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EFFECT OF VARIOUS GEOMETRY AND NUTRIENTS MANAGEMENT METHODS IN RELATION TO MECHANIZATION ON PRODUCTIVITY OF SUGARCANE (*SACCHARUM SPECIES* HYBRID)

Satendra Kumar[1]*, S.P. Yadav[2], S.N.Rai[1] S.C. Singh[2], Y.P.Bharti[1] and B.L.Sharma[2]

[1*]Genda Singh Sugarcane Breeding and Research Institute, Seorahi
[2]U.P. Council of Sugarcane Research, Shahajanpur

Abstract

A field experiment for consecutive two years *i.e.* 2014-16 and 2015-17 was conducted at research farm of genda singh sugarcane breeding and research institute, Seorahi Kushinagar in autumn season to find out optimum plant geometry and nutrients for efficient use of machinery. The soil of the experimental plot was medium in organic carbon, medium in available phosphorus and low in potash with pH 8.2. The experiment consisting of four plant geometry *i.e.* S_1 - 90 cm row spacing (Conventional method, S_2 - Trench planting in paired row at 120 (90:30) cm. S_3 - Trench planting in paired row at 150 (120:30) cm. S_4 - Trench planting in paired row at 180 (150:30) cm and two nutrient management practices *i.e.* F_1 -100% recommended dose of fertilizers through inorganics F_2 - 100% recommended dose of fertilizers through inorganics and 25 % N through organic manures along with biofertilizers (*Azotobactor* + P.S.B. @ 10 kg/ha each) was laid out in factorial randomized block design with three replications. S2 treated plot produced significantly higher shoot population (207.83 and 171.05 thousand/ha), cane yield (104.22 and 105.21 t/ha) and CCS (13.01 and 13.19 t/ha) over conventional planting method in both the years, respectively. Significantly lower germination (48.39 and 39.15 per cent) and single cane weight (0.671 and 0.667 kg) were noted under conventional planting treated plots during both the years, respectively. Effect of nutrient management on germination, shoot population, single cane weight, cane yield, number of internodes, CCS (t/ha) were observed significantly higher in 100% recommended dose of fertilizers through inorganics and 25 % N through organic manures along with biofertilizers (*Azotobactor* + P.S.B. @ 10 kg/ha treated plots (F_2) in both the years except germination and shoot population in 2015-17 year. More cane yield in paired row trench planting may be due to border effect, higher light interaction and proper aeration in wide row spacing trenches as compared to convention planting method. CCS per cent was not affected significantly with different treatments in both the years.

Key word: Sugarcane, fertility, Azotobactor, PSB, trench planting, geometry, mechanization.

Introduction

Sugarcane is the most important agro-industrial crop next to cotton, which is being cultivated in around 4.50 million hectares area in India. The country has produced more than 355 million tonnes of cane at a national average of 70 tonnes per hectare. In the present context of globalization, ways and means have to be further evolved to produce more sugar per unit area, time and input in order to keep pace with the population growth while preserving the soil and water resources. As today's labor force is reluctant to come forward for agricultural operations in view of the tough nature of the job and low remunerations and also considering the lack of efficiency of manual labor. Again in order to enable the shift to mechanization it created awareness among farmers on the benefits they can achieve through mechanization. It also educated them on the need for creating wide spacing between planting rows which facilitate the use of mechanized cane harvesters. The challenges in the millennium can be met effectively by adopting the appropriate mechanical alternatives not only for increasing the productivity but inculcating cost efficiency in sugarcane production system. The farm mechanisation in the context of sugarcane cultivation aims at introducing timeliness of operation, reducing human drudgery and improving overall production efficiency. After land

