



Yield, Economics and Nutrients Uptake by Castor Hybrids as Influenced by Different Methods of Planting and Fertility Levels

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Abstract: A field experiment was conducted during kharif 2020-2021 in loamy sand soil of Agronomy Instructional Farm, C.P. College of Agriculture, Sardarkrushinagar, Gujarat. The experiment was laid out in factorial randomized block design with two hybrids (GCH 7 and GCH 8), two planting methods (direct seed sowing and transplanting) and two fertility levels (75% of recommended dose of fertilizers (RDF) and 100% RDF). Among different hybrids GCH 8 recorded significantly higher seed yield (3220 kg ha⁻¹), net return (1,73,923 Rs./ha), BCR (4.38) and N, P, K and S uptake by seed (144.2 kg ha⁻¹, 33.41 kg ha⁻¹, 34.16 kg ha⁻¹ & 9.15 kg ha⁻¹, respectively). Among planting methods, direct seed sowing recorded significantly higher seed yield (3231 kg ha⁻¹), net return (1,80,618 Rs./ha), BCR (4.97) and N, P, S uptake by seed (145.9 kg ha⁻¹, 34.0 kg ha⁻¹, 9.36 kg ha⁻¹, respectively) and among the fertility levels, application of 100% RDF recorded significantly higher seed yield (3191 kg ha⁻¹), net return (1,71,117 Rs./ha), BCR (4.28) and N, P, K and S uptake by seed (146.0 kg ha⁻¹, 34.42 kg ha⁻¹, 32.53 kg ha⁻¹ and 9.53 kg ha⁻¹, respectively).

Key word: Fertility levels, hybrid, planting methods and transplanting

Castor (*Ricinus communis* L.) is known since time immemorial for its medicinal value and of late as an industrial crop for non-edible oil. It belongs to family Euphorbiaceae and is grown under tropical, sub-tropical and temperate regions. Its cultivation is spread over thirty countries of the world. India, Mozambique, China, Brazil, Angola, Philippines and Thailand are the leading countries and produce nearly 85% of total castor production of the world. India occupies a premier position in area, production and productivity. Gujarat is a leading castor growing state in India having 0.652 mha cultivated area, 1.345 mt production and 2062 kg ha⁻¹ average productivity. The area under castor in India was 0.887 mha with 1.647 mt of production and an average productivity of 1856 kg ha⁻¹ (Anonymous, 2021). It is an important oilseed crop of India because its oil has diversified uses and has great value in the foreign trade. Unfortunately, in Gujarat like rest of the country, castor is often grown with limited use of fertilizers on nutrient deficient soils leading to low productivity. Thus there is ample scope to enhance the growth and yield of hybrid castor by proper nutrient management and the yields

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can be further enhanced by the adoption of high yielding hybrid varieties and proper agronomic practices. Therefore, in the present study, effect of different methods of planting and soil fertility levels on yield, economics and nutrients uptake by high yielding castor hybrids was studied.

Materials and Methods

A field experiment was conducted during kharif season 2020-21 at Agronomy Instructional Farm, C.P. College of Agriculture, Sardarkrushinagar, Gujarat. Soil of the experimental field was loamy sand in texture, low in organic carbon (0.32%) and available nitrogen (136 kg ha⁻¹), medium in available phosphorus P₂O₅ (46.7 kg ha⁻¹), available potash K₂O (247 kg ha⁻¹) and available sulphur (10.5 mg kg⁻¹) with 7.2 pH. The experiment consisted of eight treatment combinations with two hybrids (GCH 7 and GCH 8), two planting methods (direct seed sowing and transplanting) and two fertility levels (75% recommended dose of fertilizers (RDF) and 100% RDF) and was laid out in factorial randomized block design with three replications. Castor hybrid GCH 7 and GCH 8 seeds were dibbled in open furrows at the depth of 4.5-5.0 cm in direct seeding treatment. The crop was sown by keeping 150 cm inter and 120 cm intra row spacing. For transplanting, seedlings of both varieties were first raised in nursery bags and were then transplanted in different treatments. Soil used in nursery bags was mixed well with farm yards manure (FYM) with volumetric soil: FYM ratio being 3:1. 21 days old seedling were transplanted in field as per the treatment. The recommended dose of fertilizers for castor crop is N (180 N kg ha⁻¹), P (40 P/P₂O₅ kg ha⁻¹), K₂O and S (20 kg ha⁻¹). Full dose of phosphorus, sulphur and 1/4th dose of nitrogen were applied just before planting as basal application through urea, DAP and bentonite sulphur and remaining 3/4th part of nitrogen was applied equally at 30-35 DAS/DAT, 60-65 DAS/DAT and 90-95 DAS/DAT in the form of urea. First irrigation was given after sowing and before transplanting of crop. Remaining irrigations were given as per need of the crop. Observations on seed yield under different treatments was recorded, nutrients uptake by seeds was analysed and economics was calculated. Data recorded for various parameters during the course of investigation were statistically analyzed by a procedure

appropriate to the design of experiment as described by Gomez and Gomez (1984). The significance of difference was tested by "F" test at 5 per cent level. The critical difference was calculated when the differences among treatment were found significant under "F" test.

