

Optimizing Plant Density for Promising Castor Hybrid DCH 519

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ABSTRACT

Field experiments were conducted at Tapioca and Castor Research Station, Experimental farm during Rabi 2015 and *Kharif* 2016 season under irrigated and rainfed condition, respectively to find out the optimum plant density for higher productivity and economics of hybrid castor DCH 519. The experiment consisted of six treatments such as T₁ 120x120 cm, T₂ 150x120 cm, T₃ 150x150cm, T₄ 180x120 cm, T₅ 180x150 cm, T₆180x180 cm. The experiment was conducted in Randomized Block design with four replications. The results of the experiment indicated that wider spacing of 180 x 180 significantly had the highest yield attributing characters such as No. of effective spikes plant⁻¹, primary spike length, No. of capsules spike⁻¹ which was observed to be on par with 180x150cm while significantly higher plant height and seed yield were recorded under closer spacing of 120x120cm which was followed by 150x120cm spacing. Higher gross return of Rs. 51696/ha and net return of Rs.29596/ha with BCR of 2.33 was realized under closer spacing of 120x120cm.

Keywords

Optimizing plant density, Promising castro hybrid.

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Introduction

Castor is one of the ancient and commercially very important industrial and non-edible oil crop in the world. It has the ability to grow under low rainfall and fertility conditions, and is most suitable for dryland farming. The oil content of the seeds varies from 50-55% in different hybrids and varieties. The importance of oil arises from its richness of ricinolic acid (85-95%) which has number of uses in several industries. That is the reason why castor has steady and staple market price across the country and throughout the period. Thus, castor is largely grown as rainfed crop under wide range of soil and climatic condition. One of the critical factors limiting yield of castor hybrid is inadequate plant

density. The optimization of row spacing and in-row plant density is a simple procedure with a low cost but has a significant influence on yield (Soratto *et al.*, 2012) and is essential to maximize seed production. In fact, one of the major reasons for low productivity in hybrid castor in India is due to the maintenance of inadequate plant population and poor fertility management. A proper utilization of inter row spacing for rising inter crop with optimum plant density is necessary to enhance the system productivity. Optimizing planting population is an inexpensive practice that can significantly increase castor seed yield. However, the optimum plant population varies influenced

by the genotype, environmental conditions and agricultural practices. Because environmental conditions are not constant, there is not an individual plant density that can be broadly recommended for castor (Severino *et al.*, 2006d). Castor exhibits considerable plasticity to spacing variation and available research data indicated that castor hybrid performs better in terms of seed yield and quality when sown under optimum plant density. Adoption of wider spacing is beneficial in reducing the severity of botrytis disease, while in highly fertile soils with adequate water facilities, wider spacing can result in the lush growth of castor, leading to plant lodging, hindering all agronomic management practices including harvesting. Thus, plant density plays a pivotal role in influencing the seed yield. Castor exhibits considerable plasticity to spacing variation and available research data indicated that castor hybrid performs better in terms of seed yield and quality when sown under optimum plant density. Considering all facts, the experiment was conducted to standardize optimum plant density for productivity enhancement of DCH 519 both under rainfed and irrigated ecosystem.

Materials and Methods

To find out the optimum plant density for higher productivity and economics of hybrid castor DCH 519, field experiments were conducted at Tapioca and Castor Research Station, Experimental farm during Rabi 2015 and *Kharif* 2016 season under irrigated and rainfed condition, respectively with the following treatments such as T₁ 120x120 cm, T₂ 150x120 cm, T₃ 150x150cm, T₄ 180x120 cm, T₅ 180x150 cm, T₆180x180 cm. The experiment was conducted in Randomized Block design with four replications. The soil of the experimental field indicates red sandy loam with non-calcareous type and available nutrient status of the experimental site was

low in N & P (262 and 5.10 kg ha⁻¹) and high in K (355 kg ha⁻¹). The germination percentage of seed was more than 90 per cent and the required plant population per unit area as per the treatment was maintained with gap filling done within 10 days after sowing. Farm yard manure @ 12.5 t ha⁻¹ was applied commonly to all the treatments. A fertilizer schedule of 60:30:30 kg N, P₂O₅ and K₂O ha⁻¹ were kept constant for all the treatments and were applied along the planting rows as urea, DAP and Muriate of Potash and covered with soil. All other plant protection measures were adopted as per the technical programme.

