

Integrated nitrogen management studies in tropical sugarbeet

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ABSTRACT

Field experiments were carried out at Agricultural College and Research Institute, Killikulam, Southern Tamil Nadu (TNAU) during September 2005 to March 2006 and September 2006 to March 2007 to evaluate the suitable integrated nitrogen management practice of tropical hybrids. The experiments were laid out in split plot design with three replications. The treatments consisted of four nitrogen management practice viz., 100 per cent recommended dose of N (RDN) (N_1), 75 per cent RDN + 25 per cent N as FYM (N_2), 50 per cent RDN + 25 per cent N as FYM + 25 per cent as vermicompost (N_3) and 100 per cent RDN + bio fertilizer + FYM (N_4) in main plots and three sugarbeet hybrids (Cauvery, Indus, Shubra) in subplots. The results revealed that higher growth attributes viz., germination percentage, plant height and leaf area index and Brix reading were observed under 100 per cent RDN + bio fertilizer + FYM and this was at par with that of N_2 and N_3 . Integrating inorganic (100 per cent RDN as urea) and organic (bio fertilizer + FYM) sources of nitrogen registered higher tuber weight and was significantly higher than N_1 and at par with both N_2 and N_3 in both the years of study. Higher growth and yield attributes were associated with the hybrid Indus followed by Cauvery. Integrated application of 100 per cent recommended dose of fertilizer nitrogen, bio-fertilizer and FYM (N_4) registered higher tuber yields of 44.3 and 26.8 t ha⁻¹ in 2005-06 and 2006-07, respectively which was at par with N_3 and significantly higher than that of N_2 and N_1 in both the years of study. Among the hybrids, Indus recorded higher tuber yield which was at par with that of Cauvery.

Key words : Tropical sugarbeet, Hybrids, Nitrogen, Yield, Integrated nitrogen management.

INTRODUCTION

Tropical sugarbeet (*Beta vulgaris* spp *Vulgaris* var *altissimo* Doll) is a biennial sugar producing tuber crop grown in temperate countries. It provides more than 45 per cent of world sugar requirement. It is one of the most efficient converter of solar energy into stored energy and has great potentiality of augmenting sugar production at lower cost (Ahlawat *et al.*, 2002). Recently tropical sugarbeet hybrids are gaining momentum in tropical and sub tropical countries as a promising energy crop and alternative raw materials for the production of ethanol. With the recent development of tropicalised hybrids of sugarbeet it has been possible to grow crop in tropical and subtropical areas as supplementary crop for alternate sources of sugar production (Kala *et al.*, 2008). Tropical sugarbeet is now emerged as commercial field crop because of the favourable characters like shorter duration, moderate water requirement, higher sugar content of 12-15 per cent etc. As the harvesting period of sugarbeet coincides with the off season of sugar factories, it helps in continuous function of sugar mills. Being the introduced crop in Tamil Nadu, there is an urgent need to standardize the agronomic practices of sugarbeet for wide scale adoption of this crop. Hence, fields experiments were conducted to evaluate the integrated nitrogen management practice and to select the suitable hybrids for Tamil Nadu conditions.

MATERIALS AND METHODS

Field experiments were carried out at Agricultural

College and Research Institute, Killikulam, Southern Tamil Nadu during September 2005 to March 2006 and September 2006 to March 2007 to evaluate the suitable integrated nitrogen management practice of tropical hybrids. The experiments were laid out in split plot design (S.P.D.) with three replications. The treatments consisted of four nitrogen management practice viz., 100 per cent recommended dose of N (RDN) (N_1), 75 per cent RDN + 25 per cent N as FYM (N_2), 50 per cent RDN + 25 per cent N as FYM + 25 per cent as vermicompost (N_3) and 100 per cent RDN + bio fertilizer + FYM (N_4) in main plots and three sugarbeet hybrids (Cauvery, Indus, Shubra) in subplots. The soil of the experimental field was sandy loam with the available NPK status of medium, medium and low, respectively. The sugarbeet seeds were sown at a spacing of 45 x 15 cm under ridges and furrow method. The fertilizer application was done as per the treatments with a blanket recommendation of 150:75:75 kg NPK ha⁻¹. Half the dose of N and full dose of P and K were applied as basal and remaining half dose of nitrogen was applied in to two equal splits during 25 and 45 days after sowing. Biometric observation on growth, yield attributes and tuber yield were recorded.

