions. Despite such a devastating impact of abiotic stresses on the root system, they have been less studied considerably as compared to the impact on the shoot system mainly because of the limited accessibility towards root observations. This particular research is based on the recent scientific work done related to the performance of root systems in horticultural plants under the circumstances of abiotic stress conditions such as waterlogging, drought, salinity, extreme temperature, nutrient deficiency, increased atmospheric CO 2 heavy metals, low light conditions, restrictions by mechanical means, changes in root: shoot ratio and reduced moisture level, less exposure to solar radiation results in the lesser shoot to root ratio. Restrictions towards the movement of metabolites from the shoot system to the root system are often observed under high-temperature, salt, drought, and nutrient-deficient conditions. On the other hand, less exposure to solar radiation results in an increment in the shoot to root ratio. The increased CO 2 concentration in the atmosphere and lower moisture levels my result in the development of an extensive root system. However, most of the abiotic stresses restrain root growth and bring notable alterations in roots. More often, a short root system with significant branched roots can be seen. Arbuscular mycorrhizal fungi colonize and bring changes in roots which not only enhance its resistance against abiotic stress but also against biotic factors i.e pathogens. Under abiotic stress, numerous biochemical processes and hormones play a role in root growth regulation. Ethylene, ascorbic acid, reactive oxygen and nitrogen species have been associated with regulatory functions.

INTEGRATED MANAGEMENT OF LEAF SPOTS IN FOXTAIL PALM (*WODYETIA BIFURCATE*)

Zil e Huma[1], ***Imran Ul Haq**[1], Siddra Ijaz[2], and Nabeeha Aslam Khan[1]

[1]Fungal Molecular Biology Laboratory, Department of Plant Pathology University of Agriculture Faisalabad
[2]Centre of Agricultural Biochemistry and Biotechnology, University of Agriculture, Faisalabad
*Email: imran_1614@yahoo.com

ABSTRACT

Ornamental palms uplift the economy of the world by adding million dollars due to aesthetic values, pharmacological and therapeutic properties. Foxtail Palm (*Wodyetia bifurcate*) is one of ornamental palm belongs to the *Arecaceae* family found in tropical and subtropical regions of the world. It is widely used in gardens and parks for landscaping. Some important constraints in the growth of foxtail palm including biotic and abiotic stresses. Among pathogens, fungi are highly destructive pathogenic microorganisms that cause huge losses. Pestalotia spp.

cause leaf spots that greatly damage the aesthetic value of the foxtail palm. It is necessary to adopt appropriate management practices to overcome this problem. This research was designed to apply an integrated management approach (fungicides and plant hormones). Antifungal potential of fungicides (Difenoconazole, Trifloxystrobin, Tebuconazole Tebuconazole, and Tebuconazole+ Trifloxystrobin) was evaluated in vitro at different concentrations (150ppm, 200ppm, 250ppm). Among these fungicides Difenoconazole and Trioxystrobin showed best results with 86.5%, 82.7% fungal growth inhibition at 250ppm after 96 hours followed by other fungicides. Efficacy of two fungicides (Difenoconazole, Trioxystrobin) and plant hormone (salicylic acid) was determined in the greenhouse to manage the disease. Salicylic acid in combination with Difenoconazole reduced maximum disease severity as compare to fungicides and salicylic acid alone.

RESPONSE OF OLIVE (*OLEA EUROPAEA* L.) CULTIVARS TOWARDS PROPAGATION THROUGH CUTTINGS UNDER SPTS (SHADED PLASTIC TUNNELS)

*__Khalid Hussain__, Rashad Waseem Khan Qadri, Muhammad Tahir Akram, Umais Asghar Khan, and Kashaf Ramzan

Institute of Horticultural Sciences, University of Agriculture Faisalabad.
*Email: khalidjutt2589@gmail.com

ABSTRACT

Olive (*Olea europaea* L.) is one of the most important fruit grown under subtropical regions and indigenous to the Mediterranean basin. Propagation of olive can be done sexually and asexually but the seeds of olive are naturally low viable. Through sexual reproduction (seed) plants remain unproductive for a longer period and never show the complete characteristics of the parent plant. So, the propagation in olive is carried out exclusively by the asexual methods. The most important problem in olive propagation is the low rooting percentage due to the low ability of regeneration. This research plan was aimed to test the rooting response of semi-hardwood cuttings of different olive cultivars grown in the Potohar region of the Punjab-Pakistan under SPTs (shaded plastic tunnels). One-year-old semi-hardwood cuttings of olive cultivars (Arbequina, Koroneiki, Gemlik, BARI Zaitoon-1 BARI Zaitoon-2) were prepared and planted under SPTs in sand media. Data on the following parameters were recorded during the experiment i.e. total no. of cuttings planted, no. of sprouted cuttings, no. of rooted cuttings, no. of roots per cutting, fresh and dry weight of roots, mean branch length and average root shoot ratio. The results showed that maximum sprouting percentage (85%) and no. of rooted cuttings (34.00) were recorded in Arbequina cultivar. The highest survival percentage was observed in cultivar BARI Zaitoon-1 (30.66) and the minimum survival percentage was observed in Gemlik (14.00). Overall performance was in the following order Arbequina > Koroneiki > BARI Zaitoon-1 > BARI Zaitoon-2 > Gemlik.

GIBBERELLIC ACID IMPROVES THE PHYSICO AND PHYTO-CHEMICAL ATTRIBUTES OF STRAWBERRY CV. “CHANDLER”

Ahsan Kamal, *__Kashif Razzaq__, Ishtiaq A. Rajwan, Sami Ullah, Hafiz Nazar Faried, and Faria Zafar Rana

Department of Horticulture, MNS-University of Agriculture, Multan, Punjab, Pakistan
*Email: kashif.razzaq@mnsuam.edu.pk

ABSTRACT

Gibberellic acid (GA 3) plays a vital role in influencing the fruit quality of many fruit crops including strawberry (Fragaria × ananassa Duch.). Therefore, the current study aimed to evaluate the effect of pre-harvest application of GA 3 on the physical- and phytochemical characteristics of strawberry cv. “Chandler”. Foliar application of GA 3 at 0, 50, 75, 100 and 125ppm was applied at 95 days after transplantation (Mid - January). The research was conducted under a randomized complete block design (RCBD) and replicated thrice. Results showed that the fruits sprayed with GA 3 @100ppm exhibited maximum fruit weight (15.01 g), fruit size (40.37 mm), fruit firmness (2.96 N),

Vitamin C contents (376.19 mg -1 100ml), Total phenolic contents (309.37 mg -1 100g GAE), Antioxidants (65.78 % DPPH), POD (0.06 Umg -1 protein), CAT (0.07 Umg -1 protein) over untreated fruit. However, the highest TSS (7.33 ○ Brix), TSS: TA (46.61) Juice pH (3.64), SOD (552.95 Umg -1 protein) were exhibited by the fruits treated with GA 3 @125ppm. Conclusively, the pre-harvest application of GA 3 @100pmm significantly improved yield and overall fruit quality of strawberry.

NUTRITIONAL PROFILE ASSESSMENT OF WHITE BUTTON MUSHROOM AGAINST CALCIUM CHLORIDE ENRICHED SUBSTRATE

*__Muhammad Ahsan Khatana__[1], Muhammad Muzammil Jahangir[1], Waseem Iqbal[1], Khurram Ziaf [1], Ghufrana Samin[2], Faheem Zafar[1], and Mehmood Ul Hasan[1]

[1]Institute of Horticultural Sciences, University of Agriculture, Faisalabad, Pakistan
[2]University of Engineering and Technology (Lahore) Faisalabad Campus, Faisalabad, Pakistan
*Email: ahsansiddique2319@gmail.com

ABSTRACT

Button mushroom is a popular mushroom all over the world due to its nutritional profile and it is grown worldwide on larger scales. Calcium chloride plays an important role in nutritious profile improvement and post-harvest life enhancement of different crops and mushrooms. An experiment was designed to evaluate the impact of calcium chloride on growth and yield of button mushrooms. Two strains of button mushroom viz. V1: SA 15 (Belgium) and V2: SA 67 (USA) were cultivated. Different concentrations of calcium chloride were applied on substrate i.e. T0 (without $CaCl_2$), T1 (0.25 % $CaCl_2$) T2 (1.25 % $CaCl_2$) and T3 (2.25 % $CaCl_2$). 2-factors factorial under CRD design was used with four replicates. Numerous biochemical traits were studied. Results revealed that V1 and V2 gave maximum (191.40g and 186.74g correspondingly) yield at T1 and T3 accordingly whereas minimum (140.03g and 124.87g) was at T2. Maximum (12.11%) reducing sugar contents were observed at T2 for V1 and V2 12.34% at T0 whereas minimum (8.92%) contents were observed at T0 for V1 and 7.76% of V2 at T2. Maximum (14.81%) and minimum (12.92%) non-reducing sugars contents of V1 were observed at T1 and T3 respectively whereas for V2 maximum (11.85%) and minimum (8.78%) was observed at T2 and T0 respectively. Total sugars were observed maximum (29.32%) and minimum (18.76%) for V1 at T1 and T3 accordingly, while for V2 maximum (19.49%) and minimum (18.78%) was observed at T3 and T0 correspondingly. Protein contents for V1 were observed maximum (4.28%) at T1 and minimum (2.46%) at T2 contrary to this for V2 maximum (4.59%) was at T1 and minimum (2.46%) was at T0. Vitamin C was observed maximum (158.4%) at T3 and minimum (120.67%) at T2 for V1 while for V2 maximum (151.66%) and minimum (107.59%) was observed at T1 and T0 respectively.

COMPARATIVE PERFORMANCE OF TOMATO (*SOLANUM LYCOPERSICUM*) UNDER DIFFERENT CLIMATIC CONDITIONS

*__Liaquat Ali__, Nadeem Akhtar Abbasi, and Najma Yousaf Zahid

Department of Horticulture Pir Mehar Ali Shah Arid Agriculture University, Rawalpindi, Pakistan
*E-mail: liaqat.ju99@gmail.com

ABSTRACT

Tomato (*Solanum lycopersicum* L.) is a member of the *Solanaceae* family and widely consumed for culinary purposes all over the world. The inadequate supply of tomato in the central regions of Pakistan is one of the major shortfalls during monsoon. This experiment was designed to address the above-mentioned problem keeping in view the production potential at two different sites with diverse climatic conditions. Different locations were selected for research trial i.e. PMAS Arid Agriculture University Rawalpindi and Hussainabad Skardu, Gilgit-Baltistan. The main objective of the study was to observe the performance of tomato for availability during the period of shortage (August, September). Two determinate varieties (Roma and Rio-Grande) and two indeterminate varieties (Sahel and Diamond) were selected for experiment and parameters like plant height (cm), number of leaves, number of flower clusters per plant, the total number of flowers per plant, flower drop percentage (%), days to first fruit set after transplanting, fruit set percentage (%), fruit drop percentage (%), days to maturity after fruit set, no of fruits per

plant, the average weight of individual fruit, fruit length and width, number of diseased or abnormal fruits and total yield per plant (kg) were studied. Comparing the two localities the performance of all the varieties at Skardu condition during late summer was better as compared to the Rawalpindi condition. The climate of Skardu was conducive due to normal temperature ranges between 20-30˚C, humidity 60-70% and adequate sunlight for the better performance of tomato. At the same time, the production at Skardu continued till the end of August which extended the production period to fulfill the shortfall of tomato during these months. On the other hand, the climatic condition of Rawalpindi was not suitable for the tomato production during the late summer season due to high temperature, ranges between 30-43˚C, humidity 47-57% and high intensity of sunlight making the climate unsuitable for better production of tomato under these conditions resulted in low yield and also the production period limited till July only. From the results, it is concluded that between determinate varieties Rio-Grande performed better at both the localities as compared to Roma and between indeterminate varieties Diamond performed better as compared to the Sahel at both conditions. The results and findings from the research have proved Diamond variety as a suitable and good performer under Skardu climatic conditions. Similar work may be carried out in other districts of Gilgit Baltistan like Ghizer and Gilgit to extend the production period up to September-October.

EFFECT OF DIFFERENT TEMPERATURES ON DRYING TIME OF CAULIFLOWER

Abroo Hashmi and Atiq Ahmad Alizai

Faculty of Agriculture, Gomal University, Dera Ismail Khan
Email:Abroohashmi919@gmail.com

ABSTRACT

Drying is the oldest method of preserving food for later use. It removes moisture from the food preventing the growth of bacteria, yeast, and mold. Oven drying is one of the methods can be used to dry fruits and vegetables which saves them time and provide clean dry products. The present study aimed to find out the time taken for drying cauliflower at various temperatures at the Laboratory of Horticulture, Faculty of Agriculture, Gomal University D.I.Khan during season 2019-2020. The study was conducted using a completely randomized design (CRD) having three treatments i.e. (T 1 =50°C, T 2 =100°C and T 3 =120°C) with three replications. The results indicated that the treatment-2 (100°C) took the optimum time of 10hours to dry out cauliflower with good quality. However, increasing temperature up to 120°C took minimum time i.e. 4 hours but it resulted in the burning of the top of cauliflower curd.

PHALSA FRUIT: NUTRITIONAL AND PHARMACOLOGICAL PROPERTIES

***Muhammad Azam**, M. Zubair, M. Arsalan Khan, Rashad Qadri, M. Awais Ghani, M.M Jhangeer, Saeed Ahmad, Raheel Anwar, Ahmad Sattar Khan, Muhammad Awais, and M. Hussnain

Pomology Labortray, Institute of Horticultural Sciences, University of Agriculture, Faisalabad, Pakistan
*Email: muhammad.azam@uaf.edu.pk

ABSTRACT

Phalsa or Falsa is commonly known as *Grewia asiatica* and it belongs to species Grewia and family Tiliaceae. The genus Grewia has about 140 species, out of which 40 species are found in India. It is native to Southern Asia from Pakistan to Cambodia. One of the most important species is Asiatica which produces edible fruit of falsa. Plant of genus Grewia consists of shrubs and trees and mostly found in the warmer regions. The fruit is of 5-12 mm diameter, having purple to black color when ripe. The fruit is a rich source of nutrients, carbohydrates, protein, fiber, anthocyanins, and tannins phenolic and flavonoids. sub-acidic and contain vitamin-A and C, as well as good sources of phosphorus and iron. Edible phalsa fruit is used to cure inflammation, respiratory, cardiac, and blood disorders, as well it is used as a digestive and antipyretic. Extract of the stem and bark relieves irritation. The root used to cure

rheumatism and leaves of phalsa is also used for the treatment of swelling of the body parts. This review focus on the nutritional, bioactive compounds, and pharmacological properties of different parts of phalsa plants.

EFFECT OF HUMIC ACID ON THE VEGETATIVE AND REPRODUCTIVE GROWTH OF MARIGOLD (*TAGETES ERECTA* L.)

Shanza Gul, Atiq Ahmad Alizai, Saleem Jilaani, Saeed Ahmad, Muhammad Afnan Khan, and Waqas Ali.

Faculty of Agriculture, Gomal University, Dera Ismail Khan, Pakistan
Email: shanzaniazi101@gmail.com

ABSTRACT

African Marigold (*Tagetes erecta* L.) is one of the flowers grown for commercial purposes in many areas of Pakistan. It is hardy, annual plants and is a popular plant for cheering up any garden. It can easily be grown in wider climatic conditions. It is mainly known as Poor man' s Saffron because of its medicinal and culinary values. Marigold like many other flowering plants requires a good nutritional plan to produce early quality flowers. Humic acid has been used for a wide variety of plants including ornamentals to improve the yield and quality. Humic acid hastens the flower and helps improve vegetative growth. Humic acid is a type of organic acid obtained from organic constituents of soil, peat, and coal. It is an important chelator with distinctive features that help vigor plant growth and better soil structure. . The current research study was designed to examine the effects of humic acid on the growth and quality of marigold plants at the Faculty of Agriculture, Gomal University, D.I.Khan. The trial has been carried out during 2019-20. The experiment was designed in Completely Randomized Design with three replications. The treatments designed were: T 1 (Control) with zero Humic Acid, T 2 50ml H.A/200ml of water, T 3 100mlH.A/200ml of water, T 4 150mlH.A/200ml. The studies showed that T 3 (100ml of Humic Acid) significantly improved plant growth and increased the number of flower buds in plants. Percent increase in plant height was maximum for plants received Humic Acid @ 100 ml. Flower size in terms of diameter was significantly increased by applying Humic Acid @ 100ml and resulted in earlier flower production.

EFFECT OF FOLIAR APPLICATION OF MICRONUTRIENTS ON YIELD AND QUALITY OF GRAPES (*VITIS VINIFERA*) CV. FLAME SEEDLESS

Wazir Mohsin Abbas[1], Irfan Ali[1], Nadeem Akhtar Abbasi[1], and Mahmood Ul Hassan[2]

[1]Department of Horticulture, PMAS Arid Agriculture University Rawalpindi, Pakistan
[2]Department of Plant Breeding and Genetics, PMAS Arid Agriculture University Rawalpindi, Pakistan
Email:wazeermohsinabbas@gmail.com

ABSTRACT

Grapes (*Vitis vinifera* L.) belong to family Vitaceae, which is named after a Latin word meaning grapevine. It is the highest-ranked cultivating fruit crop of the world, growing for their manifold benefits. In Pakistan, per hectare production of grapes are very low as compared to the world-leading countries. Which is basically due to multiple reasons including soil fertility, cultural practices, climate change, selection of varieties, etc. Among these factors, micronutrient (Iron, Zinc, and Boron) deficiencies are the basic and prominent factors affecting grapes quality and yield in the Pothwar region. To overcome these deficiencies different levels of micronutrients were applied foliar on grapevines at 5 different, berry development stages during two growing years (2018 and 2019). The two years data suggested that foliar treatment of micronutrients significantly increased almost all yield parameters including several bunches per vine, bunch weight, yield per vines, bunch length, berry number per cluster, berry diameter, berry weight, and cluster compactness. Quality attributes of berries including sugars (reducing, non-reducing as well as total sugars), ascorbic acid content, pH and brix^{o} values were all highest in grapevines which were exposed to foliar Fe, Zn and B treatment @ 200 ppm individual sprays. Biochemical leaf analysis including chlorophyll a and b, leaf micronutrient content (Fe, Zn and B) were also highest in grapevines that received individual sprays of exogenous foliar Fe, Zn, and B @ 200 ppm. Overall results revealed that the performance of grapevines CV. “Flame Seedless”

growing in the climate of the Pothwar region was improved as a result of foliar application of Fe, Zn, and B @ 200 ppm. The results also suggested that a further increase in the concentration of each nutrient might be helpful to get improved quantity and quality berries.

EFFECT OF MICRONUTRIENTS ON GROWTH, YIELD, QUALITY AND POSTHARVEST LIFE OF TUBEROSE UNDER CALCAREOUS SOIL

*Sana Mudassar and Muhammad Akbar Anjum

Department of Horticulture, Faculty of Agricultural Sciences and Technology, Bahauddin Zakariya University, Multan, Pakistan
*Email: sanamudassar1@yahoo.com

ABSTRACT

Tuberose (*Polianthes tuberosa*) belonging to family Amaryllidaceae, is one of the top ten most important cut flowers. It is mostly cultivated as an ornamental cut flower in tropical and subtropical areas of the world for commercial production due to its aesthetic value. It is grown on a large scale in Asia, including Pakistan. In Pakistan, most of the soils are calcareous, which hamper plants to absorb nutrients from the soil. Therefore, the present study was conducted to study the effect of foliar application of micronutrients on growth, yield, quality and postharvest life of tuberose under calcareous soil during 2018 and 2019. The experiment was conducted in a randomized complete block design (RCBD) with 8 treatments. The micronutrient treatments applied were; control, Fe alone, Zn alone, B alone, Fe + Zn, Fe + B, Zn + B and Fe + Zn + B. Fe was applied as FeSO 4 .7H 2 O, Zn as ZnSO 4 .7H 2 O and B as H 3 BO 3, each at 2% level. Bulbs were planted on March 13, 2018, on ridges spaced 60 cm apart with the plant to plant distance of 20 cm on calcareous soil. Twenty bulbs were planted in each treatment, which was replicated thrice. The first spray was applied 60 days after planting, second 90 days after planting and third 120 days after planting. Results showed that the micronutrients significantly affected the studied parameters as compared to the control. Regarding different micronutrient levels, the combined application of all the three micronutrients (Fe + Zn + B) performed the best for plant height, number of leaves, relative leaf chlorophyll content, leaf fresh and dry weights, number of stalks, stalk length, stalk fresh weight, number of florets per spike, floret fresh weight per spike, fresh weight per plant, dry weight per plant, root length and vase life of flowers as compared to other combinations and alone applications. Zn alone and Fe + Zn also gave good result for plant height, number of leaves per plant, relative leaf chlorophyll content, leaf length, leaf dry weight, number of stalks, stalk dry weight, length of the floret, floret fresh weight, floret dry weight, fresh weight per plant, dry weight per plant and root length. However, Fe + B performed the best for leaf width and B alone for a time to flower emergence.

RECENT DEVELOPMENTS IN EXTENDING STORAGE AND SHELF LIFE OF GREEN CHILIES

*Mahmood Ul Hasan[1], Aman Ullah Malik[1], Raheel Anwar[1], Rana Naveed Ur Rehman[1], Ahmad Sattar Khan[1], H. Hadiqa Anum[1], Qamar Rasheed[1], Samia Sarfraz[1], Khurram Ziaf[1], and Habat Ullah Asad[2]

[1]Postharvest Research and Training Centre, Institute of Horticultural Sciences, University of Agriculture Faisalabad, 38040 Pakistan
[2]CAB International, Rawalpindi, Pakistan
*Email: mahmoodsipra1@uaf.edu.pk

ABSTRACT

Green chilies are highly perishable with limited postharvest life due to rapid loss of water resulting in shriveling, wilting, disease incidence and susceptibility to microbial decay. Loss in visual quality also significantly reduces the acceptability of consumers with a lower price at the retail end. Different studies were planned under an ACIAR funded vegetable value chain project aiming at evaluating different postharvest interventions. For this purpose, eight commercial Chili cultivars were sourced from Sindh and Punjab provinces, were sorted out, weighed and divided into different lots for research trials. Among multiple studies, low-density film packaging (LDFP) of 12µ was tested at ambient (18 ± 2 ºC) and cold storage (5 ± 1 ºC) simulating refrigerator conditions. To reduce the disease incidence and decay, three chili cultivars were dipped for short hot water treatments. Promising edible coatings including Aloe Vera and chitosan were tested to enhance the storage life of chilies. Furthermore, to overcome shelf life and chilling

injury problems, different anti ethylene chemicals (oxalic acid, salicylic acid, and L- arginine) were also tested under low-temperature storage (5± 1 ºC). LDFP improved marketability index and shelf life for 9 to 15 days depending upon the cultivar at ambient conditions (winter season). At simulated refrigerated temperature, the storage life of chilies was extended for four weeks with better acceptance of quality. Short hot water dip at 52ºC for 60 sec and chitosan coating significantly reduced disease incidence in cv. Longi followed by Kunri and Talhari respectively. Optimized doses of salicylic acid and oxalic acid significantly maintained fruit color, firmness, and reduced red chili percentage, decay, disease incidence, moisture loss with extended storage for four weeks. Moreover, L- arginine promisingly reduced chilling injury and maintained fruit quality during cold storage. In prospects, a technology package for chilies shelf life extension will be developed based on best results and shared with growers and industry stakeholders.

EFFECT OF VARIOUS ORGANIC POTTING MEDIA ON THE GROWTH AND QUALITY OF CHILI (*CAPSICUM ANNUUM* L.)

Afaque Ahmed

Sindh Agriculture University, Tandojam, Pakistan
Email:afaque2k14@gmail.com

ABSTRACT

Excessive use of synthetic fertilizers and pesticides has caused tremendous harm to the environment as well as affects the human population indirectly. Use of organic manures to meet the nutrient requirement of the crop is essential for sustainable agriculture growth since; organic manures generally improve the soil physical, chemical, and biological properties along with conserving the moisture-holding capacity of the soil and thus resulting in enhanced crop productivity along with maintaining the quality of crop production. This pot experiment was conducted in 2017 to observe the effect of various organic potting media on the growth and quality of chili (*Capsicum annuum* L.). The trial was laid out at the Department of Horticulture, Sindh Agriculture University Tandojam in a three replicated Completely randomized design (CRD)- factorial. Two chili varieties were evaluated V1= Golden hot and V2= Ghotki. The treatments included T 1 = Control +canal sediment+ soil (ratio 0:2:0.5), T 2 = Poultry manure +canal sediment + soil (1:2:0.5), T 3 = Sheep manure +canal sediment+ soil (1:2:0.5) and T 4 = Compost (Terminix pro) +canal sediment+ soil (1:2:0.5). It was noted that the growth of chili varieties was significantly (P<0.05) affected by various organic manures. The chilli varieties with sheep manure+canal sediment+ soil (1:2:0.5) produced maximum results in 43.50cm plant height, 151.72 leaves plant -1 , 23.50 fruits plant -1 , 7.50 branches plant -1 , 34.89cm average plant spread, 3.02g fresh weight, 0.71g dry weight of fruit, 1.95cm fruit diameter and 200.39mg 100gm -1 vitamin C content, whereas in The chilli varieties with control +canal sediment+ soil (0:2:0.5) produced minimum results in 33.77cm plant height, 55.73 leaves plant -1 , 10.50 fruits plant -1 , 5.90 branches plant -1 , 25.12cm average plant spread, 2.53g fresh weight, 0.45g dry weight of fruit, 1.18cm fruit diameter and 155.62mg 100gm -1 vitamin C content.

EFFECT OF BOILING OF GRAPES ON THE QUALITY OF RAISIN

***Abdul Sattar Shah** and Atiq Ahmad Alizai

Faculty of Agriculture, Gomal University, Dera Ismail Khan
*Email: sattar.shegal@gmail.com

ABSTRACT

Grape production in Pakistan is increasing every year with the cultivation of new varieties in tropical and sub-tropical regions. The increasing supply would end up with the lowest market rates in a year or two. It is now time to look for ways of value addition to utilizing the surplus fruit. Raisin preparation is one of the easiest ways to add value and enhance the market window of this important commodity. A study was carried out at the Department of Horticulture Faculty of Agriculture, Gomal University, DIKhan during 2019-20 to prepare the raisin in a short possible time with good quality raisins. Two types of grapes 'Round and Oval' were used for the study. Both types were subjected to four boiling treatments i.e. 1. No boiling, 2. Boiling grapes for 4 minutes 3. Boiling grapes for 6 min and 4. Boiling grapes for 8 minutes. The trial was replicated three times. Grapes were kept in a glasshouse for

drying and making raisins. It was observed that time taken to complete the process of making raisin was significantly reduced by boiling the grapes as compared with grapes that were not boiled. It was further observed that boiling grapes for four minutes resulted in the maximum percentage of best quality raisins followed by grapes that were not boiled. Boiling grapes for more than six minutes deteriorated the quality and reduced the percentage of best and good quality raisins. Both types of grapes behaved similarly to various treatments.

A REVIEW: INDIGENOUS PLANTS OF PAKISTAN USED FOR THE TREATMENT OF HEPATITIS

***Muhammad Bilal Shaukat**, Karim Yar Abbasi, Hassan Munir, Muhammad Irfan, Ashraf, Yasir Majeed, and Iqra Kanwal

Institute of Horticulture, University of Agriculture, Faisalabad, Pakistan
*Email: sidhubilal786@gmail.com

ABSTRACT

From the very beginning of human existence, man has familiarized himself with plants and used them in a variety of ways throughout the ages. Plants are important for all living organisms for food, shelter, and medicine. They contain different chemicals, drugs and secondary metabolites that have the potential to make new medicine for the treatment of different diseases and disorders. Among all the diseases, Hepatitis is the most growing disease in the world after cancer cardiovascular and diabetes diseases. In Pakistan, approximately 5 and 10 million people are affected by hepatitis B and C respectively. While every fifth death in Sindh province is being attributed to hepatitis B and C and it is believed that 20 to 25 percent of the population of Sindh infected with the deadly viral disease. Many modern allopathic and homeopathic medicines for hepatitis are used which are found to be very costly and also have some side effects. There are varieties of medicinal plants which are cultivated and widely grown in Pakistan, have the potential to cure this disease. Indigenous plants of Pakistan belong to these families e.g. Acanthaceae, Adiantaceae, Anacardiaceae, Apiaceae, Apocynaceae, Asphodelaceae, Asteraceae, Berberidaceae, Bignoniaceae, Brassicaceae, Caesalpinaceae, Capparaceae, Compositae, Cucurbitaceae, Cuscutaceae, Equisetaceae, Euphorbiaceae, Fabaceae, Fagaceae, Fumariaceae, Lamiaceae, Liliaceae, Lythraceae, Meliaceae, Moraceae, Myrsinaceae, Myrtaceae, Nyctaginaceae, Oxalidaceae, Papilionaceae, Phyllanthaceae, Piperaceae, Plantaginaceae, Poaceae, Polygonaceae, Puniaceae, Rhamnaceae, Rosaceae, Rutaceae, Santalaceae, Scrophulariaceae, Solanaceae, Violaceae, and Zingiberaceae have potential to make modern medicine for the curing of different classes of hepatitis. Because, Plants of these families contain different classes of phytochemicals like polyphenols, tannins, flavonoids, terpenoids, tannins, mucilage, capillerine, mucin, gallic acid, glycoside, steroids, saponins, ascorbic acid, carotene, glutathione, riboflavin, etc. which alone or in the combination with other compounds are responsible for the treatment of hepatitis. By consuming local plant material, medicines can develop to eradicate hepatitis from Pakistan.

ASSESSMENT OF SELENIUM APPLICATION FOR THERMOTOLERANCE POTENTIAL OF CUCUMBER (*CUCUMUS SATIVUS* L.)

