

Comparison of Sugar Recovery of Sugar Beet and Sugar Cane

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Abstract

Sugarcane (*Saccharum officinarum*) is an important cash crop 2/3rd of world sugar production. Sugar in Pakistan is manufactured from cane and beet. There is about 1 million hectares of land under cane and beet in four provinces. Pakistan ranked 5th with 50.045 million tons (FAO, 2009). Sugar beet is an important sugar production crop in the world. It provides almost 30% of the world sugar for human consumption. It is an alternate sugar crop of the region. Sugar beet is grown and processed in the Khyber Pakhtunkawa (KPK), Pakistan. Experiment was conducted at Water Management Research Centre (WMRC), University of Agriculture Faisalabad (UAF) to investigate the sugar recovery loss in cane and beet. The experiment was designed under Randomize complete block design (RCBD) with two repetitions. Growth parameters of sugarcane measured during experiment were cane yield, plant height, weight, stalks, cane diameter, commercial sugarcane and sugar yield tested. Growth parameters of beet measured during experiment were plant height, tuber weight, tuber yield and diameter. Results shows that weight loss in beet are 4.5, 9, 13 and 17% on 2, 3, 4 and 5th day after harvesting, respectively. Sugar recovery loss is recorded 1, 2.2, 5.37 and 7.8%, respectively for the corresponding periods. It is recommended that beet should be transported and sliced within 24 hours of harvesting in the month of May and June. Water saving in case of sugar beet is 60% as compare to sugarcane (PARC, July 2009 - June 2014). Losses may be considerably reduced by storing the beet under certain cover. Sugar recovery comparison shows that much higher yield per acre as that of sugar cane but with 20-25 percent higher recovery just in 7 months crop season. It is concluded that sugar beet ensures higher sugar production per acre per month.

INTRODUCTION

From former age, agriculture has been the prime profession of the populace of Pakistan. According to economic survey of Pakistan 2013-14, agriculture contribution in Pakistan's economy is 21.0 percent of GDP and engages almost 43.7 percent of the total employed labor force of the country, however agriculture utilizes around 90-95% of the

freshwater (Sayed, 2011). It not only feed the fatten population but also provides raw material for industries and a base for foreign exchange.

Among the 105 countries, Pakistan ranks 4th in area, 14th in production and 16th in yield of sugarcane. In 2013-14 record production of sugarcane crop was reported by the crop reporting departments of the provinces, crop area of sugarcane at 1.172 million ha⁻¹ with cane production of 67.428 million ha⁻¹. Although, Pakistan world's fourth largest grower of sugarcane it has perhaps the lowest yield in the world. The average sugarcane yields in Pakistan have remained between 40-54 tonnes per hectare which is considerably less than those obtained in many other countries. Average yield of sugarcane in the world is around 65 tonnes per hectare and Asia 65.4 tonnes per hectare while China 77.1 tonnes per hectare, India 70.6 tonnes per hectare and Pakistan 46.0 tonnes per hectare (Akhtar and Ahmad, 2012.). The sugar recovery is 8.5% against the obtainable recovery of 10.5%. For three thousand years, sugarcane considered largely as a tropical grass, retained provision for sweetness, until from its arrival to nineteenth century of its viral. Sugar beet replaced cane from major source of sugar in continental Europe in 1880. Sugarcane set out a long journey that it first come to India and then to China.

In the beginning Indians first introduce the techniques to extract sugar from cane and named it as a "Sarkara". Persians followed by Greeks, "reeds that produce honey without bees". In our daily diet, a natural nutrient sugar is known as a sucrose that meet our body energy requirements, carbohydrates should account between 50-55% shares of balance diet. Supply of sugar to the world from sugar beet is twenty percent while remaining eighty percent of the world get sugar from sugarcane. Sugarcane is cultivated in tropical climate in developing countries of the world.

