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Study on Yield Gap and Prioritization of Castor production Constraints for semi-arid regionin Gujarat

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ABSTRACT

Castor (*Ricinuscommunis L.*) is as one of the most important oil crops of the Panchmahal district of Gujarat. However, its productivity of castor in the district is very low. Attempts are made to improve productivity and to increase area under castor by adopting HYVs. In order to compare conventional castorvarieties withHYVs, 75 front line demonstrations were carried out in systematic manner on farmers' field to show the worth of a HYVsin comparison to local varietiesand thereby convincing farmers about potentialities of improved production management practices of castor for further adoption, involving feasible and effective scientific package of practices. The demonstrations clearly showed enhancement of productivity, at the same time area under castor cultivation was also noticed to be enhanced. The yield was found to be increase from 1980kg/ha in local varieties to 2990kg/ha in demonstrations. Similarly, the benefit cost ratio for HYVswas found to increase to 3.4 as compared to local varieties (2.5). The economic and benefit cost ratio can be further improved to 3.8 by giving slightly higher inputs for cultivation and marketing. The impact of FLDs was analyzed which showed improvement of knowledge and satisfaction of farmers as the main reason for mass scale adoption.

Keywords: Castor, frontline demonstration, production technology

INTRODUCTION

Castor (*Ricinuscommunis L.*) is cultivated around the world because of the commercial importance of its oil. The world production of castor seed hovers around at an average of 12.5 lakh tons and of castor oil is 5.5 lakh tons. The top most country in the list is India with around 65% share in production followed by China with 23% and Brazil with 7% of share. India is the world's largest producer of castor seed and meets most of the global demand for castor oil. The average yield of castor in India is very low that is 987 kg per ha (Anonymous, 2010-11).Gujarat is the leading state in castor seeds production in India followed by Rajasthan and Andhra Pradesh. Gujarat contributed 71% of the total production of castor seed in India in 2007-08, followed by Rajasthan at 16%, Andhra Pradesh at 9% and other states sharing 4%.In Gujarat, it is grown on an area of 3.54 lakh hectareswith an annual production of 6.51 lakhtones with a productivity of 1838 kg per ha (Anonymous, 2010-11).

Low productivity of castor is attributed to the fact that the crop is usually grown under rainfed condition on marginal and low fertility of soils. Further, lack of proper nutrient management is one of the major causes for low yields. Castor responds well to integrated nutrient management. Integrated use of organic manures and mineral fertilizers help in maintaining stability in production, besides improving soil physical properties.

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MATERIALS AND METHODS

An extensive survey was conducted to collect information pertaining to various usage of castor in the Panchmahals District.Seventy five farm families each from seven villages of (who grew castor) were selected from three Talukas viz. Shehara, Kalol, and Godhra for gathering the information. A questionnaire containing (6) questions were put to the respondents and data were analyzed. To popularize the improved castor production practices, were identified through participatory approach. Preferential ranking technique was utilized to identify the constraints faced by the respondent farmers in castor production. Farmers were also asked to rank the constraints they perceive as limiting castor protection in order of preference. Thequantification of data was done by first ranking the constraints and then calculating the Rank Based Quotient (RBQ) as given by Sabarathnam (1988), which is as follows:

$$R.B.Q = \frac{\sum fi\ (n + 1 - ith)}{N \times n} \times 100$$

Wherein,

fi = Number of farmers reporting a particular problem under i^{th} rank

N = number of farmers

n = number of problems identified

Based on top rank farmers problems identified, front line demonstrations were planned and conducted at the farmers' field under technology demonstration. In all, 75 full package frontline demonstrations were conducted to convince them about potentialities of improved variety of castor GCH-7 during 20011, 2012 and 2013. All the participating farmers were trained on all aspects of castor production management. Recommended agronomic practices and genuine seeds were used for FLDs in 0.5 ha area. A one fifth area was also devoted to grow localstandard check. To study the impact of front line demonstrations, out of 75 participating farmers, a total of 75 farmers were selected as respondent through proportionate sampling. Production and economic data for FLDs and local practices were collected and analyzed. The technology gap and technology index were calculated using the following formulas as given by Samui et al. (2000).

$$\text{Technology gap} = \text{Potential yield} - \text{Demonstration yield}$$

$$\text{Technology index} = \frac{\text{Potential yield} - \text{Demonstration yield}}{\text{Potential yield}} \times 100$$

Knowledge level of the farmers about improved production practices of castor before frontline demonstration implementation and after implementation was measured and compared by applying dependent't' test. Further, the satisfaction level of respondent farmers about extension services provided was also measured based on various dimensions like training of participating farmers, timeliness of services, supply of inputs, solving field problems and advisory services, fairness of scientists, performance of variety demonstrated and overall impact of FLDs.

