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Comparative Studies on Castor Based Intercropping Systems

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Abstract A field experiment was conducted during 2015-16 on loamy sand soil under irrigated condition to find out suitable intercrops viz., greengram, groundnut, clusterbean and sesamum under three different row spacings of castor 120, 180 and 240 cm. It was observed that in all intercropping systems plant height of castor decreased than sole crop but maximum decline was observed with sesamum followed by clusterbean intercrops. Among the different intercropping, higher dry matter production per plant was obtained in castor + greengram followed by castor + groundnut in 1:2, 1:4 and 1:6 at 60, 90, 120 days after sowing and at harvest. Results showed that castor planted at 240 cm row spacing significantly improved the yield attributes (capsule spike^{-1}, spike plant^{-1}, primary branches plant^{-1} and length of primary spike) of castor. Among intercropping significantly higher value of yield attributes were recorded in castor (240 cm) + greengram (!:4) intercropping system. The magnitude of reduction in seed yield of castor was more severe with sesamum followed by clusterbean. Significantly highest castor equivalent yield (6037 kg ha^{-1}) was obtained in castor (180 cm) + groundnut (1:4), closely followed by castor (240 cm) + greengram (1:2) intercropping system.

Keywords Castor, Intercropping, Row spacing, Castor equivalent yield.

Introduction

Castor (*Ricinus communis* L.) is most important oil seed crop of India due to the fact that it's oil has diversified uses and has great value in foreign trade. It is being cultivated in 1.09 million hectares with a production of 1.86 million tonnes. In Haryana castor occupies 3 thousand hectares with production of 4 thousand tonnes. Being a widely spaced crop long duration and initial slow growth in nature, castor offers good scope for intercropping. Advantage of intercropping in casor can be increased by reorienting crop geometry for better availability of solar energy Srinivas et al. [1] and putting suitable intercrops. Legume crops may be better choice owing to beneficial effect of fixing atmospheric nitrogen and thereby some extra nitrogen was perhaps made available to the castor to utilize more efficiently beyond 90 DAS to harvest of castor. By adopting appropriate crop geometry in the intercropping systems, the total productivity can be enhanced. Looking to good proposal of castor in irrigated ecosystem of Southern-Western Haryana this experiment was conducted to realize higher net return.

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Materials and Methods

A field experiment was conducted during 2015-16 at Regional Research Station, Bawal (Rewari), CCS Haryana Agricultural University. The soil of the experimental field was loamy sand in texture and slightly alkaline in reaction (pH 8.5), low in organic carbon (0.20%) and nitrogen (148 kg ha^{-1}), medium in available phosphorus (13.4 kg ha^{-1}) and potassium (151 kg ha^{-1}). The experiment was conducted in randomized block design with three replications. The intercropping system comprising, sole castor, castor + greengram, castor + sesamum, castor + groundnut and castor + clusterbean under three level of row spacing of castor, viz., 120 180 and 240 cm and 15 treatment combinations were made viz., Sole castor (120 cm), Castor (120 cm) + greengram (1:2), Castor (120 cm) + sesamum (1:2), Castor (120 cm) + groundnut (1:2), Castor (120 cm) + clusterbean (1:2), Sole castor (180 cm), Castor (180 cm) + greengram (1:4), Castor (180 cm) + sesamum (1:4), Castor (180 cm) + groundnut (1:4), Castor (180 cm) + clusterbean (1:4), Sole castor (240 cm), Castor (240 cm) + greengram (1:6), Castor (240 cm) + sesamum (1:6), Castor (240 cm) + groundnut (1:6) and Castor (240 cm) + clusterbean (1:6).

Castor hybrid DCH-177, greengram var Basanti, Groundnut var. MH-4, sesamum var. HT-1 and Clusterbean var. HG 2-20 were sown on 3 July. All intercrops are sown at 30 cm × 10 cm row spacing. The fertilizer application was done on the basis of package of the main crop (Castor) and intercrops (greengram, sesamum, groundnut and clusterbean). Castor was weeded manually at 20 and 40 DAS. During the crop season there was 292.8 mm rainfall. In all these were 7 pickings 120, 150, 180, 210, 240, 270 and 300 days after sowing, respectively. All other intercultural practices were done as per package of practices.

