

RESEARCH ARTICLE**INTERCROPPING STUDIES IN PRE-SEASONAL AND SEASONAL SUGARCANE****B.Y. Kongawad*, V.C. Patil and A.M. Jambagi****Abstract**

Field experiments were conducted at KIAAR Sameerwadi, Tal: Mudhol, Dist: Bagalkot, Karnataka, during 2017-19, to study the effect of different wide row spacings and intercrops on growth, yield and quality of sugarcane. The experiments consisted of three wide row spacings i.e. 1.2 m x 0.5 m, 1.8 m x 0.5 m and 2.4 m x 0.5 m and seven intercrops namely beet root, cabbage, knol khol, Japanese mint, French bean, garlic and sweet potato in pre-seasonal planting and four intercrops namely onion, ridge guard, cucumber and fenugreek in seasonal planting. The cane yield was significantly higher at 1.2 m x 0.5 m in pre seasonal (233.14 t/ha) and seasonal sugarcane (124.86 t/ha), respectively. Higher gross and net income of Rs.2,70,975 /ha and Rs.1,93,060 /ha was realized by French bean intercropped with pre-seasonal sugarcane planted at a spacing of 1.8 m x 0.5 m. Higher gross income of Rs.2,05,493 /ha and net income of Rs.1,85,248/ha was realized by cucumber intercropped with seasonal sugarcane planted at a spacing of 1.2 m x 0.5 m.

Key words: Intercropping, wide row spacing, sugarcane

Introduction

Sugarcane occupies an important position in Indian agriculture and plays a pivotal role in national economy by sustaining the second largest organized agro industry in the country next to textile. Much of the space between two rows of sugarcane remains unutilized for an initial period of 100-120 days, because of its slow growth. Planting cane in wide rows helps in mechanization of field operations such as inter cultivation, aftercare and harvesting, as well as adopting intercropping that not only increases the efficiency but also results in reducing the cost of production and increasing the profitability of the cropping system (Chogatapur et al. 2018). Wide row spacing leads to higher yield and net returns and reduced cost of cultivation (Rajula Shanthi and Muthusamy 2012). Due to the wide row spacing and initial slow growth rate of sugarcane, there is ample scope for intercropping in sugarcane.

The major objectives of intercropping are to produce an additional crop, to optimize the use of natural resources and to stabilize the yield of crops (Willey 1979). The space available between the wide rows of sugarcane crop can be suitably used for growing inter crops for increasing the total production per unit area (Nadiger et al. 2018). Nadiger et al. (2017) obtained higher net income of Rs.2,09,745 per ha from sugarcane (at a row spacing of 1.2 m) intercropped with onion than green peas (Rs.1,68,192 per ha) and soybean (Rs.1,67,755 per ha). Keeping above facts in view, an investigation was carried out to study the effect of inter cropping in sugarcane with different row spacings for intensification of production in sugarcane farming.

Materials and Methods

Two field experiments were conducted at K. J. Somaiya Institute of Applied Agricultural Research (KIAAR), Sameerwadi, (Taluk:

B.Y. Kongawad, V.C. Patil and A.M. Jambagi

The K.J. Somaiya Institute of Applied Agricultural Research (KIAAR), Sameerwadi – 587 316,

Tal: Mudhol, Dist: Bagalkot, Karnataka, India.

*Corresponding author: kongawadby@gmail.com

Mudhol, Dist: Bagalkot, Karnataka) which is located at 16° 19' N latitude and 75° 69' E longitude and at an altitude of 541 m above mean sea level. KIAAR, Sameerwadi comes under northern dry zone of Karnataka (Zone no.3). The soil of the experimental field contained 187.5 kg/ha of available nitrogen; 22.05 kg/ha of available phosphorus; and 364 kg/ha of available potassium. The average annual rainfall of the area is 560 mm, but during November 2017 to February 2019 a rainfall of 336.7 mm was received.

