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Castor Frontline Demonstrations in Jodhpur District of Rajasthan : An Impact Study

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ABSTRACT

Jodhpur is one of the major castor growing districts in Rajasthan. More than150 frontline demonstrations (FLDs) were conducted by Agriculturral Research Station (ARS), Mandor in Jodhpur district of Rajasthan during last 10 years (1997-98 to 2006-07) to demonstrate the improved castor production technologies that are suitable for that particular eco-system. An attempt was made to analyze the impact of the demonstration in vertical and lateral spread of the technology and the resultant improvement in yield and income of the castor growers. Twentry-five FLD and the corresponding non-FLD castor growers were selected through proportionate random sampling procedure. There was no significant difference between the FLD and non-FLD farmers in their knowledge, adoption and yield levels. This shows the impact of FLDs in lateral spread of the improved technologies of castor crop. The castor area of the district has increased by about five times and production by about six times during the period 2002-03 to 2006-07. The frontline demonstrations had an overall expost-facto impact of 26 per cent increase in yield and Rs. 12620/ha in net returns. The B:C ratio was 3.5 and 2.8 with improved technology and farmers practices plots respectively. There is a vast scope available for increasing the yield levels of castor inthe district and the reservoir was projected. Non-availability of quality seeds is the major constraint encountered by the castor growers of the study area. There is a need for intensive extension efforts by depeartment of agriculture, through constructive collaboration with Agricultural Research Station, Mandor, Krishi Vigyan Kendras and local Non-Governmental Organisations to improve the yield as well as the production levels of castor in Jodhpur district.

Castor (*Ricinnus communis* L) is indigenous to Southeast Mediterranean region and East Africa. However, it is widespread throughout the tropical regions.The crop establishes itself easily as an apparently native plant and it can often be found in wasteland. The leading castor growing countries are India, China and Brazil. India stands first in both area and production of the crop in the world. It is grown in an area of 1.43 million/ ha. In India, the crop is grown in an area of 8.9 lakh/ha, with a productin of 9.9 lakh tonnes and productivity of 1146/ha (Damodharam and Hegde, 2007). Gujarat, Andhra Pradesh and Rajasthan are the major castor producing states of the country. The crop is also cultivated in the states like Tamil Nadu, Karnataka, Orissa, Maharashtra and Bihar although, the area as well as the production of castor in these states are limited. The castor seed contains 40-60% oil that is rich in triglycerides. The seed also contains ricin, a poison, which is also present in lower concentrations throughout the plant. Castor oil is a colourless to pale yellow oil, with mild or no odour or taste. The oil and its derivatives have applications in the manufacture of soaps, lubricants, hydraulic and brake fluids, paints, dyes, coatings, inks, cold resistant plastics, waxes, polishes, nylon, pharmaceuticals, cosmetics and perfumes. The oil is commonly used as laxative medicines and in medicines to treat skin disorders (DOR, 2007).

Castor in Rajasthan is mainly grown as role irrigated crop, in some pockets as rainfed crop and sporadically as border crop/intercrop in the fields of chilly as a shade crop. The districts namely Jalore, Sirohi, Barner, Jodhpur and Pali are important in terms of their contribution to the increase in area and production of castor in Rajasthan. Development / identification of superior castor hybrids,

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generation of production technology and dissemination of improved technology through frontline demonstrations resulted in enhancement of castor area, production and productivity in the last year years (Anonymous, 2008). However, area, production and productivity of castor in Rajasthan are fluctuating widely, which could be understood from Fig.1 to 3.

More than 150 frontline demonstrations (FLDs) were conducted in Jodhpur district of Rajasthan during last 10 years (1997-98 to 2006-07) to demonstrate the improved castor production technologies that are suitable for that particular eco-system.The concurrent impact of such demonstrations is given in Table 1. An attempt was made to analyse the impact of the demonstrations in vertical and lateral spread of the technologies and the resultant improvement in yield and income of the castor growers, with the following objectives:

* To document the profile characteristics of castor growers
* To assess the knowledge and adoption level of castor growers in Jodhpur district of Rajasthan as an impact of frontline demonstrations
* To delineate the constraints encountered by the castor growers in Jodhpur district of Rajasthan
* To suggest strategies to improve the castor cultivation scenario in Rajasthan

METHODOLOGY

Locale of the study

Jodhpur district of Rajasthan was selected as the locale of the study, since Agricultural Research Station (ARS), Mandor, conducted the frontline demonstration on castor mainly in this district. All India Coordinated Research Project on Castor was initiated in this station on April 1987. The station is under the administrative control of Rajasthan Agricultural University, Bikaner. The center lies in the Arid Western Plain Zone I a, of the state. Geographically, Jodhpur is situated in between 26^{o} 15'N to 26^{o} 45'N latitude and 73^{o}E to 77^{o}29'E longitude in the west. Average annual rainfall ranges from 100 mm in the western part to about 300 mm in the eastern part. Maximum temperature in the month of June remains around 40^{o}C and minimum temperature in the month of January is around 8^{o}C. The general soil types prevalent are alkaline loamy but free hazards of salinity. The fertility status of the soil is poor to nitrogen (0.15 to 0.3 per cent organic carbon), medium in phosphorus and high in potash availability. The area production and productivity of castor in Jodhpur district of Rajasthan is given in Fig. 1 to 3.

