



Effect of seaweed extract on growth, yield and quality of sugarcane

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Abstract : A field experiment was conducted in Suru season at Vasantdada Sugar Institute research farm during 2009-10 to study the effect of seaweed extract on growth, yield and quality of sugarcane. Experiment was designed in randomized block design with seven treatments where seaweed extract was applied in soil as well as sprayed on leaves @ of 500, 1000 and 1500 g ha⁻¹. The results showed that application of seaweed extract @ 1500 g ha⁻¹ through soil application alongwith recommended dose of fertilizer increased cane yield by 14.1 % and sugar yield by 23.1%. The juice quality was not affected either by soil as well as foliar application of seaweed extract. The effectiveness of seaweed for promoting tillering and growth alongwith nutrition may be resulted in increased cane yield and sugar yield.

Key Words : Seaweed extract, Sugarcane, Yield, Quality

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INTRODUCTION

Sugarcane is an important cash crop grown in India under irrigated conditions. Although India has the second largest area under sugarcane, average cane productivity (65 t ha⁻¹) is much lower compared to other countries. The use of high analysis fertilizers and restricted recycling of organics have resulted in low yields. Sugarcane is an exhaustive crop and depletes the soil properties like reduced organic matter, bulk density and increases soil compaction. Use of chemicals has made an adverse impact on the health-care of not only soil but also the beneficial soil microflora and fauna and the plants cultivated in such soils. This eventually has lead to a high demand of organic produce by health conscious society (Sangeetha and Thevanathan, 2010).

Seaweeds are the macroscopic marine algae found attached to the bottom in shallow coastal waters. Marine algae grow in the intertidal, shallow and deep sea areas up to 180 meter depth and also in backwaters on the solid substrate such as rocks, dead corals and pebbles.

The seaweeds are totally different from higher plants as

they neither have true leaves, stems and roots or vascular systems none specialized sex organs (Thirumaran *et al.*, 2009). Seaweed has proved effective in enhancing yield, pest and frost resistance in vegetables, fruits, cereals and pulses. Seaweed extracts had beneficial effect on seed germination and plant growth (Bhosle *et al.*, 1975; Kumar *et al.*, 1994). Verklejj (1992) reported that application of seaweed liquid fertilizer enhanced the water retention capacity of soil. The content of seaweed helps to promote plant growth, increase cell elongation, nutritional value and also sugar content of product and thus result in high yield and early maturity. It stimulates cell division, activates metabolism of each cell, increase crop physiological activity. It increases root growth and development, flowering, bloom set and fruiting. Sunarpi and Nirahman (2008) reported significant growth of bean plants, tomato plants and yield and quality of okra (Zodape *et al.*, 2008) due to seaweed extract. Hence, information about use of seaweed extract in sugarcane is lacking, therefore the present investigation was carried out to study the effect of seaweed extract on growth, yield and quality of sugarcane.

MATERIAL AND METHODS

A field experiment was conducted in Suru season at Vasantdada Sugar Institute research farm during 2009-10. The soil under experimental plot was clayey in texture, moderate in available nitrogen, phosphorus, potassium and organic carbon. Experiment was designed in Randomized Block Design with three replications and seven treatment. Treatment T₁ is control where only recommended dose of NPK fertilizer was applied. In treatment T₂, T₃ and T₄ were applied 500, 1000 and 1500 g seaweed ha⁻¹ through soil at 45 and 120 days after planting and in treatment T₅, T₆ and T₇ foliar application of 500, 1000 and 1500 g seaweed ha⁻¹, respectively at 45 and 120 days after planting. The recommended dose of fertilizers (250:115:115 kg N, P and K ha⁻¹) and other package of practices for sugarcane were imposed uniformly for all the treatments including control. Seaweed extract contains 18 amino acids, macro elements and more than 40 micro elements along with gibberellin, trehalosin, alginic acid and vitamin B1, B6 and B12. The field observations of biometric, growth and yield parameters were taken at different stages of the crop and at harvest. Sugarcane juice quality for brix and pol percentage was analyzed by using ICUMSA method. The data on biometric, growth, yield and quality of sugarcane were analyzed with methods given by Gomez and Gomez (1984).

RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Cane yield:

The data presented in Table 1 and Fig. 1 indicated that the treatment 1000 and 1500 g seaweed extract either by soil or foliar application alongwith recommended dose of fertilizer at 45 and 120 days after planting were found to be significant over control. The seaweed extract @ 500 g ha⁻¹ either by soil application or foliar application did not differ significantly. The highest cane yield 89.23 t ha⁻¹ was obtained where 1500 g ha⁻¹ seaweed extract was applied in soil along with RDF at 45 and 120 days after planting and was significantly higher than all other treatments of seaweed extract either by soil or foliar application.

