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Effect of Foliar Application of Micro Nutrients on the Growth Traits of Sugarcane Variety Cp-65/357 (Ratoon Crop)

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Abstract: Field experiments were conducted to asses the effect of different micro nutrients on the growth traits of sugarcane variety CP-65/357 (Ratoon crop) on silt loam soils at Sugarcane Crops Research Institute, Mardan, Pakistan. It was observed that application of micro nutrients significantly affected all the growth traits of sugarcane variety CP-65/357, whereas plant height, tops weight, cane length, internodes and length of internodes were significantly increased by the application of all the micro nutrients over the control. The average plant height, tops weight, cane length, number of internodes and length of internodes of ratoon crop were maximized by the lowest rates of Zn and Cu. Furthermore data revealed that the highest rates of B and Mn increased all the growth traits in comparison to their lowest rates.

Key words: Sugarcane, micro nutrients, foliar fertilizer, growth, yield

Introduction

Sugarcane (*Saccharum officinarum* L.) is one of the most important cash and industrial crop of Pakistan. However, the growth performance, yield and sugar content are low as compared to other sugarcane growing countries of the world. The probable reasons for the low cane growth and yield performance may be micro nutrients deficiency in soil or in plants. Though small amount of Cu, Zn, B and Mn are essential for growth and quality of the crop because these micro nutrients also control most of the physiological activities of the crop by interrupting the level of chlorophyll content in leaves which ultimately influence the photosynthetic activity of the plant (Kanwar and Randhawa, 1967). Maribo and Albuquarque (1981) reported that applications of micronutrients increased the number of tillers per plant, plant height and cane yield over control and increased doses of Cu and Zn reduced the number and size of cane length. Nayyer *et al.* (1989) reported that all the yield contributing traits like tillers, plant height and others were positively affected by the application of Zn and Fe sources and beyond certain levels of the application of these elements adversely affected the several traits of the crop. Shinde *et al.* (1986) reported that the application of $ZnSO_4$ significantly affected the morphological characters like tillers, height, leaf area, tops weight, trash weight and cane yield.

Keeping in view, the importance of micro nutrients application on sugarcane, this research has been carried out to study the effect of micro nutrients on the growth traits of sugarcane ratoon crop under agro climatic conditions of Mardan, Pakistan.

Materials and Methods

Experiment was conducted to assess the effect of different micronutrients on plant height, tops weight and length of sugarcane variety CP-65/357 at Mardan. The experiment was laid out in a Randomized Complete Block Design and each treatment consisted of seven rows, 10 meters long with a row to row spacing of 90cm. NPK fertilizer application and other agronomic practices were carried out uniformly according to the recommendations in all the treatments. Foliar application of the micro nutrients at the requisite rates was made in the two split doses, first dose was sprayed at 50 cm height of crop and second at height of 75 cm. The micronutrient were applied in the form of $CuSO_4$ (25% Cu), $ZnSO_4$ (22% Zn), H_3PO_4 (17% B) and $MnSO_4$ (26% Mn).

The treatments were, control, 1.50, 3.00 and 4.50 kg Zn ha^{-1}, 0.50, 1.00 and 1.50 kg Cu ha^{-1}, 0.25, 0.50 and 0.75 kg B ha^{-1} and 1.00, 2.00 and 3.00 kg Mn ha^{-1}. The determination of physico-chemical characteristics of the soil was made by following the methods of Kanwar and Chopra (1959) and all other diethylene triamine were made (Anonymous, 1954). Whereas available Zn, Cu and Mn were determined by DTPA, (Lindsay and Norvell, 1978) and Boron was determined as described by Jackson (1958). The soil physico chemical characteristics are presented in Table 1.

For recording height tops weight, cane length, inter nodes and length of internodes, a random samples of ten canes were taken from central rows of each treatment. The data recorded on different growth traits were statistically analyzed according to Steel and Torrie (1980).

Results and Discussion

Data (Table 2) revealed that plant height was significantly affected by foliar application of micro nutrients. Among the micronutrients, the lowest rates of Zn, Cu and B were found more effective in increasing plant height than the higher rates of these elements. The maximum average plant height of 179.33 cm was recorded for 1.50 kg Zn ha^{-1} while application of 0.50 kg Cu ha^{-1} resulted in the second best plant height of 176.00 cm. The effect of different rates of Mn was not consistent on the height of plant. Nayyar *et al.* (1989) and Banger *et al.* (1991) have reported that plant height was positively affected by the low levels of Zn and Fe. Maribo and Albuquarque (1981) reported that application of Zn and Cu increased plant height while the increasing rates of Cu reduced the height of sugarcane plant. Greater response to Zn might be due to the low level of available Zn in the soil (Table 1). Similarly, data indicated that foliar application of micro nutrients significantly increased the weight of cane tops. It is apparent from the results that t he average tops weight of 100 canes in plots, treated with different rates of Zn was comparatively lower than the rest of the elements tested. Application of different rates of Cu, B and Mn produced almost similar results. However, among the micro nutrients, the average highest tops weight of 9.10 kg perplot was recorded for the treatments receiving 0.50 kg Cu ha^{-}.