Rozina Kazmi and Zahoor Hussain

Department of Horticulture, College of Agriculture, University of Sargodha.
Email: mabubakar013@gmail.com

ABSTRACT

Cucumber (*Cucumis sativus* L.) is the important vegetable crop in Pakistan. It is an important member of the Cucurbitaceae family. It is a native of Asia and Africa. In Pakistan, it is grown on a large scale and its production decline every year. A lot of abiotic factors such as water, salt, and temperature stress reduce its yield. Among these factors, the temperature is a vital abiotic factor, which seriously restricts plant growth and development. The current study was designed to screen out the tolerant and heat-sensitive cucumber genotypes through parameters at three separate stages of temperature i.e 23 ° C, 40 ° C and 45 ° C. All the selected genotypes were allowed to grow at 23°C. After that plant were exposed to high temperature (40 ° C and 45 ° C) for 10 days in separate growth chambers. In the present study, ten available cucumber genotypes screen out for diverse heat stress levels to recognize morpho-physiological, biochemical markers for heat tolerance in cucumber and induced the heat tolerance in cucumber genotypes through exogenous application of selenium. Selenium (Se) is a trace element that is an

essential nutrient for humans, plants, animals and environmental toxicants. It can increase the tolerance of plants to UV-induced oxidative stress, delay senescence, and promote the growth of seedlings aging. Recently, it has been shown that Se can regulate the water status of plants under conditions of drought and heat stress. It also needs a small amount. The experiment was laid out under Completely Randomized Design (CRD) with two-factor factorial arrangements. The results showed from the first experiment that Safoora F1 hybrid presented the maximum and Cucumber desi C-500 exhibited the minimum value for morpho-physiological and biochemical markers under heat stress (23°C, 40°C and 45°C). In the current study, it was concluded that Safoora F1-Hybrid and Fazal F1-Hybrid Cucumber can be categories as heat tolerant, while Khushab Local, Summer Green, Bush Green, C- 200, C-400 and Cucumber Desi were regarded as heat-sensitive cucumber genotypes. In the second experiment incorporation of heat stress treatments showed a significant interaction for growth, physio-biochemical, enzymatic and yield aspects of thermo-tolerant and not- tolerant cucumber varieties at p< 0.05 in relation. The third study determined to identify the best level of selenium that was more effective in inducing thermo-tolerance capacity in cucumber. It was concluded from this research that (0.7 ppm) selenium dose was more effective as compared to other doses. Four experiments were conducted for the alleviation of heat-stress through exogenous application of selenium. It was determined that (0.7 ppm) exogenous foliar and seed treatment of selenium significantly alleviated the loss of injury and increased seedling, reproductive and final maturity phase at 40 ° C.

MORPHOLOGICAL RESPONSE OF DIFFERENT CITRUS ROOTSTOCKS TO VARIOUS CONCENTRATIONS OF NACL

Shamaila Rasheed, *__Saima Mumtaz__, M. Iman, Sanjeela Sabahat, M. Sudheer Tariq, and Taj Naseeb Khan

Horticultural Research Institute, National Agricultural Research Centre, Islamabad, Pakistan
*Email: saimamumtaz124@gmail.com

ABSTRACT

Soil salinity is considered one of the major consequences of global climate change which negatively affects the agricultural yields worldwide. Out of the total 80 million hectares country land, almost 6.3 million hectares of land is saline. In this context, the present research was designed to screen out different citrus rootstocks i.e., C-35, Benton citrange, Cleopatra mandarin, Poncirus trifoliata, Troyer citrange, Carrizo citrange and Rough lemon against NaCl stress (20mM, 40mM, 60mM, 80mM, 100mM, and 120mM) for their morphological attributes under field conditions. Our results indicated a significant interaction between citrus rootstocks and NaCl concentrations for various parameters i.e., root length, shoot length, root diameter, shoot diameter and number of leaves. Strong interaction was found between Poncirus trifoliata and 100mM and 80mM NaCl concentrations for root length (21.5cm) and shoot length (14.25cm) respectively. Likewise, Sour orange exhibited substantial interaction with 60mM for root diameter (1.31mm) whereas, more shoot diameter (1.04mm) was found on C-35 with 120mM. More leaves i.e. 9.25 were observed in Poncirus trifoliata at 120mM. Based on summary of salinity response, the citrus rootstocks were grouped in descending order of NaCl concentrations as Poncirus trifoliata>Sour orange > C-35 > Rough lemon >Cleoptara mandarin >Carrizo citrange>Cox mandarin >Troyer citarnge> Benton citrange. Of the citrus rootstocks tested for salinity stress Poncirus trifoliata, Sour orange, C-35, Rough lemon, and Cleopatra mandarin had high salinity tolerance rates with good seedling growth and new leaves developed a light green color. Other rootstocks Carrizo citrange, Cox mandarin, Troyer citrange, and Benton citrange had low seedling vigor and produced too few root tips to be properly assessed. The results are useful because of the identification of various citrus rootstocks as a potential source of salinity stress tolerance.

PREHARVEST APPLICATION OF SILICON (SI) IMPROVES FRUIT QUALITY IN KINNOW MANDARIN (CITRUS NOBILIS LOUR × CITRUS DELICIOSA TENORA)

Hafiz Faiq Bakht[1], ***Muhammad Shafique Khalid**[1], Mohammad Imran Razzaq[1], Atyab Amjad[2], and Muhammad Shafique[3]

[1]COMSATS University Islamabad, Vehari Campus, Vehari, Punjab, Pakistan
[2]Directorate of Floriculture, Agriculture Department, Agriculture House, 21-Davis Road, Lahore, Pakistan
[3]University of Agriculture Faisalabad, Sub-Campus Burewala-Vehari, Punjab, Pakistan
*Email: Shafique.khalid@cuivehari.edu.pk

ABSTRACT

Silicon (Si) is the second most abundant element in the lithosphere and has been well documented for its beneficial effects on plants facing various biotic and abiotic stresses. This study was intended to investigate the beneficial effect of Si to evaluate Kinnow fruit quality. Three commercial Kinnow orchards were selected in each of the three growing districts (Vehari, Multan, and Khanewal) of Punjab. The Si was applied as foliar (solution), soil (as sodium silicate) and combined (foliar ad soil) application. There were following treatments; T 1 =Control, T 2 =2mM soil application, T 3 =2mM foliar application, and T 4 =2mM soil application+2mM foliar application. Physio-chemical parameters were studied at harvest. The results revealed that; regardless of districts, all treatments with Si application enhanced physical and chemical fruit quality parameters however, maximum fruit diameter (91.3 mm) was recorded in the foliar application of Si. Juice contents were also maximum (58.57%) in treatment where combined Si was applied whereas ascorbic acid was maximum (167.9 mg/100 ml)) in soil application of Si. Maximum A and B grade fruits were also recorded in soil and foliar application of Si respectively. Regardless of treatments fruit diameter and juice contents were recorded maximum in district Khanewal whereas, maximum blemished fruit was recorded in district Multan. The above observations strongly recommends that the combined application of Si (foliar and soil) improve the quality of Kinnow mandarin.

POSTHARVEST APPLICATION OF CALCIUM CHLORIDE, SODIUM BICARBONATE, AND GIBBERELLIC ACID EXTEND THE SHELF LIFE AND REDUCE THE DECAY INCIDENCE OF GRAPEFRUIT (*CITRUS PARADISI* MACF.) AT AMBIENT TEMPERATURE

Sana Shahzad[1], Saeed Ahmad[1], Muhammad Jafar Jaskani[1], Rashid Ahmad[2], and Sundas Shehzad[3]

[1]Institute of Horticultural Sciences, University of Agriculture, Faisalabad (38000), Pakistan
[2]Department of Agronomy, University of Agriculture, Faisalabad (38000), Pakistan
[3]Department of Plant Pathology, University of Agriculture, Faisalabad (38000), Pakistan
Emails: sanashahzad247@gmail.com; saeedsandhu@uaf.edu.pk

ABSTRACT

'Grapefruit' (*Citrus paradisi* Macf.) is a leading citrus cultivar of Pakistan. The study was conducted to examine the effects of calcium chloride, sodium bicarbonate and gibberellic acid on the shelf life and quality of grapefruit under ambient temperature (25°C). Freshly harvested fruits of grapefruit were immersed in different concentrations of $CaCl_2$ (5 and 6%), $NaHCO_3$ (2 and 3%) and GA 3 (0.3 and 0.4%) for 15 minutes. Treated and untreated fruits stored at ambient temperature and analyzed for physical, physiological fruit quality characteristics and for chemical analysis which were performed before storage and after 5, 10, 15, 20, and 25 days of storage interval. Fruit peel color maintained with the application of GA 3 (0.4%) in comparison with other treatments. Fruits peel weight, rag weight and juice weight maintained by the application of $CaCl_2$ (5%) and extend storage life up to 25 days at ambient temperature. Fruit weight loss significantly reduces in treated fruits in comparison with untreated fruits. Fruits decay percentage was higher in control treatment in comparison with fruits which were treated with the application of $NaHCO_3$ (3%). Maximum total soluble solids were observed in untreated fruits due to a higher respiration rate while minimum total soluble solids were observed in treated fruits. Maximum vitamin C contents (35.2 mg/100g) were observed in fruits treated with $CaCl_2$ (5%) in comparison with untreated fruits. Higher values

of sugar content observed after 25 days of storage in control treatment while treated fruits showed lower values. Overall, optimized concentrations of $CaCl_2$ (5%) and $NaHCO_3$ (3%) were proved better for maintaining fruit quality and also extend the shelf life of grapefruit at ambient storage by reducing decay incidence.

EFFECT OF GA 3 AND PLANT GROWTH PROMOTING RHIZOBACTERIA (PGPR) ON GROWTH AND DEVELOPMENT OF WODYETIA BIFURCATE

*__Muhammad Kashif__, Adnan Younis, Muhammad Asad Shabbir, Sumaya Yaseen, and Urwa Irshad

Institute of Horticultural Sciences, University of Agriculture Faisalabad, Pakistan
*Email: kashifchand13@gmail.com; adnanyounis@uaf.edu.pk

ABSTRACT

The foxtail palm (Wodyetia bifurcate) is the most used landscape palm tree in the world which is native to Australia. It has popularity because of its durability, drought tolerance, and adaptability to different environments. In this research, the effect of plant growth regulators and plant growth-promoting rhizobacteria was studied. This study was conducted at the Lalazar nursery area, the University of Agriculture Faisalabad to evaluate foxtail palm for determining their growth and quality performance by using plant growth regulators (GA 3) and plant growth-promoting rhizobacteria (PGPR) bacillus strain. The experiment was laid out in Completely Randomized Design under factorial arrangement with ten treatments. Complete data of growth, leaf and plant canopy was recorded at the maturity stage. Data were statistically analyzed by using the Tukey Test and analysis of variance technique and treatment means were compared using the Least Significant Difference (LSD) test at 5% level of probability. No leaves/plant, chlorophyll content, leaf area, plant height, and plant canopy were high in T5 (GA3 applied @ 8 ppm and PGPR 40 ml). Fresh leaf weight, survival percentage, stem diameter, fresh root weight, and dry root weight were high in T6 (GA3 applied @ 8 mg and PGPR 60 ml). T9 (GA3 applied @ 12 mg and PGPR 60 ml) showed the poor results in this experiment and the overall result showed that T5 is the best. The effective and non-phytotoxic combination of GA3 and Plant growth-promoting rhizobacteria (PGPR) could be used to enhance the growth and development of foxtail palm.

QTL MAPPING FOR GRAIN NUTRITIONAL PROFILE IN MAIZE USING SEGREGATING POPULATION

***Javed Iqbal Wattoo[1],** Sunaina Ishaq[1], and Muhammad Ashfaq[2]

[1]Department of Biotechnology, Faculty of Life Sciences, University of Central Punjab, Lahore
[2]Institute of Agricultural Sciences (IAGS), University of the Punjab, Lahore
*Email: javed.nibge@gmail.com

ABSTRACT

Maize is an important cash crop of Pakistan with major industrial and domestic applications Grain nutritional profile defines and characterizes the dimensions of grain quality. Bio-fortification breeding projects employing maize require extensive genetic mapping to understand the inheritance of complex nutritional traits to develop new cultivars with superior grain quality traits. The current study was designed to map the Quantitative Traits Loci (QTLs) for grain nutritional profile in maize using segregating population. A doubled haploid population was developed and genotyped with 120 SSR markers distributed randomly across different linkage groups. Grain quality assays were conducted underlying different attributes like Protein contents, Fiber contents, Lipids contents, Carbohydrate contents, Nitrogen contents, and Ash contents. Linkage analysis revealed 19 main effect QTLs with significant phenotypic variation (5.56-18.5%) in all the doubled haploid lines. A main effect QTL *qCC-4* flanked by 1621-1652 was identified on linkage group 4 explaining 18.5% phenotypic variation. Similarly, another major QTL *(qAC-9)* was identified on chromosome 9 with a 16.7% Phenotypic variation. A novel QTL for protein contents was identified on linkage group 4 explaining 9.26% phenotypic variation. In conclusion, the findings of the current study showed that the linked SSR markers with all the nutritional attributes may be successfully employed to transfer the genes/loci associated with different grain quality parameters using Genomic Assisted Plant Breeding Approaches.

GENOME ASSISTED BREEDING TOMATO UNDER DIFFERENT SALINITY LEVELS

*Imran Ahmad[1], Mohammad Yasir[1], Abdur Rab[1], Mehboob Alam[1], Humaira Wasila[2], Asim Muhammad[3], and Shahryar Javed[1]

[1]Department of Horticulture, The University of Agriculture, Peshawar Pakistan
[2]Department of Human Nutrition, The University of Agriculture, Peshawar Pakistan
[3]Department of Agronomy, The University of Agriculture, Peshawar Pakistan
*Email: imran73pk@gmail.com

ABSTRACT

Abiotic stress negatively affects plant physiology and thus influencing the overall growth and development of the plant. Saline stress is one of the most severe environmental problems limiting the production of the crop plant. Biofertilizers are rectifying elements used for enhancing tolerance towards salinity and drought stress in soil. In the present study, we investigated the effect of salinity stress on qualitative and quantitative attributes of cherry tomato plants (Lycopersicon esculentum cerasiforme) with biofertilizer application after different days of transplanting. Different levels of salinity (0, 50, 100 & 150 mM) were used with biofertilizer (Azospirillum sp. and Azobecter sp.) application after different days of transplantation (0, 15 & 30 days). The studied variables which were significantly affected by salinity (150 mM NaCl) and were recorded with minimum levels of leaf area (52.42cm 2), root length (6.54cm), fresh roots weight (13.64 g), yield (6.52 tons/ha) and leaf chlorophyll content (36.11 mg/m 2) and maximum level of TSS (8.87 Brix 0). Higher leaf area (58.35 cm 2), root length (15.23 cm), fresh roots weight (17.86 g), yield (9.39 tons/ha), leaf chlorophyll content (44.09) and lower TSS (7.93 Brix 0) were recorded in control samples (No application of NaCl). Similarly plants with biofertilizer application 15 days after transplanting were observed with higher plant height (73.41cm), stem diameter (0.74cm), leaf area (61.16 cm 2), root length (15.35 cm),fresh roots weight (29.49 g), roots dry matter (56 %), yield (10.43 tons/ha),leaf chlorophyll content(42.55), fruit dry matter content (10.12 g),pH (4.52) and TSS (9.30 Brix 0), Whereas minimum plant height (51.33 cm), stem diameter (0.55cm), leaf area (49.6 cm 2), root length (7.04 cm),fresh roots weight (22.47g), roots dry matter (10.87 g), yield (5.1 tons/ha), leaf chlorophyll content(35.18), fruit dry matter content (6.59 g), pH(4.27) and TSS(7.55 Brix 0) were recorded in plants with no application of biofertilizer. The present study revealed that most growth and quality variables were negatively affected by salinity except TSS that showed a positive effect on the application of 150 mM of NaCl. Biofertilizer application at 15 days predominantly influences the quantitative and qualitative attributes of cherry tomato under different levels of salinity.

PRESENT STATUS OF VARIOUS GEOPHYTES PRODUCTION IN PUNJAB, PAKISTAN

Muhammad Junaid khan

Email:m.junaid8083@pern.onmicrosoft.com

ABSTRACT

The present status of various geophytes being cultivated in Punjab, Pakistan was investigated. At present, farmers were cultivating only three geophytes viz. gladiolus, tuberose, and Lilium on a commercial scale. Gladiolus and Lilium were being grown in winter while tuberose was grown in summer. The majority of farmers (63%) were literate (having qualification under matric) aged up to 35 years and were involved in geophytes cultivation for the last three to five years. Moreover, the majority of growers had one to five acres under geophytes cultivation. Farmers were using 8 cm to 10 cm diameter corms for gladiolus, more than 12 cm diameter bulb for Lilium and 12 cm to15 cm bulbs for tuberose. Almost all farmers were facing problems related to water shortage, soil born diseases and scarcity of skilled labor. It was noted that no government or private organization was taking interest in solving their problems. No cold storage was available and progressive farmers were using air-conditioned rooms for storage of cut flowers for 1-2 days. The majority of farmers were facing 4% postharvest losses of cut geophytes from

harvesting till marketing. No refrigerated transport was available for cut geophytes. Average net return from one acre of cut geophytes ranged from two hundred thousand to two hundred and fifty thousand rupees for tuberose, three hundred thousand to four hundred thousand rupees for gladiolus and ten hundred thousand to twelve hundred thousand rupees from Lilium. In summary, growers were interested to grow more flowers, but have a lack of technical knowledge and facilities for quality flower production.

TO STUDY THE RELATIONSHIP OF ABIOTIC FACTORS WITH THE POPULATION DYNAMIC OF JASSID ON EGGPLANT (*SOLANUM MELONGENA* L)

***Muhammad Ali** and Muhammad Ashfaq

Institute of Agricultural Sciences, University of the Punjab, Lahore, Pakistan
*Email: ali.klasra@gmail.com

ABSTRACT

The study conducted regarding the jassid population and its interaction with the weather. The coefficient of determination values was observed to find the role of weather effects on population fluctuation jassid on brinjal. The data were recorded at weekly bases and correlated with the weather factors so that to find out the effects of rainfall, minimum temperature, relative humidity, average temperature, and maximum temperature. The experiment was conducted in the Institute of Agricultural Sciences, University of the Punjab Lahore. The RCBD was used with the three replication. The maximum temperature played an important role in the fluctuation of the jassid population which is 37.5% and average temperature 20%, minimum temperature7.6%, and rainfall showed and 9% respectively. While humidity showed the less effective for population increasing and decreasing. The recorded data were transformed to square root transformation and processed for the Simple Correlation and Multiple Linear Regression analysis for study to check the role of weather factors in the fluctuation of the pest population.

GREEN BUILDING

***Muhammad Shahzaib**, Shahbaz Nasir khan, and Abdul Nasir

Department of Structure and Environmental Engineering, Faculty of Agriculture Engineering and Technology, University of Agriculture Faisalabad, Pakistan
*Email: shahzaibgujjar7925@gmail.com

ABSTRACT

Green building refers to the structure and using a process that is environmentally responsible and resource-efficient throughout a building's lifecycle. Leadership in Energy and Environmental Design (LEED) is a set of rating systems for the design, construction, operation, and maintenance of green buildings which has developed by the U.S. Green Building Council. Another certificate system that confirms the sustainability of buildings is the British BREEAM (building research establishment Environmental Assessment Method) for buildings and large-scale development. Pakistan green building council (Pakistan GBC) directly under the umbrella of the World green building council (WGBC). The world GBC is a union of 98 national green building councils from under the world, making it the largest international organization that influenced the green building marketplace. Since building consumes more than 40% of world total primary energy and 24% of global carbon dioxide emission. On the other hand, the green building consumes a minimum amount of energy with the use of energy-efficient material. Green buildings enjoy the benefits of saving 40-50% energy by reducing CO2 emissions into the atmosphere. It also saves about 20-30% of water by using rainwater harvesting or greywater re-use techniques. The basic principle of green building to reduce the overall impact on human health and the natural environment by using energy, water, and other resources efficiently. By reducing waste, pollution, and environmental degradation. More than 100 building has been registered as a green building in India. In Pakistan, few buildings have been designed and recognized as green buildings.

MANAGEMENT OF SOIL BY MICROBIOTA, ORGANIC FERTIGATION AND DEVELOPING INDIGENOUS URBAN FORESTS ENSURE SOIL BETTER ENVIRONMENT

Rashida Sultana, Bilal Chaudary, Hassan Muneer, Rehmat e Bari Wajeeha, Mirza Naseer Ahmad, and ***Abdul Wadood**

*Email: panchi39.aw@gmail.com

ABSTRACT

Soil management protects as well as enhances soil performance. Soil is the primary source of nutrients and essential ions. Furthermore, it also ensures proper aeration and development of roots. Plants not only utilize nutrients of soil but also develop the soil's structural, chemical, physical and biological properties. Plantation not only involves in soil development but also aids in controlling soil erosion and deformation of soil structure. Soil erosion may lead to desertification. By developing the biological properties of soil we can increase the fertility of the soil. Microbiota exerts many beneficial effects on soil development. Due to the urbanization trend of planting rapidly growing exotic trees has increased. This has resulted in a decrease in local soil microbiota that was responsible for the decomposition of litter. This has increased soil degradation. Organic fertilizers and Indigenous plants are considered natural soil management sources. In the current study, two plots were selected in Rabwah. One plot of degraded, saline and barren land was treated with organic manures comprising of ripened fruit extracts, local microbiota, bigas, wheat straw cuttings, and dung. While another plot was comprising of normal soil and no treatment was applied. In both plots, 40 different types of trees and bushes were planted. The growth rate of plants in both plots was observed. The growth rate of all indigenous plants on organic fertigated saline soil was triple the growth rate of non-organic fertigated normal soil. Moreover, local microbiota was also increased in soil that enhances the decomposition of fallen leaves of indigenous trees. This led to the recycling of nutrients between soil environment and plants permanently. Addition of organic matter and plantation of indigenous trees created natural self-sustaining soil

environment. So, the management of soil by organic fertigation and developing indigenous urban forests can ensure a better soil environment.

HORTICULTURAL THERAPY: NATURE CAN BE A REMEDY FOR PSYCHOLOGICAL DISORDERS

***Ahmad Sahab**[1] and Tuba Sahar[2]

[1]Department of Plant Pathology, University of Agriculture, Faisalabad, Pakistan
[2]National Institute of Food Science and Technology, University of Agriculture, Faisalabad, Pakistan
*Email: ahmadsahab111@yahoo.com

ABSTRACT

Plants are an important part of our life, it provides us food, wood, and habitat. An important characteristic of plants is that their sensory stimulation (color, texture, and sound). Due to these unique characteristics plants are used in a professional setting to improve the physical and mental health of individuals know as horticultural Therapy. It runs throughout life. From the very past, these kinds of therapies are used for many mental and emotional disorders like blood pressure, depression, Anxiety, Heart problems, Diabetes, Dementia, and stroke. Therapeutic Horticulture is widely used in clinical, nursing and rehabilitation centers, participants are involved in this, actively or passively. The purpose of this therapy is to maximize the people's social, psychological, cognitive as well as physiological function. A sample size of 50 participants was taken and was divided into 2 groups, one is for indoor (planting, crafting, and cooking) and other for outdoor nature base activates (Gardening, community outing, etc). Outdoor nature-based and indoor plants used to prove beneficial in dementia and stroke as well. Outdoor horticultural therapies have significantly beneficial for relaxation, stress relief, lessen pain perception, improve mood, and increase social interaction and high self-esteem. Indoor gardening involves improving agitation, sleep and overall quality of life. As the results show, horticultural therapy proves to be a very effective remedy for reducing the severity of different behavioral and psychological issues with great significance.

CLEAN AND GREEN PAKISTAN INITIATIVE: A PRODUCTIVE APPROACH FOR ENVIRONMENT SUSTAINABILITY

Muhammad Tariq Iqtadar

Institute of Agriculture Sciences, University of the Punjab, Lahore
Email: tariqiqtadar@hotmail.com

ABSTRACT

Climate change, unhealthy activities, polluted environment, lack of waste disposal facilities, improper sanitation and lack of cleanliness are the major factors contributing to the poor health of the citizens in the developing counties including Pakistan which in return putting stress on the mother earth affecting the life of every living organism. The only solution to these everyday increasing threats is the adoption of eco-friendly approaches and developing strategies and practicing clean and green culture in the society in the form of cleanliness, sanitation facilities, and development of hygienic practices. Cleanliness is a part of the faith of Islam and a lot of emphases is given in religion Islam. WaterAid reported that Pakistan is at 7th position in terms of lack of access to basic facilities of sanitation. The initiative is a complex of five pillars which are safe water, healthy sanitation, cleanliness, mass plantation, and solid and liquid waste management. To gain the popularity and contribution of the society in the Clean and Green program, the theme of the initiate is designed with the name of "My City My Responsibility" is attracting community voluntarily and giving productivity. After the success of one billion tree plantation in KPK and the campaign for planting 10 billion trees in the whole country in the next five years. It is yet another milestone to improve the environment, cleanliness, and lives of the community. A lot of emphasis and importance is given by the government at all level including public, print, and social media guidance and awareness. Various funding programs at union council levels are one of the initiatives of the current government to address the lack of clean and safe

drinking water, provision of hygiene facilities and establishment of waste disposal places. Indeed, it's a great cause and project is vital to address the environmental and social issues in Pakistan.

BIOCHAR AS ECO-FRIENDLY FRIENDLY FERTILIZER TO BOOST THE STRAWBERRY (FRAGARIA ANANASSA) PRODUCTION IN ARID CLIMATE

***Umbreen Shahzad**[1], Muhammad Khalid[1], Nauman Noor[1], Madiha Butt, Tahira Abbas[1], and Muhammad Shahjahan[2]

[1]College of Agriculture, Bahauddin Zakariya University, Bahadur Campus Layyah, Pakistan
[2]Department of Plant Pathology, PMAS-Arid Agriculture University Rawalpindi, Pakistan
*Email:umbreenshahzad@bzu.edu.pk

ABSTRACT

Strawberry (Fragaria ananassa) was considered to be the fruit of temperate areas, but now it can be grown anywhere in the world such as in the southern parts of Pakistan, India, the U.S.A and even in the Philippines. The study was designed to evaluate the effect of different biochar (Rice husk, Wheat straw, and Coal) on the growth and yield of strawberry varieties (Chandler, Sakoya, and Camino). The effect of biochar was significantly best among all growth and fruit quality parameters as compared to control. Wheat straw and rice husk biochar amendments showed highest fruit yield (544g) TSS (11ºbrix) fruit area (76 cm) leaf area (145 cm) and fruit quality, decreased days to initiate flower minimum (48 days), increased total number of flowers maximum (27) fresh fruit weight (27g) fruit dry fruit weight (4.3g) compared with other biochar amendments. The significant effects of all the parameters tested were confirmed through statistical analysis. Coal biochar showed the minimum result of total yield and growth of strawberry varieties compared with the other two biochar. The maximum yield (457g) was observed in Rice-husk biochar meanwhile, the results proved that coal and wheat straw biochar in different varieties of strawberries. Hence, the study concludes that the production of strawberries was improved by wheat straw and rice husk biochar.

EFFECT OF EXOGENOUS APPLICATION OF BIOSTIMULANTS (AMINO ACID AND YEAST) ON FLOWERING QUALITY OF ROSE

***Tehseen Ashraf**[1] Muhammad Asim[2], Sehrish Mushtaq[1], Abu Bakar[1], Hafiz Muhammad Bilal[1], and Ehsan-ul-Haq[2]

[1]Department of Horticulture, College of Agriculture, University of Sargodha, Punjab, Pakistan
[2]Citrus Research Institute, Sargodha, Punjab, Pakistan
*Email: asimcri@gmail.com

ABSTRACT

A pot experiment was conducted to examine the response of exogenous application of biostimulants (ammo acid and yeast) substance on the growth and flower quality of roses in the Department of Horticulture, University College of Agriculture, and University of Sargodha. Different concentrations of amino acid and yeast were sprayed at the vegetative and reproductive stages. Maximum plant height (154.93 cm) was recorded from 4 gm/liters yeast application at the reproductive stage and minimum plant height (121.89 cm) was recorded at control. A maximum number of leaves /plant (76.66) was recorded from 1.75 ml/liters amino acid + 6 gm/liters yeast application and the minimum number of leaves/plant (53.66) was recorded from control at reproductive stage. Maximum days to flowering (77.66 days) were recorded from control treatment and minimum days to flowering (51.00 days) were recorded from 1.75 ml/liters amino acid + 6 gm/liters yeast application at reproductive stage. Maximum bud diameter (1.37 cm) was recorded from 1.75 ml/liters amino acid + 4 gm/liters yeast application at the reproductive stage. A maximum number of flowers /plant (46.30) was recorded from 1.75 ml/liters amino acid + 4 gm/liters yeast applied and the minimum number of flowers/plant (25.40) was recorded under control conditions at reproductive stage. Maximum flower stalk length (5.75 cm) was recorded from the 1.75 ml/liters amino acid + 4 gm/liters yeast applied and minimum flower stalk length (5.36 cm) was recorded under control condition at reproductive stage. Maximum chlorophyll contents (6.73 mg/100g) were recorded from 1.75 ml/liters amino acid + 4gm/liters yeast applied and minimum chlorophyll contents (5.61 mg/100g) were recorded under control conditions at the reproductive stage. Maximum flower diameter (9.56 cm) was recorded from 1.75 ml/liters amino acid + 4gm/liters yeast applied and minimum flower diameter (5.66 cm) was recorded control conditions at the reproductive stage. It was concluded that among all the treatments (1.75 ml/liters amino acid + 4gm/liters yeast) and treatment (1.75

ml/amino acid + 6 gm/liters yeast) were proved best and significantly enhanced the rose growth and productivity at both vegetative and reproductive stage application.

MICROPROPAGATION IN POTATO CULTIVARS

Naila Mirbaz[2,3], Tariq Parvez[1], Shah Zaman[2], Bilquees Fatima[3], and *Muhammad Usman[3]

[1]Department of Agriculture and Food Technology, Karakoram International University, Gilgit- Baltistan, Pakistan
[2]Directorate of Agriculture Research, Gilgit-Baltistan, Pakistan
[3]Plant Tissue Culture Cell, Institute of Horticultural Sciences, University of Agriculture, Faisalabad-38040, Pakistan
*Email: m.usman@uaf.edu.pk

ABSTRACT

Potato (Solanum tuberosum L.) is one of the leading nutritious food crops and an important cash crop of Gilgit Baltistan. Micropropagation is a useful tool for plant multiplication and virus free seed production. Two cultivars Barna and Kuroda were subjected to micropropagation and the effect of different phytohormones including BAP and Gibberellins were used in combinations (GA 3; 0, 1+1, 3+2, 5+3 mgL -1) was evaluated for shoot proliferation. Data were collected for shoot growth, number of shoots, and number of leaves, plant fresh and dry weight. Shoot length was higher in cv. Kuroda at higher levels of PGRs. The number of shoots was higher in cv. Barna at lower levels of PGRs and was further reduced at higher doses. The number of leaves produced was higher in cv. Kuroda at 3 mgL^{-1} BAP and 2 mgL^{-1} GA 3. These studies indicated the higher potential of these cultivars for micropropagation which could be further utilized to estimate the in vitro tuberization behavior for disease-free tuber production.