***Author for correspondence :** E-mail : satendrayadav.agro@gmail.com

preparation sugarcane planting is the major operation to be mechanised first. This is essential to pave the way for mechanising subsequent cultural operations. Sugarcane remains in the field for almost a year and right from land preparation to harvesting of crop there is heavy demand of labour and machinery throughout its crop cycle. Sugarcane accounts for 60-70% of the cost of sugarcane production and thus has a vital role to make sugar industry a commercially valuable venture (Singh *et. al*. 2011). In the present context of globalisation, ways and means have to be further evolved to produce more sugar per unit area, time and input in order to keep pace with the population growth while preserving the soil and water resources. For this purpose it has been experienced that use of modern machinery is inevitable. Use of machinery helps in labour saving, ensures timeliness of operation, reduces drudgery, helps in improving quality of work, reduces cost of operation and ensures effective utilization of resources. In case of sugarcane crop although machinery has been developed, however the adoption of these implements and machinery have not been up to the desired level. Thus there is a considerable mechanization gap, especially in the area of sugarcane planting, interculture, harvesting and ratoon management. Therefore it is necessary that concentrated efforts be made for adoption, development and popularization of sugarcane machinery for various cultural operations. Limited horizontal expansion of sugarcane area due to industrialization of cultivable lands, the vertical growth by adopting effective crop management techniques is the option left (Manimaran *et al.,* 2009). Planting of sugarcane in paired rows compared with that in single row has proved beneficial in India (Yadav *et. al*., 1997) and in Pakistan (Bajelan and Nazir, 1993). In south India sugarcane is planted in wide deep trenches. Bhullar *et al. (*2002) advocated that planting method should provide enough opportunity to conserve soil moisture to facilitate settling establishment. Therefore, keeping above facts in view, the present investigation was conducted to effect of various geometry and nutrients management methods in relation to mechanization on productivity of sugarcane (*Saccharum species* hybrid)

Materials and methods

Field experiments were conducted during 2014-16 and 2015-17 at research farm of Genda Singh Sugarcane Breeding and Research Institute, Seorahi, Uttar Pradesh. The experiment consisting of four plant geometry *i.e.* $\mathbf{S_1}$ - 90 cm row spacing (conventional method, **S2** - Trench planting in paired row at 120 (90:30) cm. $\mathbf{S_3}$ - Trench planting in paired row at 150 (120:30) cm. $\mathbf{S_4}$ - Trench planting in paired row at 180 (150:30) cm and two nutrient management practices *i.e.* $\mathbf{F_1}$ -100% recommended dose of fertilizers through inorganics. $\mathbf{F_2}$- 100% recommended dose of fertilizers through inorganics and 25 % N through organic manures along with biofertilizers (*Azotobactor* + P.S.B. @ 10 kg/ha each) was laid out in factorial randomized block design with three replications. The soil of experiment plot was medium in organic carbon, low in available phosphorus and medium in potash with nearby pH 8.02. Recommended dose of fertilizers was 200, 80, 60 (NPK) kg per ha for spring planted sugarcane crop. The nitrogen 1/3 and full dose of P and K were applied at the time of planting and remaining nitrogen was applied in two equal split doses as top dressing before the onset of monsoon season. Sources of nitrogen, phosphorus and potash were urea, single super phosphate and murate of potash, respectively. The improved crop management practices were followed during experimentation in the both years. Shoot population and germination per cent were recorded from each net plot and the data were computed in thousands on hectare basis. The crop was harvested from ground level and green and dry leaves were stripped off.

RESULTS AND DISCUSSIONS

Effect of geometry

Showed in table-1, $\mathbf{S_4}$ treatment produced significantly higher number of internodes (25.00 and 25.38) over $\mathbf{S_1}$ and $\mathbf{S_2}$ treatments but statically same with $\mathbf{S_3}$ treatment in both the years, respectively. $\mathbf{S_4}$ treated plot recorded 31.57 and 27.66 per cent more number of internodes over $\mathbf{S_1}$ treatment. Cane thickness was recorded significantly lower in $\mathbf{S_1}$ treatment (1.85 and 1.89 cm) as compare with $\mathbf{S_3}$ (2.10 and 2.20cm) and $\mathbf{S_4}$ (2.25 and 2.30 cm) and at par with $\mathbf{S_2}$ treatment (1.98 and 1.95 cm). Data given in table 02 revealed that CCS t/ha was recorded significantly higher in $\mathbf{S_2}$ as compare to remaining geometry treatments but in case of CCS per cent noted that effect was non significant however, maximum value obtained in $\mathbf{S_3}$ treatment (12.51 and 12.54 per cent). In table 1 showed that germination percent was noted significantly lower in $\mathbf{S_1}$ treatment over remaining treatments. $\mathbf{S_2}$ treated plot produced significantly higher shoot population and cane yield as compared to other remaining treatments in both the years however, $\mathbf{S_1}$ treatment recorded significantly lower cane weight as compared to rest treatments except $\mathbf{S_2}$ treatment. Higher population of shoots and cane yield in paired row trench planting could be assigned to the border effect the rows received in the form of higher light interaction and proper aeration due to wide spacing between the trenches as compared to

Table 1: Effect of treatments on germination, shoots, single cane weight and cane yield.

