

Effect of Good Agricultural Practices versus Conventional Practices on Date Palm in Khairpur District

Qamaruddin Solangi¹, Mushtaque Hussain Soomro*¹, Raheel Anwar², Jawad Hassan²,
Muhammad Fiaz²

¹Agriculture Extension, Khairpur, Sindh, Pakistan

²Institute of Horticultural Sciences, University of Agriculture, Faisalabad, Punjab 38040,
Pakistan

Emails: soomro110@gmail.com (S.M.H.), jawad2012@live.com (J.H.),
fiaz.m2002@gmail.com (M.F)

Abstract

The present research was conducted on *Phoenix dactylifera* L. cvs. Aseel and Karbalain in district Khairpur to compare the effect of different fertilizers and their doses on visible quality attributes of dates. Three plants were selected from each variety at three different locations i.e., Village Therhi, Village Gagri and Village Loung Fakir and supplied with either commercially adapted set of fertilizers (0.5 kg each of urea and diamonium phosphate) or improved sets of fertilizers (Set 1: 1 kg urea, 1 kg diamonium phosphate, 1 kg murate of potash, 250 g zinc sulphate and 100 g boron per tree; Set 2: 2 kg nitro-phos, 1 kg calcium nitrate, 1 kg murate of potash, 250 g zinc sulphate, 100 g boron per tree). Improved sets of fertilizers were applied in three split doses during September, late December and first week of May. Application of 1 kg urea, 1 kg diamonium phosphate, 1 kg murate of potash, 250 g zinc sulphate and 100 g boron per tree yielded highest fresh fruit weight. This increase in fruit weight was mainly because of pulp weight gain whereas seed weight and fruit shape index (fruit length/diameter) remained unaltered. Such findings may help convince farmers to adapt improved nutrient management methods to improved fruit yield and quality.

INTRODUCTION

The date palm (*Phoenix dactylifera* L.) is a dioecious tree, belongs to family Palmaceae which is the earliest cultivated plant species having world population of 100 million from different cultivars (Zaid and de Wet, 2002). Annual global production of date is 8.1 million tonnes from 1.2 million hectares of land (FAO, 2013). Leading date producer countries are Egypt, Iran, Saudi Arabia, Algeria, Iraq, Pakistan, Sudan, Oman and UAE (FAO, 2013). In Pakistan, major production areas are Khairpur, Sukkur, Jhang, Muzaffargarh, Dera Ghazi Khan, Bahawalpur, Panjgur, Turbat, and Dera Ismail Khan while 85% of Sindh dates production is from Khairpur District (Abul-Soad, 2010). Commercial varieties of Pakistan are Karbalaen, Aseel, Begum Jhangi, Muzawati, Halawi, Fasli, Sabzo, Dashtiari, Dhakki, Koharba, and Rabai (Ata, 2011). Khairpur and

Turbat districts have more than 300 varieties it is considered as center of origin (Markhand *et al.*, 2010). Dates contain anti-mutagenic compounds, antioxidants (Khan *et al.*, 2008), vitamins, carbohydrates, minerals, dietary fiber, protein, salts, and fatty acids which makes it an ideal food in human nutrition (Al-Shahib & Marshall, 2003). In addition to its fresh consumption at 'Khalal' and 'Rutab' and 'Tamar' stages, major volume of it is also processed into value added products like jam, juice, jelly, ice cream, cakes, spread, paste, syrup, vinegar, bread, pudding and alcohol are available in market (El Hadrami and Al-Khayri, 2012).