The experiments were laid out in split plot design with three replications. The main plots consisted of three row spacings i.e. 1.2 m, 1.8 m and 2.4 m and sub plots consisted of seven intercrops namely beetroot, cabbage, sweet potato, knol khol, Japanese mint, garlic and French bean in preseasonal and four intercrops namely onion, ridge guard, cucumber and fenugreek in seasonal sugarcane planting. The crop was planted on 30th November 2017 and 10th February 2018 and harvested on 29th January 2019 and 9th February 2019 in pre seasonal and in seasonal planting, respectively. Plot size was 36 sq. m. in both the seasons. 45 days old single eye bud settlings were planted in both the seasons. Fertilizers were

applied based on soil test values for a target yield of 250 t/ha (664:263:265 N, P₂O₅ and K₂O kg/ha and 677:258:238 N,P₂O₅ and K₂O kg/ha) for pre seasonal and seasonal planting, respectively along with 5 t/ha of vermi-compost applied at the time of planting. The recommended doses of fertilizers were applied to the intercrops. At the time of sowing, 50 per cent of the total nitrogen and full dose of phosphorus and potash were applied in furrows by mixing with the soil and remaining 50 per cent nitrogen was top dressed at 30 days aftersowing.

Results and Discussion

Pre-seasonal sugarcane

Significantly higher cane yield was observed in 1.2 m x 0.5 m row spacing (233.14 t/ha) as compared to 1.8 m x 0.5 m (150.59 t/ha) and 2.4 m x 0.5 m (131.66 t/ha) spacing (Table 1). Significantly higher CCS yield was observed in 1.2 m x 0.5 m row spacing (32.68 t/ha) as compared to 1.8 m x 0.5 m (21.67 t/ha) and 2.4 m x 0.5 m (18.80 t/ha) spacing (Table 2).

Higher yield of intercrops was observed in 1.8 m x 0.5 m spacing as compared to 1.2 m x 0.5

Table 1. Effect of intercropping on sugarcane yield (t/ha) in pre-seasonal Sugarcane

Treatments	Beetroot	Cabbage	Sweet potato	Knolkhol	Japanese mint	Garlic	French bean	Check	Mean A
1.2 m x 0.5 m	225.78	244.73	220.90	254.79	217.49	225.46	235.02	240.94	233.14
1.8 m x 0.5 m	151.08	128.55	140.29	144.48	180.73	155.33	153.94	150.28	150.59
2.4 m x 0.5 m	156.47	161.74	102.55	141.86	129.84	124.04	116.08	120.73	131.66
Mean B	177.78	178.34	154.58	180.38	176.02	168.28	168.35	170.65	
Factors					SE(m)			C.D.	
Factor(A)					4.25			17.11	
Factor(B)					9.37			NS	
Factor(A)at same level of B					15.76			NS	

Table 2. Effect of intercropping on CCS yield (t/ha) in pre-seasonal sugarcane

Treatments	Beetroot	Cabbage	Sweet potato	Knolkhol	Japanese mint	Garlic	French bean	Check	Mean A
1.2 m x 0.5 m	31.11	33.29	31.62	36.81	30.57	32.39	32.41	33.24	32.68
1.8 m x 0.5 m	21.86	18.16	20.3	21.44	25.93	21.83	22.36	21.48	21.67
2.4 m x 0.5 m	23.15	21.87	15.03	20.34	18.53	17.45	16.25	17.8	18.80
Mean B	25.37	24.44	22.32	26.2	25.01	23.89	23.68	24.17	
Factors					SE(m)		C.D.		
Factor(A)					0.74		2.98		
Factor(B)					1.24		NS		
Factor(A) at same level of B					2.14		NS		

Table 3. Yield of intercrops (t/ha) in pre-seasonal sugarcane

Treatments	Beetroot	Cabbage	Sweet potato	Knolkhol	Japanese mint	Garlic	French bean
1.2 m x 0.5 m	21.38	31.94	2.18	74.81	6.37	1.22	7.87
1.8 m x 0.5 m	22.96	35.18	3.05	75.46	6.82	1.19	8.61
2.4 m x 0.5 m	18.88	24.77	2.32	65.27	6.42	1.04	8.24
Mean B	21.07	30.63	2.51	71.85	6.54	1.15	8.24
Factors				SE(m)		C.D.	
Factor(A)				0.35		1.438	
Factor(B)				0.62		1.79	

m and 2.4 m x 0.5 m spacing. Highest yield was recorded by knol khol (75.46 t/ha) intercropped with sugarcane planted at 1.8 m x 0.5 m spacing followed by cabbage (35.18 t/ha). Lowest yield was recorded in garlic intercrop (1.19 t/ha) at 2.4 m x 0.5 m spacing (Table 3).

