RESEARCH ARTICLE

PERFORMANCE OF SUGARCANE VARIETIES AND INTEGRATED NUTRIENT MANAGEMENT ON PRODUCTIVITY, PROFITABILITY AND QUALITY OF SUGARCANE UNDER NORTHERN HILL ZONE OF CHHATTISGARH

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Abstract: A field experiment was conducted during cropping seasons of 2015–16 and 2016-17 at Instructional cum research farm RMD CARS Ambikapur to evaluate sugarcane mid–late varieties (Co 86032,Co 62175, CoT 8201) under 6 levels of nutrient management (N_1) RDF (250:80:80 NPK Kg ha^{-1}), (N_2) 125%RDF (N_3) 150% RDF, (N_4) RDF+FYM @10 t ha^{-1}, (N_5) RDF+ Poultry manure @ 2 .0 ha^{-1} (N_6) RDF +Vermicompost @2.5 t ha. Higher growth in terms of shoots (121.46 x10^3 ha^{-1}), millable cane length 238.05 (cm), total dry matter yield (41.80 t ha^{-1}) and yield attributes Viz. number of millable cane (87.62 x10^3 ha^{-1}), cane weight cane yield (109.25 t ha^{-1}) and CCS yield (11.61 t ha^{-1}) were recorded highest with Co 86032, respectively. Variety 'Co 86032' showed non significantly values on quality parameters of brix%, pol %, purity % in juice across the planting season. Variety 'Co 86032' gave the maximum net returns (Rs 256867.61 ha^{-1}) and benefit: cost ratio (3.64). Genotype Co 86032 gave better yield, Significantly higher shoots (122.65 thousand/ha), millable cane length (250.79 cm), dry matter yield (43.14 t ha^{-1}), cane girth (8.35 cm), number of millable canes (93.15 x10^3 ha^{-1}) and cane yield (113.74 t ha^{-1}) net returns (Rs 273943.00 ha^{-1}) and benefit: cost ratio (4.07) obtained with the application of 150% RDF respectively.

Keywords: Sugarcane, Nutrient, Management, Northern hill

INTRODUCTION

Sugarcane is an important cash crop of India grown in an area of 4.4 million ha with a annual production of 306 million tonnes and the average yield is 69.0 t/ha. In chhattisgarh, it occupies an area of 0.2 million ha, with the production of 8.0 million tonnes and productivity is 41.0 tonnes/ha (ISMA, 2016). Despite all the attempts, productivity of sugarcane in state is quite less than the national productivity. This situation may be overcome by using high yielding genotypes having better production potential and also adopting proper nutrient management practices. It is an input – intensive crop needs high quantities of N, P and K during the period of its efficient utilization, particularly at formative and grand growth stages for higher productivity. Earlier studies showed positive response of sugarcane genotypes to fertility level under diverse planting season (Shankar, 2015). Application of major plant nutrients in right proportion and in optimum quantity through correct method for specific soil – climatic condition is the key input for sustained crop production. There is differential response of the genotypes to higher levels of nutrients due to differential genetic potentiality of the particular genotypes (Sinha *et al*., 2005).

MATERIALS AND METHODS

An experiment was conducted during spring seasons of 2016 and 2017 at Instructional farm, RMD College of agriculture and research station Ambikapur to find out the suitable mid late varieties with integrated nutrient management for northern hill zone of Chhattisgarh condition. The soil was sandy loam in texture, acidic in reaction pH 5.6, 0.33% organic carbon, 195.5, 8.3 and 276.0 kg/ha available N, P and K, respectively. Three mid late sugarcane varieties ('Co 86032', 'Co 62175' and 'CoT 8201') were under six levels of fertilization *viz.* (N_1) RDF 100%,(N_2) RDF125%,(N_3) RDF150%, (N_4) RDF+FYM @10 t ha^{-1}, (N_5) RDF+ Poultry manure @ 2 .0 ha^{-1} (N_6) RDF + Vermicompost @2.5 t ha^{-1}, split plot design with three replications during spring season. Urea, Single super phosphate and muriate of potash were taken as sources of nitrogen, phosphorus and potassium, respectively. Full dose of P and K were applied as basal at the time of planting and full N in two equal splits during first and second earthing up during both the seasons in each year.The sugarcane was planted in second week of February during spring season respectively and harvested on second week of February during both the years. The mean rainfall received during the crop growth period was mm.1223.23 mm. Whole cane samples were taken at the time of harvest and cane juice was extracted with power crusher machine and juice quality was estimated as per method given by Spencer and Meade (1955). Net returns was calculated by deducting the total cost of cultivation from the gross returns for each treatment and expressed as per hectare on the basis of cost of inputs and prices of outputs in experimentation year. The benefit: cost ratio was calculated as ratio of gross return to cost of cultivation.