The selected respondents were interviewed personally with the help of a pre-tested and well structured interview schedule. Client Satisfaction Index was calculated as developed by Kumaran and Vijayaragavan (2005).

The individual obtained score

$$\text{Client Satisfaction Index} = \frac{\text{The individual obtained score}}{\text{Maximum score possible}}$$

The harvest index was worked out by using following formula given by Donald (1962).

$$\text{Harvest index} = \frac{\text{Seed yield (kg ha}^{-1}\text{)}}{\text{Seed yield (kg ha}^{-1}\text{) ? Stalk yield (kg ha}^{-1}\text{)}}$$

The data thus collected were tabulated and statistically analyzed to interpret the results.

RESULT AND DISCUSSION

Constraints in castor Production

Farmers' castor production problems were documented in this study. Preferential ranking

Table 1: Ranks given by farmers for different constraints

(n=75)

Constraints	Ranks					
	I	II	III	IV	V	VI
Lack of suitable HYVs	33	19	9	6	6	2
Low technical knowledge	24	18	11	9	7	6
Low soil fertility	16	16	21	7	7	8
Insect infestation	21	19	14	11	6	4
Weed infestation	12	16	20	14	8	5
Wild animals	19	18	13	10	9	6

technique was utilized to identify the constraints faced by the respondent farmers in castor production. The ranking given by the different farmers are given in table 1. A perusal of table indicates that lack of suitable HYVs was given the top most rank by 33 respondent farmers. The FLD participants were provided HYVs seeds as critical inputs. Based on the ranks given by the respondent farmers for the different constraints listed out in table 1, the rank based quotients were calculated and presented in table 2.

The analysis of data presented in the table 2 revealed that lack of suitable HYVs, insect infestation, Low technical knowledge and followed bylow soil fertility were the major constraints to castor production. Other constraints such as weed infestationand wild animalswere also found to reduce castor production. Other authors (Ouma et al. 2002; Joshi et al. 2005) have reported similar problems in maize production.

Table 2: Frequency distribution of RBQ values given by farmers (n=75)

Problems	R.B.Q	Overall rank
Lack of suitable HYVs	77.56	I
Low technical knowledge	72.22	III
Low soil fertility	67.33	V
Insect infestation	72.44	II
Weed infestation	65.56	VI
Wild animals	68.89	IV

Performance of FLD

A comparison of productivity levels between demonstrated variety and local checks is shown in table 3. During the period under study it was observed that in front line demonstrations, the improved castor variety GCH-7 recorded the higher seed yield (29.9 qha^{-1}) compared to local check (19.8 q ha^{-1}). The percentage increase in the yield over local check was 50.01. Similar yield enhancement in different crops in front line demonstration has amply been documented by Haque (2000), Tiwari and Saxena (2001), Tiwari et al. (2003), Hiremath et al. (2007), Mishra et al. (2009), Kumar et al. (2010), Dhaka (2010) and Taware et al. (2006). From these results it is evident that the performance of improved variety was found better than the local check under local conditions. Farmers were motivated by results of agro technologies applied in the FLDs trials and it is expected that they would adopt these technologies in the coming years. Yield of the front line demonstration trials and potential yield of the crop was compared to estimate the yield gaps which were further categorized into technology index and harvesting index. The technology gap shows the gap in the demonstration yield over potential yield and it was 5.9 qha^{-1}. The best potential yield comes from the scientists fill where all inputs are given at optimum level. The observed technology gap may be attributed to dissimilarities in soil fertility, salinity and erratic rainfall and other vagaries of weather conditions in the area. Hence, to narrow down the gap between the yields of different varieties, location specific recommendation appears to be necessary. Technology index shows the feasibility of the variety at the farmer's field. The lower the value of technology index more is the feasibility. Table 3 revealed that the technology index values were

Table 3: Yield, technology gap and technology index of demonstration

Variables	Yield (q ha^{-1})	Increase (%) over Local check	Technology gap (qha^{-1})	Technology index (%)
Local check	19.8	-	-	-
Demonstration (GCH-7)	29.9	50.01	5.9	16.85

16.85%. The finding of the present study is in consonance with the findings of Hiremath and Nagaraju (2009) in case of onion crop.