Fruit quality and yield highly depends upon fertilizer, pollination, cultivar and irrigation (Iqbal *et al.*, 2004). Sufficient levels of mineral nutrients in soil is a critical factor in fulfilling plant's need to give good fruit quality and optimum yield. Mineral nutrient management is very important to maintain sufficient levels of mineral nutrient resources as continuous uptake of mineral nutrients by plants creates their deficiency in soil (El-Shurafa, 1984). Potassium is responsible for increase in cell size and have active role in uptake and translocation of nitrogen from roots to leaves (Cushnahan *et al.*, 1995). Al-Obeed (2012) showed improved fruit weight, length, diameter and volume of "Khalas" dates with application of 1.5 kg calcium super phosphate and 2 kg potassium sulphate at two and three equal doses, respectively. Osman (2010) presented increased yield, fruit length, fruit weight and bunch weight with split application of 4.5 kg potassium per tree in March, June and September. El-Deeb *et al.* (2000) reported highest fruit pulp-to-stone ratio and 8.19 cm³ fruit volume of 'Hayany' date palm with application of nitrogen fertilizer. Dialamia and Mohebi (2010) observed that high yield and good quality of "Sayer" dates in Iran can be obtained by application of 0.7 kg nitrogen, 0.5 kg phosphorus and 1.3 kg potassium per tree annually. However, for Iraqi dates 2.3 kg nitrogen, 1.2 kg phosphorus and 1.4 kg potassium is recommended (Al-Rawi, 1998). Klein and Zaid (1999) suggested 0.65 kg N, 0.65 kg P and 0.87 kg K/tree annually for world-wide use. Aforementioned data indicates that dose of fertilizer highly depends upon soil, climate and variety of the date palm. In Pakistan, date palm orchards are generally intercropped and supplied with 50 kg diammonium phosphate (DAP) and 50 kg Urea per acre. Such nutrient management practices negatively impact quality and yield of date palm. Now, concept of "Good Agriculture Practices" is gaining popularity in commercial fruit crops like citrus and mango. Judicious use of fertilizers is an integral component of this concept which not only ensures proper use of resources but also improve fruit quality and plant yield. So, this study was designed with the aim to determine effect of different fertilizer doses on physical fruit quality parameters of dates.

MATERIAL AND METHOD

The proposed study was conducted at Khairpur district (27°32'N, 68°46'E), Sindh province to determine the effect of different fertilizer doses on fruit quality. For this purpose, two varieties Aseel and Karbalain. Effect of mineral nutrient management under conventional system (Control: 0.5 kg urea and 0.5 kg diammonium phosphate per acre with intercropping) on fruit physical attributes was compared with improved nutrient management packages (Set 1: 1 kg urea, 1 kg diammonium phosphate, 1 kg murate of potash, 250 g zinc sulphate and 100 g boron per tree; Set 2: 2 kg nitro-phos, 1 kg calcium nitrate, 1 kg murate of potash, 250 g zinc sulphate, 100 g boron per tree). Suggested fertilizer sets were applied in three split doses i.e., September, late December and first week of May and no intercropping was done during the study period. Fertilizer

applications were conducted under RCBD design at three different locations in Khairpur district i.e. Village Therhi, Village Gagri and Village Loung Fakir. Each treatment was replicated thrice comprising 3 palms per replication. All selected palms were same with respect to age, health and production status. Fruits were harvested at 'Khala or Doka' stage and 120 healthy fruits from each treatment (30 fruits per replication per variety) were randomly selected from each location. After harvesting, calyx was removed and fresh fruit weight, seed weight, pulp weight (fresh fruit weight - seed weight) were recorded. Pulp and seed weight percentages were calculated by dividing their weight over total fruit weight and multiplying with 100. Fruit length and diameter were recorded with digital vernier calipers and fruit shape index (length/diameter) was calculated using formula: length/diameter.

RESULTS AND DISCUSSION

Fresh fruit weight of the two varieties are present in figure 1. Improved fertilizer treatments resulted in better fruit weight gain as compared to control. Application of 1 kg urea, 1 kg diamonium phosphate, 1 kg murate of potash, 250 g zinc sulphate and 100 g boron per tree yielded highest fresh fruit weight in cvs. Aseel and Karbalain. This increase in fresh fruit weight was mainly contributed by increase in pulp weight (Figure 2) whereas seed weight remained non-significantly different among all treatments (Figure 3). This indicates that improved set of mineral nutrients had direct impact on pulp weight gain. In contrast to provision of low quantities of nitrogen and phosphorus in control, suggested fertilizer program not only provided higher doses of nitrogen and phosphorus but additionally supplemented date palms with potassium, zinc and boron. Photosynthesis is a process in which plants convert light energy into chemical energy and store these energy molecules in carbohydrate molecules. Potassium is needed for photosynthesis whereas phosphorus is utilized in making of high energy molecules like ATP, NADPH and NADP. Furthermore, nitrogen and phosphorus play important roles in manufacturing of proteins, lipids and nucleic acids. Nitrogen is a building block of amino acids, basic form of proteins, whereas phosphorus is required in making of phospholipids, a class of lipids. Nitrogen and zinc also play critical role in proper functioning of auxin, a phytohormone. Potassium is needed in activation of protein and enzyme synthesis, involved in photosynthetic process and maintaining proper water balance. Boron is required for flowering and fruit development and translocation of carbohydrates and hormones. Thus, application of aforementioned nutrient cumulatively results enhancement in plant growth, fresh fruit weight and exhibition of greener leaves. Our results corroborate aforementioned function of nutrient in plants. To determine impact of increment in fresh fruit weight on fruit shape, length and diameter of fruits from date palms grown under control and fertilizer set 1 were measured. Results showed that fresh fruit weight did not change fruit shape index (Figure 4) suggesting a proportional increase in length and diameter of the fruit. Further studies are underway which include effect of improved nutrient management practices on biochemical and postharvest quality attributes of the dates.

