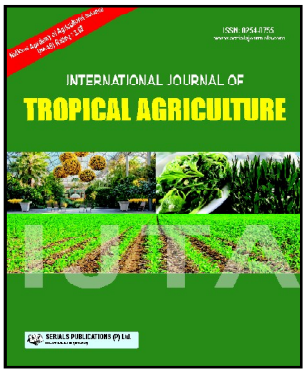

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Assessment of Yield and Yield Parameters in Sugarcane by the Application of Cytozyme Products

Varucha Misra, A. K. Mall*, A. K. Shrivastava and A. D. Pathak

ICAR-Indian Institute of Sugarcane Research Lucknow-226 002 (UP)
**Ashutosh.Mall@icar.gov.in*

Abstract: Being a solely high producer of sugar, sugarcane is crop of choice for farmers as well as millers. As it is an important cash crop and also one of the important raw materials for production of bio-ethanol, there is a need for enhancement of its production and yield. With this background, the study aims to assess the effect of application of Cytozyme products over sugarcane growth, yield and juice quality. In this experiment, two treatments were given on sugarcane crop along with an untreated canes acting as control. The spray of two treatments were T_1 consisting of two sprays, the first spray of crop XL at 1000 ml ha^{-1} + CytroNutri Zinc 750 ml ha^{-1} was sprayed when crop age was five months and have attained crop canopy of 55 cm followed by the second spray of crop XL at 1000 ml ha^{-1} + CytroNutri Boron 750 ml ha^{-1} and CytoNutri potassium 1000 ml ha^{-1} on after subsequent a month (or three weeks) of first spray and T_2 wherein at planting time, Seed + Extra at 500 ml ha^{-1} with Soil + at 500 ml ha^{-1} was sprayed directly onto the sugarcane seed pieces planted in furrows and latter were closed after 5 h of the application of treatment after which same treatment was given. The study showed that application of cytozyme products over sugarcane crop planted in both autumn and spring seasons gave relatively positive results on yield and yield parameters and need more intensive research to enhance the quality and production also.

Keywords: Cane yield, CCS %, Cytozyme, Maximum tillers, Reducing sugars, Sucrose %, Sugarcane

INTRODUCTION

Productivity of a crop is solely dependent on the process of photosynthesis (Osmand *et al.*, 1980). Taiz and Zeiger (2002) had showed that the rate of photosynthesis is associated with total light energy received in the growth tenure of a crop provided that the other nominal requirements of water and nutrients were fulfilled. Plant breeders realised that this is the right process to be focussed on to enhance crop yield potential by using molecular approaches

(Long *et al.*, 2006). Development of several agricultural practices has improved the potential of crop production over the years. Being a cash crop, sugarcane is a commercially important crop for farmers. The main product, sugar, obtained from it makes the crop important for sugar industries. Nowadays the emerging production of bio-ethanol in India makes it more vital crop of choice both for farmers as well as millers. Researchers are being conducted to enhance its productivity as well as production to fulfil the needs of our country. India although stands second in the cane production in the world but the emerging need of bio-ethanol requires more production of sugarcane as well as its high yield. Since area of cane production cannot be enhanced for more production of sugar, so, several attempts are being taken to enhance its productivity through genetic or by the application of chemicals. Application of chemicals on sugarcane although may enhance the production as well as yield of the crop to some extent but its effect on human health is not thought of. Cytozyme's product Crop+™ is obtained from concentrates from algae, *Ascophyllum nodosum* while Seed+™ is a fertiliser of vegetable origin obtained from fermentation and chemical treatment of the vegetable, seaweed product. These products had showed positive results in improving the plant productivity in many crops (Wozniak and Martineau, 2007). The effect of the Crop+™ product on chlorophyll content, photosynthetic activity and its correlation to yield increase was also evaluated in selected model plants and field crops. However, the application of Cytozyme's product has not been tested over sugarcane crop. Therefore, the study was to assess the effect of Cytozyme products on sugarcane growth, yield and juice quality parameters.