The economics of castor production under front line demonstrations were estimated and the results have been presented in table 4. Economic analysis of the yield performance revealed that front line demonstrations recorded higher gross returns (Rs. 89700 ha^{-1}) and net return (Rs. 63300 ha^{-1}) with higher benefit ratio (3.34) compared to local checks (table 5). These results are in line with the findings of Gurumukhi and Mishra (2003) and Hiremath et al. (2007) in case of potato and onion crop. Further, additional cost of Rs.3000 per hectare in demonstration has yielded additional net returns Rs. 8500 per hectare with incremental benefit cost ratio 3.44 suggesting its higher profitability and economic viability of the demonstration. Similar results were also reported by Hiremath and Nagaraju (2009).

Increase in Knowledge

Knowledge level of respondent farmers on various aspects of improved castor production technologies before conducting the frontline demonstration and after implementation was measured and compared by applying dependent‘t’ test. It could be seen from the Table 6 that farmers mean knowledge score had increased by 32.04 after implementation of frontline demonstrations. The increase in mean knowledge score of farmers was observed significantly higher. As the computed‘t’value (6.94) was statistically significant at 5 % probability level. The results are at par with Narayanaswamy and Eshwarappa (1998), Singh and Sharma (2004), Singh et al. (2007). It means there was significant increase in knowledge level of the farmers due to frontline demonstration. This shows positive impact of frontline demonstration on knowledge of the farmers that have resulted in higher adoption of improved farm practices. The results so arrived might be due to the concentrated educational efforts made by the scientists.

Farmers’ Satisfaction

The extent of satisfaction level of respondent farmers over extension services and performance of demonstrated variety was measured by Client Satisfaction Index (CSI) and results presented in table 7.

Table 4: Harvesting index of demonstration

Variables	Seed Yield (q ha^{-1})	Stalk Yield (q ha^{-1})	Harvesting index
Local check	19.8	14.7	0.57
Demonstration (GCH-7)	29.9	27.5	0.52

Table 5: Economics of frontline demonstrations

Variables	Cost of cultivation (Rs ha^{-1})	Gross return (Rs ha^{-1})	Net return (Rs ha^{-1})	Benefit cast ratio
Local check	22900	59400	36500	2.5
Demonstration	26400	89700	63300	3.34
Additional in demonstration	3000	11500	8500	3.44*

* Incremental benefit cost ratio

Table 6: Comparison between knowledge levels of the respondent farmers about Improved Farming Practices of castor

(n=75)

Mean score			Calculated 't' value
Before FLD implementation	After FLD implementation	Mean difference	
27.8	59.84	32.04	6.94*

* Significant at 5% probability level.

Table 7: Extent of farmers satisfaction of extension services rendered

(n=75)

Satisfaction level	Number	Per cent
Low	08	10.66
Medium	29	38.66
High	38	50.67

It is observed from table 7 that majority of the respondent farmers expressed high (50.67 %) to the medium (38.66%) level of satisfaction for extension services and performance of technology under demonstrations. Whereas, very few (10.66%) per cent of respondents expressed lower level of satisfaction. The results are in conformity with the results of Narayanaswamy and Eshwarappa (1998), Kumaran and Vijayaragavan (2005) in case of bajra crop. The medium to higher level of satisfaction with respect to services rendered, linkage with farmers, and technologies demonstrated etc. indicate stronger conviction, physical and mental involvement in the frontline demonstration which in turn would lead to higher adoption. This shows the relevance of frontline demonstration.

CONCLUSION

The study undertaken with the help of 75 FLD participants by KVK Panchmahal to know the economics of castor production using HYV and adoption level and constraint influencing the adoption of HYVs. The results revealed that lack of knowledge of suitable HYV, insect infestation and low technological knowledge were the three most important factors which inhibited the adoption of HYV of castor in Panchmahal. The yield of castor in demonstration was 29.9 qha^{-1} as compared local check (19.8 q ha^{-1}). The benefit/cast ration for HYV was 3.34 as compared to 2.5 in case of local check. The impact of FLD was also analyzed which showed that there was significant improvement in knowledge level and satisfaction on the part of farmers.

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