

Original Research Article

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Response of Promising Midlate Maturing Sugarcane Varieties to Different Doses of Nitrogen Fertilizer

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ABSTRACT

Field trial was conducted at Agricultural Research Station, Perumallapalle in two plant crops to evaluate the response of mid late maturing sugarcane varieties to different doses of nitrogen fertilizer. Four midlate varieties *viz.*, 2012T58, 2012T72, 2012T78 and 2012T182 were tested at four nitrogen levels *i.e.*, 100%, 125%, 150% and 175% of recommended dose of nitrogen (RDN: 224 kg/ha). Application of nitrogen @ 150% RDN produced significantly higher values for millables canes, cane yield and per cent sucrose. Hence application of nitrogen @ 336 kg /ha is the viable fertilizer nitrogen for midlate varieties of sugarcane crop in sandy loam soils of southern agro-climatic zone of Andhra Pradesh. However, the effect of nitrogen levels on juice quality parameters was not significant. Among the sugarcane midlate varieties, 2012T58 and 2012T 182 responded well to the applied nitrogen and recorded higher cane yield.

Keywords

Sugarcane,
Nitrogen levels,
Cane yield and
Juice quality

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Introduction

Most of the southern zone of Andhra Pradesh, where sugarcane is grown, low in soil nitrogen, this coupled with long term mono cropping as a consequences of raising several ratoons year after year and land scarcity justifies continued use of nitrogen fertilizer in field. However, nitrogen fertilizer is costly and indiscriminate management such as inappropriate rate, time and placement may lead to poor crop performance and yield;

besides, it may result in such losses as nitrate due to leaching, denitrification and ammonium volatilization with serious environmental pollution. Nitrogen is the primary nutrient which influences the yield and quality of cane. Earlier Saldarsringa *et al.*, (1998) reported N fertilizer rate as one of the most influencing factors on cane yields and response to applied nitrogen is universal, nitrogen increases the source of capacity, namely leaf area index, leaf area duration, early closure and rate of photosynthesis

(Hunsigi,1993). An increased sugarcane yield with nitrogen application is attributed to the increased number of tillers and yield attributes like stalk length, stalk diameter and number of millable canes (Abayomi, 1987). Different sugarcane varieties have different yield potential and their specific attributes (Tayade *et al.*, 2016). Considerable differences in the response of sugarcane varieties to applied nitrogen was reported from Tamilnadu (Srinivasan, 1995), Andhra Pradesh (Nagamadhuri *et al.*, 2011 and Sarala *et al.*, 2015). The new varieties developed have improved cane and sugar yields, resistance to pests and diseases, good milling qualities and adaptability to local growing conditions. The varieties show differential response as per the potential when cultivated in the recommended agro expected to yield as per the potential when cultivated in the recommended agro-ecological zones and applying appropriate agronomic practices. (Ramesh *et al.*, 1996), and declining soil fertility as result of depletion of the essential plant nutrients *viz.*, N,P and K (Bell *et al.*,2001; Gerside and Bell,2009 and Vajantha *et.al.*,2017). Hence this study was under taken to determine the optimum nitrogen fertilizer rate for increased and sustained cane and sugar yields and to select a high fertilizer use efficient midlate variety suitable for the southern zone of A.P.

Materials and Methods

Field experiment was conducted at Agricultural Research Station, Perumallapalle, Andhra Pradesh, during 2018-19 and 2019-20. The soils of the experimental are sandy loam in texture, Neutral in P^H, normal in EC, low in available nitrogen, medium in available phosphorus and high in available potassium. The experiment was designed in split plot with three replications ,varieties as main plots and nitrogen levels as subplots, four promising

midlate maturing varieties *viz.*, 2012T58, 2012T 72,2012T78 and 2012 T182 were tested with four levels of nitrogen *viz.*,100 %, 125%, 150% and 175% of recommended dose of nitrogen (RDN : 224 kg /ha). Nitrogen was applied in the form of urea and applied in two equal splits at 45 and 90 days after planting as per treatments. Phosphorus and potassium were applied @ 112 kg/ha in the form of SSP and MOP, respectively. Furrows were made at spacing of 90 cm and three budded setts @ 40,000/ha were planted in the first fortnight of January during both years of study. Atrazine @ 2 kg *a.i*/ha was sprayed as pre emergence on the 3rd day after planting of setts. Irrigations were provided as and when necessary. All other agronomic practices like hand weeding, earthing up, trash twist propping etc. were carried out according to recommendations. Observations in both plant crops were recorded on germination count, millable cane length, number of millable canes, cane girth, single cane weight and cane yield. Cane juice of different treatments was analysed for quality at harvest. Brix was recorded by using hydrometer and Pol% was recorded by polarimeter and sucrose was estimated by using standard procedures (Spencer and Medae, 1945).