Sampling design

The study villages namely, Sambadia, Khariamitapur and Umaidnagar were selected after discussing the scientific team of AICRP on castor of ARS, Mandor, where the frontline demonstrations were conducted during 2003-04 to 2005-06. The FLD and the corresponding non-FLD castor grower were selected through proportionate random sampling procedure. The final sample of the study included 25 each FLD and non-FLD castor growers.

Data collection and statistical tools

A well-structured interview schedule was utilized to collect the data from the selected respondents wtih the help of the key informants of the respective villages and teh scientific team from RARS, Mandor. The collected data were analyzed using standard statistical tools *viz,* mean standard deviation, percentage and t-test analyses, to have meaningful interpretation of the data.

RESULTS AND DISCUSSION

Profile characteristics of the respondents

It could be understood from Table 2 that majority of the FLD and non-FLD castor growers were middle eged (35 to 55 years). Majority the FLD castor growers were illiterate to middle school level educated, whereas non-FLD castor growers were illiterate. The farming experience of the FLD farmers was low to medium, whereas that of the other category was medium. Both the FLD and non-FLD castor growers had medium level of castor cultivation experience Majority of the FLD farmers were possessing semi-medium to medium size of farm holdings, whereas majority the other category farmers had semi-medium size of farm holdings. As far as the area under castor cultivation is concerned, the FLD and non-FLD farmers were small and marginal to small in nature.

Factors responsible for castor cultivation

Suitability of the crop to the prevailing environment of the study area is the foremost factor that contributed for the initiation and spread of castor cultivation. There are other crops like mustard, vegetable, bajra etc, are grown in the study area and this crop according to the respondents has less cost involved, which is the second important factor that contributedfor castor cultivation. Also, the damage due to pests and disease is comparatively lower and that forms third important factor that contributed for castor cultivation. Local availability of market and processing facilities for the castor seeds are the further important contributing factors that enhance the further growth castor cultivation in the study area. Availability of

credit facilities for borriwing loans for incurring the cultivation cost and possibility of having castor based cropping systems also the factors that contributed to the castor cultivation in the study area.

Concurrent impact of the frontline demonstrations

A total of 169 FLDs were conducted by the RARS, Mandor during the period of 1997-98 to 2006-07 on whole package technology, improved hybrids, recommended dose of fertilizers and plant protection measures. The impact of whole package technology on the seed yield increase was 118 and 15% under rainfed and irrigated situations respectively, with corresponding additional net returns of Rs. 8746 and 7436/ha. Similarly, the seed yield increase was 27, 7 and 2% for improved hybrids 9GCH-4 and RHC-1), recommended dose of fertilizers and plant protection, measures, with corresponding additional returns of Rs. 4861, 5104, 5720/ha respectively.

Table 1. Concurrent impact of frontline demostrations on castor in Jodhpur district of Rajasthan (1997-97 to 2006-07)

Technology	Situation	No. of demons.	Mean seed yield (kg/ha)		% increase in yield	Cost of cultivation (Rs./ha)		Gross returns (Rs/ha)		Addl. net returns (Rs/ha)	B : C ratio	
			IT	FP		IT	FP	IT	FP		IT	FP
Whole package	Irrigated	118	3239	2562	26	10974	9799	48903	38928	8746	4.5	4.0
	Rainfed	15	3000	2453	22	17464	15607	51000	41707	7436	2.9	2.7
Hybrids	Irrigated	27	2033	1609	26	8764	8022	28312	22709	4861	3.2	2.8
Fertilizer	Irrigated	7	2759	2374	16	11254	9685	38818	32145	5104	3.4	3.3
Plant protection	Irrigated	2	2601	1952	33	10519	9171	28331	21263	5720	2.7	2.3

Table 2. Distribution of respondents according to their socio-personal characteristics