Commercial cane sugar (CCS) yield:

The commercial cane sugar yield was found highest 14.96 t ha⁻¹ in treatment of 1500 g ha⁻¹ seaweed extract followed by 14.66 t ha⁻¹ in the treatment of soil application of 1000 g ha⁻¹ seaweed extract alongwith RDF (Table 1 and Fig. 1). These treatments were significantly superior over control and at par with each other. Foliar application of seaweed extract did

Table 1 : Effect of seaweed extract on cane yield, CCS yield and no. of millable canes

Treatments	Cane yield (t ha ⁻¹)	CCS yield (t ha ⁻¹)	No. of Millable canes ('000 ha ⁻¹)
Control	78.20	12.15	66.67
500 g Seaweed ha ⁻¹ soil application + RDF	81.60	13.54	72.08
1000 g seaweed ha ⁻¹ soil application + RDF	85.17	14.66	73.75
1500 g seaweed ha ⁻¹ soil application + RDF	89.23	14.96	76.67
500 g seaweed ha ⁻¹ foliar application + RDF	79.14	12.36	69.17
1000 g seaweed ha ⁻¹ foliar application + RDF	83.37	13.92	72.08
1500 g seaweed ha ⁻¹ foliar application+ RDF	84.47	13.98	73.33
S.E.±	1.69	0.86	2.19
C.D. (P=0.05)	3.67	1.88	4.77

Table 2 : Effect of seaweed extract on biometric and growth observation

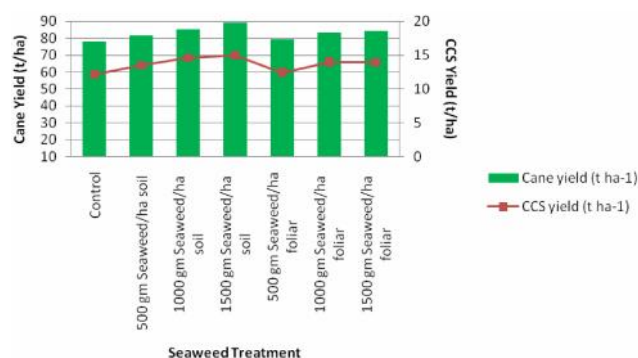
Treatments	Millable cane height (cm)	Cane girth (cm)	No. of Internodes/cane	Germination (%)	Tillering ratio
Control	214.00	10.21	20	55.17	1.26
500 gm seaweed ha ⁻¹ soil application + RDF	231.00	10.44	20	59.70	1.21
1000 gm seaweed ha ⁻¹ soil application + RDF	207.93	10.00	18	53.83	1.44
1500 gm seaweed ha ⁻¹ soil application + RDF	256.40	10.33	19	52.07	1.52
500 gm seaweed ha ⁻¹ foliar application + RDF	223.00	10.89	19	54.13	1.52
1000 gm seaweed ha ⁻¹ foliar application + RDF	215.00	10.39	18	56.43	1.53
1500 gm seaweed ha ⁻¹ foliar application + RDF	228.50	10.59	19	53.57	1.69
S.E.±	24.29	0.69	1.37	2.38	0.08
C.D. (P=0.05)	NS	NS	NS	NS	0.17

NS=Non-significant

Table 3 : Effect of seaweed extract on cane juice quality

Treatments	Brix (%)	Pol (%)	Purity (%)	Commercial cane sugar (%)
Control	22.00	24.53	89.72	15.53
500 g seaweed ha ⁻¹ soil application + RDF	22.82	23.80	95.87	16.59
1000 g seaweed ha ⁻¹ soil application + RDF	23.65	24.61	96.11	17.22
1500 g seaweed ha ⁻¹ soil application + RDF	23.20	24.49	94.70	16.78
500 g seaweed ha ⁻¹ foliar application + RDF	21.94	24.15	90.97	15.58
1000 g seaweed ha ⁻¹ foliar application + RDF	23.03	24.22	95.10	16.70
1500 g seaweed ha ⁻¹ foliar application + RDF	22.91	24.25	94.50	16.56
S.E.±	0.92	0.40	3.57	0.93
C.D. (P=0.05)	NS	NS	NS	NS

NS=Non-significant

**Fig. 1 :** Effect of seaweed extract on cane yield and CCS yield

not show any significant response with respect to CCS yield. It indicates that soil application of 1000 g ha⁻¹ seaweed extract was beneficial to increase the cane and sugar yield.

Number of millable canes:

Number of millable cane presented in Table 1 showed that number of millable canes per ha increased due to soil application of seaweed extract as well as foliar application. The maximum millable canes 76.67 thousand ha⁻¹ were obtained with soil application of 1500 g ha⁻¹ seaweed extract alongwith RDF followed by 73.75 thousands ha⁻¹ due to soil application of 1000 g ha⁻¹ seaweed extract alongwith RDF. Both these treatments were significant over control (66.67 thousand ha⁻¹).

Growth observation:

The growth parameters *viz.*, millable cane height and girth of cane were increased in all the treatments of seaweed extract application but not significantly differed. The maximum millable cane height (256.40 cm) was found in 1500 g ha⁻¹ seaweed extract application in soil. Cane girth and number of internode per cane remained more or less same in all the treatments and the differences were insignificant (Table 2).

Biometric observation:

The germination after 45 days of planting varied from

52.07- 59.70 % in the experimental plot. The data of germination percentage did not show any significant difference due to soil as well as foliar application of seaweed extract. The tillering ratio at 90 days was found to be statistically significant due seaweed extract application over control. The tiller ratio was highest (1.69) in treatment T₇ with foliar application of 1500 g ha⁻¹ seaweed extract alongwith RDF and which was significant over all treatments. Similar findings were also reported by Sunarpi *et al.* (2010) and Kavitha *et al.* (2008) in rice crop (Table 2).

Juice quality:

The juice quality parameters with respect to Brix, Pol, Purity and CCS per cent are presented in Table 3 indicated that the juice quality was not affected either by soil as well as foliar application of seaweed extract.

Conclusion:

The effect of seaweed extract on growth, yield and quality of sugarcane was studied in suru season. The results revealed that the application of seaweed extract @ 1500 g ha⁻¹ through soil application alongwith recommended dose of fertilizer increased cane yield by 14.1 % and sugar yield by 23.1%

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