FUTURE PROSPECTS OF BROCCOLI CULTIVATION IN PAKISTAN

***Waseem Iqbal**[1], Chaudhry Muhammad Ayyub[1], Muhammad Muzammil Jahangir[1], Muhammad Ahsan Khatana[1], Ghufrana Samin[2], and Rashid Iqbal Khan[1]

[1]Institute of Horticultural Sciences, University of Agriculture, Faisalabad, Pakistan
[2]University of Engineering and Technology (Lahore) Faisalabad Campus, Faisalabad, Pakistan
*Email: waseemch427@gmail.com

ABSTRACT

Broccoli (*Brassica oleracea* L.) originated from the Mediterranean region and a member of the Brassicaceae family. It is a high-value vegetable crop containing certain nutritional and healthy ingredients such as minerals, vitamins, carotenoids, beta carotenoids, and especially the most important glucosides (anticancer agents). These all play a regulating and important role in various metabolic processes of the human body. Broccoli needs cool weather and fertile soil to grow better. Pakistan has tremendous potential for the cultivation of broccoli during the winter season. Favorable agro-ecological and climatic conditions may replace the already growing, nutritionally and economically cruciferous vegetables such as cabbage and cauliflower. Under changing environmental conditions, particularly the recent prolonged winter season is favoring broccoli cultivation by reducing the risk of bolting. Being hardy it is better in resistance against various biotic and abiotic stresses than other vegetables. Therefore, broccoli cultivation is recommended to be adopted on a commercial scale.

COMPARATIVE GROWTH EVALUATION OF EIGHT ROSE CULTIVARS UNDER OPEN FILED AND GREEN NET CONDITIONS IN THE POTHOHAR REGION

***Atyab Amjad[1]**, Malik Abid Mahmood[1], Muhammad Saleem Akhtar[1], Muhammad Shafique Khalid[2], Muhammad Amin[3], Riaz Bukhari[1], and Riaz-Ur-Rehman[1]

[1]Directorate of Floriculture (T&R), Punjab, Agriculture Department, Agriculture House, 21-Davis Road, Lahore
[2]Department of Environmental Sciences, COMSATS University Islamabad, Vehari Campus
[3]Department of Horticulture, Muhammad Nawaz Sharif University of Agriculture, Old Shujabad Road, Multan
*Email: amjad@gmail.com

ABSTRACT

A study was conducted to evaluate the comparative growth performance of eight hybrid rose cultivars i. Kanchi, ii. Marshish, iii. Gladiator, iv. Merry Jane, v. Great Gala, vi. Barbra Bush, vii. Blue Ocean and viii. Casanova under open field and green net conditions. The study was conducted at Horticultural Research Institute for Floriculture & Landscaping, Islamabad and laid out under Randomized Complete Block Design (RCBD) with factorial arrangements. Results revealed that plant height (147.6 cm), flower stalk length (97.5 cm), flower diameter (59 mm) was maximum in variety Casanova under green net condition, however, a higher number of flowers plant^{-1} (5.6 numbers) was recorded in variety Kanchi under green net condition. It is concluded that a variety of Casanova performed well under green net conditions in the Pothohar region.

IMPROVING SALT TOLERANCE IN SPINACH THROUGH EXOGENOUS APPLICATION OF PHYTOHORMONES

***Madiha Butt**[1], Muhammad Shafique[2], and Muzamil Ijaz[3]

[1]Bahadur Sub-campus, BZU, Layyah
[2]Sub-campus Burewala-Vehari, University of Agriculture Faisalabad, Vehari
[3]University of Agriculture, Faisalabad
*Email: madihab99@gmail.com

ABSTRACT

Salinity is a common abiotic stress that limits the productivity of horticultural crops. Augmented salt levels are toxic to seed germination, seedling growth and ultimately diminishing the economic yield of crops. The current research trial was comprised of five spinach varieties 'Pahuja', 'All Green', 'Ambika', 'Durga' and 'Desi Palak' treated with of 24-epibrassinolide (EBL) and methyl jasmonate (MeJA) and grown under different saline regimes (0, 50, 75, 100 and 125 mM). Seeds of all five spinach varieties were sown in plastic pots that were filled with sand as a growing medium along with half-strength Hoagland solution as plants nutrient medium. Potted spinach plants of all varieties were subjected to different levels of foliar application of EBL (0.5, 1.0 and 1.5 µM) and MeJA (0.5, 1.0 and 1.5 µM) to analyze the salt tolerance. Results revealed that priming of spinach seeds of all five varieties with EBL and MeJA concentrations significantly enhanced salt tolerance potential of spinach plants by alleviating the drastic effects of salt stress on seed germination percentage, along with other plant growth attributes including shoot length, root length, shoot fresh weight, root fresh weight shoot dry weight and shoot dry weight. Among all five spinach varieties, 'All Green' was most tolerant to salt stress; whereas, 0.5 µM EBL and 1.5 µM were the most effective treatments in alleviating salt stress. Hence, it can be concluded that the foliar application of EBL and MeJA enhanced salt tolerance potential of spinach genotypes.

STRATEGIES TO ENHANCE BIOACTIVE COMPONENTS IN HORTICULTURAL PRODUCE FOR COUNTERING METABOLIC SYNDROME

***Muhammad Rizwan Tariq** and Shinawar Waseem Ali

Institute of Agricultural Sciences, University of the Punjab-Lahore, Pakistan
*Email: rizwan_choudary143@yahoo.com

ABSTRACT

Fruits and vegetables are part and parcel in healthy dietary patterns. Approximately more than 50 percent of energy is obtained from horticultural produce directly or indirectly daily. Due to advancements in traditional agricultural practices, dependence is switching towards cereal grains. Utilization of cereal grains, pulses, roots along with little dairy and meat products can leads towards the development of metabolic diseases i.e. cancer, type 2 diabetes. Various essential micronutrients are present in fruits and vegetables. Vitamin A, Zn, and iron are the most important among them. The deficiency of these nutrients is progressing remarkably in the world's population. Poverty restricts access towards food so the consumption of fruits and vegetables having enhanced nutritional quality may assist in solving nutritional problems in population consuming horticultural produce. Hence there is dire need to produce such crops having enhanced nutritional contents. It is mandatory to employ biotic and abiotic stresses like UV radiation, water, temperature pathogens, etc. to stimulate the synthesis of functional ingredients. By using different strategies like postharvest management, biotechnological tools, in vitro studies, food processing, manipulation of plants from seed treatment to maturity and genetic manipulation, bioactive components in fruits and vegetables can be improved.

ASSESSMENT OF STORAGE POTENTIAL TO EXTEND THE MARKETABLE WINDOW OF POTATO

***Muhammad Kamran**[1], Aman Ullah Malik[1], Mahmood Ul Hasan[1], C.M. Ayyub[1], Raheel Anwar[1], Khurram Ziaf[1], M. Waseem Haider[1], and Hafiz Mehmood Rehman[2]

[1]Postharvest Research and Training Centre, Institute of Horticultural Sciences, University of Agriculture, Faisalabad, Pakistan
[2]CAB International (Central and West Asia) Rawalpindi, Pakistan
*Email: kamran189m@gmail.com

ABSTRACT

Potato is the largest vegetable crop in Pakistan with respect to area and production. Information regarding the storage potential of locally grown potatoes is lacking. To maximize the marketable window, the optimal storage potential of different cultivars need to be determined. The present study was part of an ACIAR funded project aiming at evaluating the storage potential and tuber quality of commercial potato genotypes under cold storage conditions during 2019. Thirteen potato genotypes were harvested at commercial maturity, were sorted, graded and divided into three replications and stored in plastic crates at 10 ± 1°C. Data was collected at 15 days' interval. The experiment was designed according to CRD with the factorial arrangement. Genotypes were evaluated for various parameters; no sprouting was observed till one month of storage in all potato genotypes while at last removal (90 days), Sante performed best with minimum number of sprouts (5.3 %) followed by SL 5-2, Astrix and Ruby respectively while Musica showed higher number of sprouts (24.33%). Fruit weight loss was higher (5.3%) in Sadaf genotype, while other genotypes exhibited approx. 2-4 % weight loss after 90 days of storage. TSS exhibited non-significant findings while Sadaf potato genotype displayed higher TSS (8.3 ºBrix) as compared to other genotypes under study.

HORTICULTURE IS BENEFICIAL FOR HEALTH: A META-ANALYSIS AND REVIEW

***Sadia Nawaz**, Sehrish Feryal, Shagufta Saeed, and Mudassir Ali

Institute of Biochemistry and Biotechnology, University of Veterinary and Animal Sciences, Lahore
*Email: sadia.nawaz@uvas.edu.pk

ABSTRACT

There is substantial evidence that gardening provides substantial human health benefits. Horticultural therapy may be defined as the process of utilizing fruits, vegetables, flowers and plants assisted by a trained therapist or healthcare provider, to achieve specific treatment goals or to simply improve a person's well-being. The prevalence of lifestyle diseases, such as heart disease, stroke, depression, diabetes, and obesity is becoming a major public health issue worldwide. Gardening therapy is being used for therapy or rehabilitation programs for cognitive, physical, social, emotional, and recreational benefits, thus improving the person's body, mind, and spirit. Between 5% to 15% of people with these lifestyle disorders continue to experience symptoms despite medication, and may also develop undesirable adverse effects, horticultural therapy may be of value for these people.

CHARACTERIZATION OF TOMATO HYBRIDS DEVELOPED FROM EXOTIC GERMPLASM

***Zeshan Hassan**, Sami Ul-Allah, Muhammad Yasir Khan, Muhammad Hamza Sajid, Azhar Abbas Khan, and Umbreen Shahzad

College of Agriculture, Bahauddin Zakariya University, Multan, Bahadur Sub Campus, Layyah, Pakistan
*Email: zeshan.hassan@bzu.edu.pk

ABSTRACT

Tomato (*Solanum lycopersicum*) is a highly valuable crop and is a member of the *Solanaceae* family (Gebhardt, 2016). However, there is a lack of tomato breeding and hybrid seed production in Southern Punjab. The current study was aimed to develop tomato hybrids and find the combination of parents in hybrids exhibiting heterosis. Tomato commercial varieties were imported from Centre for Genetic Resources, the Netherlands. Six tomato varieties were intercrossed to develop five hybrids. There was a difference in thickness of pericarp, locular cavities and no. of septa between the locular cavity of hybrids and it was almost intermediate between both parents. For instance, Fortuna had two locular cavities and the Moneymaker had three, but hybrid from them contains two big locular cavities and the third was reduced. The money maker had a large number of intercalary leaflets, but the size of the compound and terminal leaflets was relatively small while the dwarf moneymaker had large compound and terminal leaflets but less no of intercalary leaflets. Their F1 hybrids had both the phenomenon. Generally, hybrids had significantly large height, a hybrid from Allround and Muchamiel had maximum height. There was an unusual difference in the leaf area of the hybrid between Fortuna and Moneymaker. Leaves of F1 hybrid were nearly seven times more than that of Moneymaker and twice than Fortuna. One hybrid (Allround * Muchamiel) exhibited heterosis having nearly double yield compared to both of its parents. Specifically, in F1 hybrid from Fortuna and Moneymaker, there was a decrease in yield than other hybrids and respective parents, but it had large plant height. A significant increase in yield was observed in one hybrid that can be used for commercial hybrid production (by introducing male sterility). By understanding the mechanism of enhanced leaf area observed in a hybrid might be useful in leafy vegetable breeding.

STRUCTURAL MODIFICATIONS IN THE ECOTYPES OF BERMUDAGRASS [*CYNODON DACTYLON* (L.) PERS.] FOR ENVIRONMENTAL HETEROGENEITY

Aasma Tufail

Department of Botany, Division of Science and Technology, University of Education Lahore, Pakistan
Email: aasmatufail@gmail.com

ABSTRACT

Evolution plays a critical role in evolving tolerant ecotypes against environmental heterogeneity. Differently adapted ecotypes of Bermudagrass [*Cynodon dactylon* (L.) Pers.] were collected from various regions of the Punjab, Pakistan to evaluate differential structural and functional modifications that are specific to cope with environmental hazards. Each ecotype showed a different type of modifications for their existence in a specific habitat that reflects to their ecological success. Derawar Fort-Saline desert showed anatomical modifications like stem cross-sectional area and leaf sheath thickness that contribute towards water storage, vascular tissues for proficient translocation of solutes and trichomes that provide resistance to water loss, hence water conservation is the priority. Sclerification in root is the only notable modification in the Gatwala-saline semiarid ecotype from saline arid habitat where rainfall is not as low as in the Cholistan Desert. Two ecotypes from hypersaline wetlands, Ucchali Lake-hyper saline, and Khabbeki Lake-hyper saline relied upon the number and size of vascular tissue, central cavity, and scarification in the stem that is important for the conduction of solutes, water loss and bulk movement of salts, respectively. The ecotype from the reclaimed site was not much different from its counterpart from hyper-saline dryland, and this might due to too short time to be required for the evolution of any specific characteristic. The ecotypes from non-saline habitats, Muzaffar garh-Riverbank, and Botanic Garden-non saline showed no visible sclerification in their above or below-ground plant parts and no other prominent modification. Anatomical characteristics represent adaptive components in *C. dactylon* ecotypes that ensure growth, survival and ecological success against environmental hazards, mainly by modifications for water conservation.

CRISPR/CAS9: A RISING GENOME EDITING TOOL FOR HORTICULTURAL CROPS IMPROVEMENT

***Shahbaz Shafiq**[1], Shahid Ali Chand[1], Muhammad Atiq[1], Muhammad Kashif [2], and Zohaib Ahmad[1]

[1]Department of Plant Pathology, University of Agriculture, Faisalabad, Pakistan
[2]Institute of Horticultural Sciences, University of Agriculture, Faisalabad, Pakistan
Email: aptshahbaz@gmail.com

ABSTRACT

Crops including vegetables, fruits, and ornamental plants are known as horticultural crops, constitute a major part of the agriculture sector and play a key role in sustaining human life on earth. As the world's population is growing at a steady pace, posing the consequential need for more food production to face major challenges to guarantee major food security. Although crop breeding utilizing conventional approaches have significantly contributed to the development of reliably important varieties, new approaches (molecular level) are also crucial to further improve horticultural crop production. Clustered regularly interspaced short palindromic repeats (CRISPR) or CRISPR allied protein 9(Cas9) has emerged as a valuable genome-editing tool able to change DNA sequences precisely chosen loci. The CRISPR/Cas9 system made based on the bacterial adaptive immune system which comprises an endonuclease guided by one or more single guide RNAs that generate double-strand breaks (DSBs) and these breaks are repairable by the natural cellular repair mechanisms, during which genetic mutations are incited. The use of CRISPR technology is very limited up to some specific vegetables, fruits and ornamental plants consequently the scientific community should increase its use to other crop plants also considering its large scale applications having the capability to knock out undesirable genes and insertion of desirable genes to improve the genetic makeup and enhance productivity. In this era of climate change, CRISPR would prove a game-changing technology and we

should enhance its applications by removing social and technical barriers as this technology can bring revolution by enhancing crop production and resistance to environmental barriers.

SEEDLING GROWTH OF MARIGOLD AS EFFECTED BY ORGANIC MANURES

Laiba Malik and Atiq Ahmad Alizai

Faculty of Agriculture, Gomal University, Dera Ismail Khan, Pakistan
Email: maliklaiba536@gmail.com

ABSTRACT

Organic manures are usually recommended to avoid the use of chemicals, especially for ornamental plants because of their household utilization. This experiment was therefore conducted at the Department of Horticulture, Faculty of Agriculture, Gomal University, DIKhanduring the winter season 2019-2020 to examine the seedling growth of marigold received different organic manures**.** The trial was carried out using complete Randomized design (CRD) having four treatments; T_1 = Control, T_2 =FYM with 1:1(FYM: Soil), T_3= Compost manure with 1:2 (Compost: Soil) T_4= Coco Peat with 1:2(Coco Peat: Soil). Coco Peat was found to be the best-growing medium having a maximum percent increase in plant height (112.09 %), a maximum number of buds (3.16)and maximum flower diameter (4.35 cm) after one month of planting seedlings. Application of compost was found better as well followed by FYM as compared with the control where no organic manures were applied.

THE RESPONSE OF SILVER NANOPARTICLES ON VASE LIFE OF CUT TULIPS (TULIPA GESNERIANA L.) C.V 'INVADER'

***Ahmed Faiz Akbar**[1], Mohsin Bashir[1], Arslan Ali[1], Ghulam Habib ur Rehman[1], Aima Ahmad[1] , M Awais Fareed[1], Mishaim Anwar[1], and Ambreen Ashar[2]

[1]Institute of Horticultural Sciences, University of Agriculture Faisalabad Punjab, Pakistan
[2]Department of Chemistry, Govt. College Women University Faisalabad Punjab, Pakistan
*Email: faizi9066@gmail.com

ABSTRACT

Tulip (Tulipa gesneriana L.) is amongst the most appreciated cut flower in the global floriculture trade and is considered as a delicacy in the local floriculture industry of Pakistan. Perpetuated display life of cut tulips is always desired by florists and consumers to enjoy the exuberance of stem in the vase. Silver compounds have shown a promising and important role in the quality and preservation of many cut flowers. Nano-silver (NS) particles are proved to be novel antimicrobial compounds that have the potential to inhibit bacterial growth in vase solution. The objective of this study is to determine the efficacy of NS particles (25nm) to improve the display life of cut tulips. The following NS treatments of 5mlL $^{-1}$, 10mlL $^{-1}$, 15mlL - ^{1}, 20mlL $^{-1}$ and 25mlL $^{-1}$ along with control was used in vase solution after harvesting stems at bud burst stage. Data regarding various parameters were recorded at respective growth stages and analyzed by using standard statistical methods. The experiment was conducted according to Complete Randomize Design (CRD) having three replications of each treatment at Post-harvest and Floriculture Lab, Institute of Horticultural Sciences, University of Agriculture Faisalabad. Data collected were statistically analyzed by using Statistix 8.1 software computer package with Tukey's HSD of variance at a 5% level of probability to compare the treatment means. In this experiments 25ml Silver nanoparticles prolonged the vase life (12.83 days), delayed senescence (11.5 days), high amount of water uptake (42.77 ml) and control the microbial activity in vase solution (1.07 CFU). It is concluded that the Silver nanoparticles inhibited the bacterial growth in vase solution and increased the vase life of cut tulips accompanied by delay the senescence.

RESOURCE UTILIZATION EFFICIENCY IN NOMINATED CROPS GROWN UNDER POLY TUNNEL CONDITION

***Shoaib Ur Rehman**[1], C M Ayub, K Y Abbasi, Omar Aziz, Raheel Anwar[2], and Toheed Iqbal and Safdar Bashir

[1]Department of Horticulture, UAF Sub-Campus Depalpur, Okara, Pakistan
[2]Institute of Horticultural Sciences, University of Agriculture Faslabad, Pakistan
*Email: shoaibhort@googlemail.com

ABSTRACT

The yield potential of indeterminate crops is much higher under tunnel conditions as compared to conventional vegetable farming. This high yield requires a lot of resources to manage the crops in the tunnel, which hamper the economic condition of farmers. The unintegrated solar drip irrigation system connected with tunnels may cause huge losses in management and operation, and ultimately reduce the yield potential of crops grown in the tunnel. The use of water and energy resources based on demand for crop production has repeatedly increased the yield potential and a high market return. Moreover, the proper selection of cultivars, schedules, and market-oriented demand may help in combating environmental and market challenges. Two types of tunnels, walk-in tunnels, and high tunnels are mainly used to produce indeterminate vegetables. Studies have been conducted throughout the Punjab province to assess the resource utilization efficiency and economic feasibility of selected vegetables grown vertically in tunnels. Quonset and arch high tunnels were common in tomato and parthenocarpic cucumber production, covered by insect nets and spun bond fabrics, while walk-in tunnels were mostly used for cucumber and gourds. These tunnels are equipped with drip irrigation systems (30 to 35%), while solar-drip system components were installed on a smaller scale (10 to 15 %). In terms of composition, the input cost was the highest for operational practices (35-39%) and covering material (24-28%), while the lowest cost was the estimated total production cost using seeds and fertilizers (8-12%). Compared with open field cultivation, tunnel farming contributing 4 to 5 times by integrating all these resources with optimal input and application time.

OLIVE OIL (*OLEA EUROPAEA*) RESIDUES AS NATURAL PRESERVATIVES WITH INCORPORATION INTO CHITOSAN FILM ON APPLE (*MALUS DOMESTICA* VAR.ANNA)

***Qamar Sajjad,** Qamar Abbas Syed, and Hafiza Anam Asghar

National Institute of Food Science and Technology, Faculty of Food, Nutrition and Home Science, University of Agriculture Faisalabad, Pakistan
*Email: qamarsajjaduaf@gmail.com

ABSTRACT

In food processing, the incorporation of the antioxidants and antimicrobial in edible films is a novel technique. Apple has the therapeutic nature and shelf life of apple affected to a great extent due to the decomposition of these components. Chitosan film proved efficient in the maintenance of these compounds. This study reviewed the applicability of olive oil residues to improve the life stability of apple by chitosan film coating. It was investigated that the addition of Olive oil residues and Chitosan led to increasing the antifungal and antimicrobial activities particularly high against *Penicillium expansum* than *Rhizopus stolonifer* in-vitro and in-vivo. The drastic changes rapidly occurred in uncoated apples than coated. The decayed area and weight loss increased significantly in uncoated apples. The reduction in the gradual decline of flavonoids, phenolic and antioxidants occurred by the addition of leaf extract of olives in Chitosan coating films. Both olive pomace and leaf extract enhanced the coating distribution because apple's surface has no pores. The amount of 20g kg^{-1} Olive oil residues slightly affected the film appearance but significantly solubility and thickness of coating film. So, the only 2% Olive leaf extract incorporation into chitosan is the best formula than other ones. So, this review summarized that Olive oil residues should be used as natural preservatives than synthetic preservatives by incorporation with chitosan film to improve the shelf life and nutritional quality of apple during post-harvesting.

NUTRITIONAL AND MEDICINAL PROFILE OF ENDIVE

***Ahsan Ahmad Awan[1],** Muhammad Muzammil Jahangir[1], Muhammad Ahsan Khatana, Waseem Iqbal[1], and Ghufrana Samin[2]

[1]Institute of Horticultural Sciences, University of Agriculture, Faisalabad, Pakistan.
[2]University of Engineering and Technology (Lahore) Faisalabad Campus, Faisalabad, Pakistan
*Email: ahsanawanahmad@gmail.com

ABSTRACT

Cichorium endivia L. belongs to the family Compositae and originated from the Mediterranean. It is a lesser-known leafy vegetable here but considered a delicacy in Europe. The nutritive value of the endive is far better as compared to lettuce. Mostly, it is eaten as a fresh salad. It is a rich source of water (about 93%), antioxidants and several other minerals. It contains more fibers than calories. This property helps to recovers appetite and thus used to cure anorexia. Due to the absence of fat, it helps to reduce blood cholesterol level. There are numerous bitter-tasting compounds present that are anti-inflammatory and anti-tumor agents hence it prevents cancer. Medically an important chemical is extracted called inulin- helps in renal function and maintains blood glucose. Other minerals found are: Vitamin A, improves eyesight; Vitamin K, increases calcium uptake in bones; K^+ electrolyte, counters hypertension; probiotics, boost immunity. Endive is also composed of a good amount of B-complex groups: folic acid, pantothenic acid, pyridoxine, thiamin, and niacin. These compounds concentrate neural activity and increase blood flow to the brain. Folates are crucial for fetus development in mothers.

EFFICACY OF SOME AQUEOUS PLANT EXTRACTS AGAINST PLANT-FEEDING THRIPS (THYSANOPTERA) AND MITES (ACARI) IN VEGETABLES

***Bilal Saeed Khan**[4], Abdul Ghaffar[1], Imran Ali[1], M. Farooq[1], Muhammad Irfan[2], Karim Yar Abbasi[2], C.M. Ayub[2], and Munawar Almas[3]

[1]Ayub Agricultural Research Institute (AARI), Faisalabad
[2] Institute of Horticulture Sciences, University of Agriculture, Faisalabad
[3]Directorate of Floriculture, Punjab, Lahore
[4]Department of Entomology, University of Agriculture, Fasisalabd
*Email: bilalentomologyuaf@gmail.com

ABSTRACT

Mites (Acari) and thrips (Thripidae) are considered as the most destructive pests of fruits, vegetables, and ornamental plantation. Many botanicals extracts are currently used against different sucking insect pests in vegetables. In the research trial, the effectiveness of aqueous solutions of Garlic (Allium sativum), Mint (Mentha) and Onion (*Allium cepa*) was evaluated against spider mites (*Tetranychus urticae*) and onion thrips (*Thrip tabaci*) in lab conditions. Three replications (CRD) including four treatments (including control) each were used against sucking pests with different concentrations of aqueous solution (T 1 = 5%, T 2 = 2.5%, T 3 = 1.25% and T 4) as control. The prepared aqueous solutions were applied on collected vegetable leaves, which were used for thrip and mite cells. The data was collected after 24, 48, 72 and 96 hours against the pest population already released in treated cells/ arenas. The tendency of mortality by solutions was observed and it was for garlic (86.00) ≥ onion (77.00) ≥ and mint (72.00) respectively. Maximum mortality for each of the aqueous solutions was obtained by using (5% aqueous extract) in T 1 and least was obtained by using T 3 (1.25% aqueous extracts). Further, the mortality percentages were more in the case of *T. tabaci* as compared to *T. urticae*.

INFLUENCE OF 24 EPIBRASSINOLIDE ON GROWTH, YIELD AND PHYSIOLOGICAL TRAITS OF *JASMINUM SAMBAC* L.

Ahsan Akram[1*], Adnan Younis[1], Muhammad Asif [1], William Bill Miller[2], and Muhammad Fayyaz[3]

[1]Institute of Horticultural Sciences, University of Agriculture Faisalabad, Faisalabad, Pakistan.
[2]Department of Horticulture, College of Agriculture and Life Sciences, Cornell University, NY, USA.
[3]Department of Horticulture, Institute of Agriculture Sciences, University of the Punjab, Lahore, Pakistan.
[*]Email: ahsanakram66@gmail.com; ahsan.akram@uaf.edu.pk

ABSTRACT

The present study was carried out to elucidate the effect of EBL levels on growth and yield of *Jasminum sambac*. The experiment was executed in KPL greenhouses, Department of Horticulture, Cornell University, New York, USA. Jasmine plants were planted in pots and put them in a controlled condition greenhouse. Foliar applications of 24-Epibrassinolide using four different levels (1, 2, 3 and 4 µM) were applied after 30th 60th and 90th days after plantation. Data were recorded after 120th days. The results indicated that EBL concentration 2 µM proved to be the best treatment for morpho-physiological and bio-chemical traits like, plant height (9.25), number of leaves per branch (21.80), bud diameter (6.52), chlorophyll contents (0.050 mg g^{-1}), Chl.a, (0.035 mg g^{-1}), chl.b (0.011 mg g^{-1}), total chlorophyll contents (0.046 mg g^{-1}), fresh and dry ratio (2.51), CO_2 diff. (19.83), photosynthetic rates (9.87µmol m^{-2} S^{-1}), stomatal conductance (57.57mmol m^{-2} S^{-2}) and sub-stomatal cavity (583.59 µmolmol^{-1}) compared with rest of the treatments. However, plants treated with 3 µM showed better results for growth indices like leaf area (10.96 cm^2), number of flower per plant (7.02), flower diameter (18.08 mm), fresh weight of flower (0.172 g) and dry weight of flower (0.073 g) as compared to rest of the treatments. In the case of several branches per plant (4.26), flower diameter (18.08 mm) control treatment gave the maximum values compared to other treatments. The present study revealed that 2 µM exhibited good results on morpho-physiological attributes in *Jasminum sambac*. Current investigations showed that the EBL application enhanced the plant growth, chlorophyll contents and photosynthesis rate of the *Jasminum sambac*.

ZINC OXIDE NANOPARTICLES FROM MORINGAOLIFERA: A MICRONUTRIENT IN NANO BIONICS

***Abdullah Ikram**[1], Imran Hussain[1], Arifa Khan[1], Rabia[1], Shazia Erum[2], and Tariq[2]

[1]International Islamic University, Islamabad, Pakistan
[2]BioResources Conservation Institute, National Agriculture Research Center, Islamabad, Pakistan
*Email: abdullahikrambutt123@gmail.com

ABSTRACT

Potato (Solanum tuberosum L.) is a widely planted crop. The primary obstacles for potato production are the high demands of fertilizers. To overcome these problems the bioabsorption of nanoparticles can be an efficient tool for increasing agricultural production and to scrap with future challenges. Traditional intensively managed agroecosystems depend on fertilizers and biocides, which could induce soil degradation and environmental problems. The present study aimed to evaluate the effect of ZnO nanoparticles on the micro propagation of potato. ZnO NPs of size (13.1 nm and 16.5 nm) which have been confirmed by SEM and XRD were prepared via green biosynthesis from the Moringa plant and it was amended in MS media at varying concentrations ranging from 0.01 ppm to 100 ppm. Moringaolifera is a highly nutritive plant and has many medicinal applications in the treatment of many plant diseases thus increasing the crop yield. Data was recorded on phenotypic parameters @ 15 days interval of time. Optimum results were obtained at concentrations ranging from 1 to 1.5 ppm of ZnO NPs. This research is the way forward towards sustainable, true type, disease-free, eco-friendly potato production.

EFFICACY OF TOXIC CHROMATE REMOVAL BY HIGHLY CR (VI) RESISTANT BACTERIA FROM TANNERY EFFLUENT

*__Rida Batool__ and Asma Kalsoom

Department of Microbiology and Molecular Genetics, University of the Punjab, Quaid-e-Azam Campus, Lahore 54590, Pakistan
*Email: rida.mmg@pu.edu.pk

ABSTRACT

Chromium (Cr) is a heavy metal, naturally found in the biosphere. The two oxidation states i.e. Cr (III) and Cr (VI) are of biological concern. Cr (III) occurs in the environment in less toxic and insoluble form whereas Cr (VI) is soluble and more toxic to living cells. Leather tanneries are the main source of Cr (VI) contamination in the ecosystem. The improper disposal of tannery waste is of biological concern because of chromium toxicity. This study aims to screen highly chromate resistant bacterial strains from the tannery polluted site of Lahore, Pakistan. Ten distinct chromate resistant bacteria were isolated at an initial concentration of 1500 mg/L K_2CrO_4. Morphological and biochemical analysis showed that most of the strains were Gram-positive cocci except R2 and were oxidase-positive except A2, A10, A12. For the catalase test, all Cr (VI) resistant strains were catalase-positive except strain A6. Most of the strains exhibited multiple heavy metals ($NiCl_2$,$CuCl_2$,$ZnCl_2$,$PbCl_2$,$CoCl_2$,$HgCl_2$) and antibiotics resistance (chloramphenicol, tetracycline, ampicillin). Strains A8 could tolerate up to 50 mg/ml chromate stress on LB agar. Strain A8 and A20 exhibited the highest Cr (VI) reduction potential of 77% and 74%, respectively, after 24h incubation (1500 mg/L K 2 CrO_4). Strain A8 also revealed significant exopolysaccharide (EPS) production in the presence of chromate (1500 mg/L). These high chromate tolerant strains can be suitable candidates for the remediation of chromate contaminated sites.