Results and Discussion

Growth parameters

Castor sown at 240 cm row spacing recorded significantly higher plant at successive growth stage (30, 60, 90 and 120 DAS) and dry matter production at 60, 90, 120 DAS and at harvest over castor sown at 120 and 180 cm row spacing. These findings are in line with that of Daisy et al. [2] in respect of plant height of castor in 150 cm row spacing over 120 cm row spacing. Among different intercropping systems at 30 and 60 DAS higher plant height was recorded in castor (240 cm) + clusterbean (1:6) and castor (240 cm) + groundnut (1:6), respectively and at 90 and 120 DAS higher plant height of castor was recorded with castor (240 cm) + greengram (1:6) intercropping system. Castor dry matter production at 30 DAS was not

Table 1. Effect of different treatments on growth of castor at different periodical interval.

	Treatments	Plant height (cm)				Dry matter plant^{-1} (g)				
		30 DAS	60 DAS	90 DAS	120 DAS	30 DAS	60 DAS	90 DAS	120 DAS	At harvest
T_1	Sole castor (120 cm)	26.41	69.82	97.85	5.48	5.48	82.11	302.77	743.11	1076.69
T_2	Castor (120 cm)+greengram (1:2)	26.76	67.21	92.29	5.45	5.45	78.54	291.58	724.66	1021.75
T_3	Castor (120 cm)+sesamum (1:2)	26.70	57.23	78.85	5.30	5.30	68.02	241.02	662.42	978.77
T_4	Castor (120 cm)+groundnut (1:2)	26.19	64.42	87.16	5.70	5.70	75.30	289.31	691.67	1006.60
T_5	Castor (120 cm)+clusterbean(1:2)	27.80	60.91	83.74	5.81	5.81	72.66	277.72	675.91	992.31
T_6	Sole castor (180 cm)	26.06	73.16	99.24	5.74	5.74	80.33	333.44	794.35	1257.79
T_7	Castor (180 cm)+greengram (1:4)	26.43	72.06	101.63	5.33	5.33	77.85	326.35	784.80	1224.79
T_8	Castor (180 cm)+sesamum (1:4)	26.54	61.57	85.48	5.38	5.38	76.83	312.08	740.68	1158.54
T_9	Castor (180 cm)+groundnut (1:4)	27.70	66.31	94.62	5.84	5.84	80.73	323.31	772.49	1202.53
T_{10}	Castor (180 cm)+clusterbean (1:4)	26.04	65.90	90.48	5.26	5.26	80.89	318.49	762.87	1181.65
T_{11}	Sole castor (240 cm)	27.88	80.82	118.51	5.52	5.52	89.79	348.36	811.78	1448.37
T_{12}	Castor (240 cm)+greengram (1:6)	27.41	76.11	111.47	5.54	5.54	82.97	339.39	794.85	1406.28
T_{13}	Castor (240 cm)+sesamum (1:6)	26.55	67.95	98.79	5.59	5.59	80.15	317.64	760.56	1342.39
T_{14}	Castor (240 cm)+groundnut (1:6)	27.11	76.56	104.61	5.59	5.59	81.04	333.11	784.14	1386.68
T_{15}	Castor (240 cm)+clusterbean (1:6)	27.64	71.71	99.94	5.45	5.45	80.44	325.90	772.58	1362.46
	SEm ±	0.57	4.54	5.91	0.15	0.15	2.76	14.03	44.57	59.37
	CD (p=0.05)	1.17	9.36	12.17	NS	NS	8.03	40.86	91.77	122.25

Table 2. Effect of different treatments on yield attributes and yield of castor.

