Indian Journal of Agronomy **45** (4) : 795–798 (December 2000)

Effect of zinc on cane population and yield of sugarcane (*Saccharum officinarum*) in calcareous soils

V.P. SINGH AND U.K. PRASAD

Sugarcane Research Institute, Rajendra Agricultural University, Pusa, Samastipur, Bihar 848 125

Received: October 1999

ABSTRACT

A field experiment was conducted during 1994–95 to 1996–97 to study the effect of Zn on cane population and yield of sugarcane (*Saccharum officinarum* L.) in calcareous soil. The maximum final stalk number was produced by basal application of 10 kg Zn/ha. Its splitting could not bring marked effect. The highest cane yield was also owing to basal application of 10 kg Zn/ha but was at par with that of its 2 or 3 splits during first 2 years where 1 split was given at the time of planting. Foliar spray did not improve cane yield in the first year, but 0.1% in the second year and 0.2% in the third year gave significantly higher yield than control.

Key words : Zn, Tillering, Calcareous soil, Sugarcane

Most of the soils of sugarcane-growing tract in north Bihar are calcareous and about 80% of such soils are deficient in Zn with mean value of DTPA-extractable Zn as 0.70 ppm where its critical limit is 0.78 ppm as reported by Sakal *et al.* (1982).

The growth of above-ground portion of the plant is a direct function of the number of stalks per unit urea and their expansion in both height and diameter. The maximum stalk number is generally reached 5 months after planting. Under irrigated condition as high as 3 40,000 stalks/ha were reported by Gosnell (1968). This appears to be an over-production of stalks, for up to 50% died and stable stalk population was achieved at 7 months and thereafter, there was little change in stalk number. Keeping above facts in view, the present investigation was undertaken.

MATERIALS AND METHODS

A field experiment was conducted at Rajendra Agricultural University, Pusa (Samastipur), for 3 years (1994–95 to 1996–97). The soil was sandy loam having 210–218 kg available N/ha, 30–35 kg available P_2O_5/ha, 132–140 kg available K_2O/ha, 28.6% free $CaCO_3$, 8.3 pH and 0.65 to 0.70 ppm available Zn. Thus soil was alkaline-calcareous in nature and it was also deficient in Zn, as its critical limit in the calcareous soil is 0.78 ppm (Sakal *et al.*, 1982). The experiment was laid out in

randomized block design with 3 replications. The treatment consisted of T_1, No Zn; T_2, 5 kg Zn/ha as basal; T_3,10 kg Zn/ha as basal; T_4, 2.5 kg Zn/ha as basal + 2.5 kg Zn/ha as side-dressing at 150 days after planting (DAP); T_5, 5 kg Zn/ha as basal + 5 kg Zn/ha as side-dressing at 150 DAP; T_6, 5 kg Zn/ha as basal + 2.5 kg Zn/ha as side-dressing each at 150 and 210 DAP; T_7, 5 kg Zn/ha as side-dressing at 150 DAP; T_8, 5 kg Zn/ha as side-dressing each at 150 and 210 DAP; T_9, 0.1% Zn as foliar spray at 150, 180 and 210 DAP; and T_{10}, 0.2% Zn spray at 150, 180 and 210 DAP. The source of Zn was zinc sulphte.

The crop was planted in the first week of November during every year and fertilized with 15 tonnes compost, 120 kg N, 85 kg P_2O_5 and 60 kg K_2O/ha. The variety of cane was 'BO 128' of mid-early maturity group.

RESULTS AND DISCUSSION

Effect of Zn nutrition on plant population

Effect of the Zn nutrition on plant population was not observed. However, its effect on maximum stalk number was significant only in the first year where the maximum number of stalks was owing to application of 10 kg Zn/ha as basal dose (T_3) and it was at par with all those treatments having Zn applied as basal dose (Table 1). During 1995–96 and 1996–97, though the effect of Zn nutrition was not marked, T_3 recorded the highest number of stalks/ha. The final stalk number, i.e. millable cane was significantly affected by Zn nutrition except in 1995–96. In the first year, the highest stalk number was recorded under T_3, but it did not differ significantly from those treatments having Zn applied as basal dose (T_2 to T_6) and even T_7 where Zn was not applied basally. Except T_3, no other treatments showed any marked difference form that of the control. The difference between T_3 and T_1 treatments was in the tune of 9×10^3 canes/ha. During 1996–97 the effect of Zn was well pronounced where the millable canes produced under T_3 (10 kg Zn/ha as basal dose) were significantly higher than those of other treatments except T_2. All the treatments except foliar sprays (T_9 and T_{10}) and also T_7 (5 kg Zn/ha applied at 150 DAP) produced significantly more number of millable canes than the control. By and large, there was a positive effect of Zn nutrition on plant population. Application of Zn at the time of planting was found more effective than its delayed application.