MATERIALS AND METHODS

Crop Culture

Two plant crops were planted in autumn and spring season using an early ripening and high sugar variety, CoPk 05191 in different fields at ICAR-Indian Institute of Sugarcane Research, Lucknow farm. These fields were prepared using cultivator and harrow. The furrows were opened at 90 cm row-to-row spacing using with tractor mounted furrower. The experiment was conducted in randomized Block Design (RBD) with three replications while plot area was 8 x 5.4 m. The fertilizer dose in the experiment field was given as per the following 150 Kg N in three splits; 80 Kg P_2O_5 as DAP (Basal) and 80 kg K_2O as MOP (Basal). Proper care and all essential cultural practices were being taken for healthy sugarcane growth. In both autumn and spring planted sugarcane, two chemical treatments were given. The first treatment (T_1), consists of two sprays of different chemicals at different time of crop age. The first spray of crop XL at 1000 ml ha^{-1} + CytroNutri Zinc 750 ml ha^{-1} was sprayed when crop age was five months and have attained crop canopy of 55 cm followed by the second spray of crop XL at 1000 ml ha^{-1} + CytroNutri Boron 750 ml ha^{-1} and CytoNutri potassium 1000 ml ha^{-1} on after subsequent a month (or three weeks) of first spray. In the second treatment, T_2, in both the seasons, at planting time, Seed + Extra at 500 ml ha^{-1} with Soil + at 500 ml ha^{-1} was sprayed directly onto the sugarcane seed pieces planted in furrows and the furrows were closed after 5 hours of the spray application and thereafter the first spray and second spray of chemicals was given as that of the first treatment. During both the sprays, the Control was sprayed with water only.

Growth parameters analysis

Growth parameter analysis was performed to assess the effect of chemicals over sugarcane growth. Number of tillers was counted during the tillering period of sugarcane to determine maximum number of tillers. Cane weight of different treated canes was measured by weighing balance. Soil analysis was conducted at the time of planting and detailed analyses are mentioned in the Table 1 and 2.

Table 1
Initial Soil Analysis (Autumn planted crop)

Crop season: 2014-15

Parameter	*R1*			*R2*			*R3*		
	Soil depth (cm)		*Mean*	*Soil depth (cm)*		*Mean*	*Soil depth (cm)*		*Mean*
	0-15	*15-30*		*0-15*	*15-30*		*0-15*	*15-30*	
pH (1:2)	7.69	7.82	7.76	7.7	7.9	7.8	7.78	7.9	7.84
EC (1:2)	0.18	0.16	0.17	0.17	0.14	0.16	0.18	0.15	0.17
Organic Carbon	0.41	0.3	0.36	0.41	0.26	0.34	0.44	0.3	0.37
Available N (kg/ha)	232	203.84	217.92	232	197.56	214.78	235.2	200.7	217.95
P_2O_5 (kg/ha)	29.12	18.39	23.76	28.35	15.32	21.84	27.59	16.86	22.23
K_2O (kg/ha)	293.04	240.24	266.64	291.98	239.71	265.85	294	240.76	267.38

Table 2
Initial Soil Analysis (Spring planted crop)

Crop season: 2015-16

Parameter	*R1*			*R2*			*R3*		
	Soil depth (cm)		*Mean*	*Soil depth (cm)*		*Mean*	*Soil depth (cm)*		*Mean*
	0-15	*15-30*		*0-15*	*15-30*		*0-15*	*15-30*	
pH (1:2)	7.86	7.98	7.92	7.83	7.92	7.88	7.83	7.86	7.85
EC (1:2)	0.20	0.15	0.18	0.18	0.16	0.17	0.19	0.14	0.17
Organic Carbon	0.67	0.36	0.52	0.67	0.42	0.55	0.60	0.18	0.39
Available N (kg/ha)	266.56	222.65	244.61	263.42	228.92	246.17	263.42	175.61	219.52
P_2O_5 (kg/ha)	61.31	26.82	44.07	60.55	25.29	42.92	59.78	16.86	38.32
K_2O (kg/ha)	385.44	102.66	244.05	385.46	183.74	284.60	374.88	176.55	275.72

RESULTS AND DISCUSSIONS

Maximum number of tillers

In autumn planted crop, T_1 and control had almost same number of maximum tillers while in T_2 there was an increase of 9.74 per cent as compared to control, however, both the treatments showed no significant difference (Fig. 1). In spring planted crop, there was an increase of 8.9 per cent in T_1 and 3.8 per cent in T_2 as compared to Control. This increase in maximum number of tillers due to the application of treatments showed significant difference at 1 per cent and 5 per cent (CD is 36.12 and 21.78, respectively) as compared to control (Fig. 2).