	Treatments	100 seed weight (g)	No. of capsule spike^{-1}	No. of spike plant^{-1}	No. of primary branches plant^{-1}	Length of primary spike (cm)	Seed yield (kg/ha) Castor	Inter crop	Castor equivalent yield (kg/ha)
T_1	Sole castor (120 cm)	29.48	70.58	9.15	5.95	62.59	5246		5246
T_2	Castor (120 cm)+greengram (1: 2)	30.15	68.14	8.16	5.61	61.53	5140	420	6026
T_3	Castor (120 cm)+sesamum (1: 2)	29.40	60.81	6.06	3.43	58.78	4987	155	5287
T_4	Castor (120 cm)+groundnut (1: 2)	29.56	66.75	6.39	4.96	60.26	5053	636	5813
T_5	Castor (120 cm)+clusterbean (1: 2)	30.05	62.32	6.78	4.06	61.04	5020	280	5359
T_6	Sole castor (180 cm)	29.37	76.64	11.62	6.14	66.27	5163		5163
T_7	Castor (180 cm)+greengram (1: 4)	29.12	72.14	10.32	6.13	65.17	4913	580	5907
T_8	Castor (180 cm)+sesamum (1: 4)	29.42	63.98	7.80	4.52	61.02	4807	330	5307
T_9	Castor (180 cm)+groundnut (1: 4)	30.01	68.08	9.51	5.56	63.36	4898	886	6037
T_{10}	Castor (180 cm)+clusterbean (1: 4)	29.80	65.40	8.86	5.05	63.09	4859	368	5180
T_{11}	Sole castor (240 cm)	29.32	85.37	16.32	8.85	66.49	4515		4515
T_{12}	Castor (240 cm)+greengram (1: 6)	29.22	80.66	14.50	7.97	65.68	4567	720	5933
T_{13}	Castor (240 cm)+sesamum (1: 6)	29.40	70.89	10.08	5.78	62.15	4350	421	4717
T_{14}	Castor (240 cm)+groundnut (1: 4)	29.23	76.07	12.62	7.14	63.33	4533	1120	5828
T_{15}	Castor (240 cm)+clusterbean (1: 6)	29.46	73.63	11.83	6.41	64.77	4401	688	4919
	SEm ±	0.42	5.20	0.74	0.45	0.90	173	55	267
	CD (p=0.05)	NS	10.70	1.53	1.59	2.63	490	163	526

affected by different treatments. Among all intercropping systems highest dry matter production was observed in castor at 240 cm + greengram (1:6) at 60, 90, 120 DAS and at harvest, it was at par with sole castor planted at 240 cm and 120 cm row spacings. Castor intercropped with 2, 4 and 6 rows of sesamum tended to accumulate less dry matter than other intercropping systems at 30, 60, 90, 120 DAS and at harvest (Table 1).

Yield attributes and yield

Castor planted in 240 cm row spacing increased yield attributes i.e. primary branches plant^{-1}, spike plant^{-1}, capsule spike^{-1} and length of primary spike significantly. These increases in yield attributes could be ascribed to significant increases in growth parameter of the crop under 240 cm row spacing. Closer planted castor might have experienced competition for sunlight, water, nutrients and space and in turn produced lower number of branches plant^{-1}. Number of spike produced more in wider space because of more radiation interception above the canopy and higher availability of nutrients and water below canopy during growth cycle of the crop. Among different intercropping system higher number of primary branches plant^{-1},spike plant^{-1}, capsule spike^{-1} and length of primary spike were obtained in castor (240 cm) + greengram (1:6) intercropping system (Table 2). Similar result was obtained by Porwal et al. [3]. 100 seed weight of castor was not affected by different intercropping systems and row spacing of castor. Patel et al. [4] also reported similar results.

The highest castor seed yield was obtained when castor crop was sown as sole castor at 120 cm row spacing. A significant reduction in seed yield of castor was observed under intercropping treatments. The reduction in seed yield of castor, in the intercropping system was mainly due to reduction in plant stand of castor in different intercropping treatment replacement type of intercropping system was followed in the present study. Among different intercropping systems higher seed yield of castor was obtained in castor (120 cm) + greengram (1:2) intercropping system. The magnitude of reduction in seed yield of castor was more severe with sesamum followed by clusterbean. Similar result was also reported earlier that castor + sesamum intercropping recorded lower seed yield. Although significant reduction in the seed yield of base crop and intercrops in different intercropping treatments was recorded, yet the recovery in the seed yield in treatment like castor + groundnut (1:4) and castor + greengram (1:2) was higher which

leads to higher castor equivalent yield than sole castor. Castor equivalent yield was significantly higher in castor + groundnut (1:4) and castor+ greengram (1:2) over sole castor and other intercropping systems which might be due to higher yield of groundnut and greengram as well as less reduction of castor seed yield in this intercropping system. Higher castor equivalent yield under castor + legume intercropping system over sole castor and castor + sesamum. These results are in conformity with the earlier findings of Sharma and Singh [5].

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