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Research Paper

Optimization of Castor (*Ricinus Communis* L.) Production under Limited Resource Conditions in Central Dry Zone of Karnataka

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ABSTRACT: *Field trials for optimization of castor production in relation to limiting production factors were conducted at Zonal Agricultural Research Station, Hiriyur on medium black soil to identify the hierarchy of production factors for efficient use of resources for optimum production. The result revealed that adoption of full package of practices is highly remunerative in castor production. Among the individual production factors, withdrawal of weeding (660 kg/ha) from recommended package of practice, alone caused substantial reduction in yield (57 %), followed by fertilizer (30 %) and plant protection (12 %). Fertilizer alone or plant protection in the absence of weeding did not increase yield considerably. Thus, weeding emerged out to be the most limiting factor in castor production under rain fed condition.*

Keywords: *Castor, Full Package, Weeding*

I. INTRODUCTION

Castor (*Ricinus communis* L) is a principle oil seed crop of India for both internal and export purpose. In India, castor along with other oilseed crops are raised under rain fed conditions leaving the crop thirsty and hungry by the resource poor farmers. Rain fed farmers, with their limited investment capacity cannot afford to adopt full package of practices which limited per unit area productivity. Among various package of practices, weeding, fertilizer and plant protection contribute much towards the growth and yield of castor under rainfed condition. But, relative contribution of these factors has not been quantified in Central Dry Zone of Karnataka. Hence, present study was conducted to identify the hierarchy of production factors according to their contribution to the yield and for efficient use of resources under limited resource condition by giving maximum emphasis to those particular inputs which contributes maximum towards yield.

II. MATERIAL AND METHODS

Field experiment was conducted during the 2009, 2010 and 2011 *kharif* seasons at Zonal Agricultural Research Station, Hiriyur, Karnataka, to identify the hierarchy of production factors for efficient use of resources for optimum production. The soil of the site was medium black having P^H of 7.7 with low available nitrogen (162 kg/ha), medium available phosphorus (16.2 kg/ha) and medium available potassium (270 kg/ha). The experiment was laid out in Randomized Block Design with eight treatments consisted of T_1: Full Package, T_2: T_1-Fertilizer, T_3: T_1-Plant protection, T_4: T_1-Weeding, T_5: T_1-(Fertilizer + plant protection), T_6: T_1-(Fertilizer + weeding), T_7: T_1-(plant protection + weeding), T_8: T_1-(plant protection + Fertilizer + weeding) (Table 1) replicated thrice. Castor hybrid DCH-177 sown in the 2nd fortnight of July at 90 cm row to row and 60 cm plant to plant. The total rainfall received during 2009, 2010 and 2011 was 745.2, 937.6 and 347.8 mm with 50, 51 and 29 rainy days respectively. Harvesting of spikes was done in three pickings at monthly interval starting from 90 days after sowing.

III. RESULTS AND DISCUSSION

The pooled results revealed that adoption of full recommended (T1) package of practices resulted in significantly higher seed yield (1534 Kg/ha) over other treatments. The increase in seed yield was mainly attributed to significanty increased number of spikes/plant, capsules/spike and higher spike length and 100 seed weight. Studies conducted at Bawal (Haryana), Navasari Gujarat, Kanpur, Mandor (Rajasthan) and Yethapur (Tamilanadu) on optimization of castor production under resource constraints also indicated the need for adoption of full package of practices to obtain the highest seed yield of castor (Anonymous, 2009). Among the

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individual production factors, withdrawal of weeding (660 kg/ha) from full recommended package of practices, alone caused substantial reduction in yield (57 %). Non adoption of fertilizer and plant protection measures decreased seed yield by 30 and 12 percent respectively (Table 1). This indicates that fertilizer is the next most important factor after weeding to enhance productivity of castor under rain fed conditions.

Non adoption of weeding allowed the weeds to grow throught the crop period, which completely smothered the castor and also suppressed plant growth due to severe competition for inputs viz., soil moisture and nutrients, as a result castor produced lower number of spikes/plant, capsules/spike, shorter raceme and 100 seed weight which ultimately reflected in poor seed yield. Further withdrawal of fertilization, affected the castor growth and seed yield due to poor available nitrogen, medium available phosphorus and potassium in the soil. However non adoption of plant protection measures (T_3) from full package caused less reduction in seed yield as compared to non adoption of weeding and fertilizer, because of fluxuation in the severity of pests and disease incidence in different seasons, it indicates that pest and disease incidence is season bound.

Non adoption of fertilizer + plant protection (961 kg/ha), fertilizer + weeding (625 kg/ha) and weeding +plant protection (737 kg/ha) decreased seed yield by 37, 59 and 52 percent respectively over adoption of full package (Table 1). Non adoption of the three factor gave the least yield (406 kg/ha). Fertilizer alone or plant protection in the absence of weeding did not increase yield considerably. Thus, weeding emerged out to be the most limiting production factor in castor under rain fed condition in the central dry zone of Karnataka. At Navasari (Gujarat), non adoption of weeding significantly suppressed castor yield (1809 kg/ha) closely followed by non adoption of fertilizer input (3437 kg/ha) as compared to full package (3940 kg/ha), thus proving their importance in castor production (Anonymous, 2010).

