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Response of crop nutrient solution for growth, yield and quality contributing characters of preseasonal sugarcane grown on Inceptisols

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Abstract
An experiment was conducted at STCRC Research Farm, Rahuri, Maharashtra during preseasonal of 2017-19 to asses the response of crop nutrient solution for growth, yield and quality of preseasonal sugarcane grown on Inceptisol". The experiment was laid in randomized block design with ten treatments and three replications. The results indicated that significant improvement of higher growth, yield attributes and yield in terms of average cane weight (2.17 kg), No of millable canes (85.86), girth of internode (4.43 cm), at harvest of preseasonal sugarcane as compared to general recommended dose of fertilizers. Plant height, no of internodes were non significant. Cane yield (187.31 t ha^{-1}) and commercial cane sugar yield (23.61 t ha^{-1}) were recorded with application of 50% more of RDF (510:255:255:90 kg ha^{-1}) through complex crop nutrient solution grade fertilizer (CNS grade), Urea, bensulf and 20 t ha^{-1} FYM.

Keywords: Growth, yield and quality of preseasonal sugarcane

Introduction
Sugarcane (*Saccharum spp*. hybrid complex) is the premier sugar crop of India and occupies about 4.88 mha area and it is contributing about 7.5% of the gross value of agricultural production in the country with an annual sugarcane production of 342.38 MT (Anonymous, 2012). With the fast increasing population, the demand for sugar is consistently increasing and it is estimated that by 2020, the total sugarcane requirement of our country would be nearly 625 MT (Manimaran *et al.*, 2009) [3]. To fulfil the increased sugar demand with shrinking resources, it is necessary to increase yield per unit area. Judicious use of fertilizers provides one of the quickest means of increasing sugarcane production. Basically nitrogen, phosphorous and potash which are essential for the existence of plant along with limiting micronutrients. Supply of adequate plant nutrient is thus, the most important resource to augment the yields per unit area. Therefore, keeping in view of the to asses the response of crop nutrient solution for growth, yield and quality of preseasonal sugarcane grown on Inceptisol were studied in present investigation.

Material and methods
The field experiment was conducted in the preseasonal sugarcane during year 2017-19 on Inceptisol soils at STCRC Research Farm, Department of Soil Science and Agricultural Chemistry, Mahatma Phule Krishi Vidyapeeth, Rahuri, Ahmednagra Dist. Geographically the location of experimental site was N 19^o 21' 513'' latitude and E 074^o 39' 029'' longitude. The soils of experimental plot was dominant with montmorillonite type of clay mineral, medium deep black soil. The texture of soil was clay with slightly alkaline pH 7.85, EC 0.25 dS m^{-1}, low in available nitrogen (238.38 kg ha^{-1}), medium in available Phosphorus (15.2 kg ha^{-1}), very high in available Potassium (504 kg ha^{-1}), organic carbon (0.72%), $CaCO_3$ (6.80%). The experiment was planned with 10 treatments and 3 replications. The treatments of the field experiment study are T_1: Farmers practice (300:150:150 kg ha^{-1}), T_2: GRDF (340:170:170 kg ha^{-1} + 20 t ha^{-1} FYM), T_3: RDF (340:170:170:60 kg ha^{-1} Cu + Zn + Mg + Mn + Fe + B + Cu),T_4: Farmers practice through CNS grade (300:150:150 kg ha^{-1}), T_5: RDF (340:170:170:60 kg ha^{-1}) through CNS grade, T_6: 25% more of RDF (425:212: 212:75 kg ha^{-1}) through CNS

Grade, T_7: 25% less of RDF (255:128:128:45 kg ha^{-1}) through CNS grade, T_8: 50% more of RDF (510:255:255:90 kg ha^{-1}) through CNS grade, T_9: 50% less of RDF (170:85:85:30 kg ha^{-1}) through CNS grade, T_{10}: Absolute control. FYM application @ 20 t ha^{-1} to all treatments except Farmers practice and absolute control.