RESPONSE OF INDOLE-3-ACETIC ACID ON ROOTING OF STEM CUTTINGS OF CLIMBING ROSE (*ROSA HYBRIDA* L.)

***Muhammad Anwar ul Haq** and Hasan Zaman Shah

Department of Horticulture, Faculty of Agricultural Sciences and Technology, Bahauddin Zakariya University, 60800, Multan, Pakisan
*Email: anwarulhaq913@gmail.com

ABSTRACT

Climbing rose (*Rosa hybrida* L.) is the most ancient ornamental species. Rose growers in Pakistan have repeatedly observed poor rooting of cuttings. The optimum concentration of appropriate indole-3-acetic acid is used to promote effective rooting. Randomized complete block design (RCBD) is adopted and it consisted of four treatments including control, of different concentrations of Indole-3-acetic acid (50 ppm, 100 ppm, 150 ppm) on stem cuttings of climbing rose. Silt, leaf mold and soil with ratio (1:1:1) were taken and mixed them well manually. After this, 12 pots were filled equally. In this experiment, 12 pots of 9-inch size were used, 5 cuttings in each pot and a total of 60 cuttings were planted. The length of the cuttings was 6 inches and 1/3 the length of cuttings was buried in pots. Cuttings of every treatment were dipped for 10 minutes in their solution before planting. Uprooting was done after 60 days of planting the cuttings. IAA with 150 ppm considered best treatments to produced maximum number of roots (11.167), root length (8.833 cm), fresh root weight (0.873 g), dry root weight (0.383 g), number of sprouted buds (3.0), number of leaves (11.167), fresh leaves weight (0.908 g) and dry leaves weight (0.385 g) as compared to other treatments.

RESPONSE OF *RHIZOCTONIA SOLANI* STRAINS AGAINST POTATO VARIETIES AND INTEGRATED MANAGEMENT OF BLACK SCURF DISEASE

Azhar Hussain[1], ***Ishtiaq Hussain**[2], Sartaj Ali[1], Furrukh Faiz[1]Amjad Ali[1], MaqsoodHussain[1], and Shahnawaz Qasim[1]

[1]Department of Agriculture and Food Technology Karakoram International University Gilgit, Gilgit-Baltistan, Pakistan
[2]Department of Agriculture Research, Gilgit-Baltistan, Pakistan
*Email: drishtiaq.mondoq@gmail.com

ABSTRACT

Black scurf is an important disease of potato all over the World. It reduces tuber quality in terms of nutrition as well as the yield. In the current study two types of field experiments viz. The aggressiveness of *Rhizoctonia solani* strains against potato varieties and integrated management of black scurf were undertaken. In the 1st experiment, black scurf incidence and disease severity were used as the criteria to evaluate the aggressivity of *Rhizoctonia solani* strains. Results showed that differential aggressivity was apparent in the strains of *R. solani* against the tested varieties, but none of them proved to be apathogenic neither destroyed all test plants. The potato varieties also responded differently to *R. solani* infection. The highest susceptibility was observed in 'Desiree', while the lowest in Muroto. In the 2nd experiment two types of field trial viz. growing healthy potato tubers in the artificially infected field and naturally infected ones for integrated management of black scurf. Healthy and naturally infected tubers were treated with either T_1 or T_2*Trichoderma* based preparations by dipping the tubers before planting. The results revealed that T_1 was more effective for the management of black scurf in both trials as compared to T_2. The information generated through this study could help the potato growers regarding disease management and selection of resistant varieties for improving profitability and food security in the region.

IMPACT OF $CACL_2$ ENRICHED MEDIA ON MORPHOLOGICAL TRAITS OF BUTTON MUSHROOM

***Muhammad Ahsan Khatana**[1], Muhammad Muzammil Jahangir[1], C.M. Ayyub[1],Waseem Iqbal[1], Ghufrana Samin[2], Faheem Zafar[1], Rashid Iqbal Khan[1], and Ahsan Ahmad Awan[1]

[1]Institute of Horticultural Sciences, University of Agriculture, Faisalabad, Pakistan
[2]University of Engineering and Technology (Lahore) Faisalabad Campus, Faisalabad, Pakistan
*Email: ahsansiddique2319@gmail.com

ABSTRACT

Button mushroom is a popular mushroom all over the world. Therefore, an experiment was designed to evaluate the impact of calcium chloride on the morphology of button mushroom. Two strains of button mushroom viz. SA 15 (Belgium) and SA 67 (USA) were cultivated. Different concentrations of calcium chloride were applied on substrate i.e. T0 (without $CaCl_2$), T1 (0.25 % $CaCl_2$) T2 (1.25 % $CaCl_2$) and T3 (2.25 % $CaCl_2$). Data regarding numerous morphological parameters were recorded. The experiment was designed according to 2- factors factorial arrangement under CRD with four replicates. Results regarding SA-15 strain revealed that T1 gave the highest (98.25g) 1 st flush weight while T3 gave the highest (60.64 g and 53.79 g) 2 nd and 3 rd flush weight respectively. Whereas, T2 gave the lowest weight (44.08 g, 50.28 g and 36.96 g) of 1st, 2nd, and 3 rd flush respectively. Some pinheads were observed maximum (70) at T2 while minimum (32.66) were at T0. For flushes completion minimum days (90.65) were observed at T2 whereas maximum (104.31) at T3. Maximum (56.5 mm) and minimum (50.11mm) pileus diameter was observed at T0 and T3 correspondingly whereas maximum (3.70cm) and minimum (3.06cm) stipe length was observed at T2 and T1 correspondingly. Results regarding SA-67 strain showed that T3 gave highest (84.71g and 50.62g) weight for 1 st and 2 nd flush while T1 gave (54.79g) for 3 rd flush whereas lowest weight (28.98g,32.54g,34.17g) of 1st, 2nd, and 3 rd flush was observed at T2, T1, and T0 respectively. Pinheads number was observed maximum (79.66) at T3 and a minimum (40.33) was at T1. Minimum (91.98) days for flushes completion was observed at T1 while maximum (104.99) at T2. The maximum (51.88mm) pileus

diameter was observed at T1 and minimum (48.65mm) at T0. Minimum (2.70cm) stipe length was observed at T1 and maximum (3.66cm) at T0.

POTENTIAL BIOLOGICAL CONTROL AGENT, AFRICAN MOTH (*LSTURGIA DISPUTARIA* GUENEES) AGAINST WILD TREES AND SHRUBS IN PUNJAB, PAKISTAN

Dilawar Majeed[1], Muhamamd Zahid Sharif[1], Ahsan ul Haq[3], and *****Smina J. N. Ahmad[1,2]

[1]Integrated Genomics and Molecular Biotechnology Lab, Department of Entomology, University of Agriculture Faisalabad, Pakistan
[2]Plant Stress Physiology and Molecular Biology Lab, Department of Botany, University of Agriculture Faisalabad, Pakistan
[3]Department of Forestry and Range Management, University of Agriculture Faisalabad, Pakistan
Email: jam.ahmad@uaf.edu.pk

ABSTRACT

Trees of *Acacia nilotica* are extremely valuable sources of fuel, small timber, fodder, tannin, gum, and furniture, pharmaceutical, and medicinal value. But on the other hand, in Australia, these are recognized as invasive weeds where different strategies including leaf-feeding insects as biological control agents are being used against such wild plant species. Surveys for leaf-feeding insects on *Acacia nilotica* during 2016-2017 revealed the presence of a potential biological control agent, *Lsturgia disputaria* in Bahawalpur and Khanewal districts of Punjab, Pakistan. For proper molecular identification, DNA was extracted from collected samples and polymerase chain reaction (PCR) was performed to amplify a 710bp fragment of the mitochondrial COI gene. The amplified PCR products were sequenced and phylogenetic examination and genetic evolutionary divergence (GD) showed that studied species of *L. disputaria* exhibited 99-100% homology (NCBI Acc. No MK301226) with submitted sequences of *L. disputaria (*KX861182.1, KF147289.1) on NCBI GenBank database. Feeding and development potential of this pest in no-choice tests on the foliage of *A. nilotica spp.* indicated a good larval feeding and development capability for prickly acacia, *A. nilotica indica* and *A. tomentosa*. This is the first report of occurrence, molecular identification (DNA barcoding) and biological features of potential biological control agent *L. disputaria* in Pakistan.

MOLECULAR AND PROTEOMIC STUDY FOR THE IDENTIFICATION OF INSECTICIDE RESISTANCE GENE AND MANAGEMENT OF RED PALM WEEVIL (R. FERRUGINOUS) IN PAKISTAN

***Jam Nazeer Ahmad**[1,2], Mujahid Manzoor[1,2], and Samina Tanwir Malik[1,2]

[1]Integrated Genomics, Cellular, Developmental and Molecular Biotechnology Laboratory, PARS campus, Department of Entomology, University of Agriculture Faisalabad, Pakistan
[2] Plant Stress Physiology and Molecular Biology Laboratory, PARS campus, Department of Botany, University of Agriculture Faisalabad, Pakistan
*Email: Jam.ahmad@uaf.edu.pk

ABSTRACT

Red Palm Weevil (RPW) (*Rhynchophorus ferruginous*) is an important date palm pest worldwide. It has also caused huge loss of date palm plantation in date palm growing countries. In Pakistan, it is an emerging pest of date palms causing huge damage and loss. RPW was collected from date palm growing regions of Pakistan and reared on artificial diets in the laboratory for several generations to produce susceptible as well as resistant populations. The molecular and proteomic study was carried ou through RT-PCR and Western blotting. Insect bioassay was performed on a laboratory-reared and field-collected population of RPW under laboratory. The result showed that there was a highly significant difference of LC50 values among laboratory-reared and field-collected populations. The population from Sindh and Punjab province was more resistant as compared to the Baluchistan and KPK provinces of Pakistan. The molecular study revealed that P450 genes were associated with resistant populations. The dsRNA specific for CYP450 gene was designed and micro-injected in the thoracic region of *Rhynchophorus ferrugeninous.* Semi-quantitative PCR and real-time PCR expression of CYP-450 gene confirmed the up-regulation

in resistant population and subsequently, it's knockdown in the dsRNA treated population. Gene expression and the enzymatic study confirmed the downregulation of P450 gene and associated proteins in RPW applied with dsRNA. The application of double-stranded RNA specific for CYP450 also reduced insecticide resistance and oxidative activity in (*Rhynchophorus ferruginous*). The developmental parameters were highly affected in RPW treated with dsRNA as compared to those samples treated with water. These results support the RNAi application as a suitable tool for the management of insecticide resistance and improved efficacy of insecticides.

ISOLATION, IDENTIFICATION, AND IMPLEMENTATION OF NUCLEOPOLYHYDROVIRUSES TO CONTROL MAJOR VEGETABLE PEST *SPODOPTERA LITURA* AND INSECTICIDE RESISTANCE IN PAKISTAN

***Jam Nazeer Ahmad**[1, 2], Rashid Mushtaq[1], Muhammad Jafir[1], Samina Jam Nazeer Ahmad[1, 2], and Mubasher Ahmad Malik[1]

[1]Integrated Genomics Cellular Developmental and Biotechnology Lab, Department of Entomology, University of Agriculture Faisalabad, 38000, Pakistan

[2]Plant Stress Physiology and Molecular Biology Lab, PARS, Department of Botany, University of Agriculture Faisalabad, 38000, Pakistan

*Email: jam.ahmad@uaf.edu.pk

ABSTRACT

Spodoptera litura (Lepidoptera, Noctuidae) is a polyphagous insect pest of many economically important crops including vegetables. Nucleopolyhedroviruses are biological control agents safe for humans and the environment. In the present research, native Nucleopolyhedroses virus (SlitNPV) was isolated from vegetable fields and observed under the microscope through Geimsa Stain. These further identified by polymerase chain reaction (PCR) using NPV specific primers. In the present investigation, laboratory and field trials were conducted to investigate the efficacy of Nucleopolyhedrovirus, their synergistic, additive or antagonistic effect using sub-lethal dose rates of native isolated Nucleopolyhydrovirus (NPV) in combination with Spinosad against 3rd and 4th instar larvae collected from three different geographical areas of Punjab (Pakistan). Sequencing and phylogenetic analysis showed that studied nucleopolyhedroviruses were 98-100% similar to those isolates reported from foreign countries. The bioassay performed on insects indicated the difference in larval mortality, pupation, adult emergence, and egg exclusion. The higher but sub-lethal dose rate of NPV with Spinosad exhibited synergistic interaction, while the rest of the combinations were additive in all the tested populations, showing the population of *S. litura* from Rahim Yar Khan Region least susceptible, and that of Faisalabad highly susceptible. It may be inferred that the mixtures of the correct sub-lethal doses of Spinoad + NPV can be a proven potential pest and insecticides resistance management (IRPM) strategy against *S. litura* in vegetable and major crop growing areas of Pakistan.

ETIOLOGY OF LEAF BLIGHT OF CAT PALM (*CHAMAEDOREA CATARACTARUM*) IN PAKISTAN

***Imran Ul Haq**[1], Sidra Ijaz[2], M. Usman[1], and Iqra[1]

[1]Fungal Molecular Biology Laboratory, Department of Plant Pathology University of Agriculture Faisalabad.

[2]Centre of Agricultural Biochemistry and Biotechnology, University of Agriculture Faisalabad.

*Email: imran_1614@yahoo.com

ABSTRACT

The ornamental plant is widely cultivated throughout the world for aesthetic values and it has emerging demand in green as well as in the floriculture industry. Additionally, they are also providing benefits due to economical and medicinal significance. Palm family having 184 genera and 25000 species is a diverse and distinctive group of ornamental plants that are extensively grown in tropical Asia, Australia, Madagascar, Central, and South America. Cat Palm (*Chamaedorea cataractarum*) is one of the popular ornamental palms that is affected by many biotic and abiotic factors. There are many fungi, bacteria, nematodes and viruses that have been known to cause different diseases in ornamental plants like crown gall, slime flux, aspen leaf spot, powdery mildew, root rot, anthracnose, leaf spot, and blight. Among different diseases, leaf blight caused by Cylindrocladium is an important fungal disease-causing significant loss to its production in Pakistan. In the present investigation, the surveys of different

ornamental nurseries were conducted in district Faisalabad and Pattoki for assessment of disease incidence and sample collection of leaf blight infected plants. Maximum disease incidence observed in district Faisalabad was 41.30 percent and in the district, Pattoki was 35 percent. Leaf blight pathogen (Cylindrocladium) was isolated and purified. The identification of Cylindrocladium was done on a morphological basis. It produced white mycelium and cylindrical conidia and conidiophores having stipe with a vesicle on PDA (potato dextrose agar) medium. Pathogenicity was confirmed by following Koch's postulates. So, leaf blight of cat palm is one of the emerging threats to palm industry in Pakistan that emphasizes the great need for the development of a comprehensive management plan to reduce the disease losses up to the minimum level. We acknowledge HEC project # 2762 (for providing funds), Fungal Molecular Biology Lab and FMB Culture Collection, Department of Plant Pathology, University of Agriculture Faisalabad, for facilitation and completion of this research.

DISEASE ASSESSMENT OF *HYOPHORBE LAGENICAULIS* (BOTTLE PALM) WILT CAUSED BY *FUSARIUM SP*. IN PAKISTAN

Samreen Hashim[1], ***Imran Ul Haq**[2], Siddra Ijaz[3], and Anjum Faraz[2]

[1]Department of Botany, University of Agriculture Faisalabad
[2]Fungal Molecular Biology Laboratory, Department of Plant Pathology University of Agriculture Faisalabad
[3]Centre of Agricultural Biochemistry and Biotechnology, University of Agriculture Faisalabad
*Email: imran_1614@yahoo.com

ABSTRACT

Hyophorbe lagenicaulis (Bottle Palm), ornamental palm tree cultivated in tropical and subtropical areas. It increases the aesthetic value of gardens home lawns and landscape areas. Its growth affected by fungal disease Fusarium wilt in Pakistan. Survey of gardens, Parks and ornamental plant growing nurseries of Faisalabad, Kasur, Lahore, and Islamabad districts Punjab province was conducted. During survey chlorotic symptoms on one side of rachis while in severe infection Partial or complete death of frond was observed. The brown color of vascular bundles appeared in the partially wilted frond. A maximum disease incidence of 65% with 87% severity was observed in district Kasur. Diseased leaves were collected from surveyed areas and processed for isolation of fungal pathogens. Symptomatic leaves were cut into 4-5 mm pieces disinfected, placed onto Potato dextrose agar (PDA) medium under aseptic conditions and incubated at 25-28ºC. After 48 hours incubation purification of fungal culture was done by a single spore technique. White to violet color sparse abundant mycelia appeared on the PDA medium. Macrocondia were orange color with straight to slightly curved with three septations and Microconidia were oval shape without septations. Based on morphological characteristics frequently isolated pathogen was identified as Fusarium. The pathogenicity test was confirmed using Koch's Postulates. Spore suspension of 1×10 6 was mixed with pot soil of healthy juveniles of bottle palm while distilled water was applied to control plants. After two months of inoculation Symptoms on inoculated similar disease symptoms were appeared as observed in the field, while control plants remained healthy. The fungal culture was deposited with Accession No FMB0022 at Fungal Molecular Biology Lab-Culture Collection (FMB-CC-UAF) Department of Plant Pathology University of Agriculture Faisalabad (http://gcm.wfcc.info/). To our best knowledge, this is the first report of Fusarium wilt of *Hyophorbe lagenicaulis* in Pakistan.

BIO-FORTIFICATION OF FRUIT CROPS: A NOVEL TOOL TO ABATE MALNUTRITION

***Umais Asghar Kha**n[1], Rashad Qadri[1], Muhammad Tahir Akram[1], Khalid Hussain[1], Arslan Ahmad[1], and Ghulam Ghous[2]

[1]Institute of Horticultural Sciences, University of Agriculture Faisalabad Pakistan
[2]Faculty of Horticulture and Landscape Engineering, Slovak University of Agriculture, Nitra- Slovakia
*Email: umaisasgharkhan@gmail.com

ABSTRACT

Humans need a lot of nutrients that are found in the edible parts of fruit, nuts and berry crops to meet their metabolic needs and stay healthy. Even inadequate intake of nutrients can lead to malnutrition that is responsible for the largest

number of deaths, increased disability, morbidity, and mental retardation. Many varieties of fruit are rich in vitamin A (jackfruit, papaya, mango, persimmon), vitamin B (nuts, beal), vitamin C (citrus, guava, canola, etc.) and mineral nutrients (dates, banana, litchi, banana, Karanda, etc.) are available in their edible parts and new genotypes with high mineral density are in the development process. Bio-fortification is the process of developing micronutrient dense fruit crops by agronomic practices, conventional breeding, genetic selections, and modern biotechnology as well as the other complementary interventions containing supplementation, fortification, and diet diversification approach. In grapefruits, foliar application of K ensured the concentrations of vitamin C and β-carotene. The concentration of carotenoids increased with N application, while the concentration of vitamin C decreased. Foliar application of S and K enhanced vitamin C, folic acid, β-carotene and antioxidant. In bananas, K has a positive correlation with fruit quality parameters like ascorbic acid & sugar contents and a negative correlation with fruit acidity. A potentiating agent like organic acids (malic acid, fumaric acid, ascorbic acid, and citric acid) has been found in fruit crops to promote the bioavailability of Fe and Zn. Conventional breeding also provides opportunities to breed for nutrient-rich fruit crops. Genetically modified bananas containing genes that increase Fe and vitamin A contents have been developed through genetic engineering. Soybean genes encoding ferritin have been injected in banana cells to make a protein that enhances Fe storage in the banana pulp.

EVALUATION OF ESSENTIAL MINERAL ELEMENTS FROM VARIOUS GRAPE (*VITIS VINIFERA* L.) GENOTYPES COLLECTED FROM POTOHAR REGION OF THE PUNJAB, PAKISTAN

***Kashaf Ramzan**, Rashad Waseem Khan Qadri, Muhammad Tahir Akram, Khalid Hussain, and Umais Asghar Khan

[1]Institute of Horticultural Sciences, University of Agriculture Faisalabad, Pakistan.
*Email: kashaf.ramzan12@gmail.com

ABSTRACT

Grapes (*Vitis vinifera* L.) are considered highly nutritious fruit due to the presence of minerals, carbohydrates, vitamins, and several biochemical compounds. The present study was conducted to evaluate the concentration of macro and microelements from some cultivated grape genotype (Flame Tokay, Italia, Gola, Taifi, Gol, White Seedless, Kishmish, Sundar Khani, Red Globe, Flame Seedless, Sahebi, Chassless-B, BRI-001, and Superior) successfully grown in the Potohar (salt range) region of Pakistan. Atomic absorption spectroscopy (AAS) technique was used to evaluate the concentration of macro and microelements from grapes juice. Among macro-nutrient elements, potassium (K) was highest in genotype Taifi (3400 µg/100 ml) while nitrogen content was rich in genotype Vitro Black (180 µg/100 ml). Iron is a trace element and plays a key role in hemoglobin formation was found highest in the Red Globe genotype (323.92 µg/100 ml). Other microelements were present in the descending order Mn > Cu > Zn > Co in all genotypes. Grapes found in the Potohar region were enriched with all essential elements which are required for proper health.

IMPACT OF ORANGE AND BANANA PEELS EXTRACT ON THE GROWTH AND PHYSIOLOGY OF TOMATO (*SOLANUM LYCOPERSICUM*) SEEDLINGS INFECTED BY *FUSARIUM OXYSPORUM* L.

***Sundus Akhtar**, Syeda Zainab Aslam, and Javed Ahmed

Department of Botany, Minhaj University, Lahore
*Email: drsundusiags@gmail.com

ABSTRACT

Fungal pathogen *Fusarium oxysporum* L. is a common soil pathogen that affects a wide variety of hosts of any age. In the present study impact of orange and banana peels extract on the growth, physiological and biochemical alterations of tomato plant grown under the stress of *F. oxysporum* was studied in a greenhouse. The pot experiment was carried out with nine different treatments: negative control, positive control, orange peels extract (2, 4 and 6%) + fungal pathogen and banana peels extract (2, 4 and 6%) + fungal pathogen. Various growth (root, shoot length and biomass), physiological (total chlorophyll content and reducing sugar) and biochemical (total protein content,

peroxidase, and polyphenol oxidase activities) were studied after 45 days of seed germination. The results revealed that the growth of the tomato plant in positive control was significantly ($P \leq 0.05$) reduced up to 80% over negative control. Whereas, soil amendment with 2 to 6% of orange peel extracts significantly enhances the plant growth over positive control. Moreover, the physiological content and biochemical traits were significantly increased and decreased in tomato plants, respectively with the application of orange peels extract as compared to the positive control. However, none of the positive action in the tomato plant was observed with the application of banana peels extract. Thus, orange peels extract could be effective in controlling the Fusarium wilt of tomato. Nevertheless, further field experiment is required to study the mode of action of plant extract in managing the fungal pathogen.

INDIGENOUS PLANTS OF PAKISTAN: ALTERNATIVE OF SYNTHETIC CHEMICALS TO CONTROL POSTHARVEST DECAY OF FRUITS AND VEGETABLES.

Zarsha Afzal, Karim Yar Abbasi, *Muhammad Bilal Shaukat, Hassan Munir, Yasir Majeed, and Mubashir Mushtaq.

University of Agriculture, Faisalabad
*Email:idhubilal786@gmail.com

ABSTRACT

Fruits and vegetables are necessary for human beings to maintain their health by consumption as important vitamins and minerals. Postharvest losses of fruits and vegetables are ranging from 25 to 40 % and even more. A major part of these losses is caused by bacteria and fungi during postharvest. It is necessary to save food by controlling the postharvest decay of fruits and vegetables. Several fungal and bacterial diseases that damage major fruits and vegetables during postharvest are white rot, blue mold, gray mold, crown rot, green mold, anthracnose, gray mold, soft rot, fusarium rot, Alternaria rot, and stem-end rot, etc. Traditionally, several synthetic chemicals and fungicides are used to control these diseases (caused by fungi and bacteria) increased the level of toxic residue in the products and are unsafe for human health and the environment. Alternate of these chemicals and fungicides are plant-based compounds that are non-toxic, eco-friendly and biodegradable. Continuous uses of synthetic fungicides produce resistance in fungi while plant-based chemicals produce resistance slowly. Plants produce secondary metabolites in response to environmental stress and attack of pathogenic microorganisms, as defensive mechanisms. Several secondary metabolites present in plants have antifungal and antibacterial properties. These secondary metabolites extracted from plants in the form of essential oil which can be used to control diseases. For example, carvacrol which is an essential oil, commonly known as thyme oil used to control Anthracnose, diseases of oranges and cherries, eucalyptus oil used to control Alternaria leaf spots and citral known as oil of lemon also plays an important role to prevent citrus from the green mold. Indigenous plants of Pakistan (i.e. coriander, cumin, lemongrass, fennel, oval kumquat, mint, bitter gourd, kalonji, sweet basil, rosemary, sage, Jamun, ajwain, thyme, turmeric, eucalyptus, chamomile, and neem, etc.) have antifungal and antibacterial properties. Essential oils of these indigenous plants have the potential to reduce postharvest losses and can be used as the best alternative to synthetic chemicals and fungicides for the control of postharvest diseases in fruits and vegetables.

CONTROL OF BOTRYTIS MOLD OF NEW SEEDED TABLE GRAPE 'BRS NUBIA' DURING COLD STORAGE USING SULPHUR DIOXIDE GENERATING PADS

Saeed Ahmed[1, 3], Atiq Ahmad Alizai[1], Muhammad Saleem Jilani[1], ***Waqas Ali**[1], Nazeer Ahmed[2], and Sergio Ruffo Roberto[3]

[1]Department of Horticulture, Gomal University, Dera Ismail Khan, Pakistan
[2]Department of Agriculture, University of Swabi, Pakistan
[3]Department of Horticulture, State University of Londrina (UEL), Parana, Brazil
*Email: wikishahani@gmail.com

ABSTRACT

Gray mold, caused by Botrytis cinerea Pers. Fr. is considered to be the main postharvest decay of table grapes causing extensive losses worldwide. The objective of this work was to evaluate the incidence of gray mold of the seeded table grape 'BRS Nubia' grown under subtropical conditions, during the cold storage. Grape bunches were obtained from a commercial field located at Marialva, State of Parana (Brazil). Grapes were subjected to the following treatments in a cold room at 0 ± 1°C: (i) Control; (ii) SO 2 -generating pad; (iii) Control with bunches inoculated with the Botrytis cinerea suspension; (iv) SO 2 -generating pad with bunches inoculated with the *Botrytis cinerea* suspension. The completely randomized experimental design was used with four treatments, each including five replicates. The incidence of gray mold and other physicochemical variables, including bunch mass loss, shattered berries, skin color index, soluble solids (SS), titratable acidity (TA), and SS/TA ratio of grapes, were evaluated at 50 days after the beginning of cold storage and seven days at room temperature (22 ± 2°C). The results of this study showed that a good reduction of gray mold was achieved by SO 2 generating pad during cold storage and shelf-life periods without affecting fruit quality. Also, bunch mass, mass loss, color, SS, TA and SS/TA of the grape tested were not negatively affected by SO 2 treatments.

EFFECT OF MICROWAVE ENERGY ON THE SHELF LIFE OF DHAKKI DATES

***Muhammad Afnan** and Atiq Ahmad Alizai

Faculty of Agriculture, Gomal University, Dera Ismail Khan, Pakistan
*Email: afnank013@gmail.com

ABSTRACT

Date Palm (*Phoenix dactylifera* L.) is an important fruit tree of Pakistan and the district of Dera Ismail Khan is known for its best date variety "Dhakki" which is well known for its largest fruit size and high contents of carbohydrates. Due to the unavailability of proper processing facilities, the dates in this area are dried in open fields where it is exposed to various calamities resulting in poor quality processed fruit. The fruit is usually stored in cold storages and brought to the markets in parts to avoid deterioration and pest growth during storage. Stored pests usually infest the fruit during open field drying and later on deteriorate it by multiplication inside the fruit. On the other hand, continue rains adversely affect the fruit quality as well and a sizeable percentage of harvested dates become moldy, fermented, and infested due to insect attack in storage. To minimize post-harvest damage and improve shelf life it is essential to take protective measures before storage. The current research study was conducted in the Department of Horticulture, Faculty of Agriculture, Gomal University Dera Ismail Khan during the season 2019-20 to investigate the effect of microwave (Mw) radiation to prolong the shelf life of Dhakki date fruit in storage by controlling the pest infestation. The experiment was based on two factors i.e different levels of power (Low, Low-medium, and Medium) and time of treatment (1 minute, 2 minutes, and 3 minutes) with 3 replications. The radiated samples along with non-radiated ones were placed at room temperature. Encouraging results were obtained after 40 and 50 days of treatment. Exposing the fruit to microwave energy for 2 or 3 minutes resulted in improved fruit quality as compared with non-treated fruits. Percent infestation was significantly reduced by treating fruit in a household microwave. The article provides detail of power levels and their effects on various parameters of Dhakki dates.

