

Intercropping in castor (*Ricinus communis*) under dryland condition in Rajasthan

I. N. GUPTA AND S. S. RATHORE

Agriculture Research Station, Rajasthan Agriculture University, Bhilwara 311 001

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ABSTRACT

A field experiment was conducted during 1987-88 to 1990-91 on silty-loam soil to select a suitable rainy-season crop for intercropping with castor (*Ricinus communis* L.). The highest mean castor-equivalent seed yield (25.16 q/ha), land-equivalent ratio (1.43), net return (Rs 12,995/ha) and monetary advantage (Rs 39,07/ha) were obtained by intercropping 2 rows of greengram (*Phaseolus radiatus* L.) in between the castor crop sown at 1 m row spacing. This was followed by castor + blackgram (*P. mungo* L.) (2 rows) and castor + groundnut (*Arachis hypogaea* L.) (2 rows).

Castor (*Ricinus communis* L.) is a remunerative crop under adverse climatic conditions, as it utilized the moisture from deeper layers. Being a long-duration, widely-spaced crop with comparatively thin plant population in comparison with other field crops, it offers a great scope for using its inter-space by growing short-duration crop and thereby helps harvest the potential productivity (Singh and Singh, 1988). Intercropping of short-duration crop like greengram (*Phaseolus radiatus* L.), blackgram (*P. mungo* L.) and clusterbean [*Cyamopsis tetragonoloba* (L.) Taubert] with castor is remunerative (Singh and Singh, 1988) for dryland conditions. The present investigation was therefore undertaken to select the best rainy-season crops for intercropping with castor for increasing net returns and land-equivalent ratio.

MATERIALS AND METHODS

The field experiment was conducted during the rainy seasons of 1987-88 to

1990-91 on silty-loam soil under dryland conditions at Arjia-Bhilwara. The experiment consisted of 13 treatments, viz. sole crops of castor, greengram, blackgram, soybean [*Glycine max* (L.) Merr.], sesame (*Sesamum indicum* L.), maize (*Zea mays* L.) and groundnut (*Arachis hypogaea* L.), and intercropping of castor with all these crops.

The treatments of sole groundnut and castor + groundnut were not included during the first year. Randomized block design was followed with 4 replications. The gross plot size was 6 m × 5 m and net plot size varied in different treatments due to variation in number of rows of component crops harvested.

Castor variety 'Aruna', greengram 'K 851', blackgram 'T 9', soybean 'Punjab 1', sesame 'C 50', maize 'Ageti 76' or 'Novjot' and groundnut 'JL 24' were used. Castor was sown at 1 m row spacing in sole as well as in intercropping treatments. Two rows of greengram or blackgram or soybean or sesame or groundnut and 1 row of maize

Table 1. Weekly meteorological data during crop-growth period

Standard week no.	Rainfall				Evaporation (mm)			
	1987- 88	1988- 89	1989- 90	1990- 91	1987- 88	1988- 89	1989- 90	1990- 91
25	37.0	2.5	68.2		25.9	135.1	123.9	111.5
26		116.1	69.0	48.6	46.2	67.9	74.9	91.2
27	7.2		13.0	122.3	46.2	90.3	56.7	17.8
28		61.5	2.4		56.0	20.3	72.8	65.5
29	32.6	63.2	69.6	38.6	46.2	35.0	42.7	46.2
30	3.6	60.0	19.9	107.9	87.5	7.7	24.5	55.3
31		32.8	1.5	88.0	88.9	7.7	46.9	41.0
32		17.6	142.2	60.7	24.5	20.3	37.8	23.6
33	3.0		142.4	17.1	25.2	38.5	31.5	52.0
34	39.6	84.2	138.4	78.2	26.6	14.7	29.4	26.6
35	199.9		212.2	40.6	45.5	21.7	28.7	28.5
36	67.4			17.2	50.4	48.3	42.0	33.5
37				14.2	50.4	45.5	45.5	35.3
38				43.6	61.6	30.8	47.6	38.1
39		22.8	7.0	9.3	58.1	20.3	42.7	31.7
40		54.8			53.2	42.0	50.4	21.2
41					51.1	41.3	48.3	24.8
42					45.5	38.5	45.5	28.4
43					33.6	30.8	36.4	36.3
44					45.5	38.5	35.7	36.1
45					37.8	34.3	31.5	38.3
46				6.2	32.9	31.5	24.5	31.4
47					30.1	29.4	24.5	25.0
48			1.20		30.1	26.6	17.5	23.9
49					28.0	23.1	21.7	23.5
50					12.6	17.5	21.7	20.8
51					12.6	16.8	18.9	20.0
52					16.8	22.4	18.9	26.8
1					19.6	18.2	20.3	21.4
2	0.8	11.4			21.7	13.3	22.5	17.0
3					21.7	18.9	29.7	21.8
4					28.0	19.6	30.8	27.0
5					30.1	28.7	29.8	30.1
6					32.2	31.5	29.9	31.0
7			2.6		33.6	34.3	26.4	35.4
8			9.6		37.8	41.3	29.7	32.7
9			5.6	6.1	46.2	44.8	29.4	40.5
10		2.8			46.2	41.3	50.0	42.3
11					47.6	47.6	58.0	47.4
12					55.3	48.3	60.8	56.8
13					57.4	46.9	57.3	64.8
Total	391.1	529.7	905.5	699.0				

were intercropped between 2 rows of castor in intercropping treatments. Sole crops of greengram, blackgram, soybean, sesame and groundnut were sown at 30 cm-row spacing, whereas the sole maize was sown at 60 cm-row spacing using recommended seed rates of different crops. Plant-to-plant spacing of 50 cm in castor and 25 cm in maize was maintained by thinning. Fertilizer application through diammonium phosphate and urea to different crops and other agronomic practices were done as per recommendation.

