



Seed Yield and Economic Performance of Castor at Farmers' Field in Arid and Semi-arid Regions of Rajasthan

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Abstract: Frontline demonstrations on improved practices of castor were conducted in Jodhpur, Jaisalmer and Sirohi districts of Rajasthan. The mean seed yield of castor ranged from 3680 to 4071 kg ha⁻¹ under improved practices and 3000 to 3786 kg ha⁻¹ under farmers' practices. Among hybrids, the maximum mean seed yield of 3874 kg ha⁻¹ was produced by DCH 519 followed by Commando, Sagar Moti, MRCA 409, DCH 177 and GCH 7 with 3786, 3588, 3393, 3363 and 3000 kg ha⁻¹ seed yield, respectively. Under improved practices, maximum seed yield of castor was 3803 kg ha⁻¹ in Jodhpur district followed by 3781 kg ha⁻¹ in Jaisalmer district and 3408 kg ha⁻¹ in Sirohi district. The overall productivity of the castor demonstrations was 3664 kg ha⁻¹ under improved practices and 3874 kg ha⁻¹ under hybrids which was 22.2% and 8.2% higher respectively, over farmers' practices (2998 and 3581 kg ha⁻¹, respectively).

Key words: Farmer's field, castor, seed yield, frontline demonstration, castor hybrids.

Castor is cultivated for non edible oil which is the only commercial source of a hydroxylated fatty acid (Patel *et al.*, 2016). Its oil is stimulative laxative which is used to clean out the intestines and to treat constipation (Patel *et al.*, 2016). Castor cake also serves as good organic manure (Gupta *et al.*, 2004). Castor is cultivated mainly in Gujarat, Rajasthan, Andhra Pradesh, Karnataka, Tamil Nadu, Orissa and Haryana (IIOR, 2020) in India. In Rajasthan, castor has occupied an area of 140517 ha in 2019 with annual production of 207584 t. It is grown in arid and semi arid parts of Rajasthan mostly in Sirohi, Jalore, Barmer, Jodhpur, Pali, Jaisalmer and Hanumangarh districts. The average productivity of castor in Rajasthan ranged between 500 kg ha⁻¹ in Jodhpur to 2245 kg ha⁻¹ in Hanumangarh with the state average of 1477 kg ha⁻¹ (GOR, 2018-19), which is much lower than its potential. Large number of research experiments has shown that crop productivity may be enhanced considerably through improved management practices (Sharma *et al.*, 2017; Naagar *et al.*, 2017; Singh and Sharma, 2019). Hence, present study was conducted under farmer participatory action research with the objectives to demonstrate the production technologies of castor at farmer's fields.

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Materials and Methods

Seventy-five demonstrations on improved practices were conducted in Sirohi, Jodhpur and Jaisalmer districts of Rajasthan during kharif 2018. In improved practices demonstration, hybrid DCH 177 was used with seed rate @ 5 kg ha⁻¹ along with fertilizers dose of 40 kg nitrogen and 40 kg phosphorus ha⁻¹ applied as basal followed by top dressing of 20 kg nitrogen ha⁻¹ at 35 and 80 days after sowing. Foliar spray of 0.5% ferrous sulphate (19% Fe) solution was done at 45 days after sowing. Foliar spray of Quinalphos 25 EC @ 1 liter ha⁻¹ applied at 85 days after sowing for insects' pest management. Different practices followed under improved and farmers' practices are given in Table 1.

In another trial fifty demonstrations on castor hybrids were conducted at farmer's fields following improved practices during kharif 2019 in Osian tehsil of Jodhpur district of Rajasthan using DCH 519 (improved hybrid; IH) and other hybrid used by farmers (Sagar Moti, GCH 7, MRCA 409 DCH 177 and Commando; FH). Each demonstration was laid out in 0.40 ha area. Most of the demonstrations were sown during 1st week of August and harvested during 2nd and 3rd week of March. Farmer-scientist interaction and field day programs were also organized to create awareness among farmers regarding improved castor cultivation practices.

Table 1. Different practices followed under improved and farmers' practices

Practices followed	Improved practices (IP)	Farmers' practices (FP)
Hybrids	DCH 177	DCH 177
Spacing	120 x 90	90 x 60
Seed treatment	Carbendazim @ 2 g kg ⁻¹ seed	Nil
Organics application	FYM @ 10 t ha ⁻¹	FYM @ 10 t ha ⁻¹
Fertilizers	80 kg nitrogen, 40 kg phosphorus Foliar spray of 0.5% Ferrous Sulphate (19% Fe) solution was done at 45 days after sowing	64 kg nitrogen, 46 kg phosphorus
Seed rate	5 kg ha ⁻¹ (2 seeds hill ⁻¹)	5 kg ha ⁻¹ (2 seeds hill ⁻¹)
Thinning	15 DAS (1 seedling hill ⁻¹)	15 DAS (1 seedling hill ⁻¹)
Weed management	One manual weeding at 30 DAS + interculture by tractor at 20 DAS and 40 DAS	One manual weeding at 30 DAS + interculture by tractor at 20 DAS and 40 DAS
Water management	Irrigation through drip	Irrigation through sprinkler
Plant protection	Application of <i>Trichoderma viride</i> enriched FYM @ 10.8 g hill ⁻¹ (culture @ 2.5 kg <i>T. viride</i> in 100 kg FYM) Foliar spray of Quinalphos 25 EC @ 1 liter ha ⁻¹ applied at 85 days after sowing	Nil

Results and Discussion

Performance of technology demonstrations (whole package)

