EVALUATION OF PLANTING METHODS ON CROP PERFORMANCE AND COST EFFECTIVENESS IN SUGARCANE

Abstract: The experiment was conducted during eksali of 2017, 2018 and 2020 at Agricultural Research Station, Basanthpur, Sangareddy, Telangana in red laterite loamy soils with 7 planting methods viz., ridge and furrow method with 3 budded setts (P_1), single node planted by seedling transplanter (P_2), direct planting of bud chips (P_3), direct planting of seedlings manually (P_4), seedling transplanting by transplanter (P_5), planting with cutter planter (P_6) and farmers practice (P_7). Pooled mean of three years data indicated that the tiller count at 75 and 120 DAS (102.8 and 189.1 '000ha), cane height (306.7 cm), no. of millable canes (104'000 ha) registered were significantly highest in direct planting of seedlings. However, cane height and no. of millable canes with seedling transplanting (297.8 cm and 104 '000ha, respectively) we're on par to the above treatment. Significantly highest single cane weight and cane yield also were noticed with direct planting of seedlings (1.67 kg and 138.9 t ha^{-1}).

Key words: cane yield, cost effectiveness, crop performance, planting methods, sugarcane

INTRODUCTION:

Sugarcane is the main source of sweeteners globally and holds a prominent position as a cash crop. India occupies second position in sugarcane cultivation after Brazil. Climatic condition of India is favorable for sugarcane cultivation therefore its production was spread across the country occupying an area of 4.73million hectares in the country (Bee and Rahman, 2020).

Sugarcane plays a crucial role for overall socio-economic development of farming community. Contribution of sugarcane to the national GDP is 1.1% which is significant considering that the crop is grown only in 2.57% of the gross cropped area (Soloman, 2016). But in the present scenario, cane production is not sustainable enough to meet the demand due to constant increase in the input and labour costs (Anonymous, 2011). Population driven demand of sweeteners coupled with the expansion of sugar industries in India necessitated higher production of sugarcane in future. Considering low productivity of conventional methods, there was a need to develop a suitable method of planting by which higher yield can be obtained (Singh *et al*., 2016).

Planting is the most important and labour intensive operation in sugarcane cultivation. Sugarcane germination as well as yield is affected by planting material, lay out, plant population, method of planting and placement of bud etc. (Nalawade *et al*., 2017).The planting methods is one of the crucial factors influencing the sunlight absorption, tillering and the execution of different farming operations such as weeding, earthing up and harvesting (Ahmad *et al.*, 2022).

Sugarcane planting involves more labour and heavy investments towards harvesting of seed material, transportation to field, cutting into setts, spreading of setts which accounts to nearly 20% of the total cost of cultivation (Galal, 2016). The labour intensive methods leads to considerable losses in crop production (Dharmawardene, 2006). So it is necessary to improve the cane productivity with minimum usage of inputs through some alternate methods on the principles of "more with less" (Loganandhan *et al*., 2013).

Planting of sugarcane with two/three budded setts is the common practice in sugarcane cultivation which accounts to nearly 25% of the total cost of cultivation. Hence it is proposed to study the application of planting cane seedlings including nursery growing, direct planting and mechanical transplanting to facilitate easy and cost effective application of the technique. By changing the way of raising nursery and transplanting is hypothesized to bring down the cost up to 75%. It may also reduce plant mortality rate; help in increasing the length and weight of cane. Its basic premise is to obtain "more with less" in agriculture.

MATERIAL AND METHODS:

The study was conducted during eksali of 2017, 2018 and 2020 at Agricultural Research Station, Basanthpur, Sangareddy, Telangana situated at 17^{o} 47' 52.55" N Latitude and 77 ^{o}32' 37.77" E longitude at an altitude of 626 m MSL.

The soil of the experimental field was red laterite loam, low in available N, medium in organic carbon, phosphorous and potassium. The treatments involved 7 planting methods viz., ridge and furrow method with 3 budded setts (P_1), single node planted by seedling transplanter (P_2), direct planting of bud chips (P_3), direct planting of seedlings manually (P_4), seedling transplanting by transplanter (P_5), planting with cutter planter (P_6) and farmers practice (P_7)(Two budded setts). The treatments were laid out in randomized block design in three replications with the variety, Co 86032 which is a wonder cane, is a medium thick, reddish pink

cane amenable for planting through out the year. It gives higher cane yields both in plant as well as ratoon crops with high quality and maintaining them for longer periods.

The spacing adopted was 150 cm x 30 cm. The recommended doses of NPK@ 250-100-100 kg ha-^{1} were applied in the form of urea, single super phosphate and muriate of potash, respectively. The experimental data was subjected to statistical analysis following the procedure for randomized block design as outlined by Panse and Sukhatme (1967). The significance was tested by "F" test at 5% level of probability (Snedecor and Cochran, 1967). Critical difference was worked out for the effects which were significant.