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RESULTS AND DISCUSSION

Data indicated that different varieties of sugarcane had significant effect on germination percentage. Sugarcane variety 'Co-86032' had recorded the highest germination per cent (66.16 %) at 45 DAP while varieties 'Co 62175' and 'CoT 8201' was statistically at par. Among the nutrient management significantly highest germination per cent (66.54) was recorded with 150% RDF followed by (55.54 and 65.70) with 125%. The variation in germination percentage was owing to chemical composition of soluble solids in juice as well as enzymes and hormones present in cell sap, which varies from genotype to genotype. Sugarcane variety 'Co 86032' showed significantly highest number of shoots (121.46 $x10^3$ ha^{-1}) at 120 DAP but it was comparable to 'Co 62175' (120.29 $x10^3$ ha^{-1}) and CoT 8201 (118.91 $x10^3$ ha^{-1}). The variation in number of tillers among different variety might be due to genetic characters of varieties. Sinare *et al. (*2006), Aravinth and Wahab (2011). Integrated nutrient management practices had significant influence on number of shoots. Significantly highest numbers of number of shoots (122.65 $x10^3$ ha^{-1}) at 120 DAP was recorded under 150% RDF which was statistically at par with (N_5) and (N_2) but significantly superior over rest of the treatments. This might be due to higher dose of chemical fertilizers which increased the population of tillers due to immediate and quick supply of plant nutrients. Further higher dose of NPK also reduce the mortality of tillers. The results are in agreement with the finding of Virida and Patel (2010). The dry matter yield of sugarcane as influenced by varieties and nutrient management systems recorded at harvest have been presented in Table 1.Sugarcane varieties showed significant effect on dry matter yield and maximum dry matter yield (41.80 t ha^{-1}).was recorded with Co 86032 found significantly superior over both the varieties. While Co 62175 and CoT 8201 were statistically at par with each other. The data on dry matter yield was significantly influenced with nutrient management. Maximum dry matter yield (43.14 t ha^{-1}) was obtained with 150% RDF which was statistically superior over other treatments.

Maximum cane girth (8.28 cm) and average cane weight (2.464 kg $cane^{-1}$) was recorded highest with variety Co 86032 followed by Co 62175. Cane girth was no significant with nutrient management. The highest cane girth (8.35cm) and average cane weight (2.479 g $cane^{-1}$) was recorded under the treatment 150% RDF found significantly superior over rest of the treatments assured supply of nutrients to sugarcane for growth and development. This result is agreement with the finding of Manickam *et al.* (2008).Improvement in average diameter of cane was due to increased metabolic processes in plant, resulting in greater metabolic activity thereby improving the sink size which manifested in to thicker canes. These results confirm the findings of Pandey and Shukla (2003).Integrated nutrient management practices had significant effect on cane girth and average cane weight at harvest.

Table 1. Growth yield attributes of sugarcane as influenced sugarcane varieties and nutrient management

Varieties	Germination (%)at 45 DAP	No. of shoots ($x10^3$) at 120DAP	Millable cane length(cm)	Dry matter yield (t ha^{-1})	Cane Girth (cm)	Cane weight (g)	CCS Yield (t ha^{-1})	Cane yield (t ha^{-1})
V_1 CoT 8201	63.35	118.91	238.05	39.06	8.21	2.377	10.44	96.40
V_2 Co 86032	66.16	121.46	244.04	41.80	8.28	2.464	11.61	109.25
V_3 Co 62175	64.65	120.29	241.99	40.07	8.25	2.427	11.26	105.02
SEm±	0.75	0.34	0.41	0.22	0.02	0.006	0.10	0.91
CD (P-0.05)	2.93	1.33	1.62	0.88	0.07	0.023	0.41	3.57
Integrated Nutrient Management								
N_1RDF (250:80:80KgNPK $^{-1}$)	63.84	117.97	234.59	37.89	8.11	2.372	10.52	89.86
N2 125 % RDF	65.70	120.06	242.42	40.42	8.25	2.420	10.95	104.12
N3 150 % RDF	66.54	122.65	250.79	43.14	8.35	2.479	12.15	113.74
N_4 RDF + FYM @10 t ha^{-1}	64.80	119.59	239.12	39.04	8.21	2.410	10.77	102.80
N_5 RDF+ PM @2 t ha^{-1}	63.86	121.16	241.42	41.29	8.30	2.431	11.13	105.81
N_6 RDF + VC @ 2.5 t ha^{-1}	63.89	119.91	239.81	40.10	8.27	2.422	11.08	105.01
SEm±	0.74	0.46	1.82	0.46	0.05	0.006	0.16	1.40
CD (P-0.05)	2.13	1.31	5.24	1.32	0.13	0.017	0.45	4.04

