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Inter cropping on growth, productivity and economics of kharif castor in YSR Kadapa district of Andhra Pradesh, India

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ABSTRACT

A field experiment was conducted at Agricultural Research Station, Utukur, YSR kadapa district of Andhra Pradesh during rainy season of 2020 to study the performance of different intercrops in castor (*Ricinus communis* L.). The treatments were sole castor, castor + groundnut (1:3), castor + foxtail millet (1:3), castor + greengram (1:3), paired row of castor + groundnut (2:4), paired row of castor + foxtail millet (2:4), paired row of castor + greengram (2:4) and sole crops of groundnut, foxtail millet and greengram. Furrows were opened with inter row spacing of 90 cm and seed was planted at 60 cm for sole castor and 1:3 row proportion of castor intercropping systems. For paired row system of planting, two rows of castor were spaced at 60 cm with an inter row space of 120 cm between two pairs. Three rows of inter crops were sown in between two rows of castor and four rows of inter crops in between two pairs of castor (120 cm). From the study it can be concluded that paired row system of castor intercropped with foxtail millet in 2:4 row proportion gave significantly highest castor equivalent yield (2267 kg ha^{-1}) closely followed by castor intercropped with greengram in 2:4 row proportion. Thus, 4 rows of foxtail millet intercropped in paired rows of castor (60/120 x 60 cm) is beneficial in maximizing the productivity and profitability under rainfed conditions.

Key words : *Intercropping, Castor, Growth, Yield, Land equivalent ratio and net returns*

Introduction

Castor (*Ricinus communis* L.) is one of the most important oilseed crops of India with its oil having diversified uses and great value in foreign trade. It is a non-edible oil seed crop (45 to 50 % oil) having high industrial importance due to presence of unique fatty acid and ricinoleic acid. India contributes to 56 per cent area and 84 per cent production in the world. Thus, India is a leading country in the world not only in area and production, but also in productivity of castor. Among the different states, Gujarat, Rajasthan and Andhra Pradesh contribute 96 per cent of the total castor production in India. In the YSR Kadapa district, ground nut is a predominant crop during kharif, but due to climate change, farmers are looking for better assured crops to switch over and in such situations, castor is a boon to farmers which is drought resistant. The productivity of castor under rain fed conditions is very low because of low and erratic rainfall, poor soils, improper adoption of latest technology etc. Hence, Intercropping has been identified as a kind of biological insurance against risks under aberrant rainfall

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conditions in rain fed regions (Koli *et al*., 2004). It is ideally suited for intercropping systems due to wider inter and intra row spacing. Shortage of pulse and oil seeds in our country have focused the attention on their inclusion in intercropping systems which have a capacity to get more return per unit area as well as improve the physical, biological and chemical properties of soil. But several factors like cultivar, seeding ratios, planting pattern and competition between mixture components affect the growth of species in intercropping. Hence, the present study was undertaken with an objective of suitability of intercrops and maximizing productivity in castor based intercropping systems. Different legumes and cereals were evaluated between wide spaced castor rows as intercrops.

Materials and Methods

Field experiment was conducted at Agricultural Research Station, Utukur, YSR Kadapa district, Andhra Pradesh during kharif season of 2020. The soil of experimental site was sandy loam with pH 7.2 and EC 0.32ds m^{-1}. The soil was medium in available nitrogen (283 kg ha^{-1}), low in available phosphorus (16 kg ha^{-1}) and medium in available potassium (259 kg ha^{-1}). The experiment was laid out in a randomized complete block design consisting of ten treatments of different sole and intercropping systems and replicated thrice. The treatments were sole castor (DCH- 519), castor + groundnut (1:3), castor + foxtail millet (1:3), castor + greengram (1:3), paired row of castor + groundnut (2:4), paired row of castor + foxtail millet (2:4), paired row of castor + greengram (2:4) and sole crops of groundnut (Kadiri -6), foxtail millet (Suryanandi) and greengram (WGG-42). Furrows were opened with inter row spacing of 90 cm and seed was planted at60 cm for sole castor and 1:3 row proportion of castor intercropping systems. For paired row system of planting, two rows of castor were spaced at 60 cm with an inter row space of 120 cm between two pairs. Three rows of inter crops were sown in between two rows of castor and four rows of inter crops in between two pairs of castor (120 cm). Seed yields were recorded and net returns were calculated on the basis of market rates.