Treatments	Germination (%)		Shoots 000/ ha		Single cane weight (kg)		Cane yield (t/ha)	
	2014-16	2015-17	2014-16	2015-17	2014-16	2015-17	2014-16	2015-17
Plant geometry								
S_1- 90 cm conventional method	48.39	39.15	181.56	157.52	0.671	0.667	94.70	90.35
S_2 -Trench planting in paired row at 120 (90:30) cm.	51.60	55.25	207.83	171.05	0.698	0.713	104.22	105.21
S_3 - Trench planting in paired row at 150 (120:30) cm.	52.01	51.70	191.72	167.41	0.905	0.921	96.38	97.11
S_4- Trench planting in paired row at 180 (150:30) cm.	53.27	56.88	188.30	144.62	1.025	1.032	96.09	81.66
SE±	0.29	3.15	2.19	8.35	0.02	0.028	1.06	1.75
CD (5%)	0.69	6.76	4.76	17.91	0.06	0.085	3.21	5.29
Nutrient								
F_1- 100% recommended dose of fertilizers through inorganics.	50.23	49.70	184.11	155.92	0.795	0.797	93.21	88.61
F_2- 100% recommended dose of fertilizers through inorganics and 25 % N through organic manures along with biofertilizers (*Azotobactor* + P.S.B @ 10 kg/ ha each).	52.40	50.78	200.60	164.38	0.862	0.858	102.49	98.56
SE±	0.22	4.46	1.51	11.81	0.015	0.020	0.75	1.23
CD (5%)	0.36	NS	3.36	NS	0.047	0.060	2.27	3.74

Table 2: Effect of treatments on number of internodes, cane thickness, CCS per cent and CCS t/ha.

Treatments	Number of internodes		Cane thickness (Cm)		CCS per cent		CCS (t/ha)	
	2014-16	2015-17	2014-16	2015-17	2014-16	2015-17	2014-16	2015-17
Plant geometry								
S_1- 90 cm row spacing (conventional method)	19.00	19.88	1.85	1.89	12.48	12.18	11.18	11.00
S_2 -Trench planting in paired row at 120 (90:30) cm	22.17	22.33	1.98	1.95	12.49	12.18	13.01	13.19
S_3 - Trench planting in paired row at 150 (120:30) cm.	24.50	24.08	2.10	2.20	12.51	12.54	12.05	11.82
S_4- Trench planting in paired row at 180 (150:30) cm.	25.00	25.38	2.15	2.24	12.43	12.43	11.94	10.15
SE±	0.71	0.65	0.07	0.04	0.16	0.18	0.29	0.24
CD (5%)	2.18	1.96	0.23	0.13	NS	NS	0.88	0.75
Nutrient								
F_1- 100% recommended dose of fertilizers through inorganics.	21.08	21.40	2.03	2.13	12.39	12.27	11.54	10.87
F_2- 100% recommended dose of fertilizers through inorganics and 25 % N through organic manures along with biofertilizers (*Azotobactor* + P.S.B @ 10 kg/ ha each).	23.75	23.17	2.14	2.15	12.56	12.40	12.87	12.22
SE±	0.50	0.46	0.5	0.02	0.12	0.13	0.21	0.17
CD (5%)	1.54	1.41	NS	NS	NS	NS	0.63	0.53

the conventional method of planting *i.e.* 90 cm distance. The present results are in conformity with the previous findings of Yadav *et al*. (1990). The sugarcane crop has the capacity to compensate for lower plant density by

increasing the weight of individual canes after stabilization of cane population (Bell and Garside, 2005). Singh *et al*. (2002 and 2005) who have reported higher number of tillers at closer spacing, however they could not contribute to higher yield due to tiller mortality and lower individual cane weight.

Recorded significantly higher in $\mathbf{F_2}$ (23.75 and 23.17) over $\mathbf{F_1}$ (21.08 and 21.40), respectively. Cane thickness was not affected significantly but maximum value (2.14 and 2.15) obtains in $\mathbf{F_2}$ in both the years, respectively. $\mathbf{F_2}$ treatment noted significantly higher CCS t/ha in both the years. CCS per cent was not affected significantly but maximum value obtain in $\mathbf{F_2}$ treated plot (12.56 and 12.40 per cent), respectively in both the years. Germination and shoot population were significantly higher in $\mathbf{F_2}$ as compared to $\mathbf{F_1}$ treatment in 2014-16 experiment year but these effect was non significant in 2015-17 year but maximum value noted in 100% recommended dose of fertilizers through inorganics and 25 % N through organic manures along with biofertilizers (*Azotobactor* + P.S.B. @ 10 kg/ha each) plot. $\mathbf{F_2}$ treated plot produced significantly higher cane weight (0.862 and 0.858 kg per plant and cane yield (102.49 and 98.66 t/ha)) during both the years, respectively. Singh *et al*., (2007) also reported improvement in physical properties of soil by addition of organic manure like F.Y.M. etc and resulting in better crop yield of sugarcane.

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