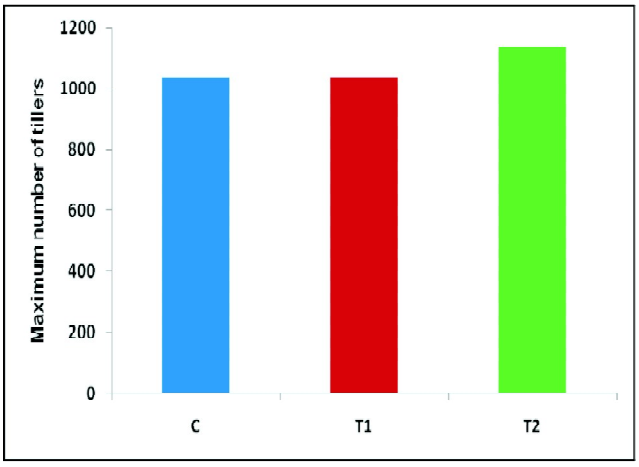

Figure 1: Maximum number of tillers in autumn planted crop

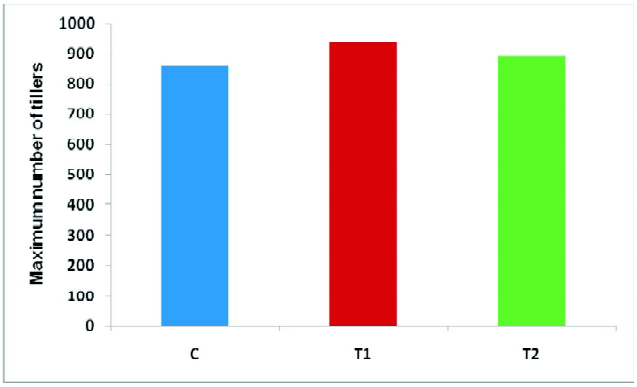

Figure 2: Maximum number of tillers in spring planted crop

Number of Millable Canes (NMC ha^{-1}): An increase of 4.5 per cent in T_1 while in T_2 an increase of 6.9 per cent was observed in comparison to control In autumn planted crop, however, this increase in NMC ha^{-1} in both the treatments was not significant (F= 0.96) (Fig. 3). In spring planted cane, there was an increase of 1.8 per cent in T_1 but in T_2 there was rather decrease in NMC ha^{-1} of 4.1 per cent (Fig. 4). On statistical analysis there was no significant difference (F=1.61) in NMC ha^{-1} in various treatments (T_1 and T_2) as compared to Control (p=0.11).

Average cane weight (kg cane^{-1}): In autumn planted crop, there was no difference in average cane weight of sugarcane of control and T_1 but there was a marginal decrease in average cane weight in T_2 in comparison to control (Fig. 5). This showed that

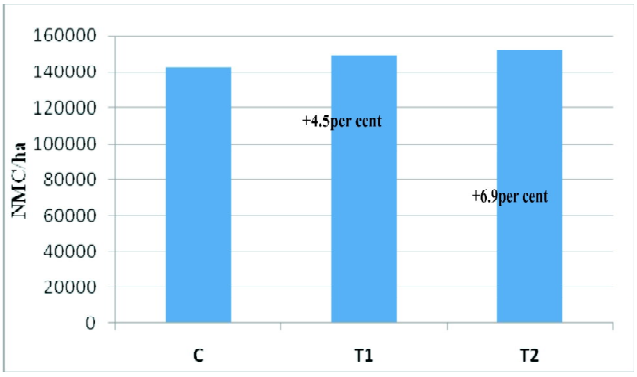

Figure 3: NMC ha^{-1} recorded in autumn planted sugarcane

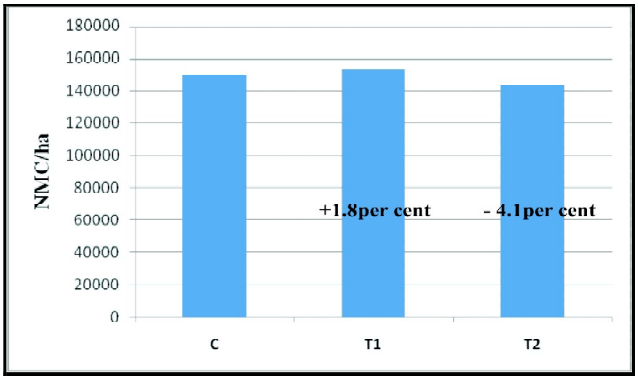

Figure 4: NMC ha^{-1} recorded in spring planted crop

there is no significant difference (F=0.3965) in average cane weight in treatments (T_1 & T_2) as compared to Control. In spring planted cane, the average cane weights in T_2 treated canes were less than the control canes while in T_1 it was almost same. This implies that there was no effect of the treatments on average cane weight. Statistical evaluation showed that there was significant difference (F= 8.82; CD @ 5per cent=0.07) in average cane weight in treatments (T_1 & T_2) as compared to Control (Fig. 6).