Results and discussion

Table 1: Growth attributes of preseasonal sugarcane as influenced by complex CNS grade

Tr. No	Treatment	ACW (kg)	NMC (000)	Plant height (cm)	No. of internodes	Girth (cm)
T_1	Farmers practice (300:150:150 kg ha^{-1})	1.84	81.80	265	22.00	4.47
T_2	GRDF (340:170:170 kg ha^{-1} +20 t ha^{-1} FYM)	2.05	80.13	273	21.00	4.22
T_3	RDF (340:170:170:60 kg ha^{-1} + Zn + Mg + Mn + Fe + B + Cu)	2.14	81.52	288	22.33	4.47
T_4	Farmers practice through CNS grade (300:150:150 kg ha^{-1})	2.06	79.86	265	21.00	4.30
T_5	RDF (340:170:170:60 kg ha^{-1}) through CNS grade	2.11	85.55	277	21.33	4.32
T_6	25% more of RDF (425: 212: 212: kg ha^{-1}) through CNS grade	2.17	85.02	268	22.00	4.43
T_7	25% less of RDF (255:128:128:45 kg ha^{-1}) through CNS grade	2.01	82.22	265	21.33	4.32
T_8	50% more of RDF (510:255:255: kg ha^{-1}) through CNS grade	2.17	85.86	287	22.00	4.43
T_9	50% less of RDF (170:85:85:30 kg ha^{-1}) through CNS grade	1.77	81.38	263	21.33	4.22
T_{10}	Absolute control	1.48	76.80	240	20.00	3.75
	SE±	0.12	2.80	0.094	1.004	0.07
	CD at 5%	0.36	8.40	NS	NS	0.21

Yield attributes

The yield contributing characters of preseasonal sugarcane *viz*., average cane weight (AWC), no of millable cane (NMC), plant height, no of internodes and girth of internode as influenced by complex fertilizers CNS grade fertilizer are reported in table 1.

The average cane weight (ACW) and no of millable canes (NMC) were significantly influenced by the complex fertilizer CNS grade. The average cane weight and no. of millable canes was significantly higher in the treatment 50% more of RDF (510:255:255:90 kg ha^{-1} N, P_2O_5, K_2O and S) through complex CNS grade, urea and bensulf (2.17 kg and 85.86), closely followed by 25% more RDF (425:212:212:75 kg ha^{-1} N, P_2O_5, K_2O and S respectively) through CNS grade fertilizer (2.17 kg and 85.02) and statistically at par with all the treatments except absolute control (1.48 kg and 76.80) and 50% less of RDF (170:85:85:30 kg ha^{-1} N, P_2O_5, K_2O and S) through complex grade, urea and bensulf for average cane weight (1.77 kg). Similar result were also recorded by Oad *et al*. (2009) [4] and Singh *et al*. (2011) [7].

Table 2: Yield and quality parameters of preseasonal sugarcane as influenced by complex CNS grade

Tr. No	Treatment	Yield (t ha^{-1})		Brix (C^0)	Sucrose (%)	Purity (%)	CCS (%)
		Cane yield	CCS Yield				
T_1	Farmers practice (300:150:150 kg ha^{-1})	150.50	19.56	19.19	18.20	94.88	13.00
T_2	GRDF (340:170:170 kg ha^{-1}+ 20 t ha^{-1} FYM)	164.26	21.2	19.19	18.11	94.42	12.91
T_3	RDF (340:170:170: 60 kg ha^{-1} + Zn + Mg + Mn + Fe + B + Cu)	180.51	22.49	18.85	17.56	93.18	12.46
T_4	Farmers practice through CNS grade (300:150: kg ha^{-1})	164.51	21.30	18.69	18.00	96.31	12.93
T_5	RDF (340:170:170: 60 kg ha^{-1}) through CNS grade	184.51	23.58	19.52	18.01	92.68	12.79
T_6	25% more of RDF (425: 212: 212: 75 kg ha^{-1}) through CNS grade	174.45	21.38	19.19	17.50	91.20	12.25
T_7	25% less of RDF (255:128:128 :45 kg ha^{-1}) through CNS grade	165.26	20.21	19.02	17.39	91.47	12.23
T_8	50% more of RDF (510:255:255 :90 kg ha^{-1}) through CNS grade	187.31	23.61	19.35	17.87	92.37	12.60
T_9	50% less of RDF (170:85:85 :30 kg ha^{-1}) through CNS grade	138.34	17.04	19.02	17.48	91.93	12.31
T_{10}	Absolute control	113.57	14.34	18.85	17.73	94.03	12.62
	SE_m±	6.93	1.16	0.313	0.319	1.569	0.250
	C.D. at 5%	19.75	3.48	NS	NS	NS	NS