REFERENCES

- Abul-Soad, A.A. 2010. Date palm in Pakistan, current status and prospective. USAID Firms project. 9-11.
- Al-Obeed, R.S., H.A. Kassem and M.A. Ahmed. 2013. Effect of Levels and Methods of Potassium and Phosphorus Fertilization on Yield, Fruit Quality and Chemical Composition of "Khalas" Date Palm Cultivar. *Life Sci. J.* 10:1111-1118.
- Al-Rawi, A.A.H. 1998. Fertilization of date palm tree (*Phoenix dactylifera L.*) in Iraq. In Proceedings of the First International Conference on Date Palms. Al-Ain, United Arab Emirates: United Arab Emirates University.
- Al-Shahib, W. and R.J. Marshall. 2003. The fruit of the date palm: its possible use as the best food for the future. *Int. J. of Food Sci. and Nutri.* 54:247-59.
- Ata, S. 2011. A study of date palm market chain and its role in food security and livelihoods of farmers in the South Punjab. M.Sc. (Hons.) thesis, University of Agriculture Faisalabad, Pakistan.
- Cushnahan, A., J.S. Bailey and F.J. Gordon. 1995. Some effects of sodium application on the yield and chemical composition of pasture grass under differing conditions of potassium and moisture supply. *Plant Soil.* 176:117-127.
- Dialami, H. 2009. Effect of nitrogen, phosphorus and potassium fertilizers on date palm, cultivar 'Sayer'. Final report of research project, Agricultural Research, Education and Extension Organization, Iran.
- El Hadrami, A. and J.M. Al-Khayri. 2012. Socioeconomic and traditional importance of date palm. *Emirates J. of Food and Agric.* 24:371-385.
- El-Deeb, M.D., M.M. Sourour and S.A. Ismail. 2000. Use of olive pomace and mineral fertilizers for 'Hayany' date palms fertilization. Proceeding of the Date Palm International Symposium. Windhoek. Namibia. 22-25.
- El-Shurafa, M.Y. 1984. Studies on the amount of minerals annually lost by way of fruit harvest and leaf prunings of date palm trees. *J. Date Palm.* 3:277-290.
- FAO .2014. Food and agricultural commodities production for Pakistan for 2012. <http://faostat.fao.org/site/339/default.aspx>. Accessed on 5 September 2014.
- Iqbal, M., A. Ghafoor and S. Rahman. 2004. Effect of pollination times on fruit characteristics and yield of *date palm cv. Dhakki*. *Int. J. Agric. Biol.* 6:96-99.
- Khan, M., A. Sarwar, M. Wahab and R. Haleem. 2008. Physico-chemical characterization of date varieties using multivariate analysis. *J. Food Agric.* 88:1051-1059.
- Markhand, G.S., A.A. Abul-Soad, N.A. Kanhar and A.A. Mallah. 2010. Fruit characterization of Pakistani dates. *Pak. J. Bot.* 42:3715-3722.
- Osman, S.M. 2010. Effect of potassium fertilization on yield, leaf mineral content and fruit quality of Bartamoda date palm propagated by tissue culture technique under Aswan conditions. *J. Appl. Res.* 6:184-190.
- Zaid, A. and P.F. de Wet. 2002. Date palm cultivation. Food and Agriculture Organization, Plant Production and Protection. Food and Agriculture Organization of the United Nations, Rome, Italy.156.

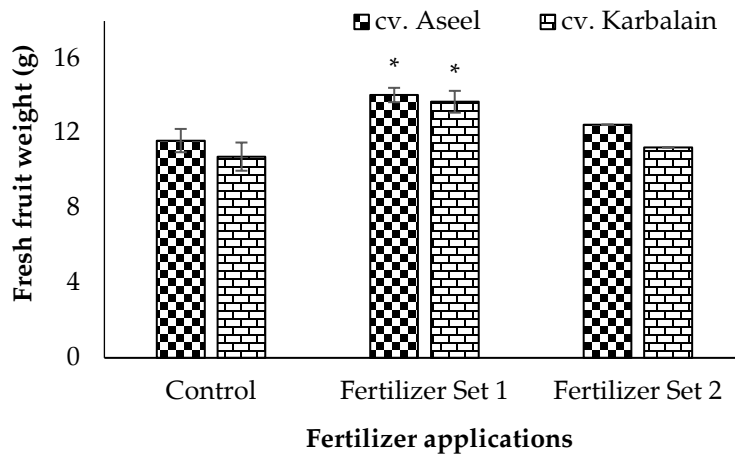


Figure 1: Effect of different doses of fertilizer on fresh fruit weight. The values represented are mean of three replications. Error bar show \pm standard error for comparison.