Cane yield: In autumn planted crop, there was an increase in cane yield in T_1 and T_2 in comparison to Control. The T_1 cane had relatively higher increase than T_2 as compared to control. However, there was no significant difference (F=1.10) in cane yield in various treatments (T_1 and T_2) as compared to Control (Fig. 7). In spring planted crop, although

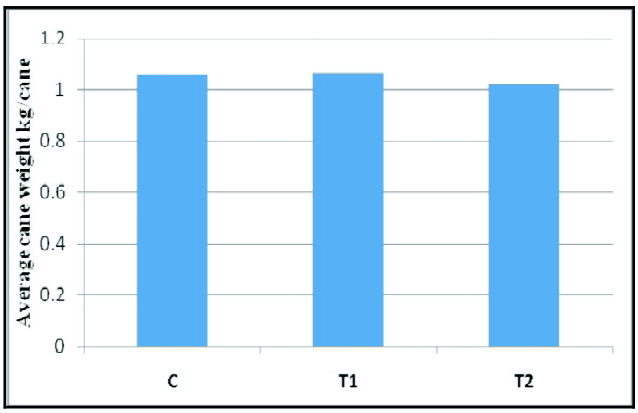

Figure 5: Average cane weight recorded in autumn planted sugarcane

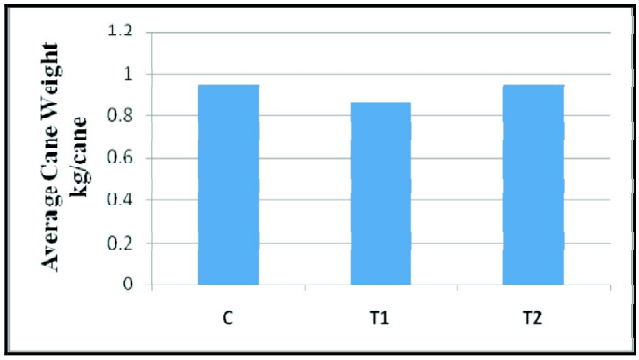

Figure 6: Average cane weight recorded in spring planted sugarcane

there was no significant difference (F=0.57) in cane yield in various treatments (T_1 and T_2) as compared to Control but the treatments showed marginal improvement in cane yield to the tune of 28.3 per cent and 33.4 per cent in T_1 and T_2, respectively (Fig. 8). This implies that cane yield (t ha^{-1}) in spring planted crop had relatively higher effect of both the treatments than the autumn planted ones.

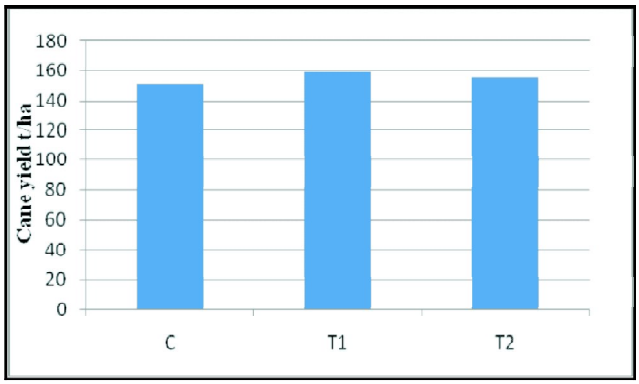

Figure 7: Yield (t ha^{-1}) recorded in autumn planted crop

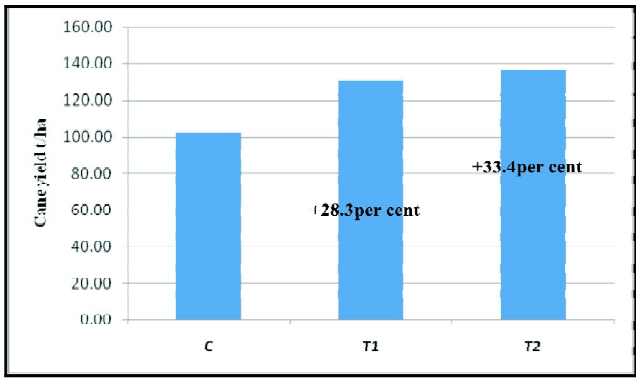

Figure 8: Yield (t ha^{-1}) recorded in spring planted crop

Commercial Cane sugars (CCS per cent): In autumn planted crop, CCS per cent of both T_1 and T_2 showed marginal increase as compared to Control canes in October. This marginal increase was of 0.02 units in both the treatments. In December, there was negative effect on CCS per cent in both the treatments however T_2 showed much higher negative effect on CCS per cent than T_1 treated canes. The CCS per cent in T_1 decreased by 0.53 units while in T_2, it decreased by 0.38 units. In the month of January, there was an increase in CCS per cent in T_1 treated canes by 0.47 units while in T_2 treated canes, there was a decrease of 0.22 units than Control canes.

