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Performance of Mung Bean and Cluster Bean under Castor- Based Cropping System

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Abstract Castor (*Ricinus communis* L.) has attracted a lot of attention all over the world as a potential crop targeting on-farm biofuel production. This crop grows widely and wildly from high, medium to low rainfall areas. The oil is the most important product of this plant and has been reported to have several industrial applications varying from aviation lubricant, biofuel and medicinal properties. In tackling the endeavor issue of food situation and energy crisis in several parts of the world, most research is currently focused on biofuel-based cropping system. Intercropping can provide substantial yield advantages compared to sole cropping. It is worth noting that legume intercropping has been shown to play a significant role in the smallholder farmers' subsistence food production in developing countries. The aim of this research was to investigate the possible effect of castor-based intercropping system on the performance of mung bean and cluster bean. This study was conducted at farmers' fields of district Bhiwani (Haryana). There were three treatments. Sole castor, castor intercropping with mung bean (1:3) and castor intercropping with cluster bean (1:3). The crop was sown in North- South direction. The varieties were DCH177, Satya and HG 563 of castor, mung bean and cluster bean respectively. Intercropping with cluster bean and mung bean proved more beneficial than the sole cropping of castor which gave 2058 kg/ha grain yield and net returns of Rs 30588. Among intercropping systems intercropping with cluster bean gave higher equivalent yield of castor (1315 kg/ha) and returns (Rs 62291) that the intercropping with mung bean 1302 kg/ha equivalent yield of castor and (Rs 61311).

Keywords Castor, Intercropping, Cluster bean, Mung bean, Economics.

Introduction

At present, the world trade of fossil fuel is being controlled by Gulf. Similarly, India should also monopolise castor trade on the globe. Although, 67% India's share in the world production of oilseeds is contributed only by castor with higher production and productivity, without being complacement there is need to further strengthen the production and export of oil by careful management and planning. Due to rapid increase in population, urbanization and industrialization the per capita land availability is going to de-

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crease, thus this limitation imposing more pressure to produce more food, feed, fiber, fuel and fodder per unit area to meet basic need. However, castor is a long duration, widely spaced crop with comparatively thin plant population as compared to other field crop, provide ample scope for growing intercrop in order to increase production from unit area of land. Intercropping is popular in tropical and sub-tropical countries as it creates favorable micro-climates, has low labor requirement, higher stability of yield and productivity. Pulses had a complementary effect and cereals had a competitive effect when they were grown as intercrops with castor. The suggested benefits of legumes as an intercrop are the increaed growth of roots and shoots, better root stratification and utilization of soil nutrients and nitrogen fixation which allows the legumes to become independent of soil nitrogen and making some nitrogen available to associate to non-legume. For achieving maximum yield potential of any crop it is necessary to provide congenial environmental conditions for the optimum growth and development of crop. The space in the field which is made available to the individual plant is an important factor affecting the growth and yield of crop. The objective of this study was to investigate the effect of intercropping of castor with mung bean and cluster beans yield and to work out the economics of different treatments.

Materials and Methods

A field trial was carried out at farmers field of village Gignau of Bhiwani district situated at 28^0 20´ to 29^0 05´ and longitude $75^0$28´ to $76^0$25´ during 2014-15 to explore the possibility of increasing productivity from castor based intercropping system by optimizing pulse and planting pattern combination. The district has a semi-arid climate with hot and dry winds in summer, severe cold in winter and humid warm weather during monsoon. The maximum temperature sometimes exceeds 47^0C in summer while temperature below freezing accompanied by frost in winter is usually experienced in the region. The average annual rainfall is 300-400 mm. About 80-90% of total rainfall are received from South-west monsoon in the month of July to September while remaining 10-20% rainfall are received from North -East monsoon in the winter season. The soils are light textured and low in available organic carbon, medium in available phosphorus and medium to high in available potash. During investigation to pulses intercrop viz., cluster bean and mung bean were evaluated under castor. There were three treatments. Sole castor, castor intercropping with mung bean (1:3) and castor intercropping with cluster bean (1:3). Under sole cropping castor was grown at a spacing of 90 × 90 cm, while in intercropping with mung bean and cluster bean it was grown in 150 cm wide row spacing and between two rows of castor three rows of mung bean and cluster bean were grown at a spacing of 30 cm each. Mung bean and cluster bean were harvested in the month of September and October, respectively, whereas castor was picked three times every year in the month of December, March and May, respectively. Other practices were applied as per recommendation and need. The varieties/hybrids were DCH 177, MH 421 and HG 563 of castor, mung bean and cluster bean respectively. All three crops were sown in North-South oriented rows during first fortnight of July during both years. The yield data were recorded by harvesting and threshing crop in one square meter area at each location and converted into per ha. Castor equivalent yield was calculated using following formula :