Results and Discussion

Seasonal Variation (*Rabi* 2015 and *Kharif* 2016)

In general, irrespective of the treatment effects, the crop performed better during *Rabi* 2015 season as compared to *Kharif* 2016 season. Higher seed yield obtained in *Rabi* 2015 season might be due to favourable weather parameters that prevailed and this might have impressed yield attributes. Favourable mean maximum and minimum temperature of 29.7 and 22.0°C, respectively, mean relative humidity of 85.6 per cent with rainfall of 374 mm during the crop growing periods invigorated yield and yield attributing characters which reflected on improved yield components. This resulted in higher seed yield of 2310 kg ha⁻¹ during *Rabi* 2015 season under closer spacing of 120x120 cm. On the other hand, during *Kharif* 2016 season, low rainfall coupled with high temperature and continuous dry spell impaired the physiological activity of the crop and thus affected yield components and hence comparatively lower seed yield was obtained. Between the two seasons studied growth, yield attributing characters and seed yield were more during *Rabi* 2015 season than that of *Kharif* 2015 season.

Table.1 Growth and yield attributing characters of castor hybrid DCH 519 as influenced by plant density during 2015 and 2016 seasons

Treatment	Plant height (cm) at harvest		Days to 50 % flowering		No. of effective spikes/plant	
	Rabi 2015	Kharif 2016	Rabi 2015	Kharif 2016	Rabi 2015	Kharif 2016
T ₁ 120x120 cm	121.4	86.2	65	68	9.5	6.9
T ₂ 150x120 cm	117.7	84.0	64	67	9.9	7.2
T ₃ 150x150 cm	114.6	74.7	65	67	10.9	8.8
T ₄ 180x120 cm	115.5	82.2	65	67	10.2	8.5
T ₅ 180x150 cm	112.2	73.8	64	68	11.4	10.1
T ₆ 180x180 cm	111.3	71.3	65	68	12.8	10.6
SEd	7.10	5.07	0.75	0.75	1.46	1.37
CD (p=0.05)	14.92	10.66	1.59	1.58	3.07	2.88

Table.2 Yield attributing characters of castor hybrid DCH 519 as influenced by plant density during 2015 and 2016 seasons

Treatment	Length of primary spike (cm)		No. of capsules/spike		Test weight	
	Rabi 2015	Kharif 2016	Rabi 2015	Kharif 2016	Rabi 2015	Kharif 2016
T ₁ 120x120 cm	60.1	56.7	84.5	65.6	26.5	24.8
T ₂ 150x120 cm	62.6	57.4	88.2	73.4	26.4	25.0
T ₃ 150x150 cm	68.5	60.2	92.7	81.2	26.6	25.1
T ₄ 180x120 cm	66.7	58.1	90.5	79.8	26.5	24.9
T ₅ 180x150 cm	72.3	61.0	95.4	88.7	26.5	25.1
T ₆ 180x180 cm	75.2	62.5	98.3	89.5	26.9	25.2
SEd	4.67	4.10	5.96	5.51	0.85	0.85
CD (p=0.05)	9.81	8.62	12.52	11.56	1.78	1.79

Table.3 Seed yield and economics of castor hybrid DCH 519 as influenced by plant density during 2015 and 2016 seasons