Category	FLD farmers (%)	Non-FLD farmers (%)
Age (years)		
Young (<35)	12.00	16.00
Middle (35 to 55)	84.00	80.00
Old (>35 to55	4.00	4.00
Educational status		
Illiterate	32.00	56.00
Primary level (upto 5th STD)	12.00	24.00
Middle level (6-8th STD)	8.00	0.00
High level (9-10th STD)	28.00	16.00
Secondary level (11-12th STD)	12.00	0.00
College level	8.00	4.00
Farming experience (years)		
Low	36.00	20.00
Medium	48.00	60.00
High	16.00	20.00
Mean		19.34
SD		8.15
Castor cultivation experience (years)		
Low	4.00	8.00
Medium	52.00	68.00
High	44.00	24.00
Mean		6.82
SD		2.50
Farm size		
Marginal (<1 ha)	0.00	0.00
Small (1-2 ha)	16.00	8.00
Semi-medium (2.01-5 ha)	36.00	60.00
Medium (5.01 -10ha)	48.00	24.00
Large (> 10 ha)	0.00	8.00
Area under castor		
Marginal (<1 ha)	20.00	16.00
Small (1-2 ha)	52.00	44.00
Semi-medium (2.01-5 ha)	28.00	40.00
Medium (5.01 -10ha)	0.00	0.00
Large (> 10 ha)	0.00	0.00

Expost-facto adoption behaviour of the respondents (lateral spread of the technologies)

Majority of the FLD and non-FLD castor growers were medium in knowledge and adoption level of recommended castor cultivation practices and the resultant yield level of their castor crop. There was no significant difference between the FLD and non-FLD farmers in their knowledge, adoption and yield levels. This shows the impact of FLDs in lateral spread of the improved technologies of castor crop. The overall such impact is mainly due to the faster spread of the technologies in Khariamitapur and Umaidnage villages and that is evident from Table 4 also.

Table 3. Distribution of respondents according to their adoption behaviour and yield

Category	FLD farmers (%)	Non-FLD farmers (%)
Knowledge level		
Low	8.00	20.00
Medium	76.00	64.00
High	16.00	16.00
Mean		17.44
SD		3.44
't' value		0.0079 NS
Adoption level		
Low	8.00	36.00
Medium	72.00	40.00
High	20.00	24.00
Mean		31.56
SD		3.00
't' value		0.2290 NS
Yield level		
Low	0.00	40.00
Medium	76.00	60.00
High	24.00	0.00
Mean		28.56
SD		8.99
't' value		6.4272 E-11 NS

Vertical growth of the crop in the study area

The vertical spread in Jodhpur district of Rajasthan could be visible very well from Fig.1. The castor area of the increased by about five times and production by about six times (Fig 2.) during the period 2002-03 to 2006-07. However, the overll productivity of the district is a matter of concern and there is a vast scope for further improvement of the same (Fig 3).

Expost-facto impact of frontline demonstrations in yield and economics

It could be understood from Table 4 that the seed yield increase, as an impact of frontline demonstrations obtained by FLD farmers in Khariamitapur was 25% more than that of the non-FLD farmers and the additional net returns obtained by the former was Rs. 12214/ha. The B:C ratio was 3.5 and 2.8 for FLD farmers respectively. In Sambadia village also, the seed yield increase obtained by the FLD farmers was to the tune of 85%, with an additional net returns of Rs. 25280/ha. Here, the B:C ratio was 3.1 and 1.7 for FLD and non-FLD farmers respectively. Contrastingly, in Umaidnagar district, the seed yield increase obtained was less than 1%, with meager additional net returns of Rs. 365/ha. The B:C ratio was 3.9 for both FLD and non-FLD farmers. This shows that the lateral spread of the technology was bettwe in Umaidnagar, followed by Khariampur. This may be due to reason that the Umaidnagar and Khariampur villages are located on the main road and have easy approach for the development personnel and researchers to visit there frequently and impart the improved castor cultivation practices.

Table 4. Impact of frontline demonstrations in Jodhpur district

Village	Mean seed yield (kg/ha)		% increased in yield	Cost of cultivation (Rs/ha)		Gross returns (Rs./ha)		Additional net returns (Rs. /ha)	B:C ratio	
	FLD	NFLD		FLD	NFLD	FLD	NFLD		FLD	NFLD
Khariyamitapur	3389	2708	25	17393	17350	61007	48750	12214	3.5	2.8
Sambadia	3060	1655	85	17617	17591	55088	29782	25280	3.1	1.7
Umaidnagar	3846	3819	0.7	17950	17828	69225	68738	365	3.9	3.9
Overall	**3432**	**2727**	**26**	**17653**	**17590**	**61773**	**49090**	**12620**	**3.5**	**2.8**

Exploitable yield reservoir in Jodhpur district of Rajsthan

It could be understood very well from Table 4 that there is a vast scope available for increasing the yield level of castor in Jodhpur district of Rajasthan. This vast exploitable yield reservoir could be acheived by making the castor growers to have complete adoption of recommended technological package through intensive extension efforts. It could be learnt from Table 5 that the expected yield projected through gap-I is ranging from 128 to 11383 tonnes for the district, instead of the actual i.e. 1018 to 9045 tonnes for the period between 2002-03 and 2006-07.However, the expected production for the same period projected through gap-II was enormous and ranging from 6151 to 55532 tonnes. Hence, there is a need for intensive extension efforts by DOA, through constructive collaboration with ARS, Mandor, KVKs and local NGOs to improve the yield as well as the production levels of castor in Jodhpur district.