$$\text{Castor equivalent yield (kg/ha)} = \frac{\text{Yield of Mung/Clusterbean (kg/ha)} \times \text{Rate of Mung/Clusterbean (Rs/kg)}}{\text{Rate of castor (Rs /kg)}}$$

Benefit: Cost (B:C ratio) was using following formula:

$$\text{B : C ratio} = \frac{\text{Gross return (Rs/ha)}}{\text{Gross cost (Rs/ha)}}$$

Table 1. Seed yield of castor and other intercrops as influenced by intercropping cropping systems.

Treatments	Castor yield (kg/ha)	Intercrop yield (kg/ha)	Castor equivalent yield (kg/ha)	Total yield (kg/ha)
Sole crop of castor	2058	–	–	2058
Castor + Mung bean (1:3)	1600	900	1302	3802
Castor + Cluster bean (1:3)	1600	1000	1315	3915

Table 2. Economics of different castor based intercropping systems. Price of castor, mungbean and clusterbean were taken as Rs 3800, 5500 and 5000 per q, respectively.

Treatments	Gross return (Rs/ha)	Net return (Rs/ha)	B : C ratio
Sole crop of castor	99531	30588	1.67
Castor + Mung bean (1:3)	137300	61311	2.34
Castor + Cluster bean (1:3)	199770	62291	2.36

Results and Discussion

Yield

The perusal of data given in Table 1 revealed that the total yield (Yield of castor + equivalent yield of intercrop) obtained from different cropping systems i.e. sole crop of castor, intercropping in castor with mungbean and clusterbean (1:3) was maximum in intercropping with clusterbean. This cropping system resulted into 90% higher yield than sole crop of castor. Similarly intercropping with mungbean resulted into 84% higher yield than sole crop of castor. However, total yield of intercropping with mung bean and cluster bean were almost similar where total yield of intercropping with cluster bean 3% higher than intercropping with mung bean. This means that intercropping improves total yield from piece of land as well as improves the land productivity. Intercropping provides substantial yield advantage over sole crop owing to temporal and spatial complementarity and minimizing inter-or intra-specific competition (Chatterjee and Mandal 1992). Similar results have been reported by Kumar (2002) and Mudalagiriyappa et al. (2011).

Economics

Intercropping in castor with clusterbean (1:3) fetched highest net returns i.e. Rs 62291. Intercropping in castor with cluster bean and mung bean gave 103 and 100% higher net returns than sole crop of castor. As a result these systems resulted into better B:C ratio of 2.36 and 2.34 in comparison to B:C ratio of 1.67 achieved under sole crop of castor (Table 2.). These results conforms the results of (Chand and Sujatha 2000) who made conclusion that castor can be successfully intercropped with blackgram, greengram and thus, economically viable. Intercropping of castor with suitable crops has been found to be beneficial in achieving higher monetary returns. The results are in close conformity with those of reported by Porwal et al. (2006).

Conclusion

Available information indicates that castor can be successfully intercropped with cluster bean and mung bean. Thus, economically viable, tailor made, simple and easy to adopt agronomic technology for intercropping of castor crop with different leguminous crops. So it was concluded that intercropping with pulses in castor based cropping system could be best alternative to increase income of farmers.

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