Out of 75 demonstrations conducted at farmer's fields, 25 demonstrations were conducted in Pindwada tehsil of Sirohi district, 29 in Osian tehsil of Jodhpur and 21 in Pokaran tehsil of Jaisalmer. Average seed yield of castor (DCH 177) under improved practices was 3408, 3803 and 3781 kg ha⁻¹ in Sirohi, Jodhpur and Jaisalmer district which was 23, 23 and 22% higher respectively over farmers practice in these districts. The overall productivity of the castor demonstrations was found 3664 kg ha⁻¹, which was 22.2% higher over farmers practice (Table 2). The yield enhancement observed under technology demonstration was mainly attributed due to the improved seed of hybrids with recommended seed rate, basal and foliar fertilization, and plant protection measures. Similarly, Prajapati *et al.* (2018) reported yield

enhancement of 22% by the use of improved practices in castor at farmer's fields in Gujarat. Satyanarayana *et al.* (2018) and Senthilkumar *et al.* (2019) have also reported yield enhancement in castor through technological interventions at farmer's field. Patil *et al.* (2018) concluded that FLD is an effective extension intervention to demonstrate the production potential of improved technologies in oilseed crops on farmers' field.

The percent increase in gross return due to IP over FP were 21.1, 19.8 and 21.3 per cent in Jodhpur, Jaisalmer and Sirohi districts, respectively (Table 2). Padmaiah *et al.* (2012) also reported comparable increase in castor yield but less returns (Rs. 12620 ha⁻¹) in Jodhpur district of Rajasthan probably due to change in price over the years. Across the three district of Rajasthan studied, B:C ratio was maximum in Jaisalmer and Jodhpur while it was minimum in Sirohi probably because impact of improved practices were more discernible in non-

Table 2. Productivity of the castor demonstrations in Sirohi, Jodhpur and Jaisalmer districts of Rajasthan at farmers' field (kharif 2018)

District	No. of demonstration	Mean seed yield (kg ha ⁻¹)		Yield increase (%)	Gross return (Rs. ha ⁻¹)		Add. Net return (Rs. ha ⁻¹)	B:C ratio	
		IP	FP		IP	FP		IP	FP
Sirohi	25	3408	2772	23	153360	124740	26620	3.51	2.98
Jodhpur	29	3803	3103	23	171155	139655	29500	3.90	3.31
Jaisalmer	21	3781	3119	22	170143	140357	27786	3.88	3.34
Mean		3664	2998	22.7	164886	134917	27969	3.76	3.21

Table 3. Seed yield of castor hybrids at farmers' field in Osian tehsil of Jodhpur district (kharif 2019)

Cluster No.	No. of demonstration	Hybrids demonstrated		Mean seed yield (kg ha ⁻¹)		Increase in seed yield (%) over IH	Cost of cultivation (Rs. ha ⁻¹)		Gross returns (Rs. ha ⁻¹)		Additional net returns (Rs. ha ⁻¹) over FH	B:C ratio	
		IH	FH	IH	FH		IH	FH	IH	FH		IH	FH
1.	04	DCH 519	Sagar Moti	4071	3588	13.5	41499	41799	146565	129150	17715	3.5	3.1
2.	02	DCH 519	GCH 7	3275	3000	9.2	41499	41529	117900	108000	9930	2.8	2.6
3.	05	DCH 519	MRCA 409	3680	3393	8.7	41499	41899	132480	122130	10750	3.2	2.9
4.	14	DCH 519	DCH 177	3690	3363	9.8	41499	41463	132846	121050	11761	3.2	2.9
5.	25	DCH 519	Com-mando	4032	3786	6.7	41499	41949	145159	136292	9317	3.5	3.2
Mean	-	-	-	3874	3581	8.4	41499	41771	139466	128905	10841	3.36	3.08

IH = Improved hybrid; FH = Farmers hybrid.

traditional areas of castor cultivation (Jodhpur) compared to traditional area (Sirohi). Similar results of economic gain of improved practices in castor were reported by Senthilkumar *et al.* (2019), Vaghasia and Dobariya (2018) and Kumar *et al.* (2015).

Performance of castor hybrids

The average seed yield of different hybrids under farmers' practices ranged between 3000 and 3786 kg ha⁻¹ however, under improved practices the seed yield of castor hybrid DCH 519 varied between 3275 and 4071 kg ha⁻¹ (Table 3). Among different hybrids, the overall maximum seed yield of 3874 kg ha⁻¹ was recorded by DCH 519 followed by Commando, Sagar Moti, MRCA 409, DCH 177 and GCH 7 with 3786, 3588, 3393, 3363 and 3000 kg ha⁻¹, respectively. All these hybrids performed better under improved soil moisture, soil fertility and environmental conditions due to their genetic yield potential which resulted in higher yield than the average yield of the State. Therefore, these castor hybrids may be promoted for cultivation to enhance the castor productivity in Rajasthan.

Castor hybrid DCH 519 recorded 13.7% more returns than Sagar Moti, 9.7% more than DCH 177, 8.8% more than MRCA 409, 9.2% more than GCH 7 and 6.8% more than Commando (Table 3). An overall increase of 8.2% in gross return was recorded in case of DCH 519 over mean gross returns of hybrids used by farmers. This led to an additional return of Rs. 10841 ha⁻¹ due to improved hybrid. The

increase in economic return due to adoption of high yielding hybrids in castor has also been reported by Satyanarayana *et al.* (2017) and Hema and Asokhan (2018).

Conclusion

Use of high yielding hybrid DCH 519 along with improved package of practices viz., seed treatment with fungicide, recommended dose of fertilizers, use of *Trichoderma* enriched FYM and irrigation through drip system can enhance the seed yield of castor significantly with appreciable increase in returns.

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