



P-ISSN: 2349-8528

E-ISSN: 2321-4902

www.chemijournal.com

IJCS 2020; 8(3): 2297-2299

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Received: 07-03-2020

Accepted: 09-04-2020

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Comparative performance of castor (*Ricinus communis* L.) and groundnut intercropping system under central dry zone of Karnataka

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DOI: <https://doi.org/10.22271/chemi.2020.v8.i3ag.9551>

Abstract

A field experiment was conducted during *Kharif* 2015 at Zonal Agricultural and Horticultural Research Station, Babbur farm, Hiriya. Pure crop of castor is tested against intercropping of groundnut. Among the different intercropping systems, castor + groundnut (1:7) ratio significantly recorded higher castor yield (916 kg ha⁻¹) and castor equivalent yield (CEY: 2107 kg ha⁻¹). Similarly, same treatment which recorded higher net returns (Rs. 55612) and B: C ratio (2.75).

Keywords: Groundnut, castor, CEY

Introduction

In recent years, a trend in agricultural production system has changed towards achieving high productivity and promoting sustainability over time. Farmers are developing different crop production systems to increase productivity and sustainability since ancient times. This includes crop rotation, relay cropping and intercropping of major crops with other crops. However, several factors like cultivar, seeding ratios, planting pattern and competition between mixture components affect the growth of species in intercropping. 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 and to overcome the risk. The intercropping systems involve smart risk protection combinations. Castor (*Ricinus communis* L.) is one of the oilseed crops and plays an important role in country's oil economy. It is indigenous to Eastern Africa and originated in Ethiopia. Red and white seeded variety of castor were described in the ancient book of Indian "Susrut Samhita" written nearly 2000 years ago, which indicates familiarity of the crop to Indians since ancient time. Castor seed contain 50-55 per cent oil and occupies second position in the production of non edible oil in the world. It is sticky, dissolved slowly in petrol and other organic solvents and does not freeze at very low temperature (-12 to -18°C) which makes it superb lubricating material.

India is the world's largest producer of castor contributing to around 80 per cent of total world production and dominating the global trade with a share of more than 10 lakh tonnes of castor seed and around 5.5 lakh tonnes of castor oil, India meets more than 80 per cent demand of castor oil, thereby enjoying a dominant position in the world castor scenario. The production in India has been with standing an increasing trend in the 2001-2014 decade due to rising usage of castor oil in different industries. Moreover, strong export demand for castor oil was also one of the reasons for rise in production. Gujarat, Rajasthan and Andhra Pradesh contribute 96 per cent of the total castor seed production in India. Gujarat is the chief producing state, having a share of 75 per cent of domestic production, followed by Rajasthan and Andhra Pradesh. Total area under castor crop in India for year 2013-14 was 9.84 lakh ha and production of castor seed was 12.03 lakh tonnes. Average yield for 2013-14 was 1223 kg ha⁻¹ (Anonymous, 1995) [1]. In this context the intercropping systems were evaluated with groundnut crop for higher productivity and soil sustainability.

Material and Methods

The field experiment was conducted at Zonal Agricultural and Horticultural Research station, Babbur farm, Hiriyur during *khariif* 2015 under rainfed condition. The station is situated at 13° 57' 32" North latitude and 70° 37' 38" East longitude and an altitude of 606 meters above mean sea level (MSL). The soil of the experimental site is vertisol with slightly alkaline pH (8.10), organic carbon (1.90 g kg⁻¹), available nitrogen (258 kg ha⁻¹), available phosphorus (35 kg ha⁻¹) and available potassium (315 kg ha⁻¹). Intercropping with groundnut in 1:5 and 6:1 row proportion with recommended dose of fertilizers

for both the crops as well as only castor on vertisols was studied under rainfed condition. The treatments included in the experiment were T₁: Sole castor, T₂: Sole groundnut, T₃: Castor + GN (1:5) RDF both crops, T₄: Castor + GN (1:7) RDF both crops, T₅: Castor + GN (1:5) RDF Castor only, T₆: Castor + GN (1:7) RDF Castor only. The experiment was laid out in a randomized complete block design with three replications. The data on growth and yield attributes were recorded. Statistical analysis was done as per the methodology suggested by Gomez and Gomez (1984) [2].

Table 1: Castor yield, groundnut yield and economics as influenced by castor + groundnut intercropping system under irrigated conditions

Treatment	Plant height (cm)	Number of branches	Number of pods	100 seed weight	Castor Yield (Kg/ha)	Groundnut Yield (kg/ha)	CEY (kg/ha)
T ₁ : Sole Castor	34.67	7.60	24.87	44.73	1565	-	1565
T ₂ : Sole Groundnut	42.60	6.10	35.20	28.30	-	992	1184
T ₃ : Castor + GN (1:5) RDF both crops	33.73	6.33	18.20	39.40	1011	777	1938
T ₄ : Castor + GN (1:7) RDF both crops	36.00	6.83	22.27	42.00	1014	916	2107
T ₅ : Castor + GN (1:5) RDF Castor only	35.33	6.73	19.47	33.67	1227	511	1837
T ₆ : Castor + GN (1:7) RDF Castor only	35.93	6.33	18.27	36.33	1436	502	2035
S.Em _±	2.65	0.41	1.42	3.93	15.3	24.2	64.3
CD (p=0.05)	8.64	1.33	4.63	12.81	45.9	72.5	193.5

Table 2: Castor, groundnut yield and economics as influenced by castor + groundnut intercropping system under irrigated conditions