Seed yields of component crops which were recorded from net plots. The seed yield of different crops thus obtained were also converted into castor-equivalent seed yields, considering the prevailing prices of produce during the corresponding years. The mean data on sole groundnut and castor + groundnut treatments were computed from the data of 3 years, as these treatments were not included during 1987–88. Other treatment means are based on 4-year data. Land-equivalent ratio was computed. The net returns were computed from the mean yield data, prevailing prices of produce and cost of cultivation during concluding year. Monetary advantages were calculated, considering the data on mean land-equivalent ratio and net return.

Bhilwara is characterized by extremes of temperatures both in summer and winter. In summer maximum temperature reaches as high as 46°C and in winter the minimum temperature drops down as low as 0°C. Average annual rainfall of the area is about 700 mm, more than 90% of which is received during the rainy season.

RESULTS AND DISCUSSION

Large variations in the seed yield of castor were observed during different years.

During 1987–88 and 1989–90 the castor yield was low. It was due to low rainfall coupled with early withdrawal of monsoon during 1987–88, and due to heavy rains and waterlogging during 1989–89. During 1988–89 and 1990–91, the distribution of rainfall was normal and well distributed.

The highest mean castor-seed yield (16.71 q/ha) was in sole crop of castor. Intercropping of different crops reduced the castor-seed yield. The maximum reduction (46.26%) in castor yield was recorded when it was intercropped with maize. Conversely, the minimum reduction in castor-seed yield was recorded when it was intercropped with blackgram (9.21%), followed by groundnut (9.6%), soybean (21%) and greengram (22%).

Castor + greengram, castor + blackgram and castor + groundnut intercropping increased the castor-equivalent-seed yield compared with castor-equivalent yields of all sole crops (Table 2). The highest castor-equivalent-seed yield of 25.16 q/ha was recorded in castor + greengram intercropping, followed by castor + groundnut and castor + blackgram. The increase of 0.45 q/ha in castor-equivalent-seed yield was accrued from castor + greengram intercropping compared with sole castor.

Land-equivalent ratio

Intercropping of all the crops increased the land-equivalent ratio compared with sole crops. The highest land-equivalent ratio was recorded in the castor + greengram intercropping, followed by castor + blackgram and castor + groundnut.

Similar to the castor-equivalent-seed yield and land-equivalent ratio, the highest mean net returns were recorded in castor + greengram intercropping (Table 2). The

Table 2. Seed yield of component crops, castor-equivalent yield, land-equivalent ratio, net return and monetary advantage in castor-based intercropping systems

System	Seed yield (q/ha)				Castor-equivalent-seed yield (q/ha)	LER	Net return (Rs/ha)	Monetary advantage (Rs/ha)
	1987-88	1988-89	1989-90	1990-91				
Sole castor	7.25	18.22	8.71	32.67	16.71	1.00	7,588	
Sole greengram	11.18	9.55	8.13	8.38	11.62	1.00	5,298	
Sole blackgram	5.53	10.78	13.92	5.51	10.53	1.00	4,232	
Sole soybean	0.80	12.98	4.85	6.00	5.06	1.00	1,057	
Sole sesame	3.38	2.96	6.62	2.12	7.03	1.00	2,022	
Sole maize	1.88	26.40	33.40	39.01	9.67	1.00	3,387	
Sole groundnut	NI	18.96	7.93	16.78	18.63*	1.00*	8,513 **	
Castor + greengram	3.19 (9.79)	14.53 (6.02)	3.00 (7.87)	31.42 (6.37)	25.16	1.43	12,995	3,907
Castor + blackgram	4.07 (3.81)	20.52 (4.23)	6.12 (9.27)	30.19 (4.51)	21.77	1.40	11,037	3,153
Castor + soybean	7.37 (F)	14.50 (4.72)	7.62 (0.60)	23.30 (2.51)	14.36	1.08	6,203	459
Castor + sesame	2.89 (3.92)	14.55 (2.05)	2.00 (5.30)	23.55 (1.09)	16.41	1.02	7,178	141
Castor + maize	3.51 (2.38)	7.77 (12.98)	1.60 (23.39)	23.06 (16.96)	14.27	1.10	5,884	535
Castor + groundnut	NI	16.90 (5.19)	5.51 (3.64)	22.91 (1.68)	22.17*	1.18*	10,556 *	1,610 *
CD (P = 0.05)	0.70	5.57	0.60	5.01				

Data in parentheses represent intercrop; NI, not included; F, failed

* Mean of 3 years

LER, Land-equivalent ratio

increases in net returns in this system were Rs 5,407, 7,697, 9,608 and 4,489/ha than in sole crops of castor, greengram, maize and groundnut respectively. Castor + blackgram intercropping ranked second for net returns. Among different intercropping systems, the maximum monetary advantage of Rs 3,907/ha was also recorded in castor + greengram intercropping, followed by castor + blackgram.

It was concluded that based on maximum monetary advantage, land-equivalent ratio, net return and castor-equivalent-seed yield, the intercropping of greengram (2 rows) in

the inter-row space of castor grown at 1 m row spacing is a highly remunerative intercropping system and it may be used by the farmers. Castor + blackgram (2 rows) intercropping may be an alternative system with reasonable high monetary advantage, net return, land-equivalent ratio and castor-equivalent-seed yield in studied condition.

REFERENCE

- Singh, J. P. and Singh, B. P. 1988. Intercropping of mung bean and guar in castor under dryland condition. *Indian Journal of Agronomy* 33 (2) : 177-180.