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The Effect of Soaking of Setts in Micro-nutrients on Growth, Yield and Quality of Sugarcane

Aman Ullah Chaudhry and Salman Yousaf
Department of Agronomy, University of Agriculture, Faisalabad-38040, Pakistan

Abstract: The highest stripped cane yield of 77.28 t ha^{-1} was obtained in control treatment followed by water soaked treatment (73.07 t ha^{-1}). The lowest yield of 2.188 t ha^{-1}) was obtained in 0.5 M $FeSO_4$ treatment. Besides stripped cane yield the yield components like no of millable canes, cane length, cane diameter, no of internodes, internodal length and weight per stripped cane were significantly affected by micro-nutrients. Similarly photo biomass producing contributors (Harvest Index, Tops weight, Trash weight, Germination) were also responsive to micro-nutrients treatments and affected more by 0.5 M $FeSO_4$ treatment. Sucrose content and commercial cane sugar was maximum for 0.25 M $MnSO_4$.

Key word: Micro-nutrients, quality, soaking, sugarcane, yield

Introduction

Sugarcane is an important and highly valuable sugar crop. It is a cash crop and plays a vital role in the economic uplift of the growers and the country. It provides basic raw material for sugar industry. It is cultivated on an area of 1.115 million hectares with total annual production of 55.19 million tones giving an average stripped cane yield of 47.7 ton ha^{-1} (Government of Pakistan, 1999), which is far below the potential yield of our existing cultivars. Although the yield potential of our existing cultivars is comparable to those grown in other countries of the world yet it has not been fully explored mainly due to unsuitable environmental conditions and poor agro management. In arid and semi arid parts of Pakistan soil salinity and alkalinity is primary growth limiting factor. Our soils are generally alkaline and calcareous and usually contain lower available micro-nutrients (Hodgson *et al*., 1966). To raise successful crops in normal and saline areas pre-sowing seed soaking seems to be a promising technique. It has been claimed that pre-sowing treatment of the seed stimulate germination and subsequent seedling growth both under normal and saline soil conditions (Idris and Aslam,1975). An important constraint that has profound influence on the yield of sugarcane is less availability of certain micro-nutrients. Application of micro-nutrient treatment for micro-nutrient deficiency include application of their compound to soil and plant.

However studies on sugarcane setts treatment with micro-nutrient are rare in Pakistan. The objective is to determine the effect of pre-sowing sugarcane setts treatments on yield and juice quality of sugarcane by fulfilling its micro-nutrients requirement under the agro-ecological conditions at Faisalabad.

Materials and Methods

The experiment was conducted at Agronomic Research Farm University of Agriculture Faisalabad during the year 1999 on a sandy clay loam soil. The experiment was laid out in randomized complete block design with four replications. The net plot size was 3.6 m × 4 m. Soil was sampled before the start of the experiment for analysis. The soil pH was 8.14. The data showed 80 ppm available manganese, 16.62 ppm available Ferrous and 2.57 available Zinc. The growing season remained normal. Setts treatment comprised control (unsoaked), water soaked. $MnSO_4$ (0.25 M and 0.5 M) and $FeSO_4$ (0.25 M and 0.5 M) solution soaked. The crop was planted in 60 cm apart rows with double budded setts. Seed rate was 80,000 setts ha^{-1}. A basal dose of 150-100-100 kg NPK per hectare in the form of urea, single super phosphate and sulphate of potash respectively was applied. All other agronomic practices were kept normal and uniform for all treatments. Cane samples were taken randomly from each plot and sucrose percentage was determined by Horn's dry lead acetate method (Spancer and Mead, 1963). The data collected were statistically analyzed by the analysis of variance techniques (Steel and Torrie, 1984).

Results and Discussion

As regard treatments (Table 1) effects, control treatment produced maximum yield which had significant difference from other treatments. The 0.5 M $MnSO_4$ and 0.25 M $FeSO_4$ remained statistically at par but significantly differ from other treatments.

Yield Components: The relationship between cane yield and its components is shown in Table 1. No of millable canes were significantly effected, control treatment produced maximum no of millable canes m^{-2} followed by water soaked.

