Influence of planting rows and intercropping on quality parameters of sugarcane under sustainable sugarcane initiative

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ABSTRACT

A field experiment was conducted at Sugarcane Research Station, Sirugamani, Tamil Nadu during the three seasons in 2016-17 and 2017-18 to study the influence of planting rows and intercropping on quality parameters of sugarcane under sustainable sugarcane initiative (SSI). Higher juice weight was observed under 180 cm double row planting (M_4) during first plant crop, 150 cm single row panting during the ratoon crop and 150 cm double row planting in second plant crop. The juice extraction was significantly higher under 150 cm double row planting. With regard to intercropping systems sugarcane with sunhemp recorded higher juice extraction followed by sugarcane with black gram during all the growing seasons. In case of intercropping systems sugarcane with sunhemp (S_4) recorded higher brix followed sugarcane with black gram during all the seasons. The planting of sugarcane at 150 cm in double rows with intercropping of sunhemp (M_2S_4) produced higher juice weight, juice extraction percentage and brix.

Keywords: SSI; sugarcane; intercropping; planting rows; drip irrigation

INTRODUCTION

Sugarcane is the second most important industrial crop in our country occupying about 5 Mha in area. India is the second largest producer of sugar after Brazil. About 4 million growers are involved in the cultivation of sugarcane. Wider spacing in sugarcane cultivation supports easy air flow and sunlight penetration into the crop canopy for healthy cane growth and higher individual cane weight leads to higher yield (Kumari 2006). Venkataraman et al (1979) observed that the purity and commercial cane sugar percentage of the cane were not significantly influenced by different systems of planting viz normal planting of 100 cm and paired row planting of 60/140 cm. Kannappan et al (1990) revealed that the commercial cane sugar percentage was not influenced significantly due to varied spacing.

Increase in the spacing from 80 to 100 cm has resulted in significant increase in the diameter of the cane but could not influence per cent juice sucrose and purity (Gopalam 1966). Cane and sugar yields did not differ significantly between 90 and 150 cm row spacing (Prabhakar 1999). Roodagi et al (2001) reported that wider row planting (160 cm) resulted in higher sugar yield (9.26 ton/ha). The systems of planting and row spacing did not influence the brix, pol, purity and commercial cane sugar percentage (Venkataraman1977, Mahadevaswamy 2001). Devaraj and Shanmugasundaram (1987) reported that there was no significant difference in juice quality with regard to systems of planting. The present study was conducted to see the effect of planting rows and intercropping on quality parameters of sugarcane under sustainable sugarcane initiative (SSI).

MATERIAL and METHODS

Field experiments were conducted at Sugarcane Research Station, Sirugamani, Tamil Nadu to study the influence of planting rows and

intercropping on quality parameters of sugarcane under SSI. The experiment was laid out as strip plot design with three replications with the test variety of TNAU Sugarcane Si 8. The main plot treatments comprised crop geometry viz M_1 (150 x 60 cm single row planting), M_2 (150 x 60 cm double row planting), M_3 (180 x 60 cm single row planting) and M_4 (180 x 60 cm double row planting). The sub-plot treatments were S_1 (Sole crop of sugarcane), S_2 (Sugarcane + greengram Co 8), S_3 (Sugarcane + black gram VBN 5) and S_4 (Sugarcane + sunhemp Co 1). The crop was raised under surface drip fertigation system. Chip-budded 30-day old seedlings were planted as per the treatments. Observations on quality parameters like juice weight, juice extraction percentage and brix were recorded.

RESULTS and DISCUSSION

The effect of of planting rows and intercropping on juice weight, extraction and brix of sugarcane under SSI is given in Table 1.

Juice weight: Variation in juice weight was observed among the planting rows. Higher juice weight was observed under 180 cm double row planting (M_4) during first plant crop, 150 cm single row panting during the ratoon crop and 150 cm double row planting in second plant crop.

Regarding the intercropping systems though numerically higher juice weight was recorded under sugarcane with sunhemp (S_4) followed by sugarcane with black gram this difference did not reach the level of significance during all the growing seasons.

The interaction between planting rows and intercropping systems on juice weight was not significant during the seasons of 2016-17 and 2017-18.

Juice extraction: The juice extraction showed slight variation among the planting rows. The juice extraction was significantly higher under 150 cm double row planting followed by 150 cm single row planting and both were comparable with each other. Lower extraction was registered under 180 cm single row during all the growing seasons.

With regard to intercropping systems sugarcane with sunhemp recorded higher juice extraction followed sugarcane with black gram during all the growing seasons.

Brix percentage: Among row planting though 180 cm double row planting registered higher brix percentage followed by 180 cm single row planting during first crop. The 150 cm double row planting during ratoon and second plant crop difference did not reach the level of significance.

With regard to intercropping systems sugarcane with sunhemp (S_4) recorded higher brix followed sugarcane with black gram during all the seasons.

Similar trend of results was seen in ratoon and the second plant crop also.

Juice quality parameters viz juice weight, juice extraction percentage and brix were the deciding factors of final commercial sugar yield. Results of the present investigations revealed that row planting and intercropping systems did not significantly influence the quality parameters of sugarcane. The higher juice weight, juice extraction percentage and brix were recorded in 150 cm in double row planting followed by 150 cm single row planting and this was on par with 180 cm double row planting in first plant crop. Double row planting registered increased quality parameters viz juice weight (1.28, 1.26 and 1.50 kg per cane), juice extraction percentage (66.00, 63.63 and 67.16) and brix (17.85, 19.38 and 20.13%) in first plant crop (2016-17), ratoon crop and second plant crop (2017-18) respectively at harvest.