COMPARATIVE STUDY OF TREATED AND UNTREATED WASTEWATER ON ESSENTIAL OIL CONTENTS OF FRAGRANT ROSA SPECIES

***Muhammad Ahsan**[1], Adnan Younis[2], and Usman Tariq[3]

[1]University College of Agriculture and Environmental Sciences, The Islamia University of Bahawalpur, Pakistan
[2]Institute of Horticultural Sciences, University of Agriculture Faisalabad, Pakistan
[3]College of Agriculture, Bahauddin Zakariya University, Bahadur Sub-Campus, Layyah, Pakistan
*Email: ahsan.horti@iub.edu.pk

ABSTRACT

Roses are hardy plants and can be successfully cultivated on soils augmented with toxic metals without any danger of metal transfer into the oil. A field experiment was conducted to investigate the effect of treated and untreated wastewater on essential oil contents of four fragrant Rosa species (*R. bourboniana, R. Gruss-an-Teplitz, R. damascena,* and *R. centifolia*) in a peri-urban area of Faisalabad. Water analysis showed that all minerals and chemicals were in permissible level in canal water and treated wastewater whereas untreated wastewater contained higher EC, biological oxygen demand (BOD), chemical oxygen demand (COD) and metals like Cd, Co, Cu, and Pb. There were 12 different constituents in essential oil which were determined by using gas chromatography. These compounds were citronellol, methyl eugenol, geraniol, linalool, benzaldehyde, phenyl ethyl alcohol, γ-undelactone, geranyl acetate, ethyl heptanoate, citral, limonene, and methyl benzoate. Results regarding the composition of Rosa essential oil showed that citronellol, methyl eugenol, phenyl ethyl alcohol, γ- undelactone, geranyl acetate, limonene, and methyl benzoate were major constituents while the percentage of others constituents was very low. Statistically, there was no significant effect of irrigation water treatments on the percentage of essential oil constituents. Phenyl ethyl alcohol was the main component of essential oil and its percentage was highest in *R. Gruss-an-Teplitz* as compare to other species in treated wastewater while the minimum level was found in *R. damascena*. Citronellol which is the principal constituent for the fragrance was highest in R. damascena in untreated wastewater while the lowest percentage was recorded in *R. Gruss-an-Teplitz*. This study indicates that there was a quantitative difference in chemical composition and aroma constituents of essential oil of all fragrant Rosa species.

POSTHARVEST SUPPLY-CHAIN OF CHILGOZA (*PINUS GERARDIANA*) IN GILGIT BALTISTAN

***Niamat Ullah**, Aman Ullah Malik, Ahmad Sattar Khan, Mahmood Ul Hasan, and Raheel Anwar

Postharvest Research and Training Centre, Institute of Horticultural Sciences, University of Agriculture Faisalabad, 38040 Pakistan
*Email: niamatullah162@gmail.com

ABSTRACT

Chilgoza belongs to the Pinaceae family of the kingdom Plantae. It is one of the most expensive fruit in the world. It is an evergreen and naturally grown tree of northern temperate region. The trees are small to medium in size with horizontal branches, compact in habit and growing at the elevation of 1800-3350 meters. Chilgoza word is derived from the Persian language and native to the Northern areas of Gilgit Baltistan, Kashmir, and Baluchistan in Pakistan. In Gilgit Baltistan (GB), Chilgoza cones reach maturity during August-September and cone collection continues until November. After harvesting the cones are placed under natural sun to dry before the extraction of nuts. After exposure of cones to open air and sunlight the cones are opened. Chilgoza nuts are extracted from the cones by hitting with sticks on hard surfaces. After the extraction of pine nuts from the cones, they are spread over the ground for further drying under the natural sun. After drying, the nuts are further cleaned from inert material by using traditional as well as mechanical way followed by packaging in jute bags. After that, the Chilgoza nuts are available in the local market through a middle man. Chilgoza nuts are consumed in fresh and roasted form. Also, nuts are being exported from Chilas to China under temperature-controlled reefer containers. However, nuts are also available in the shelled and unshelled form. Unshelled nuts have a relatively longer shelf life than the shelled ones. They have good potential for long term storage, almost three to six months. The most important issue of pine nuts is

taste, rancidity, fungus attack, insect damage, breakdown and weight loss due to moisture loss. To maintain water activity moisture and quality, pine nuts must be stored/transported in cold chain at (-1 to -4 C) which retains its physiological and physical quality parameters such as color, texture, and taste for several months.

EFFECT OF MEDIUM STRENGTH AND IBA CONCENTRATION ON THE IN-VITRO ROOTING EFFICIENCY OF CARNATION VARIETY "TABASCO"

***Sehrish Somaya**, Riaz ur Rehman, Samia Ikram, and Monis Hussain Shah

Horticultural Research Institute for Floriculture and Landscaping, Rawalpindi, Pakistan.
*Email: sehrishishaque87@gmail.com

ABSTRACT

Carnation (Dianthus caryophyllus L.) is an important cut flower grown mainly in countries like Italy, Spain, Colombia, Canary Islands, France, Holland, Germany, and the U.S.A. Tissue culture technique can be best exploited for mass and true to type production of plants. Like shoot induction, rooting also plays an important role in the successful acclimatization of a plant. The present study was conducted during the year 2018-2019 at Plant tissue culture laboratory, Horticultural Research Institute for floriculture and landscaping, Rawalpindi, to evaluate the effect of medium strength and IBA concentration on the rooting efficiency of carnation variety Tabasco. The shoot tip cultures were taken and sterilized by 0.1 % $HgCl_2$. Initially, the cultures were established on Plain MS. After the successful establishment of contaminated free cultures, the inoculation was further carried out on MS medium supplemented with 2. 0 mg/l BAP and 0.5 mg/l IBA for shoot proliferation. To establish the protocol for rooting, different treatments were performed with varying medium strength (full and half) and IBA concentrations (0.25, 0.5, 0.75 & 1.0 mg/l). Half strength medium with 0.25 mg/l IBA was found best among all the treatments performed with maximum root number (9.73), root length (4.06 cm) and minimum days (16.76) to rooting.

PAKISTAN POTENTIAL: COMMERCIAL OPPORTUNITIES FOR CROP PROTECTION THROUGH BIOACTIVE COMPOUNDS OF INDIGENOUS PLANTS

***Yasir Majeed,** Muhammad Nadeem Akram, Karim Yar Abbasi, and Muhammad Bilal Shaukat

Institute of Horticultural Sciences, University of Agriculture, Faisalabad, Pakistan.
*Email:yasirmajeed4828@gmail.com

ABSTRACT

In agriculture, Crop protection is necessary to get high yield and better quality production. Insects and weeds reduce plant yield which is traditionally controlled by pesticides and herbicides respectively. These synthetic pesticides and herbicides are nondegradable and highly toxic, causing several environmental problems by effecting water resources, air, soil, and human health. To reduce these environmental problems, bioactive compounds of plants are the best alternative to synthetic chemicals. Essential oils are the rich source of different bioactive compounds that are volatile, having aromatic components, provide specific flavor, odor and scent. Essential oils provide different functions in plants like protect them from heat or cold, attract or repel insects and provide a defense mechanism. Major Bioactive compounds of plants are indole, benzyl acetate, menthol, carvone, linalool, monoterpenes, cineole, thymol, geraniol, piperidine, limonene, oleic acid, linoleic acid, camphene, zingiberene, etc. The essential oil of garlic and lemongrass is toxic to cabbage looper. Likewise, thyme oil has the potential to control leafroller, peppermint oil control Lolium multiflorum weed, sage essential oil control Avena fatua weed, anise oil control Fusarium diseases and citronella oil control soybean rust. Pakistan has a variety of plant species that are cultivated and widely grown in different regions due to its topography and diverse climatic zone. Different plants like alfalfa, bitter almond, anise, balm, sweet basil, holy basil, bergamot, chamomile, capsicum, caraway, celery, chicory, lemongrass, citrus, oranges, coriander, cumin, elderflower, fennel, fenugreek, geranium, roses, grapefruit, jasmine, lavender, citronella, lime, mint species, garlic, origanum spp., rosemary, sage, thyme, turmeric, tuberose, eucalyptus spp., neem, ginger, carrot seed, cedarwood, pine, marigold and onion, etc grown widely and also cultivated throughout Pakistan. These plants have the potential for commercial essential oil production due to the presence of

huge raw material. Essential oils can play an important role in crop protection without contaminating the environment because of their eco-friendly nature.

CHARACTERIZATION OF EXOTIC CITRUS VARIETIES THROUGH MORPHOLOGICAL ATTRIBUTES USING CLUSTER ANALYSIS

*__Saima Mumtaz__, Shamaila Rasheed, M. Iman, Sanjeela Sabahat, M. Sudheer Tariq, and Taj Naseeb Khan

Horticultural Research Institute, National Agricultural Research Centre, Islamabad, Pakistan
*Email:saimamumtaz124@gmail.com

ABSTRACT

Understanding of the morphological diversity amongst the citrus genotypes is vital for the efficient exploitation of crop genetic resources. Ease of examination and the presence of established descriptors for assessing genetic diversity make morphological characters advantageous. Hence the present study was based on morphological characters showed a wide range of variation recorded in both qualitative and quantitative traits among 16 citrus genotypes i.e., Cara Cara, Fremont, Daisy, Beyenda, Tangor, Atwood, Fisher, Kenan, Hockney, Clementard, Caffin, Lane late, Nules, Berri, Hamlin, and Handerson. Forty-seven morphological traits (39 qualitative and 8 quantitative) evaluated on sixteen genotypes were subjected to multivariate analysis to explain the relationship among citrus varieties and within groups in the dendrogram. The quantitative traits were analyzed using ANOVA with Duncan Multiple Range Tests. Our findings revealed that Handerson had uniqueness amongst all other varieties studied in terms of leaf character (Obovate shape). Cara Cara, Fremont, and Hockney exhibited distinctive flower and fruit characters i.e., pale yellow and yellow color anther, oblate and ellipsoid fruit shape respectively whereas Fremont showed entirely different seed characters having semi deltoid seed shape. Significant variations in quantitative characters among genotypes were also observed. Maximum leaf length was noted in Beyenda (13 cm) and Clementard (12.5cm) while more fruit size was recorded in Cara Cara (76mm) and Beyenda (70mm). Similarly, flower characters related to petal length, petal width and flower diameter varied significantly. Citrus varieties showed a significant difference for peel thickness and five genotypes had peel thickness more than 4.00mm. Lane Late recorded the highest TSS value while all the remaining genotypes had TSS more than 11%. Our findings may serve as a significant reference for the comparison of genetic resources, the characterization of citrus genotypes and the citrus breeding program to select the best parents.

EFFECT OF DIFFERENT GROWTH MEDIUMS SUPPLEMENTED WITH HUMIC ACID ON THE GROWTH AND FLOWERING OF CARNATION VAR. TOBASCO

***Samia Ikram**, Riaz ur Rehman, Sehrish Somaya, Monis Hussain Shah, and Ziaullah

Horticultural Research Institute for Floriculture and Landscaping, Rawalpindi, Pakistan.
*Email: samiaikram@hotmail.com

ABSTRACT

Dianthus caryophyllus commonly known as carnation belongs to the family Caryophyllaceae is a top-ranked cut flower around the globe. Among different factors affecting the growth and flowering of carnation, potting media is the most important: a good potting medium is the one that has good water holding capacity, efficient and abundant nutrient supply and allows a healthy amount of gaseous exchange between roots and atmosphere. The present research study was designed to discover the best growth medium supplemented with Humic acid for improved performance and yield of carnation plants in the agro-metrological conditions of Rawalpindi and Islamabad. The study was conducted during 2017-2019 at the horticultural research institute for floriculture and landscaping Rawalpindi.The treatments consisted of Sand+soil (1:1), Sand+Soil+FYM (1:1:1), Soil+FYM (1:1), Sand+FYM (1:1) as growth medium supplemented with Humic acid @ 2000ppm,4000ppm,6000ppm and 8000ppm. The treatment consisting of Sand+Soil+FYM (1:1:1) supplemented with 8000ppm produced maximum plant height of 24.42 cm while the same medium with 4000ppm humic acid produced maximum number of leaves (54.67) and (3.3) flowers per plant, Stem diameter of (14.80 mm) and stalk diameter (2.12 mm), the most number of the stalk (3.67) and Stalk length (63.79cm). The above results showed that Sand+Soil+FYM (1:1:1) supplemented with 4000ppm Humic acid is the most suitable plant growth medium for carnation plant production in agro-metrological conditions of Rawalpindi and Islamabad.

FIRST REPORT OF *PODOSPHAERA PANNOSA* ON ROSA SPECIES FROM PAKISTAN

***Seerat S**, Afshan N, and Khalid A. N

Department of Botany, University of the Punjab, Lahore, Pakistan
*Email:shazma.seerat@gmail.com

ABSTRACT

Erysiphales is the group of biotrophic phytoparasites that mainly affect the aerial parts of the plant. White powdery mass is the main symptom of this infection. During the phytopathogenic survey of Khanspur (District Abbottabad) conducted in 2018-2019, the infection was observed on Rosa plants growing in the vicinity of Sir Syed Campus, Punjab University, Lahore. Hence, infected parts mostly leave and stem was collected. Detailed morpho-anatomical and molecular analysis using ITS markers of this infection identify the organism to be Podosphaera pannosa. Podosphaera is one of the three genera of tribe Cystotheceae. Chasmothecium with a single ascus and oidium type conidia with distinct fibrosin bodies are the distinguishing features of this genus. Powdery mildew of roses is a problem worldwide, in greenhouses or outdoors, wherever roses are grown. The disease can cause distortion and death of leaves and shoots, but even a mild case makes plants unsightly. Powdery mildew reduces the quality of cut flowers and makes nursery stock less saleable to consumers. This fungus is the first time reported from Pakistan and is an addition to the Erysiphalian flora of Pakistan.

LOW-COST AGRICULTURE PRODUCTS AS A SOURCE FOR SYNTHESIS OF BACTERIAL BIOPLASTICS

***Nazia Jamil** and Naima Khan

Microbiology and Molecular Genetics, University of the Punjab, Quaid-i-Azam Campus, Lahore-54590, Pakistan
*Email: nazia.mmg@pu.edu.pk

ABSTRACT

Plastic pollution increases at alarming rates in Pakistan. This persistent pollution shifted interests to develop bio-plastics. Biodegradable microbial bio-plastics provide dual benefits of utilizing waste and cost-effective production. Polyhydroxyalkanoates (PHAs) are a class of biodegradable plastic that is synthesized intracellularly by different bacteria. Several inexpensive carbon substrates such as molasses, lauric acid, whey, cellulose, plant oils and hydrolysates of starch can be excellent substrates for bacteria to produce PHAs, which could lead to significant economic advantages. The versatility of PHAs in terms of their non-toxic degradation products, biocompatibility, desired surface modifications, a wide range of physical and chemical properties, cellular growth support, and attachment without carcinogenic effects have enabled their use as in vivo implants. Microbial production of PHAs also provides the opportunity to develop PHAs with more unique monomer compositions economically through metabolic engineering approaches. We have stock of more than a hundred bacterial strains that can produce Biodegradable plastic. Biodegradable plastic was extracted from bacterial strains, which were isolated from different environments of Pakistan. All the strains were analyzed for production on Agriculture waste. The extraction of PHA was done by different methods. PCR based strategy was used to amplify the PHA biosynthesis operon. Extracted PHA polymer presents a great variety of characteristics in terms of its biodegradability, elasticity, non-toxicity, biocompatibility, ability to function as nanoparticles, and the possibility for tailor-made physical-chemical properties.

BIOCHEMICAL AND METABOLIC FINGERPRINTING OF SOME BACTERIA ISOLATED FROM SOIL OF SAUDI ARABIA

Azeem Javed and Zakia Latif.

Department of Microbiology and Molecular Genetics, University of the Punjab, Lahore, Pakistan
Email:azeem.mmg@gmail.com

ABSTRACT

Deserts are barren areas of earth and consist of about 20% of the total land on earth. They have thousands of bacteria that survive in the extremities of the environment. These bacterial strains have the potential to produce many agronomically and commercially important metabolites. During the last two decades, a lot of research has been made to identify their potential and diversity and to use them as biofertilizers Synthetic fertilizers proved useful but it is a great threat of bioaccumulation and biomagnification of different compounds in the food chain which is harmful not only to humans but also animals and other microflora. The main focus of this study is to isolate plant growth-promoting bacterial strains from hot arid regions of Saudi Arabia deserts and to check their potential to use as biofertilizers. Out of a total of 24 isolates that were characterized biochemically except K33 and K38 all were having the ability to fix the aerial nitrogen. All strains except J46, J42, J2A, and J2G were positive for IAA production. They also have the potential to tolerate metals which can help in cleaning the contaminated environment by bioremediation. All Isolated strains can grow at high temperatures and be able to produce Cellulase, Pectinase, Alpha-amylase, and Chitinase. Bacterial strain J410 was found to be the best for the production of all enzymes. Genetic fingerprinting results show that they also have genetic diversity which makes them successful survivors in extreme environments. Hence it is concluded that microorganisms from the desert soil of Saudi Arabia have the potential of improving agricultural fertilizers and producing commercially important enzymes.

SODIUM NITROPRUSSIDE (SNP) IMPROVES THE VASE LIFE OF CUT TULIPS (*TULIPA GESNERIANA* L.) CV. LALIBELA

***Mohsin Bashir**[1], Muhammad Asif[1], Hafiz Nazar Faried[2], Momal Ashfaq[1], Shammas Asad[1], Sunaira Abbas[1], and Muhammad Usman Azeem[1]

[1]Institute of Horticultural Sciences, University of Agriculture, Faisalabad, 38040, Pakistan
[2]Department of Horticulture, Muhammad Nawaz Sharif University of Agriculture, Multan, Pakistan
*Email: mohsinbashir99@gmail.com

ABSTRACT

Tulip (*Tulipa gesneriana* L.) is amongst the most attractive geophytes from the *Liliaceae* family. Its genus comprises 76 species that are present in great diversity ranging from North Africa to Central Asia and southwestern Europe. It is one of the popular and economically profitable bulbous crops owing to an inimitable beauty and exquisite stature in the global trade of floriculture. Most of the cut flowers are perishable and their prolonged display life is always marked for quality index. The inadequacies regarding quality can be minimized by providing proper storage and preservation techniques. For this purpose, vase solutions may play a pivotal role to prevail the post-harvest longevity and quality. Ingredients of vase solution are coined with the prolonged freshness of cut flowers. A variety of chemical compounds have been utilized to investigate this issue and to ameliorate the display life. The ionic form of sodium nitroprusside (SNP) in different concentrations will be analyzed to streamline its various levels and compatibility. Keeping in view this issue, an experiment will be regulated to anticipate the different levels of sodium nitroprusside (0, 20, 40, 60, 80, 100 mg -1) and 2.5% sucrose in vase solution. Data concerning following parameters like fresh mass, stem elongation, stem bending, dry mass, leaf yellowing, vase life, bud opening, water uptake, days to start senescence, flower diameter, flower quality, microbial count, membrane permeability, fresh weight changes, and microbial identification will be collected. The experiment will be executed according to Complete Randomized Design (CRD) with three replications having five observational units in each treatment. Data will be collected statistically analyzed by using Statistix 8.1 software.

APPLICATION OF ZNO NANO-PARTICLES TO ENHANCE THE VASE LIFE OF CUT TULIPS (*TULIPA GESNERIANA* L.) CV. FLYING DRAGON

*Mohsin Bashir[1], Muhammad Asif[1], Hafiz Nazar Faried[2], Hashim Abbas, and Amjad Farooq[1]

[1]Institute of Horticultural Sciences, University of Agriculture, Faisalabad, 38040, Pakistan
[2]Department of Horticulture, Muhammad Nawaz Sharif University of Agriculture, Multan, Pakistan
*Email: mohsinbashir99@gmail.com

ABSTRACT

Tulip (*Tulipa gesneriana* L.) is amongst the most appreciated cut flower in the global floriculture trade and is considered as a delicacy in the local floriculture industry of Pakistan. Perpetuated display life of cut tulips is always desired by florists and consumers to enjoy the exuberance of stem in a vase. Zinc compounds have shown a promising role in the quality and preservation of many other cut flowers. Nano-zinc (NZ) particles are proved to be novel antimicrobial compounds that have the potential to inhibit bacterial growth in the vase solution. The objective of this study was to determine the efficacy of NZ particles (25mm) to improve the display life of cut tulips. The NZ treatments of 5mlL $-^{1}$, 10mlL $-^{1}$, 15mlL $-^{1}$, 20mlL -1 and 25mlL $-^{1}$ along with control was used in vase solution after harvesting of stem at bud burst stage Data regarding various parameters was recorded at respective growth stages and analyzed by using standard statistical method. The experiment was conducted according to Complete Randomize Design (CRD) having three replications in each treatment at Post-harvest and Floriculture Lab, Institute of Horticulture sciences, university of Agriculture Faisalabad. Data collected were statistically analyzed by using Statistix 8.1 software computer package with Tukey's LSD of Variance at a 5% level of probability to compare the treatment means. In this experiment (25ml) Zinc Nanoparticles prolonged vase life, delayed senescence, improved amount of water uptake and controlled the microbial activity in the vase solution. It is concluded that the Zinc Nanoparticles of zinc kill the bacteria in vase solution and increases the vase life of cut tulips by delaying the senescence.

THE WILLINGNESS OF CONSUMERS TO PAY FOR CUT TULIPS

***Mohsin Bashir**[1], Muhammad Asif[1], Hafiz Nazar Faried[2], Muhammad Usman Azeem[1], Sunaira Abbas[1], Shammas Asad[1], and Momal Ashfaq[1]

[1]Institute of Horticultural Sciences, University of Agriculture, Faisalabad, 38040, Pakistan
[2]Department of Horticulture, Muhammad Nawaz Sharif University of Agriculture, Multan, Pakistan
*Email: mohsinbashir99@gmail.com

ABSTRACT

Tulip (*Tulipa gesneriana* L.) is an ornamental geophyte, a perennial herbaceous plant from the *Liliacea*e family. It is cultivated worldwide for its elite properties such as flower color, quality, and other alluring traits. The festive and occasional features like royalty, love, and splendor are inherent in this flower that attracts the people. It is grown as a cut flower and is marketed throughout the world. Cut stems of tulip are fancied by the consumers, yet few are unsatisfied by its price. Globally, its marketing index decreased due to climatic factors and expenses in its production chain. To promote this crop in the country, awareness is needed to develop among growers and users for identifying the value of this crop. A survey will be conducted in Lahore city to assess the response of customers towards this flower, its price, florist-consumer relationship particularly to understand the marketing process of this high-value crop. A questionnaire containing questions of sorts and point of view of clients based upon their likes dislikes and the prices will be generated to assess the cut flower quality whether it is positive or otherwise, gender-based preference or frequent or occasional use will be focused on the study. The issue of flower price is still capricious. Market demand based upon color preference like red, orange and pink of different cultivars like Lalibela, Baree Alta and Denmark shall serve as a market product on florist's shelf. The interested emptor then further be interviewed to visualize the response to make marketing efficacious.

EFFECT OF SALICYLIC ACID AND SALINITY STRESS ON THE PERFORMANCE OF TOMATO

***Imran Ahmad**[1], Mohammad Naeem[1], Mehboob Alam[1], Abdur Rab[1], Humaira wasila[3], Muhammad Asim[2], and Shahryar Javed[1]

[1]Department of Horticulture, Faculty of Crop Production Sciences, The University of Agriculture, Peshawar-Pakistan
[2]Department of Agronomy, Faculty of Crop Production Sciences, The University of Agriculture, Peshawar-Pakistan
[3]Department of Human Nutrition, Faculty of Crop Production Sciences, The University of Agriculture, Peshawar-Pakistan.
*Email: imran73pk@gmail.com

ABSTRACT

A pot experiment was conducted to observe "The effect of salicylic acid on qualitative-quantitative attributes of tomato
plant under salinity stress" at Agriculture Research Institute Tarnab, Peshawar during the summer season, 2016. The experiment was conducted under shade house and laid out in Completely Randomized Design (CRD) having 12 treatments and replicated thrice. After 15 days of the transplantation tomato plant (cv. Rio Grande) were subjected to various level of salinity (0, 30, 60 and 90 mM) and foliar application of salicylic acid (0, 0.5 and 1mM) at 6 days after salinity stress. Results revealed that salinity stress significantly reduced the fruit length (4.71 cm), fruit diameter (3.95 cm), number of fruit plant -1 (13), yield pot -1 (0.51 kg), fruit dry matter (6.89 g), and pH (4.14) with an increase in fruit firmness (2.72kg.cm 2), TSS (8.87 0 Brix) and vitamin C (18.07 mg.100 ml) with the application of NaCl at 90 mM as compared to control, while the foliar application of salicylic acid at 0.5 mM significantly reduced the harmful effect of salt stress and improve the fruit length (5.02 cm), fruit diameter(4.17 cm), number of fruit plant -1 (18.67), yield pot -1 (0.86 kg), fruit dry matter (9.04 g), fruit firmness (2.68 kg.cm 2), TSS (9.05 0 Brix) pH (4.33) and vitamin C (17.28 mg.100 ml) followed by the salicylic acid application at 1 mM. Regarding interaction both salinity and salicylic acid significantly affected all the variables except fruit firmness, TSS, pH, and vitamin C. From the present study it is concluded that salinity reduced the quantitative attributes while it increased qualitative attributes except pH. Therefore, the salicylic acid at 0.5 mM might be applied to the tomato plant under saline condition up-to 90 mM which could effectively alleviate the deleterious effect of salt stress.

EFFECT OF SEED PRIMING AND SEED PELLETING ON GERMINATION AND GROWTH BEHAVIOR OF *CELOSIA CRISTATA* L. (COCK'S COMB)

Urwa Irshad, *Adnan Younis, Fahad Ramzan, Sumiya Yaseen, Muhammad Kashif, and Muhammad Muzammil Ijaz

Institute of Horticultural Sciences, University of Agriculture, Faisalabad, 38040, Pakistan
*Email: adnanyounis@uaf.edu.pk

ABSTRACT

Celosia cristata L. (Cock's comb) is one of the best-recognized annual used in landscape, which is native to India. As an annual cock's comb is primarily grown on beds and used in mixed borders for avenue plantation. It has popularity due to its stability, prolonged durability, showy appearance, beautiful colors and adaptation to different climates. In this research, the effect of seed priming and seed pelleting was studied. This study was conducted at the Lalazar nursery area, the University of Agriculture Faisalabad, to check the cock's comb for evaluating its germination and growth behavior by using seed priming techniques (Hydropriming+ moringa leaf extract) and seed pelleting using coating materials (gum arabic+bentonite+moringa leaf powder) in different compositions. The experiment was laid out in Randomized Complete Block Design with six treatments and four replications. Data on plant germination and growth was recorded from the initial stage till maturity.No. of leaves, plant height,

chlorophyll contents, and uniform seed emergence were observed in T3 (3%moringa leaf solution) regarding seed priming. Leaf area, stem diameter and fresh weight of plant were highest in T6 (25% bentonite+75% moringa leaf powder) regarding pelleting. T1 (Control) and T2 (2% moringa solution) showed poor results in the experiment. Overall T3 &T6 showed the best results. Seed priming and seed pelleting both could be used to enhance uniform and rapid seed germination and quality of cock's comb plant.

EFFECT OF POT SIZE ON VEGETATIVE GROWTH AND FLOWERING OF THE WINTER ANNUALS

Shabroze Hussain[1], *Noor-un-Nisa Memon[1], Niaz Ahmed Wahocho[1], Tanveer Fatima Miano[1], Faiza Soomro[1], and Muzamil Farooq Jamali[1]

[1]Department of Horticulture, Sindh Agriculture University, Tandojam, Sindh, Pakistan
[2]Department of Agronomy, Sindh Agriculture University, Tandojam, Sindh, Pakistan
*Email: norimemon@gmail.com

ABSTRACT

The experiment was conducted to assess the effects of pot size on vegetative growth and flowering of the winter annuals viz. Dog flower and Pansy. The pots of four sizes viz. P_1= 5 inches, P_2 =7 inches, P_3 = 9 inches and P4 =12 inches in diameter across the rim were taken. The vegetative growth and flowering of the winter annuals were significantly affected by the pot sizes. The better seed germination (77.67%), germination time (4.00 days), germination index (6.17), seedling vigor index (2429.2), fresh shoot biomass (3.06 g), dry shoot biomass (590 mg), fresh root biomass (1850 mg), dry root biomass (850 mg), fresh biomass of single flower (490 mg), days taken to initiate flower bud (29) and flower diameter (7.88 mm) were observed from the seedlings raised in pot size of 9 inches. The number of flowers plant^{-1} and dry flower biomass had no significant differences in pot sizes. To compare means of winter annuals, Dog flower had better results for seed germination (63.17%), minimum mean germination time (6.25 days), germination index (6.17), seedling vigor index (1850.7), fresh biomass of the shoot (2.41 g), dry biomass of the shoot (500 mg), fresh biomass of the roots (1450 mg), dry biomass of the roots (560 mg), fresh biomass of single flower (380 mg) and dry biomass of a single flower (180 mg). While Pansy took minimum days to initiate flower bud (29.25 days) and better flower diameter (8.26 mm). It is concluded that the growth of the winter annuals from seed germination to the initiation of the flowers increased with the increase in pot size. However, a larger size pot of 9" is considered the best pot size for the growth of Dog flower and Pansy.

EVALUATION OF GROWTH STIMULATORY IMPACT OF EPS PRODUCING BACTERIA ISOLATED FROM HOT WATER SPRING

Noor-e-Saba Naz, **Asma Kalsoom***, and Rida Batool

Department of Microbiology and Molecular Genetics, University of the Punjab, Quaid-e-Azam Campus, 54590-Lahore, Pakistan
*Email: asma.phd.mmg@pu.edu.pk

ABSTRACT

Extremophilic exopolysaccharides (EPS) producing bacteria can play a significant role in plant growth promotion. A total of seven bacterial strains (BE1, BE2, BE3, BE4, BN1, BN2, BN3) were isolated from a water sample of Tattapani hot spring, Azad Kashmir, Pakistan. All strains exhibited EPS production however, three strains (BE1, BN1, and BN3) considerably produced EPS (14g-15g /100ml) when screened on P-medium. The selected strains were optimized for EPS production and a significant amount of EPS was obtained at pH 9, temperature 28°C, fructose and peptone as carbon and nitrogen source respectively. Inoculation of selected strains to Zea mays seeds produced maximum increment in germination (27-38%), seedling length (10-14%), shoot length (27-35%) and some roots (12-25%) as compared to un-inoculated control. Several shoots were greatly enhanced when inoculated

with BN1 strain as compared to control. Alcian blue staining revealed good colonization on inoculated Zea mays roots as compared to the un-inoculated seedling. Bacterial inoculation caused a maximum increment in auxin content as well as the soluble protein content of Zea mays seedlings. Phylogenetic analysis by the 16S rRNA sequencing technique revealed the taxonomic identification (99%) of strains BE1, BN1, BN3 to Ochrobactrum intermedium, *Bacillus pumilus* and *Enterobacter ludwigii*, respectively. FTIR analysis of EPS produced by strain BN3 indicated the presence of various functional groups such as amides, alcohols, carboxylic acids and aromatic compounds showing its complex structure. Hence, this study suggested the use of these bacterial strains as bio-fertilizers due to the EPS production ability.