Results and Discussion

Germination count recorded in both the plant crops at 30 days after planting differed significantly with sugarcane varieties where as non significant effect of graded level of nitrogen application was noticed on germination. The yield and yield parameters were recorded at the time of harvest. Among midlate varieties, 2012T58 and 2012T182 recorded higher per cent of germination. Mean cane length and cane diameter were not significantly influenced by the sugarcane varieties, but significant differences for single cane weight was observed in varieties, Among the different midlate varieties,

2012T58 registered significantly higher cane weight than other varieties. The differences in single cane weight, cane length and cane thickness could be attributed to the inherent differential phenotypic make up of the sugarcane varieties. Significant variations for yield attributing characters among the sugarcane varieties were also reported by the earlier by Bharathalakshmi *et al.*, (2003). The lengthier and thick canes were produced when nitrogen was applied @ 150 % RDN. The results are in accordance with Nagamadhuri *et al.*, (2011) and Sarala *et al.*, (2015). During both the years of study number of millable canes /ha was influenced by the varieties and graded levels of nitrogen doses. Among the varieties the sugarcane midlate maturing variety 2012 T58 registered higher number of millable canes/ha. than the other three sugarcane varieties. These results were in conformity with the result of Bell and Garside (2001) who reported substantial cultivar differences for number of millable cane. The number of millable canes is a major constituent of cane yield which provides the plant with optimum number of stalks needed for good yield is known to be dependent on the availability of various nutrients. Cane yield was influenced significantly by sugarcane varieties and nitrogen levels. During both the years of study higher cane yield was recorded by the variety 2012 T58, followed by 2012 T182.

Highest shoot population coupled with efficient conversion of tillers in to millable canes at harvest in these varieties could have contributed to higher cane yield. Similar results were reported by Srinivas *et al.*, (2003) and Tayade (2018). A significant progressive increase in cane yield was observed with increase in the dose of nitrogen from 100 % RDN to 150 % RDN. Midlate sugarcane varieties responded linearly up to 150 % RDN (336 kg N /ha). Rakkiyappan (1981) and Thakur *et a.*, (1991) also had reported the

differential response of sugarcane varieties to varied levels of nitrogen application. Juice extracted from cane assumes greater importance as it is directly related to the commercial output of sugarcane. The brix values, sucrose content and purity per centage determine the quality of cane. In the present investigation brix (%), sucrose content (%), purity (%) and CCS (%) estimated at harvest differed significantly due to different sugarcane varieties. The sugarcane midlate variety 2012T58 recorded maximum brix (%), sucrose (%), CCS(%) and purity (%) followed by 2012 T72 than other midalte maturing varieties. The juice qualities are mainly determined by the genetic makeup of the varieties this is in accordance with findings of Garside and Bell (2009). The quality parameters *viz.*, brix (%), sucrose (%), CCS (%) and purity (%) were not affected by increasing nitrogen application. This could be due to early application of nitrogen. Thus the detrimental effect of higher nitrogen on juice quality was minimized before the maturity age of the cane (Gana *et al.*, 2007). Higher quantity of nitrogen fertilizer generally results in sugars. But as the crop ages and matures, it is expected that nitrogen content will be reduced and there is an increasing conversion of reducing sugars to sucrose (Hussian *et al.*, 1990). During both the years of study interaction effect between yield and yield parameters of sugarcane varieties and nitrogen levels were non -.significant.

It is concluded, among the promising sugarcane midlate varieties, 2012T 58 and 2012 T 182 responded well to the applied nitrogen and recorded higher cane yield. Application of nitrogen @ 336 kg /ha is the viable fertilizer nitrogen for promising midlate maturing varieties of sugarcane in sandy loam soils of southern agro climatic zone of Andhra Pradesh to realize higher cane yield (Table 1 and 2).