Treatment	Seed yield (kg/ha)		Cost of cultivation (Rs/ha)		Net return (Rs/ha)		BCR	
	Rabi 2015	Kharif 2016	Rabi 2015	Kharif 2016	Rabi 2015	Kharif 2016	Rabi 2015	Kharif 2016
T ₁ 120x120 cm	2310	1426	26950	22100	56210	29236	3.08	2.32
T ₂ 150x120 cm	2147	1355	26850	22000	50442	26780	2.88	2.22
T ₃ 150x150 cm	2039	1382	26800	21950	46604	27802	2.74	2.27
T ₄ 180x120 cm	1828	1237	26800	21950	39008	22582	2.46	2.03
T ₅ 180x150 cm	1948	1257	26650	21800	43478	23452	2.63	2.08
T ₆ 180x180 cm	1895	1271	26650	21800	41570	23956	2.56	2.10
SEd	113.4	73.1	-	-	-	-	-	-
CD (p=0.05)	238.4	154	-	-	-	-	-	-

Among different plant density evaluated, plant height differed markedly at harvest. Closer spacing of 120x120 was found superior over other plant density during both seasons though it was at par with 120x150 cm. Plant density did not have any significant influence on days to fifty percent flowering during both the seasons of study (Table 1).

Effect of plant density on growth, yield attributes and yield of castor hybrid DCH 519

Plant population had a significant influence on the growth and yield attributing characters of castor as evidenced from the results of the experiment. During both the season, wider spacing of 180 x 180 significantly had the highest yield attributing characters such as No. of effective spikes plant⁻¹, primary spike length, No. of capsules spike⁻¹ which was observed to be on par with 180x150cm. As the feeding zone of castor hybrid per plant under wider spacing is more when compared to closer spacing, the plants grew laterally and resulted in higher number of productive branches plant⁻¹ (Table 2). Similar findings are in accordance with Kathirvelan *et al.*, (2006). The better yield attributing characters in wider row spacing (180 x 180 cm) was mainly due to sufficient space between rows which encouraged to produce more vigorous plants and also lesser interplant competition for space, light, nutrient and moisture and resulted in more source to sink movement and partitioning efficiency. The reduction in other yield attributing characters *viz.*, seed yield and haulm yield in wider row spacing of 180x180 cm was associated with lower plant population load per unit area.

Significantly higher plant height was recorded under closer spacing of 120x120cm which was followed by 150x120cm spacing. No significant difference was observed among the plant densities with respect to days to fifty percent flowering because this parameter is mainly governed by the genetic makeup of the plants. Though the yield

attributes like No. of effective spikes plant⁻¹, primary spike length and No. of capsules spike⁻¹ were increased significantly with lower plant population of 3086 plants ha⁻¹ (180 x 180 cm), castor seed yield was significantly higher (1436 kg ha⁻¹) with a higher population level of 6944 plant ha⁻¹ (120x120 cm) which was observed to be on par with 150x120 cm (1355kg ha⁻¹). This was mainly due to increased population load per unit area. With respect to economics, higher gross return of Rs. 51696/ha and net return of Rs.29596/ha with BCR of 2.33 was realized under closer spacing of 120x120cm (Table 3). From this study, it could be concluded that closer spacing of 120 x120 cm had recorded significantly higher yield attributing characters and seed yield with higher monetary returns.

References

- Guilherme Eugenio Machado Lopes, Henrique Duarte Vieira and Fabio Luiz Partelli. 2013. Response of Castor Bean Plants to Different Row Spacings and Planting Seasons. *American Journal of Plant Sciences*, 2013, 4, 10-15.
- Kathirvelan, P., and P. Kalaiselvan.2006. Growth Characters, Physiological Parameters, Yield Attributes and Yield as Influenced by the Confectionery Groundnut Varieties and Plant Population. *Research Journal of Agriculture and Biological Sciences*, 2(6): 287-291.
- Severino, L.S., C.R.A. Moraes, T.M.S. Gondim, G.D. Cardoso, and N.E.M. Beltrao. 2006d. Yield of castor planted at different row space. *Revista Ciencia Agronomica* 37:50–54.
- Soratto, R. P, Souza-Schlick, G. D, Fernandes, A. M, Zanotto, M. D, Crusciol, C. A. C. Narrow row spacing and high plant population to short height castor genotypes in two cropping seasons. *Industrial Crops and Products*, V. 35, N. 1, p. 244-249.

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