Indian Journal of Agronomy **67** (1): 73–76 (March 2022)

Research Paper

Performance of *suru* sugarcane under different intercropping systems

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Received: August 2020; Revised accepted: January 2022

ABSTRACT

The investigation was carried out during *suru* season of 2014–15, 2015–16 and 2016–17 at Agronomy Farm, Dapoli, Maharashtra, to study performance of *suru* sugarcane under different intercropping systems. The field experiment was laid out in randomized block design, comprising 7 treatment combinations with 3 replications. Treatments consisted of Sole sugarcane with 90-cm-row spacing, Sole paired row planted sugarcane (60 cm × 60 cm-120 cm), Paired row-planted sugarcane (PRPS) + groundnut (3 rows of groundnut at 30 cm spacing between paired row), PRPS + sweet corn (*Zea mays* L.) (2 rows of sweet corn at 45 cm spacing in between paired row), PRPS + cabbage *(Brassica oleracea* var. *capitata* L.) (2 rows of cabbage at 45 cm spacing in between paired row), PRPS + amaranth (4 rows of amaranths at 20 cm spacing in between paired row) and PRPS + greengram [*Vigna radiata* (L.) R. Wilczek] (3 rows of greengram at 30 cm spacing in between paired row). Higher yield and net returns were obtained when *suru* sugarcane was planted in paired rows at 60 cm × 60 cm – 120 cm and intercropped with 2 rows of sweet corn at 45 cm spacing between paired row.

Key words: Amaranthus, Cabbage, Greengram, Groundnut and paired row *suru* sugarcane, Intercropping, Sweet corn

Sugarcane (*Saccharum* spp. hybrid complex) is the most important cash crop of India which is produced for making sugar, jaggery and *khandsari*. India has emerged as the largest producer of sugar in the world. Sugar industry is the second largest agro-processing industry in the country with significant contribution to the income, employment and tax revenue of the rural area. It is cultivated in most of the states of India (tropical and sub-tropical regions) with acreage of 5.03 million ha. Sugarcane is a slow grower in the initial phase and as it is widely-spaced crop, there is scope for utilizing the space and time. Production of cane can be enhanced by different agronomic measures and careful selection and intercropping of suitable compatible crop with sugarcane which complements and supplements it. Different crops are being cultivated as intercrops at various locations, though not all crops are ideal. Intercropping is one of the sure ways of increasing production without much increase in the application of inputs. The slow establishment of sugarcane during the initial period and adoption of comparatively wider row spacing offer a vast scope for intercropping. The total productivity of wider row planting can be enhanced by intercropping with suitable intercrops. The inclusion of short-duration, high value crops in sugarcane-based production system, as intercrop holds get promise in making the system more sustainable. Sugarcane crop remains in the field for a year or more and the space between sugarcane rows range from 70 to 90 cm, providing ample chance for profuse weed growth which draws huge amount of nutrients and moisture from the soil. Hence, besides suppressing weeds in the inter-row spaces, additional production could be taken by growing suitable intercrops in between the cane rows. Some of the intercrops have been found to have no adverse effect on sugarcane yield.

In this background, a field experiment was conducted to study the performance of different crops as intercropping system with *suru* sugarcane and to identify the best feasible crops for taking up as intercrops.

MATERIALS AND METHODS

The field experiment was conducted during *suru* season of 2014–15, 2015–16 and 2016–17 at Agronomy Farm, College of Agriculture, Dapoli, district Ratnagiri, Maharashtra. The soil of experimental plot was clay loam in texture, slightly acidic in reaction with high in organic

