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Effect of genotypes and nitrogen levels on productivity of sugarcane (*Saccharum* spp. hybrid complex) ratooncrop

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Abstract
A field experiment was conducted during the spring season of 2015-16 on sandy loam soil of Pusa, to study the effect of 3 genotypes of sugarcane (*Saccharum* spp hybrid complex) ('CoP 11436', 'CoP 11437' and 'CoP 08436') and 3 levels of nitrogen (75, 100 and 125% recommended dose) on productivity and quality of sugarcane ratoon crop. The soil of the experimental field was a sandy loam in texture, alkaline in reaction (pH 8.2), low in organic carbon (0.48%), low in available N (220 kg/ha), medium in available P (11.6 kg/ha) and low in available K (108 kg/ha). The experiment was laid out in a factorial randomized block design with 3 replications. Results indicated that the genotype 'CoP 11437' showed better performance with significantly higher plant population (1, 90, 800/ha) and drymatter accumulation (31.0 t/ha). Significantly higher leaf area index (4.05), cane diameter (2.08 cm), single cane weight (783 g/plant) and cane yield (84.3 t/ha) was also obtained with the genotype 'CoP 11437' which was statistically comparable to 'CoP 08436'. Similarly significantly higher brix (20.1%), pol (17.81%), commercial cane sugar (12.32%) and sugar yield (10.38%) were obtained with 'CoP 11437'. Application of 125% recommended dose of nitrogen improved drymatter accumulation, leaf area index, cane yield and sugar yield. Though the differences between 100 and 125% recommended dose of nitrogen were found to be non-significant.

Keywords: Genotypes, Nitrogen levels, Productivity, Quality, Sugarcane ratoon

Introduction
Sugarcane (*Saccharum* spp hybrid complex) is one of the main sources of white crystal sugar in the world. Sugar industry which has more than 450 sugar factories in operation is the second largest agro-based industry next to cotton textile located in rural India. In India, it is cultivated in an area of 5.3 million ha, of which Bihar shares only 0.28 million ha with productivity of 50.0 t/ha [1]. Ratoon cropping of sugarcane is prevalent in about 40-45% of the total cane area in subtropical region. However, the yields of ratoon canes are comparatively much poor as compared to plant cane, which pools down the average productivity. There is urgent need for adoption of suitable genotypes and balanced nutrition for successful cultivation of ratoon crop. The yield and ratooning ability of different genotypes varies with their inbuilt genetic characters. The newly developed genotypes showed variable response to different agronomic practices. The important agronomic manipulation which can accelerate the adoption of a genotype in a particular agro-climatic region is identification of optimum dose of applied nutrient especially nitrogen [10]. As the Indian soils are universally deficient in N [5] efficient use of nitrogenous fertilizer is therefore critical [12]. Thus present experiment was undertaken to optimize the nitrogen requirement for enhanced productivity and quality of sugarcane genotypes under ratoon cropping.

Materials and methods
A field experiment was conducted at Sugarcane Research Institute, Dr.Rajendra Prasad Central Agricultural University, Pusa ($25^0$59' N and $85^0$40' E, 52.1 m above mean sea level), Bihar, during 2015-16. The soil was sandy loam with calcareous in nature (pH 8.2). The initial soil analysis indicated that it was low in organic carbon (0.48%), available nitrogen (220 kg/ha), medium in phosphorus (11.6 kg/ha) and low in available potassium (108 kg/ha) content. The treatments consisted of 3 genotypes, *viz.* 75, 100 and 125% of recommended dose. The experiment was laid out in a randomized block design with 3 replications. Recommended dose of fertilizer for ratoon crop was 170 kg N, 21.8 kg P and 49.8 kg K/ha through diammonium phosphate and muriate of potash, respectively. Nitrogen doses as per treatment were supplied through urea, after adjusting the N supplied through DAP. Full dose of phosphorus and potassium and half of N were drilled at the time of planting and remaining N was top-dressed

in two equal splits after first irrigation and late tillering stage (last week of June). The stubble shaving was done on 3rd February 2015 and harvested on Ist February 2016. The crop received a total of 932.6 mm rain in 50 rainy days. The experiment was conducted under irrigated conditions as per recommended packages of practice. Observations on growth, yield attributes and cane yield was recorded. Whole cane sample were taken at the time of harvest and analyzed for sucrose (%) in juice [11]. Sugar yield was calculated as; sugar yield (t/ ha) = [S – 0.4 (B - S) x 0.73] x cane yield (t/ ha)/ 100; where, S and B are sucrose and brix per cent in cane juice, respectively.

Results and discussion

Growth and yield attributes

The data presented in Table 1 revealed that plant population and drymatter accumulation was affected significantly due to genotypes. The significantly higher plant population (1, 90,800/ha) and drymatter accumulation (31.0 t/ha) were observed with 'CoP 11437' followed by CoP 08436. The marked improvement in plant population and drymatter accumulation was due to chemical composition of juice as well as enzymes and hormones present in cell sap, which differs from variety to variety. These results were supported by Kumar *et al.* [4]. Genotypic variation in plant population of sugarcane has also been reported by Kumar [2]. The genotype 'CoP 11437' recorded higher leaf area index (4.25) and cane diameter (2.08 cm) which was significantly superior over 'CoP 11436' and at par with 'CoP 08436'. The significantly minimum mortality percent of tillers (33.0%) was recorded in CoP 11436 was mainly due to formation of lowest tillers among the genotypes owing to availability of more nutrient, moisture, space and sunlight per tiller in unit area of land. Millable canes were not influenced by genotype. However, higher single cane weight (783 g) was obtained with the genotype 'CoP 11437' which was statistically comparable to 'CoP 08436' (767 g) and significantly superior over 'CoP11436' (689 g).