The variation in growth and yield attributes among the varieties might be due to variation in partitioning of photosynthates by the different genotypes. Sugarcane varieties Co 86032 exhibited significantly higher number of millable canes length (244.04cm) was recorded by 150% RDF, though it was on par with 125% RDF. Improvement in yield attributes of sugarcane was recorded due to increased metabolic

processes in plants, resulting in greater meristematic activity thereby improving the sink size which manifested into higher values of growth and yield contributing characters.

Yield and quality

The data pertaining to cane yield and quality have been presented in Table 1. The highest cane yield (109.25 t ha^{-1}) was recorded by Co 86032 found superior over Co 62175 (105.02 t ha^{-1}) and CoT 8201 (96.40 t ha-^{1}).

Table 2. Quality and economic analysis of sugarcane as influenced by genotypes and fertility levels.

Varieties	Brix %	Pol %	Purity %	Net Return	B C ratio
V_1 CoT 8201	18.53	15.53	83.97	218327.61	3.09
V_2 Co 86032	18.59	15.60	84.02	256867.61	3.64
V_3 Co 62175	18.54	15.60	84.28	244193.45	3.46
SEm±	0.23	0.05	0.85	2724.72	0.04
CD (P-0.05)	NS	NS	NS	10712.29	0.15
Integrated Nutrient Management					
N_1RDF (250:80:80KgNPK $^{-1}$)	18.49	15.31	82.90	203957.00	3.11
N_2 125 % RDF	18.54	15.60	84.44	245918.01	3.70
N_3 150 % RDF	18.71	15.86	84.80	273943.00	4.07
N_4 RDF + FYM @10 t ha^{-1}	18.54	15.54	84.01	234287.00	3.16
N_5 RDF+ PM @2 t ha^{-1}	18.54	15.59	84.11	243785.33	3.31
N_6 RDF + VC @ 2.5 t ha^{-1}	18.51	15.58	84.25	236887.00	3.03
SEm±	0.29	0.09	1.42	4203.90	0.06
CD (P-0.05)	NS	NS	NS	12128.22	0.17

Sugarcane variety had different potentialities and hence caused significant variation in cane yield. This may be due to inherent superiority of various growth characters and assimilating apparatus in some varieties. Performance of different varieties with variation in the yield was reported by kadam et al. (2008).Integrated nutrient management had exerted significant effect on cane yield. Maximum cane yield (113.74 t ha^{-1}) was recorded with 150% RDF. However, it remained nutrient management treatments (N_2, N_5 and N_6) were at par with each other.Highest cane yield recorded under the higher doses of NPK responsible to highest shoot population coupled with efficient conversion of tillers in to millable canes at harvest could have contributed to higher cane yield.

Varieties of sugarcane influences non significant variation in juice quality with respect of brix percentage, pol percentage, and purity percentage. Among the varieties showed highest brix (18.71%), pol (15.86%) purity (84.80%) and CCS (10.53%) was recorded under variety Co 86032. This might be due to genetic ability of this variety due to accumulate more sucrose in juice.

Sugarcane 'Co 86032 recorded significantly higher net returns (Rs 256867.61 ha^{-1}) and benefit: cost ratio (3.64). Net returns increased significantly with each successive increase in fertility level from 100 to 150% RDF. Net returns (Rs 273943.00 ha^{-1}) and benefit: cost ratio (4.07). Significantly influenced by various levels of fertilization (Table 2). The differences in net returns and benefit: cost ratio of different genotypes and fertility levels were primarily due to variations in cane yield and cost of cultivation.

CONCLUSION

Experimental findings clearly indicate that growth, yield attributes and cane yield of sugarcane varieties tested under the different integrated nutrient management practices are responding to increased level of nutrients. Among the varieties Co 86032 was found significantly superior over others varieties in terms of growth (plant height, no. of tillers), yield attributes (single cane weight, average cane girth) and cane yield.. As regard to nutrient management, application of RDF150 % was significantly superior to other nutrient management in terms of growth, yield attributes and cane yield.

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