Higher gross income of Rs.2,70,975 /ha was realized by French bean intercropped with sugarcane planted at a spacing of 1.8 m x 0.5 m followed by beetroot (Rs.1,92,693 /ha)(Table 4). Higher net income of Rs.1,93,060/ha was realized by French bean intercropped with sugarcane planted at a spacing of 1.8 m x 0.5 m followed by cabbage (Rs.1,33,871 /ha)(Table 5).

Seasonal sugarcane

Sugarcane yield was significantly higher in 1.2 m x 0.5 m row spacing (124.86 t/ha) as compared to 1.8 m x 0.5 m (93.11 t/ha) and 2.4 m x 0.5 m (59.40 t/ha) spacing. Higher cane yield (104.18 t/ha) was recorded in sugarcane intercropped with onion as compared to the other intercrops (Table 6). This might be due to non-exhaustive and dwarf nature of onion and residual effect of the additional fertilizers as well as cultural practices and irrigation water applied to intercrops grown with sugarcane as reported by Hossain *et al.*, (2003). Compared to the other intercrops, onion exerted least detrimental effect on the emergence,

Table 4. Effect of intercropping on gross income from intercrops (Rs./ha) in pre-seasonal sugarcane

Treatments	Beetroot	Cabbage	Sweet potato	Knolkhol	Japanese mint	Garlic	French bean
1.2 m x 0.5 m	179475	167505	45809	156930	121608	38406	247696
1.8 m x 0.5 m	192693	184542	64063	158325	130193	37525	270975
2.4 m x 0.5 m	158472	129906	48677	136956	122557	32752	259445
Mean B	176904	160675	52849	150688	124786	36203	259372
Factors				SE(m)	C.D.		
Factor(A)				1470.17	5926.20		
Factor(B)				3473.48	10001.85		
Factor(A)at same level of B				5760.24	17020.03		

Table 5. Effect of Intercropping on the net income (Rs./ha) in pre-seasonal sugarcane

Treatments	Beetroot	Cabbage	Sweet potato	Knolkhol	Japanese mint	Garlic	French bean
1.2 m x 0.5 m	101120	126895	27831	114485	42078	5067	172498
1.8 m x 0.5 m	106113	133872	43326	115953	35395	6315	193060
2.4 m x 0.5 m	78648	104718	30622	101560	44648	2056	183807
Mean B	94290	121828	33926	110666	40682	4479	183146
Factors				SE(m)	C.D.		
Factor(A)				1210.94	4880.49		
Factor(B)				9082.80	8876.82		
Factor(A)at same level of B				5089.05	14987.35		

Table 6. Effect of intercropping on the yield (t/ha) of seasonal sugarcane

Treatments	Onion	Ridge gourd	Cucumber	Fenugreek	Check	Mean A
1.2 m x 0.5 m	153.120	116.407	126.567	109.713	118.527	124.867
1.8 m x 0.5 m	88.870	108.667	90.790	97.847	79.420	93.119
2.4 m x 0.5 m	70.547	51.480	44.187	79.350	51.473	59.407
Mean B	104.179	92.184	87.181	95.637	83.140	
Factors				SE(m)	C.D.	
Factor(A)				4.37	17.63	
Factor(B)				5.70	NS	
Factor(A)at same level of B				9.85	NS	