The 0.25 M $MnSO_4$ produced maximum cane length followed by 0.25 N $FeSO_4$. Cane diameter is important yield component. Control treatment produced maximum cane diameter and 0.5 M $FeSO_4$ produced lowest diameter. Control water soaked, 0.25 M $MnSO_4$ and 0.25 $FeSO_4$ had non significant difference. However Patil and Somawanshi (1983) showed that application of $FeSO_4$ increased dry matter production. The number of internodes per cane determine cane length which contribute towards cane yield. There were highly significant difference among treatments. The data on internodal length (Table 1) showed highly significant difference among treatments. The 0.5 M $MnSO_4$ produced longer internodes and 0.5 M $FeSO_4$ produced shorter internodes. Internodal length can be increased by Mn, Zn, Cu (Cunha and Curtius, 1982). The weight per stripped cane has a direct effect on cane yield. There were highly significant difference among treatments. Water soaked treatment produced heavier canes but lowest canes weight were obtained by 0.5 M $FeSO_4$ treatment which was due to reduced growth. Yield was increased by spraying Mn, Fe, and Mo (Sen *et al*., 1982). The most important yield contributors were no of millable canes, cane length and weight per stripped cane and diameter.

Photo biomass: Economic yield, though indirectly is the outcome of photo biomass production. Harvest index express the production efficiency of a crop. It is determined by the following parameter, harvest index, tops weight and trash weight. These parameters has highly significant difference

Table 1: Effect of micro-nutrient treatment on yield and yield components of sugarcane

Treatments	Mean Yield (t ha^{-1})	No.of millable cane (m^{-2})	Cane length (m)	Cane diameter (cm)	No of internodes	Internodal length (cm)	Wt per stripped cane (kg)
Control	77.28A	7.625A	2.16AB	2.520A	21.75A	13.70A	1.158CD
Soaking in water	73.07A	7.225A	2.193AB	2.505A	20.75AB	13.57A	1.632A
Soaking in 0.25 M Mn solution	51.51B	5.750B	2.280A	2.485A	20.75AB	13.16A	1.4108
Soaking in 0.25 M Fe solution	32.00C	3.925C	2.247A	2.497A	19.50B	13.28A	1.275BC
Soaking in 0.5 M Mn solution	37.000	4.250C	2.060B	2.470A	20.50AB	13.87A	1.040DE
Soaking in 0.5 M Fe solution	2.818D	0.5775D	1.493C	1.695B	12.25C	11.32B	0.8775E
L.S.D value	6.389	0.9340	0.1581	0.09532	1.940	1.047	0.2184

Table 2: Effect of micro-nutrients treatment on photo biomass of sugarcane

Treatment	Harvest Index (%)	Tops wt (t ha^{-1})	Trash wt (t ha^{-1})	Germination counts
Control	81.40A	13.44A	6.015A	8.988A
Soaking in water	81.06A	14.11A	4.818B	6.733B
Soaking in 0.25 M Mn solution	77.39B	10.88AB	4.352B	4.017C
Soaking in 0.25 M Fe solution	78.13B	6.778C	2.41 2D	2.537D
Soaking in 0.5 M Mn solution	74.29C	9.32BC	3.405C	3.432C
Soaking in 0.5 M Fe solution	69.65D	0.8850D	0.4125E	0.2625E
L.S.D value	2.037	3.361	0.5818	0.8827

Table 3: Effect of micro-nutrients treatment on quality of sugarcane

Treatments	Sucrose content (%)	Commercial cane sugar (%)
Control	18.168	13.55A
Soaking in water	18.37AB	13.78A
Soaking in 0.25 M Mn solution	18.58A	13.96A
Soaking in 0.25 M Fe solution	18.23AB	13.72A
Soaking in 0.5 M Mn solution	18.19B	13.67A
Soaking in 0.5 M Mn solution	17.61C	12.60B
L.S.D value	0.381	0.4289

among the various treatments as presented in Table 2. The highest results were obtained for control treatment and lowest for 0.5 M $FeSO_4$ treatment for the above parameters. Germination has key role in the final cane yield. The Table 2 showed highly significant results. All soaking treatments had lower germination. Control treatment produced maximum germination and minimum germination was produced by 0.5 M $FeSO_4$ treatment.

Application of (Fe, Zn, Mn, Cu) increase germination (Sheudzhen *et al*., 1986) and (Hagihara and Bosshart, 1983). Priming did not have a significant effect on percent germination in sun dried beans (Pandey, 1988). Spraying of sulphates of Fe, Zn, Cu and Mg had no significant effect on germination (Anonymous, 1993).

Quality: Cane maturity and quality is determined by the sucrose content in the cane juice. There were highly significant difference among treatments (Table 3). The 0.25 M $MnSO_4$ produced significantly higher sucrose content and 0.5 M $FeSO_4$ produced lower sucrose content. Protein and neuclic acid contents adversely effected by Mn (Gupta and Rao, 1980). Commercial cane sugar was significantly affected by treatments. Control, water soaked, 0.25 M $MnSO_4$ and 0.5 M $MnSO_4$ and 0.25 M $FeSO_4$ treatment were statistically at par with each other. The lowest sucrose content were produced by 0.5 M $FeSO_4$ treatment. Sugar contents were reduced by soaking in water and in various chemicals (Ali, 1997).

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