Sugar is formed through a process of photosynthesis in the sugar beet. Root of beet is the source of sugar, which can represent between 15 to 21.5% of sugar beet total weight. 75% water content and 24.98% dry matter in the roots of beet. Dry matter of beet contains 74.99% sugar content in it. In sugar beet, sugar content varies from 12.5 to 20.92%. Beet and it's by product, such as pulp and molasses give 10% sugar which added remarkable importance in the sugar content of beet. Sugar extraction from the beet depends upon the moment of its arrival in the processing plant. Such variety of sugar beet is remarkable which contain 14% sugar or more but the average sugar content is only 11.2%. The standard beet should have a sugar content of 16%, which would give yield of 130 Kg per processing of 1 ton standard sugar beet. Ideal efficiency of beet is 82.55%. Unlike sugar cane, sugar beet does not survive in the tropical conditions. It prefers a temperate, humid climate, with dry, sunny periods just before the harvest. Sugar beet producers often select their fertile land and for the sowing of sugar beet because beet has its delicate and fragile nature in the initial stages. The sugar beet produces sugar during the first year of life and beet stores its sugar in its Root. Root of beet is almost completely buried in the soil. Root length of beet measures from 15 cm to 35 cm in length. It is harvested after the first year for the processing of beet for sugar production. If the growing cycle of beet would be allowed to continue then it would enter into a reproductive phase. Following year would use all its sugar to produce seeds. Keeping in view the above mention problem, it is sown in spring and harvested in the autumn/early winter (in a relatively long growing season). Sugar beet plays an important role in the crop rotation cycle of cropping pattern of the farm. In developed countries, sugar beet is lifted mechanically. A single machine performs several tasks and

has a “topper” or “defoliator” at the front and a “lifter” at the rear. A soil removal machine cleans the sugar beets before they are transported to the processing plant. Transporting the crop is no mean feat. It must be completed very quickly because the sugar content of sugar beets drops rapidly once the sugar beets are lifted. Sugar processing plants work day and night during the two to three months during the harvesting period of beet. The sugar beet harvested lasts about within three months, while the sugar cane harvest lasts up to six months. For each ton of sugar beet from 20% to 30% of waste but on the other hand each ton of sugar cane form less than 5% of waste. While, the harvesting date has a certain impact on the crop yield. Many other factors have a critical impact on the harvest yields and include the crop variety, the spacing between rows and the number of seeds within the rows, harvesting conditions and storage conditions. However, depending on the quality of the seeds, the climatic conditions and the cultivation methods, individual yields can vary from as much as 30 to 70 tons/ha of sugar beet roots. In 2007, the average global sugar beet yield was 39.5 tons/ha (83 tons/ha in France, placing this country among the world’s leading producers).

MATERIALS AND METHODS

Sugarcane experiment was designed with two treatments with two replications. Treatments are 120 cm furrow sowing with double sets of sugarcane as T₁ and 75 cm ridge sowing with single set of sugarcane as T₂. Water was applied through flood irrigation system. Irrigation scheduling was done through ET base by using the CROPWAT 8.0 software. Germination rate, number of tillers, crop height and yield of sugarcane was measured per meter square of treatment with three reading from each replication of the treatments. Random selection for the data which give us true representation of the data. After maturity of the sugarcane, cut the crop and take a juice of cane and compare its sugar recovery results with sugar recovery of beet.

RESULTS AND DISCUSSION

Experimental results show that the standard sugar content in beet was 16% against 12.5% of sugarcane. Extraction rate of sugar from present sugar in a juice was 40 to 80% from total 16% sugar content in beet and 30 to 100% extraction rate from total 12.5% sugar content in sugarcane.

From result comparison, it is clearly shows that the beet sugar recovery is higher than sugarcane. Sugar recovery in beet is 25% higher. Sugar beet gave 25% more sugar recovery in just seven months. Keeping in view the present water scarcity condition of Pakistan, it is recommended that increase the production of sugar beet in the country. Sugar beet production increase the sugar recovery and its production is readily available as compare to sugarcane because it is short duration crop. Most important, in the production of sugar beet water saving is 60% as compare to sugarcane.

