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Study on intercropping in *Rabi* castor (*Ricinus communis* L.)

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Abstract

A field experiment was conducted at Agronomy Instructional Farm, Chimanbhai Patel College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar to study on intercropping in *Rabi* castor (*Ricinus communis* L.) during *Rabi* season of 2017. Castor based intercropping systems found distinctly more productive than sole castor giving as higher additional yield advantage as 9519 kg/ha with 1 : 1 row ratio and 4498 kg/ha with 1 : 2 row ratio. Inclusion of marigold as intercrop increased total production per unit area per year. The total production potential in term of castor equivalent yield was maximum under castor + marigold 1:1 (5408 kg/ha) followed by castor + marigold 1:2 recorded 3998 kg/ha. Oil content (48.68 %) and oil yield (1465 kg/ha) of castor were also recorded higher under sole castor as compared to intercropped with marigold. castor + marigold at 1:2 row ratio gave higher land equivalent ratio (1.67) while the net return was greater when castor intercropped with marigold at 1:1 row ratio (₹ 155416/ha) followed by castor + marigold at 1:2 row ratio (₹ 94835/ha). The benefit: cost ratio was highest with castor + marigold in 1:1 row proportion (2.80) followed by sole castor (1.84) and sole marigold (1.79).

Keywords: Intercropping, castor, marigold, castor equivalent yield, land equivalent ratio, net returns

Introduction

Oil seed crops have the unique significance in recent era of energy crisis as they play pivotal role in the agricultural industry and export trade of India. Castor (*Ricinus communis* L.) is a non-edible oil seed crop having high industrial importance due to presence of unique fatty acid and ricinoleic acid. It belongs to family Euphorbiaceae and originated from Ethiopia. Gujarat ranks first with respect to productivity mainly due to more than 90 per cent cultivated area covered by castor hybrids under irrigated conditions with good crop management practices. It has great value in foreign trade and earns foreign exchange worth of about ₹1000 crores annually through export of oil and its derivatives. Besides its higher economic usefulness, castor is a hardy crop and grown under wide range of soil and climatic conditions. It is grown on the sandy and rich alluvial soils, starting from sea level up to an altitude of 1500 to 2100 meters. Thus, castor has shown its adaptability to variety of soils and climatic conditions. In India and particularly in Gujarat, it is grown during rainy season. To reduce the duration and to increase cropping intensity along with saving of irrigation water, castor cultivation during *Rabi* season is an option. Because of arid and semi-arid climate and lack of sources of surface irrigation, ground water table is declining. Keeping the above facts in view, it has planned to investigate the low monetary input technologies for *Rabi* castor. Castor is generally sown by maintaining plant to plant distance of 45 to 75 cm and at a row distance of 90 to 180 cm depending on the hybrid and soil type. The main principle involved in selecting intercrops is that, they should not be competitive with main crop for soil moisture, nutrients and solar radiation. As the wide space is available between two rows, in which, profitable short duration crops can be grown during early growth stages of crop as *Rabi* intercrop which gives an additional income and pest minimization also.

Materials and Methods

A field experiment conducted on Agronomy Instructional Farm, Chimanbhai Patel College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar, District Banaskantha (North Gujarat) during *Rabi* season of 2017. The soil of the experimental plot was loamy sand in texture, low in organic carbon (0.22%) and available nitrogen (142.5 kg/ha), medium in available phosphorus (38.79 kg/ha) and high in potash (286.12 kg/ha).

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Electrical Conductivity (EC) was very low showing that the soil was free from salinity hazard. The experiment was laid out in a complete randomised block design consisting of seven treatments of different sole and intercropping systems. The treatments were sole castor, sole marigold, castor + marigold (1:1), castor + marigold (1:2), Paired row castor, Paired row castor + marigold (1:1), Paired row castor + marigold (1:2). The spacing between the two row of castor was kept 150 cm for sole and intercropping while 120 cm for paired row, spacing between two row of marigold was kept 60 cm. seed yield and flower yield were recorded and net returns were calculated on the basis of market rates.