RESULTS AND DISCUSSION:

The data on Sugarcane planting methods was presented as growth and yield attributes in tables 1 and 2 discussed in detail here under:

Growth attributes:

The growth attributes were recorded in terms of tiller count at 75 and 120 DAP (Table 1) .Pooled means of three years indicated that the tiller count recorded at 75 (102.8 '000 ha) and 120 DAP (189.1'000 ha) with direct planting of seedlings manually was (P_3) significantly superior over other planting methods. The tiller count with seedling transplanting method using a transplanter in P_5 treatment followed the above treatment with 95.5'000 and 180.3'000 tillers /ha at 75 and 120 DAP, respectively. Less mortality rate and higher plant stand in direct planting of seedlings manually had resulted in higher tiller count compared to other planting methods. The tiller count in sugarcane in all the planting methods was less by 7.1% to 25.7% at 75 DAP and 4.6% to 19.1% at 120 DAP compared to direct planting of seedlings. The lowest no. of tillers were observed with single node planted by seedling transplanter (76.9'000 ha) at 75 DAP and planting with cutter planter (152.8'000 ha) at 120 DAP.

Experimental results revealed that the cane height (Table 1) at harvest also was maximum (306.7 cm) with direct planting of seedlings manually followed by seedling transplanting by transplanter (297.8 cm). Owing to planting of healthy seedlings with uniform growth, tended to uniform stand establishment and hence growth resulting in taller and sturdy canes in direct planting of seedlings manually. The lowest cane height was recorded in the crop planted with cutter planter (262.6 cm) which might be due to uneven establishment and slow growth of the setts.

Yield parameters:

The highest no. of millable canes (Table 1) were noticed (108.7 '000 ha) in direct planting of seedlings manually and seedling transplanting by transplanter (104.0 '000 ha). These treatments were significantly superior to direct planting of bud chips (97.6'000 ha), farmers practice (95'000 ha), ridge and furrow method with 3 budded setts (90.3'000 ha), single node planted by seedling transplanter (87.9'000 ha) and planting with cutter planter (85.1'000 ha).Obviously raising seed material initially in a protected condition in the nursery had given out healthy seedlings with uniform growth. This was established by higher tiller count at two dates (75 and 120 DAP) of observation during the crop growth period in the transplanting treatments (direct manual and mechanical methods). The decreased no. of millable canes of other planting methods was might be due to the initial vigour of sprouts is affected by late sprouting of lower buds (Nalawade *et al*., 2018) in response to direct sown conditions and establishment.

The maximum (2.93 cm) cane girth was noticed with seedling transplanting by transplanter (Table 1) followed by direct planting of seedlings by manual (2.89 cm) and it was significantly superior to other planting methods. Higher cane girth in the above treatment might be due to quick establishment, healthy and uniform growth of the plants resulting in active metabolism and apportioning of nutrients to the developing cane giving out sturdier canes with higher girth. On the other hand lowest cane girth was recorded with cutter planter (2.64 cm).

Significantly the highest (1.67kg) single cane weight (Table 1) was observed with direct planting of seedlings manually followed by seedling transplanting by transplanter (1.48kg). Obviously taller canes with comparably higher cane girths registered higher single cane weight in manual direct seedling planting treatment. The lowest (1.27 kg) single cane weight on the other hand, was recorded in cane planted with cutter planter. Uneven crop stand and competition for resources between the plants in this treatment might had resulted in less capture and translocation leading to lesser cane weight.

Higher cane yields (138.9 and 126.2 t ha^{-1}) were obtained from direct planting of seedlings manually and seedling transplanting by transplanter and were found best over other planting methods (Table 1). Comparably more no. of millable canes, single cane weight and cane girth had resulted in higher cane yield in manual and mechanical methods of seedling transplanting.

Conversely the lowest yield was observed with cutter planter (96.8 t ha^{-1}) which might be due to lower no. of tillers and millable canes,

.

Table 1**: Growth, yield attributes and yield of sugarcane as influenced by planting methods (Pooled mean of three years)**