Table.1 Effect of nitrogen application on germination (%) and yield attributing parameters of promising midlate maturing sugarcane varieties

Treatment	Germination per cent at 45 DAP		Millable cane length (m)			Millable cane girth (cm)			Single cane weight (kg)			Number of millable canes/ha			Cane yield (t/ha)		
	I plant crop	II plant crop	I plant crop	II plant crop	Mean	I plant crop	II plant crop	Mean	I plant crop	II plant crop	Mean	I plant crop	II plant crop	Mean	I plant crop	II plant crop	Mean
Sugarcane promising midlate maturing Varieties																	
2012T58	73.9	75.5	2.82	2.52	2.67	2.80	2.68	2.74	1.47	1.54	1.50	78569	87923	83246	104.5	112.0	108.2
2012T72	68.4	65.6	2.79	2.50	2.64	2.66	2.45	2.55	1.28	1.37	1.32	76318	84362	80340	86.0	106.6	96.3
2012T78	68.9	68.7	2.72	2.47	2.59	2.82	2.52	2.67	1.32	1.35	1.35	67009	86897	76953	80.9	107.8	94.3
2012T182	72.5	69.3	2.80	2.41	2.60	2.86	2.53	2.65	1.35	1.38	1.36	68194	80972	74583	95.8	108.6	102.2
SEm+/-	1.94	0.78	0.01	0.05	--	0.05	0.02	--	0.02	0.03	--	329	403.4	-	0.69	0.43	--
CD (0.05)	2.96	3.52	NS	NS	--	NS	NS	--	0.10	0.13	--	1471	1803.2	-	3.12	1.94	--
Nitrogen doses																	
100 % RDN	70.5	68.5	2.64	2.36	2.50	2.63	2.33	2.48	1.38	1.32	1.35	69016	77686	73351	81.9	95.2	88.5
125%RDN	71.0	67.7	2.84	2.48	2.66	2.77	2.46	2.61	1.39	1.36	1.37	69234	84507	76870	91.4	107.4	99.4
150%RDN	71.3	69.6	2.92	2.54	2.73	2.92	2.48	2.70	1.42	1.45	1.43	77318	90787	84052	99.3	119.0	109.1
175%RDN	71.2	66.2	2.70	2.52	2.61	2.64	2.42	2.53	1.45	1.40	1.42	72541	87175	79858	93.0	112.0	102.5
SEm+/-	0.36	0.60	0.03	0.03	--	0.02	0.02	--	0.016	0.019	--	981	950.2	--	0.39	1.05	
CD (0.05)	NS	NS	0.10	0.01	--	0.07	0.09	--	NS	NS	--	318	2928	--	1.22	3.26	
Varieties at Nitrogen doses	NS	NS	NS	NS	--	NS	NS		NS	NS	--	NS	NS	--	NS	6.67	
Nitrogen doses at varieties	NS	NS	NS	NS		NS	NS		NS	NS	--	NS	NS	--	NS	5.94	

Table.2 Effect of nitrogen application on quality parameters of promising midlate maturing sugarcane varieties

Treatment	Brix (%)			Sucrose (%)			CCS (%)			Purity (%)		
	I plant crop	II plant crop	Mean	I plant crop	II plant crop	Mean	I plant crop	II plant crop	Mean	I plant crop	II plant crop	Mean
2012T58	21.03	20.95	20.99	19.60	19.92	19.76	13.66	13.17	13.14	95.56	95.40	95.48
2012T72	20.39	20.36	20.37	19.15	19.24	19.19	12.97	12.93	12.92	93.42	92.25	92.83
2012T78	19.67	19.82	19.74	18.99	19.02	19.00	12.79	12.87	12.83	92.56	93.00	92.78
2012T182	19.89	19.76	19.82	19.10	19.13	19.11	12.82	12.75	12.78	92.74	92.45	92.61
SEm+/-	0.09	0.10	--	0.076	0.03	--	0.07	0.03	--	0.52	0.48	--
CD (0.05)	0.44	0.47	--	0.34	0.14	--	0.35	0.16	--	2.32	2.18	--
Nitrogen doses												
100 % RDN	20.34	20.40	20.37	19.25	19.18	19.21	12.87	12.84	12.85	93.32	93.02	93.17
125%RDN	20.44	20.45	20.44	19.15	19.03	19.09	12.92	12.79	12.85	93.93	92.75	93.34
150%RDN	20.22	20.20	20.21	19.04	19.10	19.07	12.99	12.92	12.95	93.19	93.45	93.32
175%RDN	20.10	20.01	20.05	19.18	19.13	19.15	12.87	12.98	12.92	92.68	93.24	92.96
SEm+/-	0.13	0.11	--	0.11	0.04	--	0.05	0.03	--	0.66	0.35	--
CD (0.05)	NS	NS		NS	NS	--	NS	NS	--	NS	NS	--
Varieties at Nitrogen doses	NS	NS		NS	NS	--	NS	NS	--	NS	NS	--
Nitrogen doses at varieties	NS	NS		NS	NS	--	NS	NS	--	NS	NS	--

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