MORPHOGENETIC CHARACTERIZATION OF LOCAL/DESI AND HYBRID ROSE (*ROSA INDICA* L.) CULTIVARS

***Monis Hussain Shah[1]**, Riaz-Ur-Rehman[1], Sehrish Somiya[1], Samia ikram[1], Muhammad Usman[2], and Sajida Bibi[3]

[1]Upgradation of plant Tissue Culture Project, Horticultural Research Institute for Floriculture and Landscaping, Plot No. 4, Orchard Scheme area, Murree Road, Islamabad
[2] Institutes of Horticultural Sciences, University of Agriculture, Faisalabad
[3] Plant Breeding and Genetics Division, Nuclear Institute of Agriculture and Biology, Jhang Road, Faisalabad
*Email: monishussain50@gmail.com

ABSTRACT

Rose is a significant ornamental plant around the globe. Evidence of aesthetic and ornamental use is found in the prehistoric human civilization of Egypt, Persia, and Rome. In Pakistan, since the last seventy years, hundreds of Hybrid varieties are introduced and adopted for cut-flower and landscape beauty. Several chance seedlings and spontaneous mutants are also originated with due course of time. During 2008 a comprehensive survey was conducted from Punjab and several local/desi and hybrids were collected and planted in the sub-tropical region of Punjab (Rawalpindi/Islamabad). The varieties with stable plant characters were further subjected to morphological analysis with UPOV-Rose descriptors from 2017 to 2019. Local/Desi Rose accession was compared with each other and finds significant variation however PCA was not possible due to narrow sample size. While in Hybrid rose accessions narrow range of variation was observed within the traits (11.43% and 10.14%) on factor plain (Factor1×Factor2). The leading accession-33, Accession-34, and accession-6 were chosen for desirable plant attributes such as significant flower size (cm), stem length (cm) and early flower production for development of *in vitro* propagation protocol. The explants were surface sterilized with 0.1% $HgCl_2$, Tween-20, NaOCl (10%) and 70% ethanol for 5-10 minutes each with pre-soaking in Topsin-M (0.5%) fungicide. Phenolic control was achieved with continuous sub-culture and soaking pre-inoculation of explants into the Citric acid solution (1%). The best accession performed *in vitro* aseptic environment was accession-33. This is the first report of adaptability studies of different HT-Rose accession for accessing their capacity to use in further breeding programs.

EFFECTIVENESS OF INSECT POLLINATORS IN ONION (*ALLIUM CEPA* L.) SEED QUALITY AND GERMINATION

Syeda Fatima Bukhari, **Mudssar Ali***, and Muqadas Younas

Institute of Plant Protection, MNS-University of Agriculture, Multan, Pakistan
*Email: mudssar.ali@mnsuam.edu.pk

ABSTRACT

Onion (Allium cepa L.) is one of the major vegetable crops as it stands 2nd after tomato. Onion flower is protandrous due to which it produces a low quality of seeds or fail in seed setting in the absence of pollination. Wind pollination is also documented but has no significance in onion crop. Thus, both common and hybrid onion required an adequate activity of insect pollinators. Onion umbels provide a long duration for insect foraging and visitation as it takes more than one month for anthesis and flowering and attracts many insects. Individuals of more than 10 insect species have been found as effective pollinators. Among these pollinators, 90% pollination is done by

Hymenopterans followed by Dipterans 6.47% and Lepidopterans 2.01% respectively. Without pollination, onion produces 17% fruit set while in the presence of pollinators the fruit set is up to 73% and high seed germination has been observed. Managed honeybees are the good source of onion pollination as 93% yield increases due to bee pollination, but in harsh environment areas i.e. in the Southern Punjab and Balochistan Province of Pakistan where stationary beekeeping is not possible, conserving the native pollinators is the best way for the crop pollination and production.

EVALUATION OF DIFFERENT IRRIGATION SCHEDULES AND NITROGEN FERTIGATION LEVELS FOR IMPROVING WATER USE EFFICIENCY OF POTATO UNDER DRIP IRRIGATION SYSTEM

Muhammad Bilal Chattha

Institute of Agricultural Sciences, University of the Punjab, Lahore
Email: bilal.iags@pu.edu.pk

ABSTRACT

Irrigation scheduling and nitrogen fertigation play a pivotal role in improving water use efficiency of the potato crop. To evaluate the most suitable irrigation schedule and nitrogen fertigation level for potato crops under a drip irrigation system, a field experiment was conducted at the water management research farm, Renala Khurd, Okara. Irrigation schedules included I_1=Irrigation at 20% MAD and I_2=Irrigation at 40% MAD while nitrogen fertigation levels included F_1=125% of the recommended dose of nitrogen fertilizer, F_2=100% of the recommended dose of nitrogen fertilizer, F_3=75% of the recommended dose of nitrogen fertilizer and F_4=125% of the recommended dose of nitrogen fertilizer. Results indicated that drip irrigation saves the water up to 25% and increased the tuber yield by 30% as compared to furrow irrigation (control). Maximum tuber yield (30 t ha^{-1}) was observed when potato crop was irrigated at 20% MAD and 125% of the recommended dose of nitrogen fertilizer which was at par with potato crop irrigated at 20% MAD and 100% of the recommended dose of nitrogen fertilizer. Minimum tuber yield (18 t ha^{-1}) was observed when the potato crop was irrigated at 40% MAD and 50% of the recommended dose of nitrogen fertilizer. Finally, it can be concluded that by adopting a drip irrigation system farmer can improve their water use efficiency and crop productivity.

EFFECT OF CUTTINGS TYPE ON THE ROOTING SUCCESS IN FIG (*FICUS CARICA* LINN.) PLANT

***Zarghona Siddique[1]**, Saeed Ahmad[1], Saba Sattar[1], Aliya Hanif[1], Mehwish Liaquat[1], and Urva Siddique[2]

[1]Institute of Horticultural Sciences, University of Agriculture, Faisalabad
[2]Department of Food Science and Technology, University of Agriculture, Faisalabad
*Email: zarghonachaudhary@yahoo.com

ABSTRACT

Fig (*Ficus carica* Linn.) has a good economic value due to its nutritional and medicinal properties. Unfortunately, this minor fruit plant is neglected by the researcher. It is mostly propagation by hardwood cutting but the success and health of plants are still a problem for growers. The present study was conducted to know the best type of cutting for maximum success and growth. Three types of cuttings from different vegetative growth stages such as primary growth, secondary growth, and tertiary growth were collected and prepared for transplanting. Cuttings were transplanted in February. It was observed that maximum success of 78% was achieved from the secondary growth (Semi-hardwood), Maximum number of leaves (˜32), number of branches (˜3), and height of plants (˜66.3 cm) was also noted from the same cuttings. The maximum length of roots (˜39.6cm) was also measured from the semi-hardwood cuttings. However, softwood cuttings and hardwood cuttings could not show good vegetative growth after three months of sprouting. Minimum sprouting was noted in softwood cuttings while the maximum was found from the hardwood cuttings. It could be due to less root emergence and shallow root system. Therefore, it is recommended that semi-hardwood cutting from secondary growth should be selected for the propagation of fig (*Ficus carica* Linn.).

FIRST REPORT OF ALTERNARIA LEAF SPOT CAUSED BY *ALTERNARIA SP.* ON *BISMARCKIA NOBILIS* IN PAKISTAN

M. Mouazam[1], ***Imran Ul haq**[1], Siddra Ijaz[2], Anjum Faraz[1], and Amer Habib[1]

[1]Fungal Molecular Biology Laboratory, Department of Plant Pathology University of Agriculture Faisalabad.
[2]Centre of Agricultural Biochemistry and Biotechnology, University of Agriculture Faisalabad.
*Email: imran_1614@yahoo.com

ABSTRACT

Bismarckia nobilis commonly known as Bismarckia palm is an outdoor ornamental plant belongs to family Arecaceae and commonly cultivated for landscaping. It has a gray solitary trunk with 12- meter height, rounded leaves over 3-meter wide and split on ends. The aesthetic value of Bismarckia palm is threatened by fungal leaf spots. Yellow to dark brown spots with concentric rings, spots coalesce and large necrotic lesions were observed during a survey of Faisalabad, Lahore, Kasur and Islamabad districts of Punjab, Pakistan. Maximum disease incidence 56% with 78% severity were recorded in Kasur district which is the hub of ornamental plant nurseries in Pakistan. Diseased leaves were collected and brought to the laboratory, cut into 3-5 mm pieces of diseased along with healthy portion, surface disinfected, plated on Potato dextrose agar (PDA) culture medium and incubated at 22-26ºC. After 7 days of incubation, culture was purified using a single hyphal tip technique. Brownish black color mycelial growth appeared on PDA. Conidia were long with longitudinal and transverse septations. Based on morphology the isolated fungus was Alternaria spp. The pathogenicity test was accomplished. Spore suspension of Alternaria spp with 1x 10 5 concentration was sprayed on healthy *B. nobilis* grown under greenhouse, covered with polythene bags for 24 hours to attain optimum humidity and temperature while only distilled water was sprayed on control plants. Ten days of post inoculation leaf spots symptoms appeared as observed during survey and control plants were symptomless. Pathogenicity test proved Alternaria as a pathogen of leaf spot on *B. nobilis*. To our knowledge, this is the first record of leaf spot disease caused by *Alternaria sp*. on *Bismarckia nobilis* in Pakistan.

ALTERNARIA LEAF SPOTS DISEASE; AN ALARMING THREAT TO COMMERCIAL PRODUCTION OF *CYCAS REVOLUTA* IN PUNJAB, PAKISTAN

***Imran Ul haq**[1], Siddra Ijaz[2], Samreen Asharf[3], and M. Zunair Latif[1]

[1]Fungal Molecular Biology Laboratory, Department of Plant Pathology University of Agriculture Faisalabad.
[2]Centre of Agricultural Biochemistry and Biotechnology, University of Agriculture Faisalabad.
[3]Department of Botany, University of Agriculture Faisalabad.
*Email: imran_1614@yahoo.com

ABSTRACT

Cycas revoluta is high valued, typical interiorscape ornamental cycad mainly cultivated for its unique floral beauty. Fungal leaf spots are of major socio-economic concerns for ornamental palm growers in many areas of the world. A new leaf spot disease was recorded on *C. revolute* population cultivated across the province Punjab, Pakistan. Dark brown irregular lesions with yellow halo were seen on infected leaves. In some cases, velvety fungal growth was also observed on the surface of infected tissues. Leaf samples comprising of symptomatic and asymptomatic tissues were collected and processed for the isolation of casual fungus by following established protocols. Alternaria colonies were consistently obtained from active symptomatic lesions on leaves. Morphological characterization of associated *Alternaria sp*. was done. Pure fungal colonies on synthetic media (PDA) were olive green with prominent white margins and woolly growth. One representative Alternaria isolate was tested for pathogenicity to healthy juvenile palms of *C. revoluta*. Plants were inoculated with 20 µl of conidial suspension with adjusted spore concentration of 10^3 conidia per ml of water and covered with plastic boxes. The experiment was carried out in controlled conditions with 26±2°C temperature and 70-80% relative humidity. Lesions development was observed on all the plants inoculated with fungal spore suspension approximately 3 weeks of post-inoculation. Control plants inoculated with sterile water remain asymptomatic. It is concluded that Alternaria leaf spot disease has become an emerging challenge in the commercial marketing of *C. revoluta* in Pakistan and has the potential to spread on larger geographical area. So, special attention must be paid to maintain a healthy balance in market price and high aesthetic value of this palm.

IDM FOR SUSTAINABLE CONTROL OF FUSARIUM WILT IN *DIOON SPINULOSUM*

*__Imran Ul haq__[1], Siddra Ijaz[2], Samreen Asharf[3], and M. Zunair Latif[1]

[1]Fungal Molecular Biology Laboratory, Department of Plant Pathology University of Agriculture Faisalabad.
[2]Centre of Agricultural Biochemistry and Biotechnology, University of Agriculture Faisalabad.
[3]Department of Botany, University of Agriculture Faisalabad.
*Email: imran_1614@yahoo.com

ABSTRACT

Dioon spinulosum is the tallest evergreen cycad that highly demanded its unique elegance. Fusarium wilt of *D. spinulosum* caused by *Fusarium oxysporum* is of paramount importance causing severe losses in nurseries and countryside. Management of this disease is crucial due to soil-borne nature of the causative fungus and perennial nature of the plant. In recent years, the concept of integration of bio-chemical approaches has been greatly flourished. In this work, multifaceted disease management approaches employing chemical, biological and plant hormones were combined for the effective control of Fusarium wilt of *D. spinulosum*. Antifungal potential of four synthetic fungicides (Aliette, Topsin-M, Amistar, and Tiger) was exploited using poisoned food technique. Among fungicides, Aliette (Fosetyl aluminium) was identified as most effective with 83.97% inhibition and Tiger as the least effective fungicide with 45.36% inhibition. Antagonistic potential of *Trichoderma viridae* was determined using a dual culture technique. *T. viridae* was the most effective bio-agent at day seven in suppressing *F. oxysporum* growth in culture media. The efficacy of Salicylic acid, a plant growth-regulating hormone, was tested in greenhouse trials for the management of the disease on nursery plants. Salicylic acid not only regulates disease severity but also enhanced host vigor and improved plant health. In conclusion, Fusarium wilt is a lethal disease of Dioon palms and Integrated Disease Management (IDM) is the most successful and promising tool for the sustainable control of the disease.

CLIMATE CHANGE AND THE FUTURE OF TEMPERATE FRUIT-PESHAWAR AS A CASE STUDY

***Atiq Ahmad Alizai**, Raqeeb Ullah, and Fazli Wahab

Gomal University, Dera Ismail Khan, Pakistan
*Email: atiqahmadalizai@gu.edu.pk

ABSTRACT

Climate change is likely to affect future winter chill and could have a major impact on fruit production especially temperate fruits by having increasing trends in winter temperatures and lowering the number of hours required for temperate fruit for successful growth. District Peshawar is famous for Apricot, Peaches, and Plums that need specific chilling hours to break the dormancy and initiate flower in the spring. The production of various varieties grown for a long period in the valley has been declined and a significant reduction has been recorded in the area and production of these fruits. Climate change is resulting in increasing temperatures throughout the world and the same is being witnessed in Pakistan as well. Temperate fruits are considered to be the most affected horticulture crops having the risk of lowering chilling units in changing scenarios of climate. The current study has been carried out to look into the climate effects on the changing pattern of temperatures in the valley of Peshawar and its impact on the production of low chill cultivars of Apricot, peach, and plum. Weather data for the last twenty (20) years have been compiled and studied by adopting specific models to calculate the chilling units in the valley for the last two decades. The paper includes changing scenarios of climate for all months of winters and summer from 2001 to 2019 and its impacts on the production of temperate fruits cultivated in Peshawar. Increasing trends in temperatures and decreasing chilling units observed have been presented and discussed. The current study would help plan better

strategies for the temperate zones of the country that produce a large number of fruit species for major parts of the country.

ETIOLOGY OF FUNGAL LEAF SPOTS IN LADY PALM (*RHAPIS EXCELS*) IN PUNJAB PAKISTAN

Shahid Javed[1], ***Imran Ul haq**[1], Siddra Ijaz[2], and Nabeeha Aslam Khan[1]

[1]Fungal Molecular Biology Laboratory, Department of Plant Pathology University of Agriculture Faisalabad
[2]Centre of Agricultural Biochemistry and Biotechnology, University of Agriculture Faisalabad
*Email: imran_1614@yahoo.com

ABSTRACT

Palm trees are widely cultivated and well-known member of the plant family. Ornamental palms are extensively used for landscaping due to their glorious and unique appearance, this property enhances their economic importance. Lady palm is also known as bamboo palm, having green colored finger-shaped leaflets. China and Taiwan are native regions of lady palm but now widely present in tropical and subtropical regions of the world. In landscape areas, good health and production of palms is a great challenge because palms are affected by biotic and abiotic factors which cause severe economic losses. Fungal diseases have highly destructive effects on the vigor of the plant. The research was conducted to determine the etiology of fungal leaf spot disease in lady palm. For this purpose, surveys of nurseries, gardens, parks, and greenbelt of districts Kasur and Faisalabad were conducted. Documentation of disease prevalence was done with maximum disease incidence as 45.75% recorded in district Faisalabad. Symptomatic leaves were collected and brought to the laboratory for further processing. Fungi associated with diseased leaves were isolated on potato dextrose ager medium under aseptic conditions. Frequently isolated fungus was *Pestalotiopsis spp* as 70% followed by other fungi. *Pestalotiopsis spp* was characterized on a morphological basis showing typical characters such as 3-5 celled spore with the thick outer wall as compare to septations, having anterior and posterior appendages. *Pestalotiopsis spp* was confirmed as a pathogen by the completion of Koch's postulates under greenhouse condition.

EFFICACY OF SOME PLANT ESSENTIAL OILS AGAINST *ALTERNARIA ALTERNATA* CAUSING FRUIT ROT OF GRAPES

***Gulshan Irshad**[1], Awais Sajid[1], Salman Ghuffar[1], Farah Naz[1], Gull-e-Laala[1], Muhammad Farooq Aslam[1], and Imran Hassan[2]

[1]Department of Plant Pathology PMAS-Arid Agriculture University Rawalpindi, Pakistan
[2] Department of Horticulture PMAS-Arid Agriculture University Rawalpindi, Pakistan
*Email: gulshan.irshad@uaar.edu.pk

ABSTRACT

Alternaria fruit rot (ALR) caused by *Alternaria alternata* is a serious threat to market values of grapes in Pakistan during post-harvest stages, handling, storage, transportation, and distribution respectively. The objective of this study is to determine the antifungal activities of some plant essential oils against *Alternaria alternata* causing fruit rot of grapes. For this purpose, three selected plant essential oils (PEOs) viz. Thyme (*Thymus vulgare*), Fennel (*Foeniculum vulgare*) and Ginger (*Zingiber officinale*) essential oils at 0.06, 0.08 and 0.1 % concentrations were investigated by using three methods viz. Contact assay method (CAM), Fungal culture transfer (FCT), Well diffusion method (WDM), Spore germination assay (SGA) under in vitro condition as well as application on grapes bunches. Results showed that Thyme essential oil (TEO) at all concentrations showed significant result to inhibit the mycelial growth (89.4, 92 and 96.2 percent) in contact assay method (CAM) followed by 96.2, 97 and 98.2 % growth inhibition in fungal culture transfer (FCT) method, 32%, 41% and 48% growth inhibition in well diffusion method at 7th day of incubation. Moreover, results related to spore germination assay revealed that Thyme essential

oil at 0.06, 0.08 and 0.1 % showed significant inhibition of germ tube length of *A. alternata* (140.8 µm, 77.5 µm, and 34.1 µm) as compared to control in which germ tube length was recorded 250 µm respectively. Thyme (EO) was further investigated for the presence of anti-fungal compounds viz. terpene, alkaloids, phenolic and saponins using standard protocols and found positive due to the presence of all compounds. During the application of Thyme essential oil at 0.1 % concentration on fruit bunches for the determination of decaying percentage. The result showed 12.53% decay caused *A. alternata* on treated bunches up to six days of storage and control was 85.14% calculated. It was concluded that Thyme (EO) has a great potential to inhibit the growth of *A. alternata* and may be used as a potential candidate for preservation and extension of shelf-life of grapes commercially.

SCREENING OF CHEMICALS AND BIO-CONTROL AGENT AGAINST PATHOGENS OF ORNAMENTAL PLANTS

Bushra Tabassum[1], ***Muhammad Usman Raja**[1], Tariq Mukhtar[1], and Farid Asif Shaheed[2]

[1]Department of Plant Pathology, PMAS-Arid Agriculture University, Rawalpindi
[2]Department of Entomology, PMAS Arid Agriculture University, Rawalpindi
*Email: usman2012@uaar.edu.pk

ABSTRACT

Though, ornamental plants cultivation seeing a boom period in Pakistan but pathological studies of ornamentals plants in the country are still in a juvenile phase. Therefore, the present study was planned to isolate, identify and in-vitro screening of pathogens associated with different ornamental plants. During study six pathogens viz. *Diplocarbon rosae* (Rose), *Alternaria alternata* (Rose), *Stagonospora curtisii* (Amarylis), *Fusarium oxysoprum* gladioli (Gladiolus), *Cercospora ruscicola* (Ruscus hypophyllum), *Cercospora fisci* (Ficus elastic) were isolated and identified based on morphological characters. Trichoderma sp. showing antagonistic activity in the soil sprinkling method was used in dual culture assays. Percent growth of inhibition (PGI) was calculated by using formula. Data of the study revealed that maximum PGI was found against *Alternaria alternata* (80.38%). PGI also found in other pathogens viz. Fusarium oxysoprum gladioli (46.56%), *Diplocarbon rosae* (51.61%), *Cercospora ruscicola* (58.36 %) , *Cercospora fisci* (60.36%), *Stagonospora curtisii* (61.53%). Food poisoned technique was used to study the effectiveness of fungicides (Topsin-M, Dithane M-45) and chemicals (Copper sulphate) against ornamental plants. Fungal cultural discs were put on media plates containing respective chemicals. Media plates without chemicals were considered as a positive control. Data showed that both fungicides and copper sulphate reduced growth but effectiveness varies from pathogen to pathogen. Topsin- M was found most effective against Cercospora fisci (79.06%). Dithane-M was found most effective against *Cercospora ruscicola* (62.79%), *Cercospora fisci* (62.79%). Copper sulphate found best against *Alternaria alternata* (80%) followed by Cercospora fisci (72.09%). It is plausible to mention that among Topsin-M, Dithane M-45 and Copper sulphate, copper sulphate gave the best results. The results of the study showed that ornamentals plant vulnerable against pathogens but can be controlled by safe applications of *Trichoderma sp*. and copper sulphate.

SHORT-TERM EXPOSURE TO OZONE AND ULTRASOUND INHIBITS DECAY AND DETERIORATION IN FRUIT QUALITY OF COLD-STORED STRAWBERRIES

***Ayesha Maryam**[1], Raheel Anwar[1], Aman Ullah Malik[1], Inam ur Raheem[2], Ahmad Sattar Khan[1], Basharat Ali Saleem[3], and Sajid Aleem[4]

[1]Institute of Horticultural Sciences, University of Agriculture, Faisalabad, Pakistan
[2]National Institute of Food Science and Technology, University of Agriculture, Faisalabad, Pakistan
[3]Department of Agriculture (Extension) Jail Road Sargodha, Pakistan
[4]Department of Plant Pathology, University of Agriculture, Faisalabad, Pakistan
Email: maryam.ayesha_22@rocketmail.com

ABSTRACT

Inappropriate use of insecticides and fungicides during the production of freshly consumed fruits and vegetables pose a serious threat to human health. This dilemma is worse in strawberry as succulent plants are heavily sprayed even during harvest season (multiple picking) and fruits are immediately consumed due to extremely short shelf life

in the absence of a cool chain system. So, decontamination and disinfection of strawberries before consumption is imperative. Here in this study, the efficacy of ozone and ultrasound to surface decontaminate and disinfect strawberries was tested and the impact of these eco-friendly technologies on fruit quality during cold storage was evaluated. Strawberries were treated with ozone and ultrasound for 0 (control), 1, 2 and 3 minutes and stored at 2°C and 90-95% relative humidity for further assessment on alternate days. Microbial contamination and pesticide residues were significantly reduced with short-term ozone and ultrasound treatment. Reduction in fruit decay, weight loss, and pigmentation while a delay in a temporal change in sugar: acid ratio, ascorbic acid, and organoleptic attributes during storage were positively correlated with an exposure time of strawberries to ozone and ultrasound. Total anthocyanins in strawberries were not influenced by ozone and ultrasound treatment. Enzyme activity assays showed that textural soundness of strawberries for an extended period was partially due to a significant decrease in the activity of major cell wall hydrolyzing enzymes, especially during the later storage period. Overall, the marketable volume of strawberries treated with ozone and ultrasound for 3 minutes was 29% higher than untreated strawberries after 12 days in cold storage. These findings suggest that short-term treatment of ozone and ultrasound may not only be used to reduce decay but also to maintain quality attributes in strawberries, and possibly other freshly consumed fruits and vegetables.

MOLECULAR STUDY OF ABNORMAL FLOWER DEVELOPMENT IN 16SR-IX GROUP PHYTOPLASMA INFECTED *BRASSICA COMPESTRIS*

***Samina J.N. Ahmad**[1,2], Samia Yasin[1], and Jam Nazeer Ahmad[1]

[1]Plant Molecular Biology and Biotechnology Laboratory, Department of Botany, University of Agriculture, Faisalabad, Pakistan
[2]Integrated Genomics, Cellular, Developmental and Biotechnology Laboratory, Department of Entomology, University of Agriculture, Faisalabad, Pakistan
*Email: saminatmalik@uaf.edu.pk

ABSTRACT

Phytoplasmas are phloem-limited, uncultivable, plant pathogenic bacteria. They are transmitted by insect vectors from infected to healthy plants. In this study, Phytoplasma belonging to the 16Sr-IX-H group causes developmental abnormalities (phyllody, virescence, yellowness, and stunted growth) in *Brassica campestris* affecting normal flower formation that were closely associated with changes in the expression of flower developmental genes. The alteration in the expression of developmental genes and its association with DNA methylation was investigated as a possible mechanism. Brassica plants were infected with phytoplasma using insect vector, *Orosious orientalis*, and grafting. The study was carried out through RT-PCR, Southern blotting and Bisulfite Sequencing. Transcriptional expression of methylated genes particularly orthologous to Arabidopsis APETALAs involved in petal and stamen formation during flower development was found to be globally down-regulated in plants infected with phytoplasma. The DNA methylation status of flower developmental gene in phytoplasma infected plants with 5-azacytidine restored gene expression suggesting that DNA methylation was involved in the down-regulation of floral development genes.

OPTIMIZATION OF CURING TECHNIQUE FOR LONG TERM STORAGE OF SUMMER HARVESTED ONION

Hira Amin[1], ***Muhammad Muzammil Jahangir[1]**, Aman Ullah Malik[1], Raheel Anwar[1], Mahmood Ul Hasan[1], Khurram Ziaf[1], and Habat Ullah Asad[2]

[1]Institute of Horticultural Sciences, University of Agriculture, Faisalabad, Pakistan
[2]CAB International (Central and West Asia) Rawalpindi, Pakistan
*Email: muzammil_jahangir@hotmail.com

ABSTRACT

The present study was aimed at evaluating the effect of curing technique for summer harvested onion crops on post-harvest storage quality. Onion crop cv. Phulkari was harvested at commercial maturity, field cured (for curing, onion plants with intact leaves were uprooted and placed in windrows for two weeks till their leaves dried off and then cut

down near to neck) and transferred to Medicinal and Mushroom Lab, IHS, UAF. Onion bulbs were then sorted into disease and blemish-free, separated in two treatments (T0= Non-Cured, T1=Cured) in triplicate and stored at ambient conditions (35 ± 5 ºC) for two months. Parameters i.e. weight loss, black mold, rotting, fungus, TSS, and marketable bulbs % were estimated at 15 days' interval. The experiment was performed in a completely randomized design (CRD) with the factorial arrangement. In cured onions, physiological weight loss was significantly reduced followed by minimum disease incidence i.e. black mold (%) and physical rotating after 60 days of storage at ambient conditions. Most importantly, marketable bulbs (%) were 15% higher in cured onion as compared to onion stored without field curing.

PHENOTYPIC CHARACTERIZATION OF COLCHIPLOID GERMPLASM IN MEXICAN LIME (*CITRUS AURANTIFOLIA* L.)

Bilquees Fatima, Arooge Fatima, *Muhammad Usman, and Shumaila Butt

Plant Tissue Culture Cell, Institute of Horticultural Sciences, University of Agriculture, Faisalabad-Pakistan 38040
*Email: m.usman@uaf.edu.pk

ABSTRACT

Mexican lime is an important member of acid limes and is popular due to nutritional, medicinal and culinary properties. Despite the increase in lime consumption, its production share in the citrus industry is negligible. Further, climate change is leading towards abiotic stress and polyploids offer higher heterozygosity and abiotic stress tolerance compared with diploids. Various strains of Mexican lime were screened for phenotypic and fruit quality attributes for the selection of better strains. Strain M_4 had more fruit size (43.62 mm length and 30.71 mm diameter), fruit weight (36.84 g), rind thickness (3.47 mm) and TSS (10.28 °Brix). A minimum number of seeds (3.0) and maximum TA (7.76 %) was found in M_{12}. Seeds of promising strain (M_4) were treated with different levels of colchicine and phenotypic variability was observed. Seed germination was higher in the untreated control (66.67%) and was reduced at 0.1% colchicine to 36.11%. Leaf size and the number of leaves increased at a higher level of colchicine (0.1%), however, shoot length (7.24 cm) and internodal distance (0.56 cm) was reduced. Cytogenetic characterization of putative polyploids is in progress which will help to develop diverse germplasm for future breeding programs.

PLANTS, AS AN AIR FRESHENER, EFFECTS THE HUMAN PSYCHOLOGY AND PHYSIOLOGY

***Amira Saleem Sindhu**, Khadija Iqbal, Muhammad Umer, Ghulam Junaid, Saba Liaquat, Ali Hamza, and Asia Parveen

Institute of molecular biology and biotechnology, The University of Lahore
*Email: asia.parveen@imbb.uol.edu.pk

ABSTRACT

Plants play a significant role as natural filters of the ecosystem. They are also good mood enhancers by mitigation of adverse health effects of indoor pollution. In the light of above values present project is designed to investigate the psychological and physiological effects of indoor plants on human health performance. For this purpose, some commonly available plants like Aloe Vera, Spider plant, Money plant, and Bamboo palm were selected. 50 individuals of age (13-15 years) group were selected by approval of governing bodies from a well-known government school located on the main busy road of Lahore city. Parameters like Focus test, time duration, blood pressure, and impulse rate were measured before and after the placement of selected plants at specific locations in school boundaries. The pre and post values of all parameters were recorded. The comparison of pre and post values was done by using a paired t-test. The outcomes of the analysis showed that participants took 16 minutes and 32 seconds to complete the pre-focus test with an average score of 8.54. After air freshener therapy by selected plants for 7 days' participants took 11 minutes and 54 seconds for post focus test with average score 11.22. Similarly, blood pressure values of participants recorded as pre and post 114.66/82.8mmHg and 108.88/76.38mmHg respectively**.** The value of pulse rate recorded as pre and post was 85.1BPM and 75.92BPM respectively. Significant differences were observed in all parameters. It is concluded from the analysis that plants have a significant impact on physiological and psychological human activities. So we can say plants are a cost-effective solution to air

pollution. We should do practical measures for public awareness regarding the beneficial effects of indoor plants. They cannot only purify the air but also enhance positive impulses in human health.