In spring planted crop, CCS per cent was increased in both the treated canes as compared to control canes. In T_1 treated canes, the increase was of 1.02 units while in T_2 treated canes, it was 0.85 units in the month of October. In the month of December, CCS per cent rather than increase showed a relatively higher decrease in both the treatments than Control, thereby implying a negative effect on CCS per cent. This decrease in CCS per cent was of 1.11 and 1.28 units in T_1 and T_2, respectively. This even showed that there was much decrease in CCS per cent in T_2 treated canes than in T_1 treated canes. These results were similar to the ones obtained from autumn planted crop in the same month. Even in the month of January CCS per cent of the juice of both the treated canes showed declination. This decrease was of 0.66 and 3.69 units in T_1 and T_2,

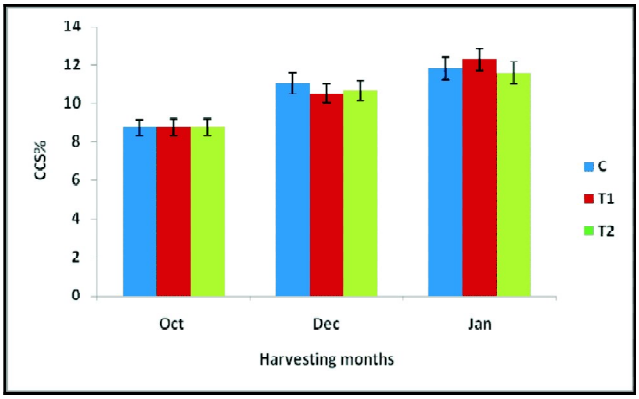

Figure: CCS per cent in autumn planted crop

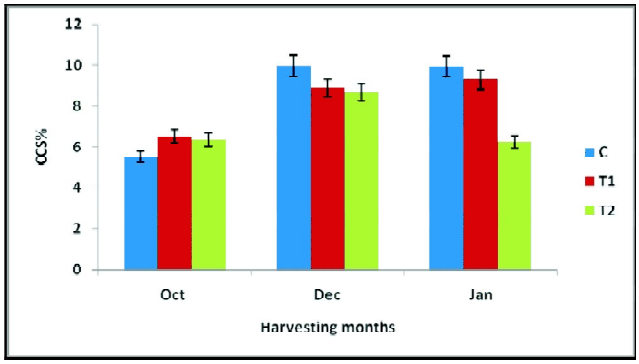

Figure: CCS per cent in spring planted crop

respectively, as compared to control canes. This also showed that T_2 treated canes had higher decrease in CCS per cent of the juice than T_1. It was also revealed that these results were similar to the results obtained in autumn planted crop.

CONCLUSION

This field study has demonstrated that it is possible to achieve a improvement in sugarcane productivity and quality by applying Cytozyme and Cytozyme improved NMC, yield and tiller when it was applied with standard concentration of Seed + Extra at 500 ml ha^{-1} with Soil + 500 ml ha^{-1}. Further research is required to investigate the correlation between nutrients and chemicals in Cytozyme.

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REFERENCES

Long SP, Naidu SL, Ort DR (2006), Can Improvement in Photosynthesis Increase Crop Yields? Plant Cell and Environment 29, 315-330.

Nelson N (1944), A photometric adaption of Somogyi method for determination of reducing sugar. J. Biol. Chem. 153, 375–380.

Osmond CB, Bjorkman O, Anderson DJ (1980), Physiological processes in Plant Ecology: Toward a Synthesis with Artiplex. Ecological Studies 36.

Taiz, L, Zeiger E, (2002), Plant Physiology. 3rd Ed. Sinauer Associates, Inc., Publishers. Sunderland, MA. USA.

Wozniak, EM, Martineau JR (2007), Cytozyme's Products for Sustainable Agriculture and their Advantages over Other Products on the Market. Plant Nut. for Sust. Agric. 10 (1), 1-6.