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carbon content. It was medium in available nitrogen, low in available phosphorus and fairly high in available potassium. The field experiment was laid out in randomized block design, comprising 7 treatment combinations with 3 replications. Treatment consisted of T_1, sole sugarcane with 90 cm row spacing; T_2, sole paired row planted sugarcane (60 cm × 60 cm – 120 cm); T_3, paired row-planted sugarcane (PRPS) + groundnut (3 rows of groundnut at 30 cm spacing in between paired row); T_4, PRPS + sweet corn (2 rows of sweet corn at 45 cm spacing in between paired row); T_5, PRPS + cabbage (2 rows of cabbage at 45 cm spacing in between paired row); T_6, PRPS + Amaranth (4 rows of amaranths at 20 cm spacing in between paired row); and T_7, PRPS + greengram (3 rows of greengram at 30 cm spacing in between paired row). Sugarcane variety 'Co 8014' was used for plantation with 30,000 three-eye bud setts/ha and fertilized with 250 : 125 : 125 N : P : K kg/ha. Dates of planting/ sowing (sugarcane and other intrecrops) were 03 January 2014, 02 January 2015, 20 January 2016 during the year 2014–15, 2015–16 and 2016–17 respectively. Dates of harvesting are given separately in Table 1. During the course of present investigation, periodical growth observations, yield-contributing characters and yield were recorded to evaluate the treatment effects. Economics of the treatment combinations was also worked out.

RESULTS AND DISCUSSION

Growth and yield attributes of sugarcane

Data pertaining to growth character, viz. millable cane height and cane girth at harvesting are presented in Table 2. It was observed that, the cane height and cane girth were significantly influenced by different planting methods and intercropping treatments. Significantly higher plant height and cane girth were recorded with treatment paired row-planted sugarcane (PRPS) + greengram (3 rows of greengram at 30 cm spacing in between paired row) which was statistically on same par with treatment paired row-planted sugarcane (PRPS) + groundnut (3 rows of groundnut at 30 cm spacing in between paired row) and significantly superior over rest of the treatments. As far as planting methods are concerned, paired row-planted sugarcane exhibited higher cane height and cane girth than normal spacing. The number of internodes/cane and number of millable canes/ha could not be influence significantly by different planting methods as well as intercropping system during study. Similar results were reported by Ahmed et al., (1991), Afolabi (1991), Karamathullah *et al.* (1992) and Hosain *et al.* (2004).

Yield of sugarcane and intercrop

Paired row-planted sugarcane (PRPS) + greengram (3 rows of green gram at 30 cm spacing in between paired row) remained on par with treatment paired row planted sugarcane (PRPS) + groundnut (3 rows of groundnut at 30 cm spacing in between paired row) and recorded significantly higher cane yield and green top yield tones/ha as compared to rest of the treatments (Table 2). Higher intercrop yield recorded under treatment PRPS + sweet corn (2 rows of sweet corn at 45 cm spacing in between paired row), followed by treatment PRPS + cabbage (2 rows of cabbage at 45 cm spacing in between paired row).

Equivalent yield

The data revealed that, the sugarcane-equivalent yield was increased under all the intercropping systems over sole sugarcane with 90-cm-row spacing and sole paired row-planted sugarcane (60 cm × 60 cm – 120 cm). Significantly highest sugarcane equivalent yield recorded when sugarcane was intercropped with sweet corn as compared to rest of the treatments followed by sugarcane intercropped with cabbage (Table 3). These results are in conformity with Kathiresan and Rajasekaran (1990), Kanwar *et al.* (1990), Singh *et al.* (2002) and Geetha *et al.* (2015).

Economics

Data revealed that, intercropping treatments were found more remunerative than both the sole sugarcane stand, i.e. sole sugarcane with 90-cm-row spacing and sole paired row-planted sugarcane (60 cm × 60 cm – 120 cm) (T_1 and T_2). The highest net income and benefit : cost ratio (₹152,988 and 1.82) were obtained under sugarcane +

Table 1. Date of harvesting of different crops

	Dates of harvesting		
Crop	2014–15	2015–16	2016–17
Sugarcane	15 January 2015	2 November 2015	05 January 2017
Amaranth	10 February 2014	11 February 2015	09 March 2016
Cabbage	19 March 2014	16 March 2015	28 March 2016
Sweet corn	22 April 2014	9 April 2015	25 April 2016
Greengram	14 March 2014	27 March 2015	25 March 2016
Groundnut	05 May 2014	07 May 2015	20 May 2016