Results and Discussion

Yield attributes and yield

Sole castor recorded significantly higher number of spikes per plant (11.17) and main spike length (68.42 cm) at harvest as compared to other treatments except castor + Marigold (1:1) and castor + Marigold (1:2) which were at par with each

other. Significantly lower number of spikes per plant (7.79) and main spike length was observed in Paired row castor + Marigold (1:2). Similarly in all pickings significantly higher number of capsules per spike was recorded with sole crop of castor (69.41), but it was at par with castor + Marigold (1:1) and castor + Marigold (1:2), 64.16 and 62.03, respectively. While, the minimum number of capsules (50.12) on main spike was recorded under [Paired row castor + Marigold (1:2)] (Table 1). Similar results were reported by Gangasaran and Giri (1985) [3].

The mean seed yield of sole castor (3010 kg/ha) was higher than that in the rest of intercropping system. Next best treatment for castor seed yield was castor + marigold (1:1) followed by castor + marigold (1:2). The reduction in seed yield of castor when paired crop with marigold (1:2) was comparatively high. Thus castor intercrop with marigold give higher castor yield compared to pair cropping (Table 2). Similar results were reported by Reddy and Venkateswarlu (1989) [5].

Table 1: Growth and yield attributes of castor as influenced by different intercropping systems

Treatments	Number of spikes/plant of castor	Length of main spike (cm)	Number of capsules/main spike
T ₁ : Sole castor	11.17	68.42	69.41
T ₂ : Sole marigold	-	-	-
T ₃ : Castor + Marigold (1:1)	10.55	61.19	64.16
T ₄ : Castor + Marigold (1:2)	9.86	60.88	62.03
T ₅ : Paired row castor	9.22	58.30	57.71
T ₆ : Paired row castor + Marigold (1:1)	8.64	57.26	54.82
T ₇ : Paired row castor + Marigold (1:2)	7.79	52.82	50.12
S.Em.±	0.46	2.75	2.56
C.D. at 5 %	1.38	8.28	7.71
C. V. (%)	9.60	9.18	8.57

Castor Equivalent Yield (CEY) and land equivalent ratio (LER)

The castor equivalent yield was significantly higher in castor + marigold in 1:1 and 1:2 row proportions than sole crop of castor. Intercropping of castor with marigold 1:1 was found to be a profitable system. Similar result reported by Ramachandrapa *et al.* (2016) [4]. The higher castor equivalent yield was due to additional intercrop yield with

lower reduction in main crop yield. These results are in agreement with the findings of Tanunathan *et al.* (2006). Among different intercropping systems castor + marigold (1:1) recorded higher land equivalent ratio (1.67). While lowest (0.98) was observed in paired row castor + marigold (1:2). These results were corroborated with finding of Chand and Sujatha (2000) [2] and Basith and Mohammad (2013) [1].

Table 2: Seed yield of castor, intercrop yield, CEY, LER and economics of different intercropping systems

Treatments	Seed yield Kg/ha (castor)	Flower yield Kg/ha (marigold)	CEY (kg/ha)	LER	Net return (₹/ha)	BCR
T ₁ : Sole castor	3010	-	3053	1.00	77091	1.84
T ₂ : Sole marigold	-	13569	3479	1.00	87104	1.79
T ₃ : Castor + Marigold (1:1)	2926	9519	5408	1.67	155416	2.80
T ₄ : Castor + Marigold (1:2)	2805	4498	3998	1.26	94835	1.55
T ₅ : Paired row castor	2544	-	2580	1.00	58649	1.40
T ₆ : Paired row castor + Marigold (1:1)	2470	5160	3828	1.20	93650	1.68
T ₇ : Paired row castor + Marigold (1:2)	2378	2575	3071	0.98	63316	1.12
S.Em.±	144		137	0.04		
C.D. at 5 %	432		409	0.12		
C. V. (%)	10.65		7.57	6.96		

CEY= Castor Equivalent yield, LER= Land Equivalent Ratio, BCR= Benefit Cost Ratio.

Economics

Among the castor based intercropping systems, intercropping of castor + marigold in 1:1 (₹1,55,416/ha) and castor + marigold in 1:2 (₹94,835/ha) recorded higher net returns. While highest B:C ratio (2.80) was obtained under castor + marigold (1:1) followed by sole castor (1.84) (Table 2). These results are in agreement with finding of Singh and Singh (1988) [6] and Ramachandrapa *et al.* (2016) [4].

Conclusion

Based on the results of one year experimentation, it is concluded that, instead of sowing sole castor, it should be intercropped with marigold in 1 : 1 row ratio for getting maximum net profit (₹ 155416/ha), BCR (2.80) and LER (1.67) in *Rabi* season under loamy sand soil of North Gujarat Agro-climatic conditions.

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