Nitrogen levels significantly influenced the drymatter accumulation and leaf area index. However, plant population, cane diameter, tillers mortality, millable canes and single cane weight were remains unaffected due to different levels of N application (Table 1). A significant increase in drymatter accumulation (27.6 t/ha) and leaf area index (4.07) were recorded up to 100% recommended dose of nitrogen.

Yield and quality

Data in Table 1 and 2 revealed significant differences among evaluated genotypes for cane yield, brix, pol, CCS percent and sugar yield. 'CoP 11437' recorded the highest cane yield (84.3 t/ha) and it was statistically comparable to 'CoP 08436' and significantly superior over 'CoP 11436'. The magnitude of increase in cane yield under the variety 'CoP 11437' over 'CoP 11436' and 'CoP 08436' was to the extent of 30.1 and 7.3%. This might be due to comparatively higher number of millable canes and optimum cane weight at harvest. Genotype 'CoP 11437' also showed the highest values of brix (20.1%), pol (17.81%), CCS (12.32%) and sugar yield (10.38%) which was significantly superior to rest of the genotypes (Table 2). This could be ascribed to its genetic potential compared to other genotypes. The results confirm the findings of Meena and Kumar [7] and Kumar and Pandey [3].

Nitrogen application significantly increased cane and sugar yield of sugarcane. However, various quality parameters did not exhibit significant variation. Application of 125% recommended dose of nitrogen gave higher cane (81.9 t/ha) and sugar yield (9.73 t/ha). However, the differences between 100 and 125% recommended dose of nitrogen were non-significant (Table 2 and 3). The increase in cane and sugar yield owing to application of 100 and 125% recommended dose of N over 75% recommended dose of N was 8.3 and 7.8; and 17.0 and 16.1% respectively. A significant variation in cane yield with N application has been amply documented by Laxmi *et al.* [6] and Singh and Kumar [8]. All the juice quality parameters like brix, pol, purity and CCS percent were not affected significantly due to N levels. Numerically pol, purity and CCS percent showed a diminishing trend, as the levels of nitrogen increased from 75 to 125% recommended dose of nitrogen. Similar findings were reported by Singh *et al.* [9], reported that different levels of N to sugarcane did not cause significant impact on brix, pol and purity of sugarcane.

Table 1: Effect of early genotypes and levels of nitrogen on growth, yield attributes and yield of sugarcaneratoon crop

Treatment	Plant population at 120 DAP ($x10^3$/ha)	Dry matter accumulation at harvest (t/ha)	Leaf area index	Cane diameter (cm)	Tillers mortality (%)	Millable canes ($x10^3$/ha)	Single cane weight (g)	Cane yield (t/ha)
Genotypes								
CoP 11436	142.4	22.7	3.78	1.87	33.0	95.5	689	64.8
CoP 11437	190.8	31.0	4.25	2.08	42.7	109.5	783	84.3
CoP 08436	164.0	28.1	4.05	2.03	36.4	104.3	767	78.6
SEm±	7.68	0.74	0.104	0.052	0.94	4.76	18.2	2.72
CD (P=0.05)	23.0	2.2	0.31	0.16	2.8	NS	55	8.2
Nitrogen level (% recommended dose)								
75	158.1	24.8	3.77	1.92	38.0	97.3	727	70.0
100	166.9	27.6	4.07	2.01	37.5	103.6	750	75.8
125	172.2	29.4	4.24	2.05	36.6	108.4	762	81.9
SEm±	7.68	0.74	0.104	0.052	0.94	4.76	18.2	2.72
CD (P=0.05)	NS	2.2	0.31	NS	NS	NS	NS	8.2

Table 2: Quality parameters of sugarcane ratoon crop as influenced by early genotypes and levels of nitrogen

Treatment	Brix (%)	Pol (%)	Purity (%)	CCS (%)	Sugar yield (t/ha)
Genotypes					
CoP 11436	19.1	16.85	88.1	11.63	7.53
CoP 11437	20.1	17.81	88.5	12.32	10.38
CoP 08436	19.4	17.03	87.6	11.73	9.22
SEm±	0.13	0.110	0.58	0.065	0.262
CD (P=0.05)	0.4	0.33	NS	0.19	0.79
Nitrogen level (% recommended dose)					
75	19.6	17.30	88.1	11.95	8.38
100	19.5	17.21	88.1	11.88	9.03
125	19.5	17.18	88.0	11.85	9.73
SEm±	0.13	0.11	0.58	0.065	0.262
CD (P=0.05)	NS	NS	NS	NS	0.79

Conclusion

The sugarcane genotype 'CoP 11437' and 'CoP 08436' could be fertilized with 100% recommended dose of nitrogen (170 kg N/ha) to get higher yield attributes, cane and sugar yield of sugarcane under north Bihar condition.

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