Table 2. Effect of different intercropping on growth and yield-attributing characters of sugarcane, yield of sugarcane, intercrop and sugarcane-equivalent yield

Treatment	Cane height at harvest (cm)	Cane girth (cm)	Internodes/ cane	Millable cane × 10^3 /ha	Cane yield t/ha	Green top yield t/ha	Intercrop yield (t/ha)		Sugarcane equivalent yield (t/ha)
							Grain/green biomass yield	Straw yield	
T_1, Sole sugarcane with 90 cm row spacing	223.9	7.47	22.37	66.03	75.18	8.52	-	-	81.99
T_2, Sole paired row planted sugarcane (60 cm × 60 cm-120 cm)	228.9	7.57	22.19	70.06	79.61	9.41	-	-	87.14
T_3, Paired row-planted sugarcane (PRPS) + groundnut (3 rows of groundnut at 30 cm spacing in between paired row)	234.3	8.24	22.82	71.28	81.30	9.65	7.40	1.09	110.60
T_4, PRPS + sweet corn (2 rows of sweet corn at 45 cm spacing in between paired row)	227.6	6.95	21.19	66.22	74.01	8.47	7.96	9.55	136.18
T_5, PRPS + cabbage (2 rows of cabbage at 45 cm spacing in between paired row)	228.0	7.49	23.83	67.70	79.94	9.51	7.50	-	117.58
T_6, PRPS + amaranth (4 rows of amaranth at 20 cm spacing in between paired row)	226.5	7.48	22.33	66.02	78.80	9.33	1.72	-	93.14
T_7, PRPS + greengram (3 rows of greengram at 30 cm spacing in between paired row)	237.7	8.48	25.11	72.84	83.82	10.13	0.22	-	97.22
SEm±	1.51	0.35	1.13	9.27	1.26	0.30	-	-	1.33
CD (P=0.05)	3.29	0.95	NS	NS	2.74	0.75	-	-	2.90

Table 3. Effect of different intercropping treatments on economics of sugarcane intercropping system

Treatment	Total cost (× 10^3 ₹/ha)	Gross returns (× 10^3 ₹/ha)	Net returns (× 10^3 ₹/ha)	Benefit: cost ratio
T_1, Sole sugarcane with 90 cm row spacing	173.4	205.0	31.6	1.18
T_2, Sole paired row planted sugarcane (60 cm × 60 cm- 120 cm)	171.9	217.9	45.9	1.27
T_3, Paired row-planted sugarcane (PRPS) + groundnut (3 rows of groundnut at 30 cm spacing in between paired row)	182.4	276.5	94.1	1.51
T_4, PRPS + sweet corn (2 rows of sweet corn at 45 cm spacing in between paired row)	187.5	340.5	153.0	1.82
T_5, PRPS + cabbage (2 rows of cabbage at 45 cm spacing in between paired row)	187.6	294.0	106.3	1.57
T_6, PRPS + amaranth (4 rows of amaranth at 20 cm spacing in between paired row)	178.6	232.9	54.2	1.30
T_7, PRPS + greengram (3 rows of greengram at 30 cm spacing in between paired row)	178.8	243.0	64.2	1.35

sweet corn intercropping system followed by sugarcane + cabbage, sugarcane + groundnut, sugarcane + greengram, sugarcane + amaranth (Table 3). Similar results were reported by Nazir *et al.* (2002), Santanu and Ray (2003), Saini *et al.* (2003) and Shinde *et al.* (2009).

From the 3 year investigation, it can be concluded that, for obtaining higher yield and net returns, *suru* sugarcane be planted in paired rows at 60 cm × 60 cm – 120 cm and intercropped with 2 rows of sweet corn at 45 cm spacing between paired row.

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