Cane and Commercial Cane Sugar Yield

The cane, commercial cane yield and nutrient uptake of preseasonal sugarcane as influenced by the complex fertilizer crop nutrient solution (CNS) grade are presented in table 2. The cane and commercial cane sugar yield was significantly influenced by the complex fertilizer crop nutrient solution (CNS) grade of preseasonal sugarcane grown on Inceptisol soils. The treatment 50% more of RDF (510:255:255:90 kg ha^{-1} N, P_2O_5 and K_2O) through CNS grade + B bensulf along with 20 t ha^{-1} FYM recorded higher cane and commercial cane sugar yield (187.31 and 23.61 t ha^{-1}) followed by RDF (340:170:170:60 kg ha^{-1} N, P_2O_5, K_2O and S) through CNS grade and bensulf + Mg, Zn, Mn, Fe, B and Cu along with 20 t ha^{-1} FYM (184.41 and 23.58 t ha^{-1}), RDF (340:170:170:60 kg ha^{-1} N, P_2O_5, K_2O and S) through CNS grade, urea, bensulf + 20 t ha^{-1} FYM (180.51 and 22.49 t ha^{-1}) and treatment 25% more of RDF (425:242:212:75 kg ha^{-1} N, P_2O_5, K_2O and S) through CNS grade, urea, bensulf + 20 t ha^{-1} FYM (174.45 and 21.38 t ha^{-1}) respectively. However, it was statistically on par with each other and significantly superior over rest of the treatment. The lowest cane and commercial cane sugar yield was recorded in absolute control (113.57 and 14.34 t ha^{-1}) followed by 50% less of RDF (340:85:85:30 kg ha^{-1} N, P_2O_5, K_2O and S) through CNS grade, urea and bensulf + 20 t ha^{-1} FYM (138.34 and 17.04 t ha^{-1}) and treatment farmers practice (300:150:150 kg ha^{-1} N, P_2O_5 and K_2O) through urea, DAP, MOP (150.50 and 19.56 t ha^{-1}) respectively. The highest cane and commercial cane sugar yield in treatment 50% more of RDF (510:255:25:90 kg ha^{-1} N, P_2O_5, K_2O and S) through CNS grade, urea, bensulf might be associated with higher amount of nutrient added to the preseasonal sugarcane. Similarly, addition of sulphur through bensulf enhanced the chlorophyll content in sugarcane leaves, which might have enhanced the carbohydrate synthesis (sugars) in leaves through photosynthetic activities translocated from source to sink. This resulted in higher cane and commercial cane sugar yield. The CNS grade complex fertilizer contains Mg, S, Zn and B apart from N, P_2O_5 and K_2O content. The sulphur and magnesium are required for chlorophyll synthesis and photosynthesis process. Boron forms the complex fertilizer with sugar borate and translocate from source to sink, it also enhanced the protein synthesis; whereas, zinc might be helped in metabolic activities of sugarcane plant. All these phenomenon may resulted into increased cane and commercial cane sugar yield of preseasonal sugarcane. Similar results were also recorded by Reddy *et al*. (2009) [6] and Madhuri *et al*. (2011) [2].

Juice Quality Parameters

The juice quality parameters *viz*. brix, sucrose, purity per cent and CCS per cent of preseasonal sugarcane were not influenced by the complex fertilizer CNS grade are reported in table 2. However numerically sucrose content was more in farmers practice (300:150:150 kg ha^{-1} N, P_2O_5, and K_2O), GRDF (340:170:170 kg ha^{-1} N, P_2O_5 and K_2O + 20 t ha^{-1} FYM), CNS grade (300:150:150 kg ha^{-1} N, P_2O_5 and K_2O (18.20, 18.11, 18.01 and 18.00%, respectively). The corrected brix and commercial cane sugar yield were not varied numerically by complex CNS grade application to preseasonal sugarcane. Similar observations were also reported by Singh *et al*. (2007) [7], Omollo *et al*. (2011) [5].

Conclusion

The application of nutrient through crop nutrient solution (CNS) grade fertilizer @ treatment T_8, 50% more of RDF (510:255:255:90 kg ha^{-1} N, P_2O_5, K_2O and S) were on par with treatment T_5 and T_3 for increase in Average cane weight (ACW), no of millable canes, cane yield, commercial cane sugar yield and juice quality in preseasonal Sugarcane. The results of present investigation are of one year, needs confirmation by conducting more field experiments at different locations.

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