Table 7. Effect of intercropping on CCS yield (t/ha) of seasonal sugarcane

Treatments	Onion	Ridge gourd	Cucumber	Fenugreek	Check	Mean A
1.2 m x 0.5 m	20.83	17.44	18.47	16.02	16.29	17.81
1.8 m x 0.5 m	12.88	15.39	12.82	14.11	11.16	13.27
2.4 m x 0.5 m	9.99	7.14	6.40	11.45	7.05	8.41
Mean B	14.57	13.32	12.56	13.86	11.50	
Factors				SE(m)	C.D.	
Factor(A)				0.62	2.51	
Factor(B)				0.84	NS	
Factor(A)at same level of B				1.45	NS	

Table 8. Yield of intercrops (q/ha) in seasonal sugarcane

Treatments	Onion	Ridge gourd	Cucumber	Fenugreek	Mean A	
1.2 m x 0.5 m	22.13	38.81	102.75	25.60	47.32	
1.8 m x 0.5 m	16.66	50.57	58.02	29.78	38.76	
2.4 m x 0.5 m	16.94	50.90	92.90	32.77	48.38	
Mean B	18.58	46.76	84.55	29.38		
Factors				SE(m)	C.D.	
Factor(A)				5.725	NS	
Factor(B)				6.728	20.14	
Factor(A)at same level of B				11.602	NS	

Table 9. Effect of intercropping on gross income (Rs./ha) from seasonal sugarcane

Treatments	Onion	Ridge gourd	Cucumber	Fenugreek	Mean A	
1.2 m x 0.5 m	22,126	116,420	205,493	63,991	102,007	
1.8 m x 0.5 m	16,663	151,710	116,030	74,458	89,715	
2.4 m x 0.5 m	16,943	152,700	185,800	81,933	109,344	
Mean B	18,577	140,276	169,107	73,461		
Factors				SE(m)	C.D.	
Factor(A)				11,688.72	NS	
Factor(B)				14,367.29	43,018.13	
Factor(A)at same level of B				24,516.71	NS	

Table 10. Effect of intercropping on net returns (Rs./ha) from seasonal sugarcane

Treatments	Onion	Ridge gourd	Cucumber	Fenugreek	Mean A
1.2 m x 0.5 m	-6,614.33	91,295.00	185,248.30	46,761.67	79,172.66
1.8 m x 0.5 m	-12,556.67	123,187.00	95,180.00	56,808.33	65,654.66
2.4 m x 0.5 m	-14,291.67	123,349.00	164,510.00	63,743.33	84,327.66
Mean B	-11,154.22	112,610.30	148,312.80	55,771.11	

Factors	SE(m)	C.D.
Factor(A)	11,688.72	NS
Factor(B)	14,367.29	43,018.13
Factor(A)at same level of B	24,516.71	NS

tillering, number of millable canes and yield of sugarcane (Hossain, 1984).

Significantly higher CCS yield was recorded in 1.2 m x 0.5 m row spacing (17.81 t/ha) as compared to 1.8 m x 0.5 m (13.27 t/ha) and 2.4 m x 0.5 m (8.41 t/ha) spacing. Higher CCS yield (14.57 t/ha) was recorded in sugarcane intercropped with onion as compared to the other intercrops (Table 7). Higher yield of intercrops was observed in 2.4 m x 0.5 m spacing as compared to 1.2 m x 0.5 m and 1.8 m x 0.5 m spacings. Highest yield was recorded by cucumber (102.75 q/ha) intercropped with sugarcane planted at 1.2 m x 0.5 m spacing (Table 8). Higher gross income of Rs.2,05,493 /ha and net income of Rs.1,85,248/ha was realized by cucumber intercropped with sugarcane planted at a spacing of 1.2 m x 0.5 m (Table 9 and 10).

Conclusion

Intercropping of French bean in pre-seasonal sugarcane planted at a spacing of 1.8 m x 0.5 m and cucumber in seasonal sugarcane planted at a spacing of 1.2 m x 0.5 m resulted in higher net income of Rs.1,93,060/ha and Rs.1,85,248/ha, respectively. Hence it may be concluded that intercropping of French bean in pre-seasonal sugarcane planted at 1.8 m x 0.5 m spacing and cucumber in seasonal sugarcane planted at a

spacing of 1.2 m x 0.5 m may be recommended for obtaining higher profits from sugarcane based cropping system.

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