ESTIMATION OF ESSENTIAL MINERAL ELEMENTS FROM DIFFERENT GRAPE (*VITIS VINIFERA* L.) GENOTYPES COLLECTED FROM POTOHAR REGION (SALT RANGE) OF PAKISTAN

***Kashaf Ramzan**, Rashad Waseem Khan Qadri, Muhammad Tahir Akram, Khalid Hussain, and Umais Asghar Khan

Institute of Horticultural Sciences, University of Agriculture Faisalabad, Pakistan.
Email: Kashaf.ramzan12@gmail.com

ABSTRACT

Grapes (Vitis vinifera L.) are considered highly nutritious fruit due to the presence of minerals, carbohydrates, vitamins, and several biochemical compounds. The present study was conducted to evaluate the concentration of macro and microelements from some cultivated grape genotype (Flame Tokay, Italia, Gola, Taifi, Gol, White Seedless, Kishmish, Sundar Khani, Red Globe, Flame Seedless, Sahebi, Chassless-B, BRI-001, and Superior) successfully grown in the Potohar (salt range) region of Pakistan. Atomic absorption spectroscopy (AAS) technique was used to evaluate the concentration of macro and microelements from grapes juice. Among macronutrient elements, potassium (K) was highest in genotype Taifi (3400 µg/100 ml) while nitrogen content was rich in genotype Vitro Black (180 µg/100 ml). Iron is a trace element and plays a key role in hemoglobin formation was found highest in the Red Globe genotype (323.92 µg/100 ml). Other microelements were present in the descending order Mn > Cu > Zn > Co in all genotypes. Grapes found in the Potohar region were enriched with all essential elements which are required for proper health.

PHYSICO-CHEMICAL AND NUTRACEUTICAL EVALUATION OF LEMNA MINOR L.

*Afshan Abdul raheem[1], Mehwish Jaffer[1], Romisha Aslam[1], and Atiq-ur –rehman[2]

[1]Department of Botany, Lahore College for women university
[2]Government College University, Lahore Pakistan
*Email: shabnum_shaheen78@hotmail.com

ABSTRACT

Lemna minor L. belongs to the family *Lemnacae* is considered as a nutrient-rich plant with a high percentage of bioactive compounds. In the following study, the *Lemna minor* L. plant was analyzed for its nutritional, phytochemical activity and mineral content. The nutritional analysis was conducted on a powdered sample of the *Lemna minor* L. by using different drying techniques (sun-dried, oven-dried, freeze-dried and shade dried). The high protein content was found in the oven-dried samples (34.43%) and the lowest was observed in the fresh samples (5.93%). The high fiber content was in the oven-dried samples (24.01%) and lower in the fresh samples (1.32%). The maximum moisture content was examined in the fresh samples and lowest in the fresh samples 87. 94%. The calculated percentage of fat, ash, and fiber was between 1.57% to 8.48%, 1.21% to 14.81% and 2.03% to 17.50% respectively. While conducting the qualitative analysis of the phytochemical analysis of the plant the phenols, tannins and flavonoids, steroids, saponins, and alkaloids were detected in the methanol, acetone, n-hexane, dichloromethane, chloroform and distilled water extracts of the *Lemna minor* L. plant. The total phenolic concentration of *Lamina minor* L. plant by spectrophotometric analysis of six different solvent extracts range from 12.67±0.39 (in Distilled water) to 25.64±0.4 (in methanol) and the total amount of tannins ranges from 80.1±1.21 to18. 58±2.45 in the methanolic and dichloromethane respectively. The flavonoid content varies from 15.09±0.18 (in methanolic extract) to 5.26±0.05 (in distilled water extract). Six different minerals were quantified by using different drying techniques. The highest calculated mineral content was observed in the freeze-dried samples phosphorus (31.75±0.25 mg/100g), Potassium (54.5±1 mg/100g), Magnesium (18.25±0.25), calcium (3±1, 4.4±1),

sodium (1.52±0.02 mg/100g) and manganese (1.52±0.02 mg/100g). Due to the presence of valuable nutrients and bioactive compounds *Lemna minor* L. can be used as a low-cost alternative to human as well as animal feed and the presence of phytochemical make this plant medicinally important.

EFFECT OF ASCORBIC ACID ON PERICARP BROWNING, BIOCHEMICAL QUALITY AND ACTIVITIES OF ANTIOXIDATIVE ENZYMES IN LITCHI

*__Muhammad Shafique__, Ahmad Sattar Khan, Aman Ullah Malik, Muhammad Shahid

UAF sub-campus Burewala-Vehari
Email:shafiqhort@hotmail.com

ABSTRACT

Postharvest pericarp browning reduces the quality and visual appearance of litchi fruit. Therefore, in this study influence of different ascorbic acid concentrations (0, 15, 30, 45 or 60 mM) on pericarp browning, biochemical quality, antioxidative and enzymatic changes in litchi cv. 'Gola' fruit under extended cold storage was investigated which has not been studied extensively. Fruit dipping in 45 mM ascorbic acid maintained higher anthocyanin contents by reduced browning index and fruit weight loss. Activities of antioxidative enzymes (SOD and CAT), level of TPC and total antioxidants contents were significantly higher in the peel as well as pulp tissues of 45 mM ascorbic acid-treated fruit. Whereas, activities of PPO in litchi peel and POD enzymes in the peel, as well as pulp tissues, were reduced in 45 mM ascorbic acid-treated fruit. Conclusively, the application of 45 mM ascorbic significantly delayed pericarp browning and maintained better quality of 'Gola' litchi fruit during cold storage.

GREEN TECHNOLOGIES FOR WASTEWATER TREATMENT

*__Sameen Fatima__[1], Shahbaz Nasir Khan[1], Abdul Nasir[1], and Umer Maqsood[2]

[1]Department of Structures and Environmental Engineering, Faculty of Agricultural Engineering and Technology, University of Agriculture Faisalabad, Pakistan
[2]Department of Food Engineering, Faculty of Agricultural Engineering and Technology, University of Agriculture Faisalabad, Pakistan
*Email: fsameen5@gmail.com

ABSTRACT

An increase in metals in solids, liquids, and gaseous toxic waste has different bad impacts due to a lack of improvement in toxic waste treatment. This has necessitated the design of different types of research works in water and wastewater treatment, industrialized wastewater management, groundwater, and maintain soil pollution at a minimal level. Simultaneously, increasing concerns about water sources are becoming a considerable matter, as only a small quantity of water has been seen all over the earth. Several expanding technologies have the know-how to modernize our world of commercialization. Advanced Treatment Techniques for Industrial Wastewater is an innovative collection of research that covers the different aspects of environmental engineering in running water and wastewater treatment processes with the different techniques and systems for pollution management. A number of them are present within the scope of improvement but there is negligence to firmly implement them in civilization, and all are favorable solutions to some very authentic challenges facing the planet. The term "Green Technology" is relatively new and has been slowly adopted over the most recent decades; emerald is the present-day system for a healthy life. This chapter illustrates different green technology challenges and their chance to enhance wastewater treatment technologies and trends toward progress.

ALUMINUM SULPHATE AND MALIC ACID HASTENS THE DISPLAY LIFE OF CUT FOLIAGE OF MAGNOLIA GRANDIFLORA

*Mohsin Bashir[1], Muhammad Asif[1], Hafiz Nazar Faried[2], Mahnoor Aslam[1], and Hashim Abbas[1]

[1]Institute of Horticultural Sciences, University of Agriculture, Faisalabad, 38040, Pakistan
[2]Department of Horticulture, Muhammad Nawaz Sharif University of Agriculture, Multan, Pakistan
*Email: mohsinbashir99@gmail.com

ABSTRACT

Southern Magnolia (*Magnolia grandifloria* L.) is a primitive evergreen tree as a basal angiosperm of the Magnoliaceae family. Its trunk and twisted branches are pleasant to behold even when bare and covered with snow and its subsequent canopy of elliptic leaves are bright green above with velvety rough surface underneath. Cut foliage with prolonged vase life is always preferred by the floriculturist for the assessment of quality. To preserve the best quality of foliage and to make them tolerant of the fluctuations in environmental conditions post-harvest application plays a pivotal role. To overcome this problem different chemical agents have been used to elevate the display life of various cut foliage. For this purpose, the ionic form of Aluminum sulphate and organic compound Malic acid in different concentrations will be interpreted in uniform cut stems of magnolia. Keeping because of this need, an experiment will be conducted to hypothesize the different levels of Aluminum Sulphate and Malic Acid (0,100,150,200,250,300 mg/L -1) as vase Solution. Data concerning following parameters like vase life, fresh mass, dry mass, stem bending, leaf curling, leaf quality, leaf wilting, day to start senescence, day to start abscission, the microbial count will be calculated. The experiment will belay out in Complete Randomized Design with three replications having three observational units in each treatment. The collected data will be analyzed statistically by using statistix 8.1 software.

ENHANCED MICROPROPAGATION IN STEVIA (STEVIA REBAUDIANA BERTONI)

Zahid Nazir[1], Bilquees Fatima[1], *Muhammad Usman[1], **Syeda Anum Masood Bokhari**[1], and Shumaila[2]

[1]Plant Tissue Culture Cell, Institute of Horticultural Sciences, University of Agriculture, Faisalabad-38040, Pakistan
[2]Department of Botany, University of Agriculture, Faisalabad
*Email: m.usman@uaf.edu.pk

ABSTRACT

Stevia is a naturally sweet herb grown as a substitute for sugar-producing crops. Its leaves have stevioside and have about 300 times more sweetness compared with other sugar-producing crops. Its seeds are small and poor in germination hence can't be used for mass propagation. Micropropagation offers efficient mass scale homogenous plant production in the desired genotypes. Hence, this study was aimed to enhance propagation efficiency using different plant growth regulators (PGRs). Days to shoot induction (SI) were reduced to 4.6-5.6 on media containing BAP and NAA compared with other PGRs. Shoot induction (%) increased with rising levels of PGRs, however, overall SI was higher in media containing BAP and NAA. Some shoots induced per explant were markedly higher (6 shoots/explant) at higher levels of BAP alone and BAP in combination with NAA (2.50 + 0.50 mgL -1). Shoot elongation, intermodal distance, number of leaves, plant fresh weight, plant dry weight, and leaf fresh weight were higher at higher levels of media containing BAP + NAA and BAP + IAA. Maximum root induction (83.33 %), a higher number of roots and root length were found on MS media supplemented with BAP and NAA (2.50 + 0.50 mgL -1). The multiplied plant material was acclimatized and transferred to a greenhouse for plant growth for further studies.

MORPHOLOGICAL CHARACTERIZATION OF GAMMA IRRADIATED GERMPLASM IN PHALSA

Hassam Tahir, *Muhammad Usman, and B. Fatima

Plant Tissue Culture Cell, Institute of Horticultural Sciences, University of Agriculture, Faisalabad-Pakistan 38040
*Email: m.usman@uaf.edu.pk

ABSTRACT

Phalsa (*Grewia subinaequalis* DC), locally called as Falsa, is a delicious summer fruit crop having valuable nutraceutical properties. It is dealt as a minor crop and with an annual production of 3978 tons and about 3.35 tons of per hectare yield. It is commercially propagated by seed, highly adaptable to diverse soil and climatic conditions and a suitable crop for cultivation under saline and drought conditions. There are two varieties of phalsa known as tall and dwarf and have little variation reported previously. Limited genetic diversity is available for selection and crop improvement. Gamma irradiation is a useful tool to induce variation and has many success stories in fruit crops. Hence, phalsa seeds were gamma-irradiated and higher seed germination (25%-30%) was observed in non-irradiated control seeds and seeds irradiated at 80-110 Gy. Plant height was more (7"-8") in seedlings irradiated at higher doses. The number of leaves was reduced at 50 Gy and 140 Gy, while the rest of the doses showed a higher number of leaves. Leaf size in treated plants was markedly greater than non-irradiated control. Significant growth variation was noted in young seedlings and further evaluation is in process. Such studies could be useful to generate genetically diverse germplasm for selection and breeding programs.

ENHANCED CLONAL MULTIPLICATION USING MINI CUTTINGS OF GUAVA

Bilal Ahmad Awan, Bilquees Fatima, and *Muhammad Usman

Plant Tissue Culture Cell, Institute of Horticultural Sciences, University of Agriculture, Faisalabad- Pakistan 38040
*Email: m.usman@uaf.edu.pk

ABSTRACT

Guava (Psidium guajava L.) is being commercially propagated through seeds in Punjab and there is a lack of commercially viable clonal propagation systems. Further, propagation by cuttings is handicapped by the availability of plant material in bulk for making cuttings and season dependent. Hence, juvenile mini softwood shoot cuttings (3"-4") of elite strains of 'Round' shaped guava cultivar having two to three nodes were treated with IBA or NAA and in different combinations with BAP. Cuttings treated with BAP and IBA (3mgL -1 + 2mgL -1) started sprouting in 8 days while sprout length was higher 14 cm in cuttings treated with BAP and IBA (3mgL -1 + 1mgL -1) and NAA (2mgL -1). Some leaves were maximum (10-12) in both treatments. Some branches per cutting (6-7) and some roots (4-5) were higher in cuttings treated with higher doses of IBA and NAA. Maximum root length 14 cm was noted in BAP and IBA (3mgL -1 + 2mgL -1). The rooted cuttings were maintained under standard growth room conditions and higher humidity till proper growth and later transferred to field. Such studies may help in enhancing clonal propagation efficiency and reduce the requirement of plant material for further propagation.

DEVELOPMENT OF DNA BARCODING SYSTEM FOR MOLECULAR IDENTIFICATION OF BROCCOLI (*BRASSICA OLERACEA VAR. ITALICAPLENK*)

Zeeshan Ali

Institute of Agriculture Sciences, University of the Punjab, Lahore
Email: zeeeshanali555@gmail.com

ABSTRACT

Broccoli (*Brassica oleracea varitalica Plenck*) is an annual vegetable as well as a medicinal crop with a significant amount of vitamin A, C, K, and glucosinolates. Glucosinolates are formed exclusively in most of the brassica species and play an important role to protect the plant against pathogens and insect pests. Myrosinase is an enzyme responsible for the breakdown of glucosinolates during food digestion in the absorption tract. Broccoli is grown more for medicinal purposes than a vegetable. The data for broccoli identification on a genetic level has not been generated except for one cultivar only. rbcL regions were sequenced in twenty-six broccoli cultivars that were collected from a different region of the world. The sequences were analyzed using SeqManII. Phylogenetic analysis showed that Sprouting Early White cultivars had a high similarity, while, Purple Sprouting Early cultivars had relatively less sequence similarity in the target region. Furthermore, the sample sequences were mined using BLAST (Basic Local Alignment Search Tool) in NCBI. Six cultivars had unique sequences having 92% to 97% similarity with *Brassicanapus and Brassica oleracea*var *capitates* respectively. In conclusion, the sequence data of the conserved rbcL gene can be used for DNA barcoding for the identification of species/cultivars.

INVESTIGATING VARIOUS INFECTIOUS PROTEIN IN SUGAR BEET BY USING THE GENE-EDITING TECHNIQUE

Muhammad Tayyab

Institute of Soil and Environmental Sciences, University of Agriculture Faisalabad, Pakistan
Email: muhammadtayyabuaf@gmail.com

ABSTRACT

The population of the world is increasing at an exponential rate and the burden of supplying food is more. To overcome this problem, innovative and quick technology is the best solution to cope with it. Clustered regularly interspaced short palindromic repeats (CRISPR/Cas 9) is an approach to create the targeted gene editing for improvements in the production of crops to cope with pest, disease and harsh climatic conditions. Genome editing is a technique for breeders, in which a guiding RNA directs a nuclease to generate a double-strand break at a target DNA, stimulating the cell repair systems eventually leading to deletion or insertion of nucleotides. It is a modern technology that helps to achieve many goals from basic science to the development of crops with bringing innovative solutions to food production and disease management. The beet necrotic yellow vein virus (BNYVV) based-vector helps to investigate different large proteins in leaf, stem, and root of an infected plant. It aids genomic research and expression of various proteins in sugar beet. However, CRISPR/Cas 9 is a quick toolbox through which we can suppress an infected or by the expression of the interesting genes in sugar beet and other related crops.

THE RESPONSE OF COSMOS GROWN ON DIFFERENT GROWTH MEDIA TO VARYING LIGHT INTERCEPTION

Nimra Khalid

Institute of agriculture sciences, University of the Punjab Lahore
Email: nmrkhalid@gmail.com

ABSTRACT

Study to determine the effect of the different growth media and a light interception on the growth of the Cosmos (*Cosmos bippinatus*) was carried out at Governor's house, Lahore. Garden soil, compost, and leaf manure were used as growth media under full sunlight, partial sunlight and full shade as light interception treatments. Data on germination rate, plant height, leaf area, leaves per plant, root length, fibrous root length, and stem diameter were recorded using standard principles and procedures. Collected data were subjected to Fisher's analysis of variance at 5 % probability and the means were separated by the Least Significance Difference (LSD) Test at α: 0.05. On the other hand, leaf length was increased by the full sun exposure and compost. Compost resulted in maximum leaves per plant which were statistically higher than that of leaf manure and garden soil. Minimum leaves per plant were found in the case of leaf manure which was statistically at par with those of garden soil. While root length and fibrous root length was increased by full sunlight. Stem diameter increased in compost and partial sunny conditions. The study leads to the conclusion that Cosmos performs well if grown in compost and provided with full sunlight under the agro-climatic conditions of Lahore.

ALOE VERA GEL COATING REDUCES OXIDATIVE STRESS, PREVENTS SOFTENING AND MAINTAINS THE POSTHARVEST QUALITY OF PERSIMMONS

Shahzad Saleem, *__Shaghef Ejaz__, Muhammad Akbar Anjum, Aamir Nawaz, and Safina Naz

Department of Horticulture, Bahauddin Zakariya University, Multan (60800), Pakistan
*Email: shaghef.ejaz@bzu.edu.pk

ABSTRACT

Aloe vera gel (AV-gel) is an environment-friendly, non-chemical and efficient plant-based product that has shown potential to be used as an edible coating on fresh fruits and vegetables. Therefore, in this study, AV-gel was applied as an edible coating to persimmon fruits and its effects on oxidative stress due to senescence, antioxidant enzyme

activities, fruit tissue softening and related quality attributes of persimmons were studied. The fruits of persimmon cv. Fuyu was coated with two AV-gel concentrations i.e. 0 and 50%. The coated fruits were stored at 20 ± 1 ºC and 85 ± 2% RH for 20 days. The results indicated that AV-gel coated persimmons had less moisture loss and electrolyte leakage along with a low concentration of hydrogen peroxide and malondialdehyde content compared to non-coated fruits. The coated fruits also showed higher enzymatic activities for superoxide dismutase, peroxidase and catalase, and ascorbate peroxidase activities. Furthermore, the coating suppressed activities of softening enzymes including pectin methylesterase, polygalacturonase, and cellulase. The coated fruits also had significantly higher vitamin C, titratable acidity, total phenolic, antioxidant activity, and total carotenoids, whereas sugars (reducing, non-reducing and total sugars) and total soluble solids were significantly lower in AV-gel coated persimmons than control. It is concluded that 50% AV-gel concentration conserves the quality of harvested persimmon fruit at 20 ± 1 ºC and 85 ± 2% RH.

SYNERGISTIC CROSSTALK OF DEFENSE-RELATED ENZYMES TO MOUNT THE APPROPRIATE DEFENSE RESPONSES AGAINST EARLY BLIGHT DISEASE OF TOMATO AFTER BASAL APPLICATION OF NUTRIENTS

Zoia Arshad Awan and Amna Shoaib

Institute of Agricultural Sciences, University of the Punjab, Lahore, Pakistan
E-mail: zoia.arshadawan@gmail.com

ABSTRACT

Alternaria solani is one of the most notorious fungal pathogens that causes the destructive early blight (EB) disease of tomato (*Solanum lycopersicum* L.). Direct application of pesticide is a perilous approach to control disease due to its residual effects, therefore manipulating crop nutrition is a holistic approach to mitigate EB disease by improving the resilience in plants against disease in the sustainable cropping system. Achieving this aim, the effects of basal fertilization of plant nutrients viz., nitrogen, phosphorus, potassium (NPK), zinc (Zn), magnesium (Mg) and boron (B) were investigated in suppressing EB. Pathogen infestation camouflaged cell mechanism and disturbed the regulation of key player enzymes (SOD, CAT, POX, PPO, and PAL) that weakened the plant immunity, therefore, the plants exhibited 100% disease incidence. Applied nutrients, reduced the EB disease by effective interference that leads to the induction of resistance in a host against pathogens to a variable extent. Zn proved strong co-factor for the activation of defense-related enzymes that ultimately managed the EB disease from 60-75% and significantly improved the plant growth and physiological attributes by 30-80% with the significant Pearson correlation among defense-related enzymes and total phenolic. The rest of the nutrients were not found effective in suppressing disease because the correlation among antioxidant enzymes probably did not facilitate intercellular communications to the desired level to boost up plant immune system.

EFFICACY OF DIFFERENT FUNGICIDES AGAINST PHYTOPHTHORA DRECHSLERI CAUSING COLLAR ROT DISEASE OF MUSKMELON IN FIELD CONDITIONS

*__Muhammad Kamran__[1], Muhammad Ehetisham ul Haq[1], Huma Abbas[2], Muhammad Umar Shahbaz[1], Waseem Abbas[3], Muhammad Iqbal[1], Shaukat Ali[1], and Muhammad Idrees[1]

[1]Plant Pathology Section, Plant Pathology Research Institute, Ayub Agricultural Research Institute Faisalabad 38000, Punjab, Pakistan
[2]Department of Plant Pathology, University of Agriculture Faisalabad, 38040, Punjab, Pakistan
[3]Vegetable Research Institute, Ayub Agricultural Research Institute Faisalabad, 38000, Punjab, Pakistan
*Email: muhammad Kamran; mkamran.uaf.pk@gmail.com

ABSTRACT

Muskmelon (Cucumis melo) is a creeping cucurbit and a popular crop with lots of medicinal values. Collar rot disease, caused by *Phytophthora drechsleri* is a serious constraint for muskmelon production. In current research seeds of T-96 variety were sown in the sick plot of an experimental area of Plant Pathology Research Institute, Ayub

Agricultural Research Institute (AARI), Faisalabad, Pakistan. Five different fungicides e.g., Ridomil Gold 72 WP (mancozeb + metalaxyl), Revus 250 SC (mandipropamid), Success (chlorothalonil + metalaxyl), Curzate (cymoxanil + mancozeb) and Nanok 25 SC (flutrifol + azoxystrobin)} were evaluated against the disease at 2.5g/L, 2.4 ml/L, 2.5g/L, 6g/L and 2.5 ml/L, respectively. In control treatment, simple water was applied. The experiment was laid out in randomized complete block design with three replications. Data was recorded on mortality of plants after 10 days of application of fungicides. Ridomil Gold significantly 74.70 % inhibited the disease over control while Success was significantly least effective against the disease. Revus, Nanok, and Curzate reduced the disease 61.81, 53.93 and 40.09 % respectively. The current research is useful to find out the most suitable fungicide against the collar rot disease of muskmelon.

USTILAGO SYNTHERISMAE A NEW SMUT FUNGUS OF CRABGRASS (DIGITARIA SANGUINALIS) FROM PAKISTAN

*__Maria Riaz__, Najam ul Sehar Afshan, and Abdul Nasir Khalid

Department of Botany, University of the Punjab, Lahore
*Email: mariariaz333@gmail.com

ABSTRACT

Digitaria sanguinalis (L.) Scop is an annoying annual weed present in most annual crops of summer. Its high densities in our fields cause severe yield losses. Its success in the field is its ability of high seed production. Ustilago (Pers.) Roussel is the genus of Ustilaginales that predominately affects the members of family Poaceae. There are about 300 species of this genus that are reported worldwide and are characterized by having olive-brown, agglutinated, medium-sized spores having verrucose and echinulated surface ornamentations. During the plant pathogenic surveys of the Himalayan moist temperate forests of Pakistan, plants of Digitaria sanguinalis were collected to be infected with smut fungus. After morpho-anatomical and molecular characterization this smut fungus is identified as *Ustilago syntherismae* (Schwein.) Peck, that is a new record for Pakistan. This fungus can be used as a biological control for the eradication of this troublesome weed that is causing yield losses in our crops.

EFFECT OF DRYING METHODS ON PHYSICOCHEMICAL AND MINERAL COMPOSITION OF MULBERRY FRUITS

***Ishtiaq Ahmad** and Muhammad Nafees

Department of Horticultural Sciences, Islamia University of Bahawalpur, Pakistan
*Email: ishtiaq@iub.edu.pk

ABSTRACT

Mulberry fruits (Morus alba and M. nigra) are highly nutritious that can be used to mitigate malnutrition of human beings, however, they have a very low shelf-life. The present study was aimed at the evaluation of different drying methods to improve shelf-life of dry mulberry fruits for their sustainable availability in the market for human consumption. For this purpose, common drying methods viz., sun drying, shade drying, and oven drying were applied on freshly harvested black and white mulberry fruits to evaluate the significant drying method with minimal nutritional losses. The fruit samples were collected from mulberry plants growing at the experimental area, The Islamia University of Bahawalpur, Pakistan. Analysis of variance showed a significant effect of drying methods on the fruit quality of mulberry ($p \leq 0.05$). There was a significant difference ($p \leq 0.05$) in fresh and dry fruit weight, fruit width and area, and Cu contents of both the species. Reduction in fruit weight, fruit area, and moisture percentage was significantly higher in the oven-dry method, followed by sundry with minimum reduction in shade dry method. The depletion in Cu and Fe contents was statistically high in the oven drying method, followed by shade dry and sun drying, respectively; however, Zn and Mn contents were not significantly affected by any drying method. Cu contents were significantly higher in black mulberry; however, Fe, Mn, and Zn were similar in both species. This study will serve in popularizing natural drying methods i.e. sundry and shade drying as well as medicinal use of fruit in the nutraceutical and herbal industry.

EFFECT OF HARVESTING MATURITY ON MARKET PERIOD OF HALMAN APRICOT

Haseena Batool [1]*, Nadeem Akhtar Abbasi [1], Umer Habib [1] and Zahid Ali Khan [2]

[1]Department of Horticulture, Pir Mehr Ali Shah Arid Agriculture University, Rawalpindi, Pakistan
[2]Agriculture Department Skardu, Gilgit Baltistan, Pakistan
Email: nadeemabbasi65@yahoo.com; haseenabatool12@gmail.com

ABSTRACT

Apricot (Prunus armeniaca) is extensively grown in Gilgit-Baltistan, Pakistan. There are 60 different known varieties of apricot. Halman is one of the sweetest variety but not very common for fresh marketing from Skardu to plain areas of Pakistan due to its perishable nature. The present study was conducted to evaluate the appropriate stage for harvest to overcome this problem. Fruits were harvested at three maturity stages M 1 (light green stage), M 2 (light orange stage) and M 3 (bright orange stage) based on skin color development 50%, > 50% and 80% respectively. For the evaluation, purpose fruits were harvested from the orchard of Agriculture Department Skardu and transported to Post-harvest laboratory, PMAS-Arid Agriculture University Rawalpindi where these were stored at room temperature for further analysis. Physical analysis such as fruit size, weight loss, and disease incidence and chemical analysis TSS, ascorbic acid, pH values, TA were carried out. The results from this research showed that loss in physical properties (size, weight) and disease incident were minima at M 2 as compared to M 1 and M 3. Fruits were firm at M 1 and turned very soft at M 3 with a high incidence of diseases. At early maturity (M 1; light green stage) the fruit remained in good firmness condition but the sugar level was below the consumer acceptability. Compare to M1 and M3 fruit harvested at M 2 maturity (light orange stage), it resulted in an acceptable sugar level and the storage life was also up to nine days. Hence, the M 2 stage of harvest can be considered as an optimum level (color break more than 50 %.) for Halman apricot. Similar work may be carried out on the other apricot varieties in the GB region to optimize the harvesting stage which will be beneficial to uplift the economy of this region.

NUTRIENT USE EFFICIENCY OF CHILIES PLANTS CULTIVATED WITH ACIDIFIED IRRIGATION WATER

***Muneeb Hashmi** and Muhammad Shafiq

Institute of Agriculture Sciences, University of the Punjab, Lahore, Pakistan
*Email: muneebhashmi28@gmail.com

ABSTRACT

The use of sulfuric acid as a soil amendment for the reclamation of calcareous sodic soils is thoroughly investigated in the literature. However, little information is available on the effect of rate and frequency of sulfuric acid drenching in irrigation water on growth and yield of vegetable crop plants cultivated in non-sodic calcareous soils. A pot experiment was conducted chili as a test plant with six levels of sulfuric acid viz. 0, 5, 10, 20, 40, 80 ppm applied once, twice or thrice with irrigation water. Various growth and yield parameters were observed during the growth period or at the final harvest. It was noted that sulfuric acid application significantly affected almost all growth and yield parameters of the chili plant. The acid drenching with irrigation water significantly reduced soil pH even at 5 ppm (equivalent to 10 kg ha-1) concentration maintained in irrigation water. Parameters like fruit number, fruit weight, and biological weight, rate of soil respiration, extractable soil phosphorus and soil EC were gradually increased with increasing rate frequency of H2SO4 drenching in irrigation water. These results need to be confirmed in field experiments by considering the economics of the practice and long term effects on soil nutrient status in various cropping systems.

IMPORTANCE OF NITROGEN (N) TO PHOSPHOROUS (P) PROPORTIONALITY OF NUTRIENT SOLUTION IN REGULATING THE GROWTH YIELD AND BIOCHEMICAL CHARACTERISTICS OF LINSEED (*LINUM USITATISSIMUM* L.)

