



Nutrient requirement of Pre-release Sugarcane Varieties in Vertisols of Northern Telangana Zone

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/IJPSS/2023/v35i234266

Open Peer Review History:

This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: <https://www.sdiarticle5.com/review-history/102184>

Original Research Article

Received: 27/08/2023

Accepted: 02/11/2023

Published: 22/12/2023

ABSTRACT

A field experiment was conducted at Regional Sugarcane and Rice Research Station, Rudrur during the two successive seasons of 2018-19 and 2019-20 to find out the performance of three sugar cane varieties (97 R 129, 2010 R 854 and Co 86032) under four fertilizer levels (75, 100, 125 and 150 % RDF). The experiments consist of 12 treatments replicated thrice in a Randomized Block Design with factorial concept. The highest cane yield (119.1 t ha⁻¹) was recorded with application of 150 % RDF which was on par with application of 125% RDF (114.4 kg ha⁻¹) and significantly superior over rest of the treatments. The lowest yields recorded under 75 % RDF (87.50 t ha⁻¹). Among the varieties tested, 2010 R 854 recorded highest cane yield (112.2 t ha⁻¹) which was significantly out yielded than the rest of the two varieties (97 R 129 and Co 86032). The highest benefit cost ratio recorded in 125% RDF followed by 150 % RDF and 100% RDF. Among the varieties, 2010 R 854 recorded highest benefit cost ratio over rest of the varieties. Based on the results of the investigation it is concluded that adoption of promising sugarcane variety 2010 R 854 with 125 % RDF (312.5-125-125 kg N-P₂O₅-K₂O ha⁻¹) is recommended for Vertisols of Northern Telangana Zone.

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Keywords: Sugarcane; varieties; nutrient levels; cane yield; vertisols.

1. INTRODUCTION

“Sugarcane (*Saccharum officinarum* L.) is an important cash crop in India grown in an area of 49.54 lakh hectares with a production of 22.17 lakh tonnes and productivity of 63.3 tonnes ha⁻¹” [1]. “In Telangana region, sugarcane grown in an area of 0.35 lakh hectares with a production of 3950 lakh tonnes and productivity of 79.80 tonnes ha⁻¹” [2]. Sugarcane being a long duration exhaustive crop with heavy nutritional demand, produces a heavy tonnage and tends to remove substantial quantum of plant nutrients from the soil thus rendered soil less fertile and fails to produce higher crop. The production potential of sugarcane crop depends upon choice of variety and adoption of balanced nutrition.

“Continuous planting of sugarcane in the same field depletes the soil nutrients. A crop having yield of 100 t ha⁻¹ removes 207 kg N, 30 kg P₂O₅ and 233 kg K₂O from the soil” [3]. “Therefore these elements must be added in adequate quantities in the root zone of the crop to obtain higher yield. Proper fertilization is an important management function in sugarcane production” [4]. “Thus, it is necessary to supply sugarcane crop with the big three (N, P and K) to secure good cane quantity and quality. The chemical source of fertilizer (N, P and K) at the rate of 225-112-168 kg ha⁻¹ proved to be more effective to produce significantly greater plant height and thicker cane girth, more tillers, better brix, higher sugar recovery and maximum cane yield ha⁻¹” [5].

“The average yield of the sugarcane varieties is much lower than their potential yield. Imbalanced fertilizer use seems to be one of the factors responsible for the constantly low cane yield in Telangana” [6]. “According to a survey report, only 4% of the cane growers use NPK and the majority (73%) of them relies on NP fertilization” [7]. “Fertilizers play an important role in increasing sugar production mainly because of their influence on cane tonnage. Most cane growers use fertilizers regularly to maintain or gain further increase in cane yields per acre” [8].

“Yield potentiality of a crop would not reach a maximum unless proper fertilizer management is made. Sugarcane variety shows a tendency to decline in yield and vigor which needs replacement of the existing varieties with the new ones. Different sugarcane varieties differ in nutrient requirement from place to place

according to soil and agro-climatic conditions” [9]. “Some varieties have ability to absorb and utilize more nutrients from a soil under the same climatic condition and produce more cane and sugar. The application of NPK beyond 100 per cent of the recommended amount had produced only marginal increase in cane and sugar yield” [10]. “Sugar yield per unit area can be increased only, if there is simultaneous increase in the production of sugarcane and the recovery of sugar” [11]. Balanced application of nutrients (NPK) is the key factor to influence sugarcane production.