Effect of age on tillering

Plant population started increasing after germination. An increase in the plant population, especially in tillering and canopy-establishment phase, was very fast during all the 3 years, as 'BO 128' was a profused tillering variety. The increase was noticed up to 6 months after planting during 1994–95 and 1996–97 and up to 7 months during 1995–96 during grand-growth phase. Thereafter it declined sharply up to 10 months after planting. The reduction in plant population from maximum to final stalk number was 64.0, 68.6 and 60.0% in the first, second and third year respectively. This was mainly due to shading of late tillers and increased competition for space and nutrients, confirming the finding of Gosnell (1968).

Table 1. Effect of Zn nutrition on stalk number (intial, maximum and final), cane weight and cane yield

Treatment	Plant population ('000/ha)														
	Initial (45 DAP)			Maximum			Final (360 DAP)			Cane weight (g/plant)			Cane yield (tonnes/ha)		
	Y_1	Y_2	Y_3	Y_1	Y_2	Y_3	Y_1	Y_2	Y_3	Y_1	Y_2	Y_3	Y_1	Y_2	Y_3
T_1	66.8	56.6	44.8	271.6	298.9	255.1	98.3	99.2	93.4	724	733	768	70.0	72.5	66.0
T_2	59.8	60.1	47.3	302.1	342.9	267.7	102.4	108.7	109.9	10,20	817	917	100.8	91.8	91.8
T_3	68.3	68.6	49.5	317.2	361.2	272.7	107.3	111.8	116.4	1,225	1,033	967	123.5	115.5	107.3
T_4	64.3	61.4	45.4	292.7	322.8	243.2	99.4	106.7	102.6	925	813	927	97.4	87.0	83.0
T_5	68.1	55.7	45.8	311.9	337.0	245.8	104.2	111.1	102.1	1,205	885	920	116.9	99.1	89.0
T_6	59.8	63.3	43.1	292.7	359.2	270.7	105.6	103.6	106.8	925	813	973	113.7	102.8	99.6
T_7	62.7	68.7	45.1	277.0	336.3	252.8	98.9	104.1	100.5	901	897	943	82.3	92.9	85.2
T_8	57.6	62.8	44.3	253.6	342.6	249.8	97.3	104.5	102.8	960	940	889	89.4	93.7	83.3
T_9	55.4	66.4	47.7	237.3	341.6	254.7	97.8	106.3	93.4	845	798	882	70.1	90.2	74.7
T_{10}	65.3	64.8	45.5	239.1	336.1	246.4	94.8	103.7	97.0	846	833	903	71.9	88.0	78.3
Mean	62.8	62.8	45.8	279.5	337.8	256.8	100.6	106.0	102.9	979	877	909	93.6	93.3	85.8
CD (P=0.05)	NS	NS	NS	27.9	NS	NS	8.8	NS	8.8	171	128	72	23.9	16.4	8.7

Details of treatments are given in Materials and Methods

DAP, Days after planting; Y_1, 1994–95; Y_2; 1995–96; Y_3; 1996–97

Cane weight and cane yield both were significantly influenced by Zn nutrition. The highest cane weight was with application of 10 kg Zn/ha, but in the first 2 years it was owing to basal application whereas in the third year owing to its application in 3 splits (Table 1). In case of cane yield too, the highest tonnage was obtained on basal application of 10 kg Zn/ha (T_3) during all the years. This yield was significantly higher than other treatments except 10 kg Zn/ha applied in 2 splits (T_5), 3 splits (T_6) and 5 kg Zn/ha (T_2) in the first year; T_5 and T_6 in the second year and T_6 in the third year. But when 10 kg Zn/ha was applied in 2 splits at 150 and 210 days after planting, the yield reduced markedly. The results revealed that the splitting of Zn was not advantageous over basal dose, but if it is to be done, that could be splitted but one split must be applied at the time of planting. The results also revealed the positive effect of Zn nutrition on millable cane (final stalk population) and cane weight which was well reflected in the cane yield. The increase in cane yield due to Zn application was also reported by Sen *et al.* (1984).

REFERENCES

Gosnell, J.M. 1968. Some effect of increasing age on sugarcane growth. (In) *Proceedings of 13 Congress, International Society of Sugarcane Technologists*, pp. 499–513.

Katyal, J.C. and Rattan, R.K. 1993. Distribution of Zn in Indian soils. *Fertiliser News* **38** (3) : 15 26.

Sakal, R., Singh, B.P. and Singh, A.P. 1982. Determination of critical limit of Zn in soil and plant for predicting response of rice to Zn application in calcareous soil. *Plant and Soil* **66** (1) : 129–132.

Sen, A., Prasad, J. and Prasad, C. 1984. Studies on the soil application of micronutrients on sugarcane in relation to plant micronutrient balance, yield and CCS. (In) *Proceedings of 48th Annual Conference of the Sugarcane Technologists' Association of India,* held at Kanpur, Uttar Pradesh, pp. 69–75.