Planting methods	Tiller count ('000 ha)		Cane height at harvest (cm)	No. of millable canes ('000 ha)	Single cane weight (kg)	Cane Girth (cm)	Cane yield (t ha^{-1})
	75 days	120 days					
Ridge and Furrow method with 3 budded setts	84.9	164.2	273.7	90.3	1.27	2.71	105.8
Single node planted by seedling transplanter	76.3	161.2	272.3	87.9	1.20	2.70	101.0
Direct planting of bud chips	84.0	174.9	284.8	97.6	1.42	2.79	117.8
Direct planting of seedlings by manual	**102.8**	**189.1**	**306.7**	**108.7**	**1.67**	2.89	**138.9**
Seedling transplanting by transplanter	95.5	180.3	297.8	104.0	1.48	**2.93**	126.2
Planting with cutter planter	77.9	152.8	262.6	85.1	1.17	2.64	96.8
Farmer's Practice (Planting with two budded setts)	89.6	170.2	278.2	95.0	1.33	2.80	111.1
S Em ±	2.24	2.45	3.99	3.27	0.03	0.03	2.77
C D (P=0.05)	6.89	7.56	12.29	10.08	0.09	0.10	8.53

Economics:

The findings of this study demonstrated that the superiority of direct planting of seedlings in terms of high B:C ratio of 1.37 (Table 2) owing to highest gross returns (Rs. 3,74,110/-) and net returns (Rs. 1,00,865/-). Conversely lowest B:C ratio has been incurred in farmers practice (planting of two budded setts) which is due to less grass and net returns obtained.

Table 2:**Economic analysis of sugarcane as influenced by planting methods (Pooled mean of three years)**

Planting methods	**Gross returns (Rs./ha)**	**Cost of cultivation(Rs/ha)**	**Net (Rs/ha) returns**	**B:C ratio**
Ridge and Furrow method with 3 budded setts	253880	206548.0	47332.0	1.23
Single node planted by seedling transplanter	241340	187654.0	53686.0	1.29
Direct planting of bud chips	326700	231456	95244.0	**1.41**
Direct planting of seedlings by manual	374110	273245	100865.0	**1.37**
Seedling transplanting by transplanter	287815	198756	89059.0	**1.45**
Planting with cutter planter	225500	176532	48968.0	1.28
Farmer's Practice (Planting with two budded setts)	270875	223450	47425.0	1.21

Conclusion: Good establishment method, which leads to good germination, and ease in doing crop management practices are key factors to increase the yield (Guru Prem et al., 2017). The investigation suggested that direct planting of sugarcane seedlings manually is viable method for Central Telangana Zonein obtaining a healthy crop with high cane yield potential and a benefit-cost ratio of 1.37and yield advantage of 12-42 t ha^{-1}.

References:

Anonymous, 2011. Productivity of sugarcane in major states of India. Sugarcane Breeding Institute, Coimbatore.

Galal, 2016.A new technique for planting sugarcane in Egypt. *Institute of Integrative Omics and Applied Biotechnology* Journal. 7(4): 15-21

Guru Prem., Ramesh Kumar., Vikram, D., Singh., Amit Kumar., Rakesh Choudhary and Afzal Ahmad. 2017. Effect of planting methods on cane yield, water productivity and economics of spring planted sugarcane (SaccharumofficinarumL.) in Ambala (Haryana). *International Journal of Agricultural Engineering*. 10(1): 186-190.

Loganandhan, N., BikshamGujja. and Natarajan, U.S. 2013. Sustainable Sugarcane Initiative: A Methodology of "More with Less". Sugar Tech. 15. 98-102.

Nalawade, S.M., Mehta, A.K and Sharma, A.K. 2017. Sugarcane Planting Techniques: A Review. *Contemporary Research in India*. 98-104.

Nida Bee and Fazlur Rahman, 2020. Growth Rate of Area , Production and Productivity of Sugarcane Crop in India. *International Journal of Environmental and Agriculture Research*. 6(4): 14-19.

Panse, V.G., Sukhatme, P.V., 1967. Statistical Methods of Agricultural Workers. 2nd Endorsement, ICAR Publication, New Delhi, India, 381.

Singh, A.K., Lal, M., Singh, A.K., Singh, S.N., Pathak, A.D and Singh, E. 2016. Effect of Planting Methods on Growth, Yield and Quality of Sugarcane in Sub Tropical India. *Indian Journal of Sugarcane Technology*. 31(2): 55-60.

Snedecor, G.W., Cochron, W.G., 1967. Statistical methods. Oxford and IBH Publishing Company 17, Parklane, Calcutta.

Soloman, S. The Indian Sugar Industry: An Overview.2011. *Sugartech*. 13. 255-265.

Soloman, S. Sugarcane Production and Development of Sugar Industry in India.2016. *Sugartech*.18.588-602.

Tanveer Ahmad. , NaeemFiaz., TasneemKhaliq . , Muhammad AkhlaqMudassir., Muhammad Shafique. , Muhammad AleemSarwar. , Muhammad Altaf., Ayesha Irum and Hafiz Ali Raza. 2022. Evaluating the effect of sugarcane planting methods on growth and radiation use efficiency of its different varieties . *Journal of Global Innovations in Agricultural Sciences.* 10(3):131-138 ISSN (Online): 2788-4546; ISSN (Print):2788-4538