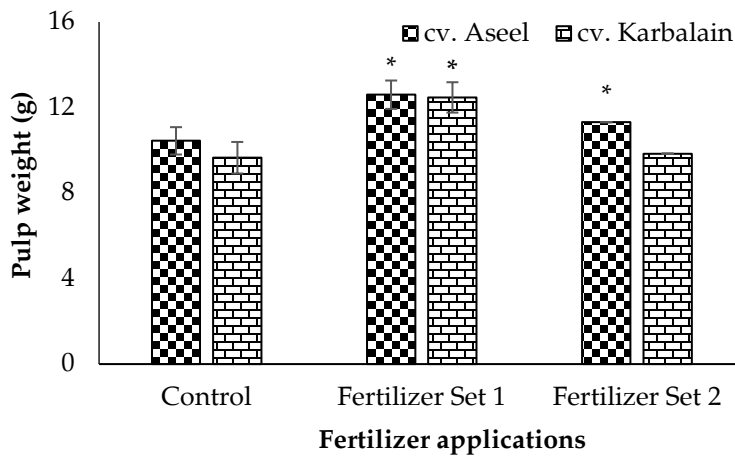


Figure 2: Effect of different doses of fertilizer on fresh pulp weight. The values represented are mean of three replications. Error bar show \pm standard error for comparison.

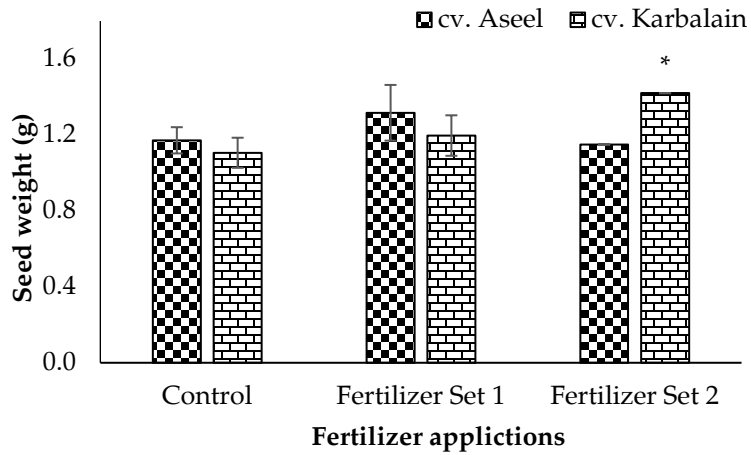


Figure 3: Effect of different doses of fertilizer on fresh seed weight. The values represented are mean of three replications. Error bar show \pm standard error for comparison.

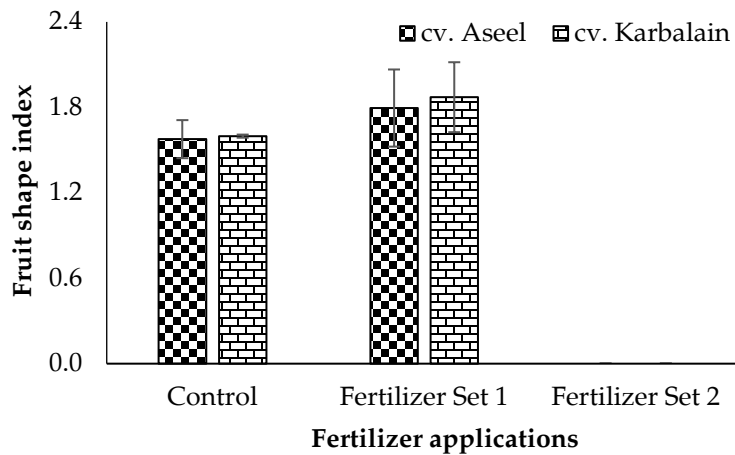


Figure 4: Effect of different doses of fertilizer on fruit shape index. The values represented are mean of three replications. Error bar show \pm standard error for comparison.