Economic analysis of different production factors also revealed that adoption of full package accrued greater monetary benefits (net returns and B:C ratio of Rs.34777/ha and 3.4 respectively). Non-adoption of weeding, fertilizer and plant protection measures individually from the whole package reduced the net returns by Rs.25841/ha, Rs.12063/ha and Rs.3436/ha respectively (Table 3), these results are in agreement with the findings of Singh (2008). Non-adoption of weeding and fertilizer either alone or in conjunction depressed net returns to greater extent. Non adoption of plant protection, weeding and fertilizer made this crop non remunerative.

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Table 1 Seed yield and yield components of castor as influenced by resource constraints in rain fed castor 2009-11)

Treatments	Seed yield (kg/ha)				Number of Spikes per plant				Length of primary spike (cm)			
	2009	2010	2011	pooled	2009	2010	2011	pooled	2009	2010	2011	pooled
T_1: Full Package	1190	1769	1643	1534	7.7	5.9	4.1	5.9	31.2	43.3	39.7	38.0
T_2: T_1 - Fertilizer	660	1002	1551	1071	6.7	3.4	4.5	4.9	27.0	28.9	43.9	33.3
T_3:T_1 - Plant Protection	737	1740	1581	1353	6.9	5.3	4.5	5.6	30.5	42.2	43.5	38.7
T_4: T_1 - Weeding	514	615	851	660	5.3	2.8	3.0	3.7	27.7	27.5	35.5	29.0
T_5:T_1 - (Fertilizer + Plant Protection)	526	1194	1162	961	7.0	5.0	5.3	5.8	27.9	39.7	38.7	35.4
T_6:T_1 - (Fertilizer + Weeding)	475	673	728	625	5.4	3.1	3.0	3.8	23.9	28.3	31.8	29.2
T_7:T_1 - (Plant Protection + Weeding)	383	934	894	737	6.6	4.7	1.7	4.4	24.1	38.7	30.0	30.9
T_8:T_1 - (Plant Protection + Fertilizer + Weeding)	284	685	247	406	3.8	3.5	1.2	2.8	27.5	30.3	24.5	27.4
S.Em+-	55.0	112.0	113.2	60.0	1.1	0.5	0.4	0.4	1.6	2.5	3.0	1.4
C.D (P=0.05)	168	332.8	332.1	178.4	3.2	1.4	1.1	1.3	4.8	7.6	8.9	4.0

Table 2. Yield components of castor as influenced by Resource constraints in rain fed castor (2009-11)

Treatments	Number of capsules per spike				100 seed weight (g)			
	2009	2010	2011	pooled	2009	2010	2011	pooled
T_1: Full Package	35	40.2	49.3	41.5	27.2	37.8	27.3	30.8
T_2: T_1 - Fertilizer	30	31.0	44.3	35.0	25.1	24.8	24.0	24.7
T_3:T_1 - Plant Protection	27	39.8	45.8	37.5	27.0	30.9	26.7	28.2
T_4: T_1 - Weeding	25	22.9	38.9	27.0	22.7	23.9	24.7	23.8
T_5:T_1 - (Fertilizer + Plant Protection)	22	38.3	38.3	32.9	25.1	29.3	27.3	27.2
T_6:T_1- (Fertilizer + Weeding)	23	26.7	34.7	28.0	23.2	24.6	28.0	25.3
T_7:T_1 - (Plant Protection + Weeding)	19	34.7	33.8	31.0	24.3	28.8	28.0	27.0
T_8:T_1 - (Plant Protection + Fertilizer + Weeding)	18	31.5	27.9	25.7	20.9	27.3	22.0	23.4
S.Em+-	2.1	3.5	4.3	1.8	1.7	2.8	1.3	1.0
C.D (P=0.05)	6.5	10.5	12.7	5.2	5.0	8.5	3.8	3.0

Table 3 Economics of castor as influenced by resource constraints (2009-11)

Treatments	Gross returns (Rs./ha)				Net returns (Rs./ha)				B:C ratio			
	2009	2010	2011	Pooled	2009	2010	2011	Pooled	2009	2010	2011	Pooled
T_1: Full Package	26775	60157	59148	48693	14625	46062	43644	34777	2.2	4.3	3.8	3.4
T_2: T_1 - Fertilizer	14850	34057	55833	34913	4700	21462	41979	22714	1.5	2.7	4.0	2.7
T_3: T_1 - Plant Protection	16583	59149	56910	44214	5253	46154	42616	31341	1.5	4.6	4.0	3.3
T_4: T_1 - Weeding	11565	20908	30644	21039	2335	8013	16460	8936	1.3	1.6	2.2	1.7
T_5: T_1 - (Fertilizer + Plant Protection)	11835	40596	41840	31424	2405	29101	29196	20234	1.3	3.5	3.3	2.7
T_6:T_1 - (Fertilizer + Weeding)	10688	22872	26207	19922	2278	11477	13673	9143	1.3	2.0	2.1	1.8
T_7:T_1 - (Plant Protection + Weeding)	8618	31740	32200	26819	1288	19945	19226	13486	1.2	2.7	2.5	2.1
T_8:T_1 - (Plant Protection + Fertilizer + Weeding)	6390	23301	8907	13799	-120	13006	-2417	3490	1.0	2.3	0.8	1.3