Results and Discussion

Growth and yield of castor

Taller plants (129.9 cm) were recorded with sole castor compared to inter cropping with legumes but it was on par with castor + foxtail millet (1:4) and castor + foxtail millet (2:4). Similarly significantly higher number of branches per plant was observed with sole castor compared to intercropping with cereals and legumes but tertiary branches are more with intercropping compared to sole cropping which might be due to later growth after the harvest of intercrops. Sole castor recorded significantly lengthier primary spikes (58.7 cm) compared to intercropping which might be due to the sharing of resources between two crops in intercropping compared to sole cropping. Similarly significantly higher number of capsules (80.0) was observed with sole castor compared to intercropping except castor + greengram (1:3) and castor + foxtail millet (2:4) which recorded on par number of capsules with that of sole castor.

Significantly higher castor bean yield (1818 kg ha^{-1}) was recorded with sole castor crop except castor +

Table 1. Growth and yield attributes of castor as influenced by intercropping during *kharif*

Treatment	Plant height (cm)	No. of secondary Branches/plant	No. of tertiary Branches/ plant	Primary spike length(cm)	No. of capsules/ pri. spike	Castor yield (kg ha^{-1})
Castor + groundnut(1:3)	102.5	2.7	2.1	46.5	74.5	1190
Castor + Foxtail millet (1:3)	126.8	2.5	2.1	43.2	68.0	1173
Castor + greengram (1:3)	93.7	2.8	1.7	47.5	75.8	1338
Castor + groundnut (2:4)	114.0	2.5	1.6	53.1	72.1	1530
Castor + foxtail millet (2:4)	120.2	2.8	2.0	45.8	82.0	1451
Castor + greengram (2:4)	108.8	2.8	2.1	51.0	73.4	1409
Sole castor	129.9	2.9	1.5	58.7	86.0	1818
S.Em±	3.52	0.25	0.19	3.56	3.58	97
CD (P= 0.05)	10.85	0.08	0.58	5.00	11.02	305
CV (%)	5.36	5.19	17.46	4.05	8.15	11.97

Table 2. Yield and economics of castor based inter cropping systems in kharif

Treatment	Inter crop yield (kg ha^{-1})	Castor equivalent Yield (kg ha^{-1})	LER	Net Returns (Rs ha^{-1})	BC ratio
Castor + groundnut (1:3)	351	1614	0.95	61,332	1.53
Castor + Foxtail millet (1:3)	700	1681	1.26	63,878	1.59
Castor + greengram (1:3)	231	1620	1.23	61,560	1.53
Castor + groundnut (2:4)	245	1705	1.06	64,790	1.61
Castor + foxtail millet (2:4)	564	2267	1.29	83,146	2.07
Castor + greengram (2:4)	224	1892	1.26	71,896	1.79
Sole castor	0	1818	1.00	69,084	1.72
Sole groundnut	1102	1334	-	-	-
Sole foxtail millet	1114	1612	-	-	-
Sole greengram	457	986	-	-	-
S.Em±	48.6	-	-	-	-
CD (P= 0.05)	145	-	-	-	-
CV (%)	11.8	-	-	-	-

groundnut (2:4). Paired row planting of castor with inter cropping recorded higher yield of castor compared to normal planting with intercropping. In contrast, Satish (2009) reported reduced the castor yield with intercropping in paired rows.

Castor Equivalent Yield and Land Equivalent Ratio

The castor equivalent yield was higher in 2: 4 row proportions compared to 1:3 row proportions. Among the different inter cropping systems, castor + foxtail millet recorded higher castor equivalent yield followed by greengram in both row proportions. 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 Mudalagiriyappa *et al*. (2011). Among different intercrops, castor + foxtail millet (2:4) recorded higher land equivalent ratio (1.29) followed by castor + greengram (2:4).

Economics

Castor + foxtail millet cropping system (2:4) recorded higher net returns (Rs 83,146) followed by castor + greengram (2:4) (Rs. 71,896/-) with B:C ratios of 2.07 and 1.79 respectively. Similar findings of benefit of inter cropping system in castor was reported by Padmavathi and Raghaviah (2004).

Conclusion

From the study it can be concluded that paired row system of castor intercropped with foxtail millet in 2:4 row proportion gave significantly highest castor equivalent yield (2267 kg ha^{-1}) closely followed by castor intercropped with greengram in 2:4 row proportion. Thus, 4 rows of foxtail millet intercropped in paired rows of castor (60/120x60 cm) is beneficial in maximizing the productivity and profitability under rainfed conditions.

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