RESULTS AND DISCUSSION

Growth parameters:

The influence of nitrogen management practice on the germination of sugarbeet was though not significant, hybrids showed significant response in both the years

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(Table 1). Among the hybrids, Cauvery recorded the highest germination percentage which was at par with that of Indus and both these were significantly higher than Shubra. During both the years of study and at both the stages of observation, the plant height was not significantly influenced by various nitrogen management practices and hybrids. However, significant response on Leaf Area Index (LAI) was observed by the nitrogen management practices at both the stages of observation and only at 120 DAS by the hybrids during both years of study. Higher LAI was observed under 100 per cent RDN + bio fertilizer + FYM and this was at par with that of N₂ and N₃. With respect to hybrids, Indus registered the highest LAI of 4.69 and 2.98 in 2005-06 and 2006-07, respectively and this was at par with Cauvery and significantly higher than Shubra. However, the LAI of Cauvery and Shubra were at par. Higher LAI under N₄ might be due to additional supply of nutrients through bio fertilizer + FYM besides the recommended dose of nitrogen. The beneficial effect of Integrated Nitrogen Management (INM) on higher growth attributes was reported by Pandey *et al.* (2007). Similarly favourable effect of application of FYM on growth attributes on hybrid rice was observed by Ghosh (2007). Application of 120 kg ha⁻¹ is required for optimum growth and development of sugarbeet (Ahlawat *et al.*, 2002).

Brix reading:

Brix reading indicates the sugar content of sugarbeet and higher values represents the higher sugar percentage. Though the brix reading was not altered by the INM practices, higher values were observed under N₄ followed by N₃ (Table 2). However, significant effect of hybrids on brix reading was noticed in both the years of study. Among them, Shubra recorded the highest value of 20.8 in 2005 – 06 and 20.1 in 2006-07 and this was significantly higher than both Cauvery and Indus.

Yield attributes:

Root girth of sugarbeet was not significantly influenced by nitrogen management practices, however, significant variation of tuber weight was made by nitrogen management practices (Table 2). Integrating inorganic (100 per cent RDN as urea) and organic (bio fertilizer + FYM) sources of nitrogen registered higher tuber weight of 201 g in 2005-06 and 167 g in 2006-07 and this was significantly higher than N₁ and at par with both N₂ and N₃ in both the years of study. The favourable effect of integrated application of fertilizers and FYM on yield attributes of sunflower (Sumathi and Koteswara

Table 1 : Effect of nitrogen management practices and hybrids on growth parameters of tropical sugarbeet

Treatments	Germination %						Plant height (cm)						Leaf area index					
	2005-06		2006-07		2005-06		2006-07		2005-06		2006-07		2005-06		2006-07			
	90 DAS	120 DAS	90 DAS	120 DAS	90 DAS	120 DAS	90 DAS	120 DAS	90 DAS	120 DAS	90 DAS	120 DAS	90 DAS	120 DAS	90 DAS	120 DAS		
Nitrogen management practices																		
N ₁ -100% RDN	48.1	38.1	49.5	39.6	50.2	45.6	3.39	1.82	3.62	2.17	3.39	1.82	3.62	2.17	3.39	1.82		
N ₂ - 75 % RDN + 25 % as FYM	50.4	40.4	49.0	393	50.7	41.2	4.00	2.61	4.69	2.35	4.00	2.61	4.69	2.35	4.00	2.61		
N ₃ - 50 % RDN ¹ + 25 % as FYM + 25 % as Vermicompost	51.0	41.0	49.9	39.6	51.5	41.4	4.47	2.95	4.87	2.56	4.47	2.95	4.87	2.56	4.47	2.95		
N ₄ - 100 % RDN + Bio fertilizer + FYM	49.7	39.7	50.9	40.3	52.4	43.0	4.61	3.17	4.98	2.92	4.61	3.17	4.98	2.92	4.61	3.17		
S.E.±	1.19	0.79	1.53	1.14	1.58	1.25	0.48	0.44	0.32	0.31	0.48	0.44	0.32	0.31	0.48	0.44		
C.D. (P=0.05)	NS	NS	NS	NS	NS	NS	1.17	1.08	0.78	0.76	1.17	1.08	0.78	0.76	1.17	1.08		
Hybrids																		
V ₁ - Cauvery	50.8	40.2	52.3	42.6	52.0	42.0	3.71	2.07	4.08	2.51	3.71	2.07	4.08	2.51	3.71	2.07		
V ₂ - Indus	47.7	38.0	50.3	40.2	52.3	42.4	3.99	2.29	4.69	2.98	3.99	2.29	4.69	2.98	3.99	2.29		
V ₃ -Shubra	40.3	30.7	46.8	36.6	49.9	39.8	3.43	1.92	3.48	2.06	3.43	1.92	3.48	2.06	3.43	1.92		
S.E.±	1.66	3.01	2.15	1.56	2.23	2.10	0.68	0.48	0.45	0.39	0.68	0.48	0.45	0.39	0.68	0.48		
C.D. (P=0.05)	3.51	6.35	NS	NS	NS	NS	NS	NS	0.95	0.83	NS	NS	0.95	0.83	NS	NS		
NxV	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS		