Recommended dose of N:P₂O₅:K₂O for Telangana region is 250:100:100 kg ha⁻¹. But farmers are using higher doses of fertilizer and getting higher yields. Further there should be revision of fertilizer schedule as the present recommendations were formulated long back. Therefore, the present investigation was undertaken to suggest the appropriate fertilizer dose for newly released sugarcane varieties for realizing maximum cane yield in Vertisols of Northern Telangana Zone.

2. MATERIALS AND METHODS

A field experiment was conducted at Regional Sugarcane and Rice Research Station, Rudrur during the two successive seasons of 2018-19 and 2019-20 to find out the performance of three sugar cane varieties (97 R 129, 2010 R 854 and Co 86032) under four fertilizer levels (75, 100, 125 and 150 % RDF). The experiment consist of 12 treatments replicated thrice in a Randomized Block Design with factorial concept. Initial soil samples were collected in each location and analyzed for alkaline KMnO₄-N [12], Olsen-P [13] and NH₄OAc-K [14]. Initial determination of native fertility revealed that, soils were neutral in reaction to non-saline in nature. Available N, P and K were low, medium to high and medium to high in status ranging from 189 to 201, 28 to 34 and 308 to 342 kg ha⁻¹, respectively.

Planting was done at 90 cm spacing using three eye budded setts (12 buds per meter row length). The recommended dose of fertilizer (100% NPK) for sugarcane in this region is N:P₂O₅:K₂O @ 250:100:100 kg ha⁻¹. Full dose of phosphorus and potassium were applied as basal at the time of planting and nitrogen was applied in two equal splits on 60th and 120th day after planting cane setts. Number of millable canes / plot (NMC/plot)

and cane yield / plot were recorded separately and expressed in terms of '000 ha⁻¹ & t ha⁻¹ respectively. Data analysis was computed by following the statistical methods out lined by Panse & Sukhatme [15]. Benefit Cost Ratio (B:C ratio) was worked out based on the standard procedure [16]. The cultivation practices were carried out periodically and the cane yield was recorded at harvest.

3. RESULTS AND DISCUSSION

3.1 Effect of Fertilizer Level

The NMC (000 ha⁻¹) and cane yield (t ha⁻¹) of sugarcane significantly influenced by different doses of fertilizers (Table 1). The highest cane yield (119.1 t ha⁻¹) was recorded with application of 150 % RDF which was on par with application of 125% RDF (114.4 kg ha⁻¹) and the lowest yields recorded under 75 % RDF (87.50 t ha⁻¹). "Application of 125% of RDF gave 30.28% and 10.68% more cane yields than 75 % and 100 % fertility levels respectively and the differences were significant. Singh *et al.*, 2005 also reported significant increase in growth and yield parameters of sugarcane by application of nitrogen @ 150 kg ha⁻¹. Singh and Mishra [17] reported that application of 125% of RDF recorded 4.32% and 16.24% higher sugar yields than 100% and 75% of RDF. Application of 100 % RDN was found optimum for realizing higher cane yield (130.84 t/ha) of sugarcane" Tayade et al. [18].

Application of 125 % NPK resulted in highest cane yield and these responses in cane yield obviously owed to the low available N status of the experimental soil and probably due to the involvement of N in formation of chlorophyll

besides many other compounds required in plant metabolism. Similar response to higher levels of N, P&K in sugarcane was reported by Ramesh and Varghese [19], Patel et al. [20]; and Sarala et al. [21-33]. This can also be attributed to the higher internodal diameter, plant height, cane length and single cane weight of the test variety.