Juice quality of sugarcane would normally depend upon various biotic and abiotic stresses that operate during the cane growth period especially during the maturity phase. Since the crop under varied planting geometry was grown under the same environment there could have been little chance for variation in the juice quality of cane and the same thing may have happened in the present case. Similar findings were reported earlier by Raju and Narasimha Rao (1983), Kannappan et al (1990), Sharma et al (1991), Mahadevaswamy and James Martin (2002), Hussain et al (2005) and Kumari (2006).

With regard to intercropping system practices sugarcane with sunhemp recorded higher juice weight, juice extraction percentage and brix in case of sugarcane with sunhemp. Various planting systems and intercrops did not significantly influence quality parameters of sugarcane. Similar findings with different intercrops were reported by Mahadevaswamy (2001).

Table 1. Influence of planting rows and intercropping on juice weight, extraction and brix of sugarcane under SSI

Treatment	Plant crop–I					Ratoon crop–I					Plant crop–II				
	M_1	M_2	M_3	M_4	Mean	M_1	M_2	M_3	M_4	Mean	M_1	M_2	M_3	M_4	Mean
Juice weight (kg/cane)															
S_1	1.20	1.12	1.25	1.07	1.16	1.24	1.11	1.05	1.06	1.11	1.32	1.43	1.36	1.38	1.37
S_2	1.06	1.23	1.16	1.18	1.16	1.02	1.15	1.11	1.09	1.09	1.33	1.52	1.43	1.46	1.43
S_3	1.11	1.20	1.03	1.30	1.16	1.33	1.09	1.17	1.18	1.19	1.51	1.61	1.39	1.39	1.48
S_4	1.15	1.44	1.24	1.56	1.35	1.44	1.22	1.18	1.41	1.31	1.43	1.42	1.43	1.48	1.44
Mean	1.13	1.25	1.17	1.28	-	1.26	1.14	1.13	1.19	-	1.40	1.50	1.40	1.43	-
	M	S	M at S	S at M	-	M	S	M at S	S at M	-	M	S	M at S	S at M	-
SEd	0.07	0.06	0.13	0.12	-	0.04	0.09	0.10	0.13	-	0.06	0.03	0.12	0.11	-
$CD_{0.05}$	NS	NS	NS	NS	-	NS	NS	NS	NS	-	NS	NS	NS	NS	-
Juice extraction (%)															
S_1	66.26	64.26	64.51	63.08	64.53	60.98	65.03	63.11	63.46	63.14	64.10	69.14	63.64	68.05	66.23
S_2	65.98	65.70	59.49	62.07	63.31	64.21	60.52	62.40	61.96	62.27	69.80	64.57	61.05	67.87	65.82
S_3	60.18	66.37	56.85	62.00	61.35	60.11	60.56	62.39	65.01	62.02	60.13	65.87	66.11	63.37	63.87
S_4	67.72	67.66	67.68	62.40	66.36	65.39	68.39	65.35	63.07	65.55	65.26	69.06	65.23	68.09	66.91
Mean	65.03	66.00	62.13	62.39	-	62.67	63.63	63.31	63.37	-	64.82	67.16	64.01	66.85	-
	M	S	M at S	S at M	-	M	S	M at S	S at M	-	M	S	M at S	S at M	-
SEd	2.49	2.17	3.82	3.63	-	2.43	1.42	4.22	3.73	-	1.42	2.65	3.61	4.25	-
$CD_{0.05}$	NS	NS	NS	NS	-	NS	NS	NS	NS	-	NS	NS	NS	NS	-
Brix (%)															
S_1	17.60	17.03	17.20	17.90	17.43	19.02	18.93	19.61	17.78	18.84	18.26	20.12	17.95	18.85	18.79
S_2	17.05	17.27	18.00	18.00	17.58	18.81	18.54	21.13	19.25	19.43	18.79	20.50	19.23	20.87	19.85
S_3	16.64	17.57	17.00	17.50	17.18	16.78	18.57	17.55	18.50	17.85	17.61	19.57	16.98	19.50	18.42
S_4	18.00	18.20	18.00	18.00	18.05	19.69	21.46	18.23	20.51	19.97	19.54	20.32	20.82	20.55	20.31
Mean	17.32	17.52	17.55	17.85	-	18.58	19.38	19.13	19.01		18.55	20.13	18.74	19.94	-
	M	S	M at S	S at M	-	M	S	M at S	S at M	-	M	S	M at S	S at M	-
SEd	0.71	0.38	1.20	1.03	-	0.77	0.58	1.16	1.05	-	0.73	0.68	1.26	1.23	-
$CD_{0.05}$	NS	NS	NS	NS	-	NS	1.43	2.62	2.33	-	NS	NS	NS	NS	-

Main plot	Spacing and row arrangement
M_1	150 x 60 cm single row planting
M_2	150 x 60 cm double row planting
M_3	180 x 60 cm single row planting
M_4	180 x 60 cm double row planting

Sub-plot	Intercropping systems
S_1•	Sole crop of sugarcane
S_2	Sugarcane + green gram
S_3	Sugarcane + black gram
S_4	Sugarcane + sunhemp

Thus the the planting of sugarcane at 150 cm in double rows with intercropping of sunhemp (M_2S_4) produced higher juice weight, juice extraction percentage and brix.

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