Result and Discussion

Yield and economics

Seed yield of both hybrids were significantly different (Table 1). Seed yield of GCH 8 (3220 kg ha⁻¹) was significantly higher than GCH 7. This is mainly attributed to comparatively higher number of spikes per plant, number of capsules on primary spike and 100 seed weight of GCH 8 as compared to GCH 7 (data not presented). Several workers have also reported variation in yield and growth characteristics of different castor genotypes (Senthil Kumar and Venkatachalam, 2018; Jat and Desai, 2020). In planting methods, significantly higher seed yield (3230 kg ha⁻¹) was recorded under direct seed sown castor. Lower yield under transplanted crop could be due to transplanting shock and the time taken by the crop to recover. Also, the root growth of transplanted castor was lesser as compared to the root growth of directly seed sown castor (data not presented) which could have affected uptake of nutrients. Rodriguez and Vazquez (2019) have reported that the castor root architecture, horizontal and vertical distribution, proliferation of secondary and lateral roots has significant influence on the growth and development of castor plants. Among different fertility levels, application of 100% RDF produced significantly higher seed yield (3191 kg ha⁻¹). On an average there was 12% increase in total yield due to 100% RDF as compared to 75% RDF. These results are corroborated with the findings of Akula and Reddy (1998), Sutaria *et al.* (1998), Raghavaiah (1999), Patel and Pathak (2001). The significant role of primary nutrients might have accounted for higher seed yield. Higher number of branches, spikes and capsules coupled with better root proliferation leading to better exploitation of nutrients and water in plants grown under higher soil fertility could explain higher yield (Rani, 2001; Hussaini *et al.*, 2002). Higher net returns (Rs.173923/ha) and benefit cost ratio (4.38) was recorded with castor cultivar GCH 8. Among the different planting

Table 1. Effect of hybrids, planting methods and fertility levels on yield and economics of castor

Treatments	Seed yield (kg ha ⁻¹)	Gross realization (Rs. ha ⁻¹)	Cost of cultivation (Rs. ha ⁻¹)	Net realization (Rs. ha ⁻¹)	BCR
<i>Hybrids</i>					
H ₁ : GCH 7	2908	203587	51490	152097	3.95
H ₂ : GCH 8	3220	225413	51490	173923	4.38
SEm±	84	-	-	-	-
CD (p=0.05)	246	-	-	-	-
<i>Methods of planting</i>					
P ₁ : Direct seed sowing	3230	226146	45528	180618	4.97
P ₂ : Transplanting	2897	202855	57453	145402	3.53
SEm±	84	-	-	-	-
CD (p=0.05)	246	-	-	-	-
<i>Fertility levels</i>					
F ₁ : 75% RDF	2937	205635	50732	154903	4.05
F ₂ : 100% RDF	3190	223366	52249	171117	4.28
SEm±	84	-	-	-	-
CD (p=0.05)	246	-	-	-	-

Note: Selling price of castor seed Rs. 70 kg⁻¹

methods, direct sowing of castor seed accrued more net return (180618 Rs./ha) and benefit: cost ratio (4.97). Crop fertilized with 100% RDF gave more net returns (171117 Rs./ha) and benefit: cost ratio (4.28). These results are in agreement with the finding of Jat *et al.* (2022).

Nutrients uptake by seed

The data indicated that the uptake of N, P, K and S by GCH 8 was higher than that of GCH 7 (Table 2). These results are confirmed

by the finding of Lakshmi and Reddy (2006). Among the two planting methods, direct sowing resulted in significantly higher N (145.9 kg ha⁻¹), P (34.0 kg ha⁻¹) and S (9.36 kg ha⁻¹) uptake by castor seed as compared to the transplanted. Similar results were also recorded by Patel (2010) in rice crop. Application of 100% RDF also lead to higher uptake of N (146.0 kg ha⁻¹), P (34.42 kg ha⁻¹), K (32.53 kg ha⁻¹) and S (9.53 kg ha⁻¹) uptake by seeds. Increase the level of RDF might have resulted in more root

Table 2. Effect of hybrids, planting methods and fertility levels on nutrients uptake by seeds of castor

Treatments	Nutrients uptake by seed (kg ha ⁻¹)			
	N	P	K	S
<i>Hybrids</i>				
H ₁ : GCH 7	128.1	28.95	29.65	7.96
H ₂ : GCH 8	144.2	33.41	34.16	9.15
SEm±	4.30	1.12	0.74	0.26
CD (p=0.05)	12.6	3.29	2.17	0.75
<i>Methods of planting</i>				
P ₁ : Direct seed sowing	145.9	34.00	32.98	9.36
P ₂ : Transplanting	126.5	28.36	30.83	7.75
SEm±	4.30	1.12	0.74	0.26
CD (p=0.05)	12.6	3.29	NS	0.75
<i>Fertility levels</i>				
F ₁ : 75% RDF	126.3	27.94	29.28	7.58
F ₂ : 100% RDF	146.0	34.42	32.53	9.53
SEm±	4.30	1.12	0.74	0.26
CD (p=0.05)	12.6	3.29	2.17	0.75

proliferation and vigorous plant growth, which in turn was used for higher uptake of moisture and nutrient from soil reservoir.

Conclusion

Cultivation of castor cultivar GCH 8 by direct sowing and fertilized the crop with 100% RDF gave higher seed yield, net return and benefit: cost ratio.

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