Experimental results show that after harvesting beet weight lose very rapidly with increase in harvesting days. After harvesting weight loss was 4.5, 9, 13 and 17% on second, third, fourth and fifth day, respectively. Delay in processing of sugar recovery recorded 1, 2.2, 5.37 and 7.8% loss respectively for the corresponding periods. Losses may be considerably reduced by doing the safety measure. Certain sealing cover should be use during transfer of beet from field to processing mill. It is recommended that increase the production of beet to enhance the sugar recovery and considerably save the 60%

amount of water. Beet should be transported and sliced within 24 hours of harvesting in the month of May and June (PARC, July 2009 - June 2014).

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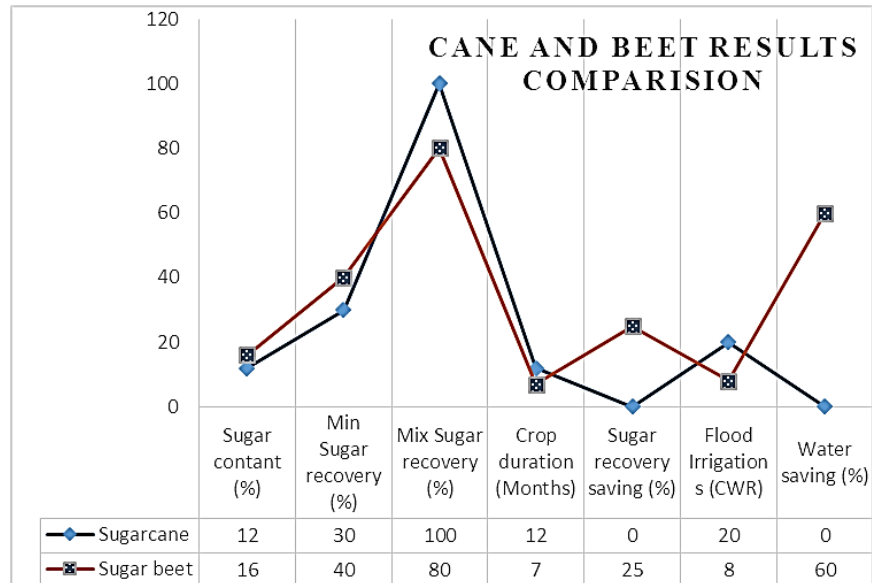


Figure 1: Shows comparison of sugar beet and sugar cane results.

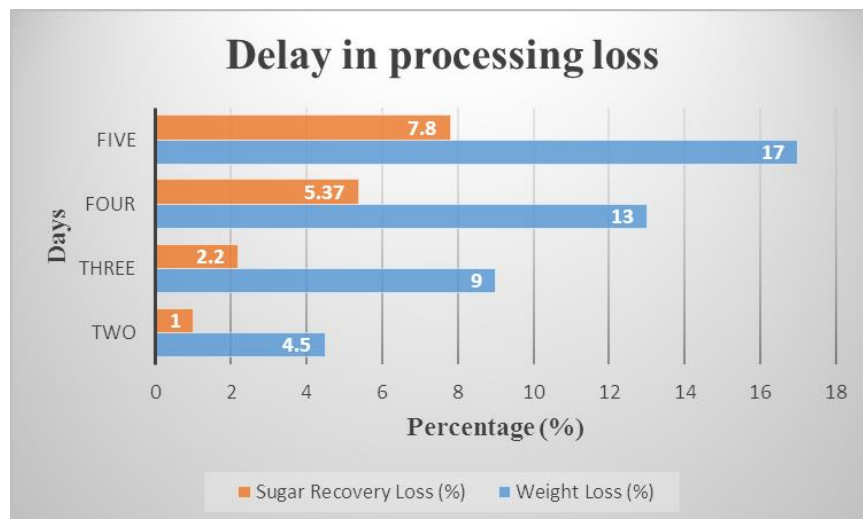


Figure 2: Shows weight and sugar recovery loss with respect to delay in processing.