NS - Non significant
RDN - Recommended dose of nitrogen

Table 2 : Effect of nitrogen management practices on yield parameters and yield of tropical sugar beet

Treatment	Brix rading		Tuber girth (cm)		Tuber weight (g)		Tuber yield (t ha ⁻¹)	
	2005-06	2006-07	2005-06	2006-07	2005-06	2006-07	2005-06	2006-07
Nitrogen management practices								
N ₁ -100% RDN	18.4	18.6	24.2	17.4	178	130	37.6	19.6
N ₂ - 75 % RDN + 25 % as FYM	18.9	19.1	24.6	18.1	189	142	39.1	22.1
N ₃ - 50 % RDN+ 25 % as FYM + 25 % as Vermicompost	19.1	19.2	4.8	19.0	196	155	43.4	25.4
N ₄ - 100 % RDN + Bio fertilizer + FYM	19.3	19.4	25.1	20.3	201	167	44.3	26.8
S.E. _±	0.93	0.90	1.62	1.40	8.2	6.3	2.08	1.59
C.D. (P=0.05)	NS	NS	NS	NS	20.0	15.3	5.07	3.88
Hybrids								
V ₁ - Cauvery	18.0	17.8	26.8	18.6	184	152	39.4	24.6
V ₂ - Indus	17.1	17.0	27.5	19.9	203	166	45.1	27.2
V ₃ -Shubra	20.8	20.1	22.0	17.0	177	140	38.5	20.1
S.E. _±	2.76	2.65	4.84	2.71	24.6	16.3	6.21	4.69
C.D. (P=0.05)	3.51	6.35	NS	NS	NS	NS	NS	NS
N x V	NS	NS	NS	NS	NS	NS	NS	NS

RDN - Recommended dose of nitrogen

NS - Non significant

Rao, 2007) was in accordance with this study.

There was also significant response of yield attributes by various hybrids of tropical sugarbeet (Table 2). Among them, Indus recorded maximum tuber girth of 27.5 and 19.9 cm, respectively which were significantly higher than Shubra and at par with that of Cauvery. Similarly the the highest tuber weight was also associated with Indus (203 g in 2005-06 and 166 g in 2006-07) and the trend was similar to tuber girth. Shubra recorded the lowest tuber girth and tuber weight in both the years but at par with Cauvery.

Tuber yield:

Different nitrogen management practices and hybrids influenced the tuber yield of sugarbeet significantly (Table 2). Among the nitrogen management practices, integrated application of 100 per cent recommended dose of fertilizer nitrogen, bio-fertilizer and FYM (N₄) registered higher tuber yields of 44.3 and 26.8 t ha⁻¹ in 2005-06 and 2006-07, respectively which was at par with 50 per cent RDN + 25 per cent N as FYM + 25 per cent as vermicompost (N₃) and significantly higher than that of 75 per cent RDN + 25 per cent N as FYM (N₂), and 100 per cent RDN alone (N₁) in both the years of study. The effect of N₃ was at par with N₂ and significantly higher than (N₁) in both the years of experimentation. The higher yield under N₄ was be due to additional application of bio fertilizer + FYM besides the full dose of recommended nitrogen which might resulted in continuous availability of nutrients thereby improving growth and yield attributes. The yield

improvement due to integrated nutrient management than inorganic alone in rainfed finger millet was observed by Ramamoorthy and Christopher Lourdhuraj (2007). Similarly beneficial effect of combined application of fertilizer and compost on higher yield in finger millet (Umesh *et al*, 2006) was in conformity with the present investigation.

The three hybrids of sugarbeet exhibited significant response on tuber yield. Among them Indus recorded a higher tuber yield of 45.1 and 27.2 t ha⁻¹ during 2005-2006 and 2006-2007, respectively and this was at par with that of Cauvery which registered 39.4 t ha⁻¹ in 2005-2006 and 24.6 t ha⁻¹ in 2006-2007. Shubra recorded the lowest tuber yield and however, the effect of Shubra on the production of tuber yield was comparable with Cauvery in both the years of study. The tropical sugarbeet hybrids suitable for Tamil Nadu are Cauvery, Indus and Shubra (Crop Production Guide, 2005).

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