***Mobeen Ali**, Muhammad Rashid, Muhammad Shafiq, Nosheen Tabassum

Institute of Agricultural Sciences, University of Punjab, Quaid-e-Azam Campus, Lahore, Pakistan
*Email: mobeenali303@yahoo.com

ABSTRACT

Linseed is an important oilseed crop having great medicinal importance. The effect of the rate of N and P fertilizers on linseed crops under various soil and environmental conditions is thoroughly investigated in the literature. However, little information is available on linseed plant responses to ratio. A hydroponic sand culture experiment was conducted to know the effect of N: P supply ratio maintained two nutrient levels on growth, yield and medicinally important components of linseed. N: P ratios developed in nutrient solutions were ranged from 2 to 18 at two levels i.e. high and low. Various growth and yield parameters were observed during the growth period or at the final harvest. It was observed that the nutrient supply level significantly affected almost all growth and yield parameters of the linseed plant. At a high supply level, the plants produced more biomass and medicinally important secondary metabolites and seeds with less oil content compared to that at a low level. Parameters like flower initiation time, several seeds per pod and total phenolics were not affected with the N: P supply ratio. At high supply level, N:P ratios 7 and 9 were found the best in improving different linseed plant parameters like shoot length, number of pods per plant, number of seeds per plant and weight of various plant parts. It is concluded from the results that a linseed plant with better quality seeds can be more successfully grown if N:P supply ratio is maintained at or near 7 in the growth medium. The effects of N: P supply ratio on growth, yield and medicinally important characteristics of linseed plant can be further explored
by varying the ratios at more than two nutrient levels.

GENOME-WIDE AND EXPRESSION ANALYSIS OF HEAT SHOCK PROTEIN IN CITRUS ROOTSTOCKS EXPRESSED TO ABIOTIC STRESSES

***Waqar Shafqat,** Muhammad Jafar Jaskani, Rizwana Maqbool, Ahsan Qureshi, and Safeer-uddin

[1]Institute of Horticultural Sciences, University of Agriculture, Faisalabad, Pakistan
*Email: waqar_shafqat@hotmail.com

ABSTRACT

Drought and high temperature are two major abiotic stress factors which are interlinked in nature in one or the other way, eventually affecting crop performance and yield negatively. The role of rootstocks in citrus is one of the most debatable and discussed issues and its selection plays a pivotal role in the planning of any citrus orchard. Hence the selection of rootstocks under changing climate is very challenging. Therefore, the current research was planned to evaluate the rootstocks against selected abiotic stresses *i.e.*, drought, heat and their combined stress. Four months old uniform seedlings of ten citrus rootstocks were selected for heat, drought and combined (heat and water) stress. Photosynthetic rate, stomatal conductance, and transpiration rate had an inverse relationship to stresses while an increase in the level of stress and duration decreased the gas exchange parameters. Brazilian sour orange and Keen sour orange among rootstocks showed a good performance against the selected stresses. Savage citrange proved the most sensitive to drought, heat and combined stress based on the gas exchange and plant water status. Heat shock proteins (CsHsp70 and CsHsp90) and Major intrinsic proteins (CsPIPs and CsTIPs) are heat and drought-responsive genes, respectively, in citrus. Members of MIP and Hsps shared the most similar gene structure and motif analysis among groups. Brazilian sour orange, the most tolerant rootstock, expressed the Hsps genes (CsHsp90, CsHsp70, and CsHsp70.1) against heat stress, MIPs (CsPIP2, CsTIP1, CsTIP2) against drought stress and both (Hsps and MIPs) against combined stress. Savage citrange exhibited little or no expression of selected genes under stresses with selected time points. It is concluded that Brazilian sour orange, tolerant against drought, heat and combined stresses, showed higher expression of selected genes against stresses. The commercial rootstocks (rough lemon and

sour orange) behaved moderately sensitive to these stresses. Savage citrange was considered as the most sensitive rootstock under both stresses.

QUALITY PERPETUATION AND SHELF LIFE ENHANCEMENT OF CUCUMBER (*CUCUMIS SATIVUS* L.) BY USING DIFFERENT MEDICINAL PLANT EXTRACTS AND SYNTHETIC CHEMICALS

***Harrem Khalid**, M. Moazzam Anees, Sadia Anwer, Subas Sajjad, Muhammad Mujtaba, and Tariq Manzoor

Institute of Agricultural Sciences, University of Punjab, Quaid-e-Azam Campus, Lahore Pakistan
*Email: harremkhalid@gmail.com

ABSTRACT

In this study, we investigated the shelf life enhancement and quality perpetuation of cucumber (Cucumis sativus) under the effect of medicinal plant extracts (Neem extract, aloe vera gel, and garlic extract) and synthetic chemical (CaCl2). The experiment was conducted under controlled conditions at 140C -250C, 65 % relative humidity for 20 days. The qualitative (color changes) and quantitative parameters (Percentage weight loss, pulp to peel ratio, titrate able acidity, ascorbic acid, total soluble solids, and pH) were monitored after every fourth day to assess coating effects. 30 % garlic extract solution was effective for controlling pH change (i.e. 6.3) as compared to control (5.5). garlic extract, 15 % neem extract and combination of both also exhibited good for controlling titratable acidity. 15 % aloe vera gel extract proved excellent to minimize percentage weight loss. Aloe vera gel in combination with CaCl2 enhanced the peel to pulp ratio more (3.80) as compared to control (3.67). CaCl2 in combination with neem extract increased Brix◦ value (i.e. 20) as compared to control (13). Generally, all treatments and their combinations proved excellent in minimizing post-harvest changes, however, the interaction of neem with aloe vera gel and garlic extract was superior among all for the quality perpetuation and shelf life extension of cucumber up to 8 days as compared to control.

METAXENIAL EFFECTS ON BIOCHEMICAL ATTRIBUTES OF DATE PALM CV. HILLAWI

***Maryam** [1], and Muhammad Jafar Jaskani[2]

[1]Department of Botany, Government Sadiq College Women University, Bahawalpur, Pakistan
[2]Institute of Horticultural Sciences, University of Agriculture, Faisalabad, 38040, Pakistan
*Email:maryamuaf1472@gmail.com

ABSTRACT

Date palm (*Phoenix dactylifera* L.) has been an important crop in the desert regions of Asia and North Africa for centuries know adopted in many countries. Date palm (2n=36) is dioecious monocotyledonous belonging to *Arecaceae* family. Fertilization and fruit set are consequences of pollination as there is an interesting but uncommon effect known as metaxenia, the direct influence of pollen on maternal tissues of the date palm. As pollen grains caused the great diversity and variations in size, quality and ripening time so 9 different pollen sources were selected to study the differential behavior of pollen parents on fruit characteristics of female cultivars i.e Hillawi. The fruit was harvested at Khalal stage from controlled pollinated treatments and biochemical analysis was carried out to study the metaxenial effect of different pollen. Biochemical characters, total sugars, DPPH, ascorbic acid, total phenolic contents, total soluble solids, total proteins, sucrose, glucose, fructose, and enzymatic activities (peroxidase, catalase, superoxidase, and protease) were highly variables. Data regarding all biochemical characters were analyzed statistically using the two-factor factorial in Randomized Complete Block Design (RCBD) that showed the significant differences in all variables. Duncan multiple range tests was used to discrete the means (using the statistica 9.1) revealed that different pollen sources respond variably. Among 9 pollen sources, M8

(Sq.no. 32) was superior because it was positively associated with most of the variables. M7 (collected from Uni campus) retained the highest capability for ascorbic acid and reduced ripening time. For a more positive correlation of pollen parents, M8 was followed by M7, M3, M5, and M4. A strong positive correlation was found among most of the traits. All the new combinations developed from pollinating the 2 date palm cultivars with 9 pollen sources were categorized by principal component analysis. The morphological and biochemical dendrogram generated from Wards method can distinguished these combinations into 3 clusters for cultivar Hillawi. Our results showed that biochemical traits (using XLSTAT software) were very appropriate for studying the metaxenail effect that can be used for further breeding targets as economically very important regarding yield and quality.

POSTHARVEST MANAGEMENT OF FRUIT AND VEGETABLES: A POTENTIAL TO ENSURE FOOD SECURITY

***Safeer Ahmad**[1], Hafiz Nabeel Ahmad[2], Ghayyoor Ahmad[3], and Muhammad Saad Akram[2]

[1]National Institute of Food Science and Technology, University of Agriculture, Faisalabad
[2]National Institute of Food Science and Technology, University of Agriculture, Faisalabad
[3]Institute of Animal and Dairy Sciences, University of Agriculture, Faisalabad
*Email: safeerahmad902@gmail.com

ABSTRACT

Fruits and vegetables (FV) are a super source of micro-nutrients. However, they immediately start to deteriorate after harvesting as FV is highly perishable and continuously respire and susceptible to spoilage by itself and microorganisms. Infected FV poses health risks along with economic losses. It is reported that a major portion of the FV produced is wasted before reaching to end consumer. In a civilized world, when millions of people go hungry, it would be a crime to allow spoilage of food to continue. Agriculture projects proceed their aim to improve nutritional status and income of the family, however, improving production without improving in post-harvest management may not mitigate food security issues. Postharvest losses introduced quantity and quality reduction of food crops at harvest, shipping, processing, storage and advertising before utilization. Lack of information on postharvest management technology has posed different economic and food scarcity problems among them that are effective for hidden hunger, poverty, and undernutrition. Postharvest loss depletion and consumption have significant tolerance on food availability. It has been known that food loss reduction is less costly as compared to equivalent increases in food production and less hazard to the environment. Considering the existing food production, reduction of postharvest losses is essential in ensuring food availability. Postharvest technologies as temperature management, controlled maturing, edible coating, and using chemical are potent tools to minimize FV post-harvest losses, improve food security and reduce poverty in developing countries throughout the globe.

FEEDING BEHAVIOR AND TOXICITY OF DIFFERENT INSECTICIDES AGAINST *BACTROCERA ZONATA* (DIPTERA: TEPHRITIDEA) UNDER LABORATORY CONDITION

***Noshin Tariq**[1], Muhammad Ahsan Khan[2], Muhammad Ashfaq[2], Asim Abbasi[2], Muhammad Dildar Gogi[2], Muhammad Ibrahim Shahid[2], and Mubashar Iqbal[2]

[1]Department of Zoology, Wildlife, and Fisheries, University of Agriculture Faisalabad, Faisalabad
[2]Department of Entomology, University of Agriculture Faisalabad, Faisalabad
*Email: drmakhanz@yahoo.com

ABSTRACT

Peach fruit fly (*Bactrocera zonata*) is one of the most damaging fruit pests in tropical, subtropical and temperate regions of the world including Pakistan. This pest damages a wider range of host plants by feeding on the pulp of fruits such as mango, citrus, peach, apricot, and guava. The current study was designed to evaluate the contact

toxicity of seven different synthetic insecticides viz. Deltamethrin, Emamectin benzoate, Trichlorfon, Lambda-cyhalothrin, Dimethoate, Permethrin and Imidacloprid against *B. zonata*. Additionally, the feeding behavior of *B. zonata* was also assessed under laboratory conditions. A free choice experiment was conducted to check the host preference of fruit fly using four different host plants viz. guava, mango, peach, and apple. The results regarding the host preference of fruit fly showed that a maximum number of eggs was found in mango (123.33 per 500 grams of fruit) and the lowest number of eggs was found in apple (32.66 per 500 grams of fruit). Similarly, the highest number of larvae and pupae were found in mango fruit (115.67 and 105.67 per 500 grams), while the lowest number was found in apple (23.66 and 13 per 500 grams). Similarly, maximum adult emergence was observed in mango (101 per 500 grams) while minimum emergence was observed in apple (11.66 per 500 grams). Similarly, among tested insecticides, maximum mortality of fruit fly adults was observed in the case of emamectin benzoate (100%) followed by Lambda-cyhalothrin (85.5%).

INTEGRATED PEST MANAGEMENT (IPM) TECHNIQUES FOR THE MANAGEMENT OF FRUIT FLY (*DIPTERA: TEPHRITIDEA*) AT GUAVA ORCHARD

***Muhammad Ashfaq**[1], Muhammad Ahsan Khan[1], Asim Abbasi[1], Muhammad Ibrahim Shahid[1], Mubashar Iqbal[1] Muhammad Dildar Gogi[1], Ameenullah[1], and Waqar Shafqat[2]

[1]Department of Entomology, Faculty of Agriculture, University of Agriculture Faisalabad, Faisalabad
[2]Institute of Horticultural Science, Faculty of Agriculture, University of Agriculture Faisalabad, Faisalabad
*Email: drmakhanz@yahoo.com

ABSTRACT

Tephritid fruit flies are the major biotic limiting factor of fruits and vegetable production causing estimated annual yield losses of about $ 200 million in Pakistan. In the current study effectiveness of different control methods i.e. insecticide (Diptrex), baiting (Spinosid), cultural and Integrated Pest Management (IPM) were compared against fruit fly. In cultural practices, we applied hoeing, ploughing and picked the discarded fruits from the orchards while in IPM

approaches all the above-mentioned techniques were used in an integrated fashion. The data regarding percent infestation was recorded at fortnight intervals by selecting five random trees from each selected orchard. The infestation was recorded with the help of a square meter iron ring. The results revealed that among all tested control measures, maximum yield (35 and 34 kg/plant) was obtained in IPM and insecticides treatment with minimum percent infestation (2 and 2.5%) respectively. Besides, untreated check, minimum yield (30 kg/plant) and maximum percent infestation (4.5%) were recorded in bait application treatment. Our results suggest that IPM approaches can be considered as an eco-friendly approach to control fruit fly therefore foreseen a logical control measure for sustainable pest management.

INFLUENCE OF SILICON NANO-PARTICLES OF *AVENA SATIVA* L. TO ALLEVIATE THE EFFECT OF *RHIZOCTONIA SOLANI*

Faiza Ahmed, ***Khajista Jabeen**, Sumera Iqbal, and Tooba Shafiq

Department of Botany, Lahore College for Women University, Lahore, Pakistan.
*Email: khajista_1@hotmail.com

ABSTRACT

Avena sativa L. commonly known as Oat is an important cereal crop worldwide. This important crop is badly affected by several abiotic and biotic stresses. Among biotic stress, root rot disease caused by *Rhizoctonia solani* Kuhn produces adverse effects on *A. sativa*. In the current study the silicon nanoparticles are used to mitigate the harmful effects of *R. solani* on the growth of *A. sativa*. To achieve this goal various in vitro as Petri plate and in vivo as pot experiments were conducted to test various biochemical and physiological parameters like chlorophyll, sugar,

proline content, relative osmotic potential, growth parameters, fresh and dry weight, and disease index. All the treatments with three replicates. The fungal suspension was prepared by using the fresh culture of *R.solani* and seeds were soaked in it for 3 hours and nano-silica of 1.5 mM concentration was applied in both experiments for the treatments they were required in. Results concluded that all the investigated parameters such as germination %age and rate, root and shoot length, fresh and dry weight, chlorophyll and carotenoid content, seed vigor, plant height, the number of pods, the number of seeds per pod, 100 seed weight, membrane stability index and relative water content were reduced under fungal stress as compare to control group, while silicon gave a very positive result close enough to control group and also helped to alleviate the negative effect caused by fungus by increasing the yield up to 40% but levels remained significantly lower than control. Thus silicon nanoparticles were potentially effective against root rot of oats can be used to evaluates the potential for improving plant resistance by modifying Si fertilizer inputs, but further studies on its efficacy under field conditions and improving its synthesis characters are needed.

A REVIEW- SYNTHESIS OF SILVER NANOPARTICLES THROUGH CROPS AND APPLICATION OF NANOPARTICLES IN AGRICULTURE

Sadia Yasin

Department of Botany, Minhaj University Lahore, Lahore, Pakistan
Email: sadia.dcn@mul.edu.pk

ABSTRACT

The use of nano-particles has a great impact on the economy through effective application in agriculture. In the modern era, one of the emerging nanoparticles is silver nanoparticles. Various studies have been done and many are going on to enumerate the role of silver nanoparticles in agriculture. Silver nanoparticles can enhance the growth and yield of wheat. The highest germination rate of corn was observed by using a dose of 1.5 mg/ml of AgNPs. Apply a dose of 40 ppm and 80 ppm can increase the number of roots of saffron spice. The best and economical method to synthesize the silver nano-particle is by the utilization of cotton leaf extract at room temperature without using any chemical. The rapid method of silver nanoparticle production is by using the leaf extract of *Azadirachta indica*. Silver nanoparticles are synthesized through grapes extract due to environment-friendly characteristics. Silver nanoparticles (AgNPs) have current and future applications in agriculture; however, under different conditions (species and age of plants, the size, and concentration of nanoparticles and experimental condition, temperature, and duration of exposure) the effects are under investigation.

ALOE VERA BASED EDIBLE COATING EFFECT ON POSTHARVEST QUALITY OF STRAWBERRY

***Hafiz Nabeel Ahmad**[1], Safeer Ahmad[1], Muhammad Saad Akram[1], and Ghayyoor Ahmad[2]

[1]National Institute of Food Science and Technology, University of Agriculture, Faisalabad
[2]Institute of Animal and Dairy Sciences, University of Agriculture, Faisalabad
*Email: Nabeel.sahzad.7@gmail.com

ABSTRACT

Fruits and vegetables (FV) quality rapidly lost and decay during post-harvesting causes economic loos as well as deteriorates the quality of the FV. Polysaccharide-based coatings like starch, chitosan, carrageenan, etc. are mostly used for coating purposes. This technology used in the industrial level to maintain the quality of FV and significant results are shown. Strawberry is the most popular food all over the world and available during the summer season. It is highly perishable fruit and during postharvest it's quality and quantity may some lost. The effect of aloe vera (AV) based coating with a combination of VIT-C on postharvest quality parameters of strawberry was assessed. Aloe Vera gel was used 4% based on weight per volume with different concentrations of VIT-C (0, 1, 3 and 6%). when

treatments of aloe vera coating applied, the fruit loses (weight loss), firmness, TSS, soluble solids content, pH, ascorbic acid concentration, total phenolic contents, and antioxidant activity, and total plate count were measured at different storage days at 4°C and 90 % RH. In the end, it was observed that: the weight loss was inhibited in treated samples, fruit softened slowly because of a combination of AV and VIT-C, soluble solid contents were stable at first 12 days, TA decreased in both treated and untreated samples and pH increased during the storage period. In conclusion, this study showed that AV in combination with VIT-C could enhance the postharvest life of strawberry fruit by maintaining or delaying fruit quality attributes.

TOMATO ROOT-KNOT NEMATODE: THE HIDDEN ENEMY

*__Wajahat Azeem__[1], Ali Asad Yousaf[2], Muhammad Tariq Adnan Khan[1], Muhammad Saeed[1], and Umair Mehmood[1]

[1]Department of Plant Pathology, PMAS-Arid Agriculture University Rawalpindi, Pakistan.
[2]Insitute of Food & Nutritional Sciences (IF& NS), PMAS-Arid Agriculture University Rawalpindi, Pakistan.
*Email:wajahat36@gmail.com

ABSTRACT

Tomato (*Lycopersicon esculentum* Mill.) belongs to the Solanaceae family, is one of the most important vegetable crops globally as well as in Pakistan. Owning to ever-rising consumer demand, its area under cultivation is also increasing. Nutritionally, it is rich in minerals, vitamins, essential amino acids, nutraceuticals, and dietary fibers. Although tomato is high yielding crop there are many biotic and abiotic factors creating problems for farmers. Tomato plants are susceptible to several types of fungi, bacteria, and viruses. However, the infestation caused by Root-Knot Nematodes (RKN) is becoming more challenging day by day. RKN attacks the tomato plant during the whole growth span. Due to its characteristic nature, symptoms like belowground obvious galls or knot-like root swellings, often develop over the period and may go unnoticed. The knots block movement of water and nutrients to the rest of the plant resulting in stunted plant growth. Additionally, tomato plants affected by root-knot nematodes are more susceptible to soil-borne diseases caused by *Ralstonia solanacearum* (bacterial wilt), *Sclerotium rolfsii* (southern blight) Fusarium, Pythium, or Rhizoctonia. This secondary infection may lead to extensive discoloration of the internal stem, root tissue and ultimately necrosis occurred. Relatively high reproduction rate and polyphagous nature make it quite hard to manage root-knot nematodes of tomato. Moreover, the application of existing nematicides has its environmental concerns due to high toxicity and beyond the limit residual effects, resultantly, killing off beneficial soil microbiota and groundwater contamination take place. Therefore, it is direly needed to introduce environment-friendly alternative measures for the management of RKN. Induced plant resistance is one of the promising non-chemical strategies for the effective management of diseases. Defense response genes encoding for the production of various pathogenesis-related proteins govern the host plant-mediated resistance.

POSTHARVEST QUALITY OF GUAVA (*PSIDIUM GUAJAVA*. L) CV. GOLA AS EFFECTED BY DIFFERENT PACKAGING MATERIALS AT AMBIENT STORAGE

*__Ali Asad Yousaf__[1], K. S. Abbasi[1], Imran Hassan[2], Memona Faiz[1], Wajahat Azeem[3], M. S. Ibrahim[1], and Muhammad Shafique[4]

[1]Institute of Food & Nutritional Sciences (IFNS), PMAS-Arid Agriculture University Rawalpindi
[2]Department of Horticulture, PMAS-Arid Agriculture University Rawalpindi
[3]Department of Plant Pathology, PMAS-Arid Agriculture University Rawalpindi
[4]Agriculture Extension Department Sheikhupura, Govt. of Punjab
*Email: aliasad.yousaf@gmail.com

ABSTRACT

Guava (Psidium guajava L.) is a highly nutritious tropical fruit, famous for its flavor, taste and distinct aroma with substantial health benefits. As “poor man’s apple of tropics”, guava truly happens to be the fruit for masses due to its

commercial availability. It ranked third after Citrus and Mango with 0.586 million tons of annual production in Pakistan. Owing to climacteric nature, it has limited postharvest storage life i.e. up to three to four days at ambient temperature, which results in 40% postharvest losses. To mitigate these losses, the study carried out intending to assess the storage stability of guava fruit in response to different packaging materials. Guava fruits (CV. Gola) were harvested from a commercial orchard located at Sharqpur Sharif (Sheikhupura) and were subjected to different treatments (packaging materials) viz low-density polyethylene (LDPE), medium- density polyethylene (MDPE), high-density polyethylene (HDPE), polypropylene (PP), polystyrene (PS), corrugated fiber boxes (CFB) and biodegradable packaging. Transition in different physicochemical and nutraceutical attributes was determined at fixed intervals during the storage period. An increasing trend was observed in parameters like weight loss, total sugars, TSS, while titratable acidity, vitamin C, total phenolic contents and radical scavenging activity continuously decreased until 24 the day of the storage at room temperature. However, low fruit decay percentage and nutritional losses were observed in fruits, packed under biodegradable, HDPE and CFB, respectively. Biodegradable and HDPE showed best results in maintaining the nutraceutical profile of guava and hence prolonging the shelf life as compared to other treatments. These packing materials impede the respiration rate and are significantly effective in maintaining fruit quality.

STABILITY OF METAXENIAL EFFECTS IN INTERVARIETAL CROSSES OF GUAVA (*PSIDIUM GUAJAVA* L.)

Syeda Anum M. Bokhari[1], ***Muhammad Usman**[1], Bilquees Fatima[1], M. Muzammal Aslam[3], and Muhammad Shahid[2]

[1]Plant Tissue Culture Cell, Institute of Horticultural Sciences, University of Agriculture, Faisalabad-Pakistan
[2]Department of Biochemistry, University of Agriculture, Faisalabad-Pakistan 38040
[3]Zhengzhou Fruit Research Institute, Chinese Academy of Agricultural Sciences, Zhengzhou 450009, China
*Email: m.usman@uaf.edu.pk

ABSTRACT

Guava is known to have metaxenial effects on fruit size, quality and show marked effect of the pollen parent. Guava cultivars i.e. Round 'R' (Gola) and Pyriform 'P' (Surahi) were selected for self and reciprocal crosses for multiple seasons to assess pollen compatibility and metaxenial. Data were pooled to eliminate the effect of environmental components and results are discussed. Pollen's parents showed a significant impact on fruit physical and biochemical properties. Parental crosses reflected higher fruit setting (%) in selfed (PxP) cross-compared with RxR, RxP and PxR cross indicating lower self-incompatibility. Fruit weight (114.08 g) increased when 'P' was self-crossed whereas, fruit weight was reduced (82.87 g) when 'R' was used as a pollen parent. Fruit ratio (1.17), flesh weight (88.15 g), seed core weight (25.93 g) and flesh thickness (13.61 mm) increased when 'P' was self- crossed. Intervarietal crosses showed a variable response to the number of seeds. Less number of seeds (115.78) were observed in RxR while seed weight (1.74 g) was maximum in PxP. TSS (10.59 °Brix), total sugars (6.65 %) and reducing sugars (3.60 %) were higher in self-parental crosses of 'R'. Whereas, minimum TA (1.43 %) was present in PxR. Ascorbic acid content was higher in selfed parental crosses compared with the reciprocal crosses. Conclusively, intervarietal crosses consistently depicted the presence of varying degrees of self and cross-compatibility, inbreeding depression and metaxenia.

MORPHOGENETIC DIVERSITY IN IRRADIATED GERMPLASM OF WHITE AND PINK FLESH GRAPEFRUIT (*CITRUS PARADISI* L.) VARIETIES

M. Usman[1], Bilquees Fatima[1], ***Muhammad Usman**[1], Iqrar A. Rana[2], and M. Awais Rana[1]

[1]Plant Tissue Culture Cell, Institute of Horticultural Sciences, University of Agriculture, Faisalabad, Pakistan
[2]Centre of Agricultural Biochemistry and Biotechnology (CABB), University of Agriculture, Faisalabad, Pakistan
*Email: m.usman@uaf.edu.pk

ABSTRACT

Most of the available elite varieties of grapefruit are either bud sports or induced mutants indicating its higher potential towards mutagenesis. Budwood of six grapefruit varieties including white flesh (Foster 'F', Frost Fresh 'FF', Reed 'R') and pink flesh (Shamber 'S', Red Mexican Foster 'RMF', Red Blush 'RB') were irradiated with different levels of gamma rays 20-140 Gy to enhance germplasm diversity. The irradiated budwood was grafted on rough lemon and grafted plants were evaluated for morphogenetic diversity using SSR markers. Plant growth was arrested with irradiation and most of the morphological parameters showed reduced growth with rising levels of gamma radiation. Irradiate budwood survival was reduced to 50% at 80Gy. A similar reduction was observed in several leaves, leaf size, shoot length and number of branches. The diversified germplasm was evaluated for genetic diversity using SSR markers. Great diversity was observed in the irradiated germplasm. Allele size ranged from 50-280 bp and mean polymorphic information content (PIC) value was 0.5683. Analysis of molecular variance revealed more variation within the population. UPGMA cluster analysis showed three main groups and five out of six parents were clustered in the same group showing their higher similarity and genetic relatedness. Such studies would help to enhance genetic diversity in the available varieties for future breeding applications.

AUTHORS' INDEX

T

U

NATIONAL COORDINATION COMMITTEE

Prof. Dr. Nadeem Akhtar Abbasi (PMAS-Arid Agriculture University Rawalpindi, Pakistan)

Prof. Dr. Muhammad Akbar Anjum (Bahauddin Zakariya University, Multan, Pakistan)

Prof. Ch. M Ayub (University of Agriculture Faisalabad, Pakistan)

Prof. Dr. Abdur Rab (The University of Agriculture, Peshawar-Pakistan)

Prof. Dr. Amanullah Malik (University of Agriculture Faisalabad, Pakistan)

Prof. Dr. Ishtiaq Ahmad Rajwana (MNS University of Agriculture Multan, Pakistan)

Prof Dr. Jafar Jaskani (University of Agriculture Faisalabad, Pakistan)

Dr. Saba Ambreen Memon (Sindh Agriculture University Tando Jam, Pakistan)

Prof Dr. Jafar Jaskani (University of Agriculture Faisalabad, Pakistan)

Dr. Muhammad Shafiq Shahid (Sultan Qaboos University, Oman)

Dr. Basharat Ali Saleem (Horticulture Extension and Citrus Production and Post-Harvest Specialist)

Dr. Muhammad Adnan Shahid (University of New Hampshire, USA)

Dr. Muhammad Nafees (Islamia University Bahawalpur, Pakistan)

Dr. Nosheen Zahid (University of Azad Jammu Kashmir)

Mr. Muhammad Nawaz Khan (CRI)

Dr. Umber Habib (PMAS-Arid Agriculture University Rawalpindi, Pakistan)

Dr. Javed Tareen (Director General, Agriculture, Quetta, Pakistan)

Prof. Dr. Farah Khan (Lahore College for Woman University, Lahore, Pakistan)

Dr. Fazal ur Rehman (Director General, Agriculture, Gilgit-Baltistan, Pakistan)

Mr. Muhammad Shakeel (Agriculture Research Institute, Quetta, Pakistan)

Dr. Ammara Fatima (Lahore College for Woman University, Lahore, Pakistan)

Mr. Tariq Tanveer (CEO Agri Tourism Development Corporation of Pakistan)

Dr. Zahoor Hussain (University of Sargodha, Pakistan)

Mr. Tariq Manzoor (Institute of Agricultural Sciences, University of the Punjab, Lahore, Pakistan)

Mr. Nadeem Shahid (Institute of Agricultural Sciences, University of the Punjab, Lahore, Pakistan)

Dr. Sehrish Mushtaq (Institute of Agricultural Sciences, University of the Punjab, Lahore, Pakistan)

Mr. Mujahid Hussain (Institute of Agricultural Sciences, University of the Punjab, Lahore, Pakistan)

Aims and Objective:

Pakistan Society for Horticultural Science encourages interest and involvement of professionals and amateurs in horticulture and related aspects and to sustain the vital connection between people and plants by:

1. Gathering all professional horticulturists at one platform to increase their interaction and share their experiences and problems with others to seek solutions.
2. Promotion of fundamental research on horticultural plants and allied aspects to improve people health, living standards, communities, and environment and to ensure food security particularly in the country and generally in the region.
3. Sharing of scientific knowledge with researchers, improve communication and coordination with the farmers and other stakeholders by holding various gatherings, workshops, seminars, symposia and conferences.
4. Holding various exhibitions and training sessions for the growers and stakeholders on modern innovations in horticulture in order to improve their businesses.
5. Creating awareness about plants and environment among young generation and the communities to protect our environment with appropriate horticultural practices.
6. Promoting circulation of advanced horticultural information to the respective stakeholders through all available media.
7. Provision of a forum to the horticulturists to demonstrate their abilities and generate knowledge for bringing positive social, environmental and economic change in the society and to help needy horticultural students eager to learn horticulture.
8. Inspiring and motivating secondary school children to learn about horticulture for discovering the health and well-being benefits of horticulture and increase entrepreneurship.
9. Developing policy notes to share with Government for solving farmers and stakeholder's problems regarding horticultural crops production and handling.
10. Dissemination of innovative findings of researchers working at various horticultural universities and research organizations.
11. Awarding talented youth and young horticulturists for promotion of horticulture in the country.
12. Finding ways to help needy members who are facing hardships for their high studies related to any issue of horticultural crop.