3.2 Effect of Variety

Significant variations were recorded in NMC (000 ha⁻¹) and cane yield (t ha⁻¹) of sugarcane plant crop due to varieties (Table 1). "Among the varieties tested (97 R 129, 2010 R 854 and Co 86032), 2010 R 854 recorded highest cane yield (112.2 t ha⁻¹) which was significantly superior over rest of the two varieties. 97 R 129 and Co 86032 were at par with each other. 97 R 129 produced the lowest cane yield due to shorter cane height and value was even 8.9% lower than 2010 R 854. Significant variations in yield attributes and cane yield, among genotypes" Singh and Mishra [17-33].

3.3 Effect of Variety and Fertility Levels Interactions

Interaction effect between fertilizer doses and varieties were found to be non significant (Table 1). Similar results were reported by Tayade et al. [18]; Singh and Mishra [17].

3.4 Economics of Sugarcane

Application of 125% NPK in plant crop fetched maximum net return 254710 with highest benefit: cost ratio of 2.74 followed by 150 % RDF and 100% RDF (Tables 2 & 3). Variety 2010 R 854

Table 1. Effect of levels of RDF on NMC and cane yield of sugarcane varieties (Pooled over two years)

Treatments	NMC (000/ha)					Cane Yield (t ha ⁻¹)				
	RDF (%)					RDF (%)				
	75%	100%	125%	150%	Mean	75	100	125	150	Mean
V ₁	102.0	111.1	119.3	12.3	113.4	88.73	98.73	109.4	113.3	102.5
V ₂	99.67	116.6	124.3	127.0	117.9	91.10	110.9	121.5	125.3	112.2
V ₃	123.0	139.0	152.3	158.0	143.1	82.67	99.37	112.3	118.7	103.2
Mean	108.2	122.2	132.0	135.4		87.50	103.0	114.4	119.1	
	S.Ed±			CD (0.05)		S.Ed±			CD (0.05)	
V	1.82			3.77		1.59			3.31	
F	2.10			4.36		1.85			5.82	
V×F	3.64			N.S.		3.19			N.S.	

V1: 97 R 129 V2: 2010 R 854 V3: Co 86032 (C)

Table 2. Net Return of sugarcane under different treatments (Pooled over two years)

Treatments	RDF (%)				Mean
	75%	100%	125%	150%	
97 R 129	154340	200309	238062	243620	209083
2010 R 854	170551	237535	275224	280109	240855
Co 86032	148093	204694	250845	264930	217141
Mean	157661	214179	254710	262886	

Table 3. Benefit: Cost Ratio of sugarcane under different treatments (Pooled over two years)

Treatments	RDF (%)				Mean
	75%	100%	125%	150%	
97 R 129	2.05	2.36	2.63	2.58	2.41
2010 R 854	2.16	2.61	2.88	2.82	2.62
Co 86032	2.00	2.38	2.72	2.72	2.46
Mean	2.07	2.45	2.74	2.71	



Fig. 1. Overall view of experimental site



Fig. 2. Performance of variety (2010 R 854)

fetches highest net return 240855 and benefit: cost ratio 2.62 followed by genotype Co 86032 (217141 and 2.46) in plant crop and lowest was observed from 97 R 129. Among the interactions, sugarcane variety 2010 R 854 with 125 % RDF (125-62.5-50 kg N-P₂O₅-K₂O ha⁻¹) fetched maximum net returns (Rs.275224) and benefit:cost ratio (2.88) over other combinations. The increase in net returns to the farmer by the adoption of this variety 2010 R 854 with 125 % of RDF over check variety (Co 86032) is to the extent of Rs. 24,379/-. The additional cost of fertilizers applied per hectare with this rescheduling is to the extent of Rs.854/-.

4. CONCLUSION

The promising sugarcane variety 2010 R 854 was found significantly superior over the local check Co 86032 sugarcane variety and linearly

responded upto 125 % of RDF application; hence for realizing maximum cane yield in Vertisols of Northern Telangana Zone, application of 312.5-125-125 kg N-P₂O₅-K₂O ha⁻¹ (125% RDF) is recommended. Replacement of non recommended, low yielding and low input responsive varieties with improved pre-release sugarcane varieties is most essential to sustain the yield and quality of sugarcane.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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Peer-review history:

The peer review history for this paper can be accessed here:

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