Treatment	Gross Returns (₹ / ha)			Cost of Cultivation	Net Returns (₹ / ha)	Additional net profit (₹ / ha)	B:C Ratio
	Castor	Groundnut	Total				
T ₁ : Sole Castor	56333	0	56333	18780	37553	-	2.00
T ₂ : Sole Groundnut		42641	42641	22400	20241	-	0.90
T ₃ : Castor + GN (1:5) RDF both crops	36383	33397	69780	19800	49980	12427	2.52
T ₄ : Castor + GN (1:7) RDF both crops	36494	39367	75862	20250	55612	18058	2.75
T ₅ : Castor + GN (1:5) RDF Castor only	44189	21958	66146	20560	45586	8033	2.22
T ₆ : Castor + GN (1:7) RDF Castor only	51700	21573	73273	20647	52626	15072	2.55
S.Em _±	Data not subjected to ANOVA						
CD (P=0.05)	Data not subjected to ANOVA						

Note: Castor: DCH-177 (90 X 60cm), Groundnut: GPBD-4 (22.5 X 10 CM), RDF for Castor: 80:40:30, RDF for Groundnut: 30:40:50 kg N, P₂O₅, and K₂O, Market rate for Groundnut pods: 4300/qlt.. Castor rate: Rs. 3600/qlt.

Table 3: Comparative studies with farmers practice of castor through best management practices

Treatments	Castor Seed yield (Kg/ha)	Plant height up to primary raceme (cm)	Number of branches /plant	Number of spikes / plant	Primary spike length (cm)	Number of capsules per spike	Gross Returns (Rs./ ha)	Net Returns (Rs./ ha)	B : C Ratio
Best Management Practices	1719	66.0	5.8	7.0	40.4	57.4	61,898	36,448	2.43
Farmers practices	1572	57.4	5.6	6.0	34.0	49.8	56,585	27,635	1.95
T-Value	29.6	6.7	0.37	0.99	5.62	4.28			

Note: * Seed Treatment:- Azospirillum-50gms, Azatobacter-50gms, PSB-50gms

* 2 Ton FYM (Both)

* RDF (NPK), Sulphur and Zinc

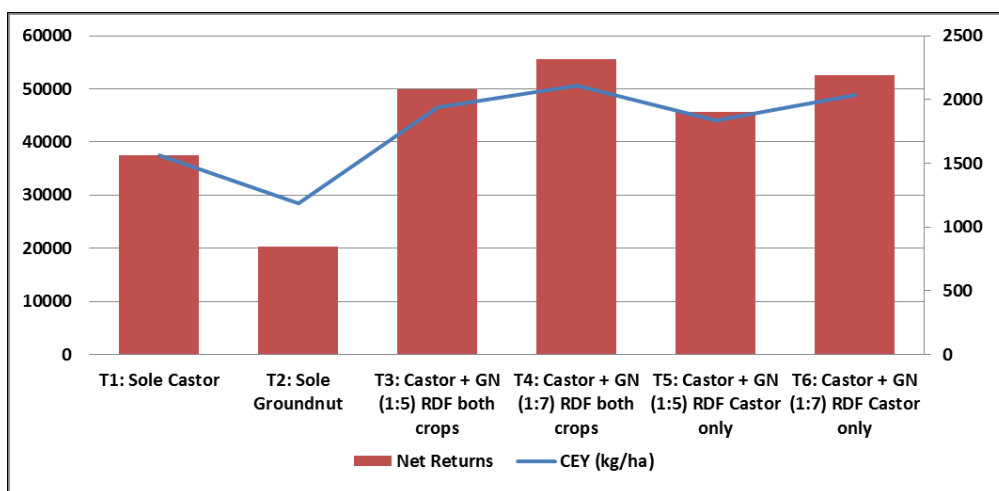


Fig 1: Graphical representation of castor equivalent yield and net returns of the different intercropping systems

Results and Discussion: castor yield obtained in sole and intercropping treatments varied significantly. Among various treatments significantly higher castor yield ($1,862 \text{ kg ha}^{-1}$) was recorded in sole castor. This could be due to higher plant population and competition free environment as compared to intercropped groundnut which resulted better growth and yield parameters. The highest castor yield was recorded in T₁ (sole castor) mainly due to the higher kernel number plant⁻¹, 100 kernel weight and shelling percent of groundnut. This result corroborates with the findings of Razzaque *et al.*, (2007) [3]. Similar results were reported by Shalim *et al.* (2003) [4]. In this study, the performance of castor based intercropping system with groundnut crops has been evaluated. The results revealed that treatments having Castor intercropped with Groundnut (1:7) RDF both crops had significantly higher castor equivalent yield ($2,035 \text{ kg/ha}$) than other treatments but it was on par with Castor + Groundnut (1:7) RDF Castor only (2035 kg/ha) and Castor + GN (1:5) RDF both crops (1938 kg/ha). This is due to higher yield of castor in the intercropping system and thereby envisages effective utilization of the resources along with millets. Similar findings have been reported by Shivakumar and Yadahalli (1996) [5]. Further, higher net returns ($\text{₹ } 52626/\text{ha}$), additional profit ($\text{₹ } 15072/\text{ha}$) and B:C ratio (2.55) was obtained from Castor intercropped with Groundnut (1:7) RDF both crops (Table 1 and 2).

Best management practices significantly improvement on growth and yield attributing parameters such as plant height (66.0 cm), Primary spike length (40.4 cm) and number of capsules per spike (57.4) which reflected in higher seed yield (1719 kg/ha) with high net returns (Rs. 36,448) and B : C ratio (2.43) as compared to farmers practice (Table 3).

Conclusion

The present study clearly indicate that highest castor yield and castor equivalent yield was recorded in castor intercropped with groundnut (1:7) RDF both crops had significantly higher castor equivalent yield than other treatments. And same treatment recorded highest monetary advantage in terms of returns.

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