Table 1: Physico-chemical analysis of soil of the experiments at Sugar Crop Research Institute, Mardan, Pakistan

Textural class of soil	Silt loam
pH	8.20
O.M%	0.83
TSS (meq L^{-1})	117.00
ECe (dS m^{-1})	0.23
N (mg kg^{-1})	0.09
P (mg kg^{-1})	21.00
Zn (mg kg^{-1})	0.40
Cu (mg kg^{-1})	0.70
B (mg kg^{-1})	0.11
Mn (mg kg^{-1})	0.60

O.M: organic matter TSS: Total Soluble Solids

Table 2: Effect of foliar application of micronutrients on the growth with traits of sugarcane variety CP-65/357

Treatments (kg ha^{-1})	Height (cm)	Tops weight (Kg)	Cane length (cm)	Internode (number)	Length of internodes (cm)
Control	139.47	6.97	113.67	11.27	7.00
Zn					
1.50	179.33	8.67	145.40	14.60	8.17
3.00	161.60	7.77	128.73	12.87	8.03
4.50	166.47	7.43	132.60	13.27	7.43
Cu					
0.50	176.00	9.10	144.93	15.07	8.77
1.00	152.13	8.30	124.33	13.20	7.97
1.50	137.07	8.47	121.53	13.33	7.63
B					
0.25	153.40	8.60	126.20	13.33	8.03
0.50	142.33	8.20	127.47	13.53	7.33
0.75	153.00	8.68	129.33	14.53	7.80
Mn					
1.00	137.73	8.57	118.93	12.33	7.97
2.00	163.60	8.67	125.47	13.60	7.90
3.00	145.27	8.80	115.53	12.22	7.23

Height	S.E. = 7.71	LSD5% = 22.45	LSD1% = 30.52
Tops weight	S.E. = 0.21	LSD5% = 0.62	LSD1% = 0.84
Cane length	S.E. = 6.63	LSD5% = 19.30	LSD1% = 26.24
Internodes	S.E. = 0.64	LSD5% = 1.85	LSD1% = 2.52
Internode length	S.E. = 0.22	LSD5% = 0.64	LSD1% = 0.87

The lowest 100 canes tops weight of 6.97 kg per plot was obtained for the check treatments (Table 2). Kanwar and Randhawa (1967) recommended the application of Fe, Cu, Zn and Mo to the plants for greater vegetative growth.

The data pertaining to the effect of micro nutrients on the cane length (Table 2), showed that foliar application of micro nutrients significantly increased cane length. It is also clear from the results that the lowest rates of zinc and copper (1.50 kg and 0.50 kg ha^{-1}) produced the highest cane length of 145.40 cm and 144.93 cm, respectively. The lowest cane length of 113.07 cm was recorded in the untreated plots. The effect of different levels of boron and manganese was however, not consistent. Whereas significant increase in cane length may be attributed to more uptake of nitrogen with the application of the lowest rates of Zn and Cu which resulted to enhance the growth of sugarcane. Furthermore, the deficiency of Zn and Cu in the soil may have also resulted in greater response to the foliar application of these elements (Table 1). Banger *et al*. (1991) have reported a significant increase in cane height with adequate but not excessive application of Fe, Cu, Zn, Mg and B.

Further the number of internodes per stalk was significantly affected by the foliar application of micro nutrients (Table 2). It is evident from the data that the application of 0.50 kg Cu ha^{-1} produced the highest average number of 15.07 internodes per stalk. This was closely followed by the application of 1.50 kg Zn and 0.75 kg B ha^{-1} by producing 14.60 and 14.53 number of internodes per stalk, respectively. The lowest number of 11.27 internodes per stalk was recorded in the control treatments. The data also manifests that sugarcane was more responsive to the lower rates of Zn and Cu rather than their higher rates. However, in case of B, the number of internodes per stalk increased with an increase in its rate. Number of internodes per stalk mostly depends upon largely on the nutrients availability and the climatic conditions during the growth period. Hence the increase in the number of internodes in the present studies may be attributed to the supply of micro nutrients especially Zn and Cu which were deficient in soil (Table 1). Application of the lowest rates of Zn and Cu has also significantly increased the nitrogen concentration in the plant tissues which might be utilized for better growth and development of sugarcane plants. These results confirm the findings of Kanwar and Randhawa (1967) and Kumaresan *et al*. (1967), who have reported an increase in the number of internodes with the application of Fe, Zn and Cu.

Furthermore foliar application of micro nutrients significantly increased internodes length over control treatments (Table 2). The results clearly showed that sugarcane showed a positive response to the lowest rates of Zn, Cu and Mn whereas a variable response was observed with the different doses of application. The maximum average internodes length of 8.77 cm was recorded for Cu when applied at the rate of 0.50 kg ha^{-1} and foliar spray of 1.50 kg Zn ha^{-1} resulted in the second highest internode length of 8.17 cm. While the lowest internode length of 7.00 cm was recorded for the control treatment. The deficiency of Zn and Cu in the soil (Table 1) seems the main reason for greater internode length. Cambria *et al*. (1989) has also reported that positive correlation of Zn and Cu with the length of internodes.

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