Table 5. Exploitable yield reservoir of castor in Jodhpur district of Rajasthan

Average yield obtained by FLD farmers (kg/ha)*	Average yield obtained by non-FLD farmers (kg/ha)*	Gap-I	Year	Average yield of Jodhpur district (kg/ha)	Gap-II	Production (tonnes)	EP-I (tonnes)	EP-II (tonnes)
			2002-03	568	504	1018	1281	6151
			2003-04	786	337	3799	4781	16588
3432	2727	26	2004-05	797	331	7234	9104	31151
			2005-06	559	514	9045	11383	55532
			2006-07	573	499	6812	8573	40801

*=Based on the data collected during the impact survey

Yield Gap-I=Increase in yield of FLD farmers over that of non-FLD farmers expressed in percentage.

Yield Gap-II=increase in yield of FLD farmers over district average yield expressed in percentage

EP-I=Expected production if Yield gap-I is bridged through complete adoption of improved practices

EP-I=Expected production if Yield gap-II is bridged through complete adoption of improved practices

Constraints encountered in castor cultivation

Non-availability of good quality seed, inadequately electricity supply for irrigation are the major constraints that are encountered by the castor growers. Higher cost of the labour and their unavailabily, frost injury during the mid-December of mid-January period and occurence of more male flowers in the genotypes grown by them are the constraints that follow the major constraints as felt by the respondents. Erratic, rainfall pattern, fluctuation in the market price, high cost of inputs and the poor quality of the irrigation water are the next important constraints that affect the castor cultivation as informed by the respondents of the study. Damage due to sucking pest, termites and wild animals are the biotic stresses that affect castor cultivation in the study area. Wild damage was also a concern in the study area part from extension constraints like unawareness towards improved production technology, lack of sufficient subsidy programmes and wider extension personnel, farmers ratio are to be overcome to improve the castor cultivatin scenario of the study area.

Training needs of the castor growers

Based on the response of the castor growers and the perception of the researchers of the study, the respondents of the study area and training on the following aspects:

* Frost injury management
* Sicking pests management
* Termite management
* Wilt management
* Improved castor cultivation technology and
* Hybrid seed production.

Suggestion to improve the castor cultivation scenario in the study area

* Streamlining the seed production of castor hybrids by RARS,Mandor, Department of Agriculture (DOA), National Seeds Corporation (NSC) and Rajasthan State Seeds Development Corporation (RSSDC), so that the castor growers will have easy access to the quality castor seeds. The improved hybrid from RARS, Mandor has to be included in the supply chain.
* Intensive training for the castor growers on efficient water management
* Management practices for damage due to frost during peak winter of the study area
* Subsidy schemes from the DOA for supply of quality seeds, plant protection chemicals, agricultural implements and micro-irrigation units.
* Intensive training for the farmers on improved castor production technology and hybrid seed production by the DOA, in close coordination with the scientistsof RARS, Mandor.
* DOA should involve KVKs, NGOs and voluntary organizations for transfer of improved castor production technologies, to bridge the wider farmer, extension personnel ratio

* Popularizing integrated package for management of insect pests, disease, wild animals and frost injury that castor crop

* Farmers' participatory hybrid seed production through collaborative efforts of RARS, DOA, KVKs and NGOs.

CONCLUSION

The castor area of the district increased by about five times and production by about six times during the period 2002-03 to 2006-07 as an impact of FLDs on vertical spread of the crop. The frontline demonstrations had an overallexpost-facto impact of 26% increase in yield and Rs.12620/ha in net returns. The B:C ratio was 3.5 and 2.8 with IT and FP plots respectively. However, the 't' statistics shows that there was no significant difference between FLD and non-FLD farmers as far as adoption behaviour towards improved castor cultivation practices, and the yield level. Still, there is a vast scope available for increasing the yield levels of castor in Jodhpur district of Rajasthan. The maximum production level in Jodhpur district of Rajasthan for the last five years could have been around 55000 tonnes instead of the actual of 9045 tonnes, if the exploitable yield reservior was utilized completely. Non-availability of quality seed is the major constraint encountered by the castor growers of the study area. The training needs for the castor growers were documented apart from the constraints encountered by them. Strategies to improve the castor cultivation scenario of the study area are suggested.

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