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On-farm assessment of technological innovation of fennel (*Foeniculum vulgare* mill) cultivation

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ABSTRACT

The seed spices constitute an important group of agricultural commodities, playing an important role in our national economy. The export of seed spices together accounts for 29.36% in volume and 19.20% in value of total export of spices. This study was conducted during the year 2009-10. A total of 120 farmers from different categories were selected purposively from adopted eight villages of Pali district of Rajasthan for conducting Front Line Demonstrations (FLDs) on their field. Materials for the present study comprised of five high yielding fennel varieties viz, RF-205, RF-125, RF-145, RF-178 and AF1 with the recommended package of practices. The need based plant protection chemicals were used to control the insect-pests. The study indicated that under diversified agro-climatic conditions, three varieties of fennel viz., AF1, RF-205 and RF-125 have given encouraging results over local check and have potential to perform well with timely management practices in arid condition of Rajasthan. These varieties may be popularized with full package of practices to explore the potential in field conditions and mitigate the extension gap. Simultaneously efforts need to be made to reduce the large technology gap described in this paper. In economic terms, an additional cost mainly for inputs was increased slightly in FLDs over local check. However, it was recovered by increasing gross and net return substantially and resulted in more benefits cost ratio than the local check. The use of latest production technologies with timely systematic management would increase productivity of fennel and income of the small and margin at farmers who are mainly associated with this crop.

Key words : Front Line Demonstration, technological innovation and fennel cultivation

INTRODUCTION

India is well-known as “Land of Spices” across the world since long back. We have been cultivating these precious spices for fulfilling our various needs since ages. Our ancestors have been using these spices for adding taste and flavour in edibles and beverages. It has been used in treatment of various ailments, which is evident from our old literature. These spices possess many medicinal properties. They are carminative, appetizer, digestive, stimulant, tonic, spasmolytic, antipyretic, anthelmintic etc. and these properties increase their importance and value. Spices are valuable due to different aroma, taste and flavour. They change flavour and taste, of drink & edible food, whenever added to these products. The aroma of seed spices is due to these products. The aroma of seed spices is due to presence of volatile oil and its quantity determines quality and value. Fennel is used in diseases like cholera, biliousness, dysentery, diarrhea, cough, cold, constipation and also for those diseases, which affect chest, lungs and kidneys. It possesses both digestive and carminative properties. Fennel and its oil both stimulate aromatic and stop flatulence. It decoction is given to women for blood purification and uterus clearing.

India is the largest producer of fennel seed and it is cultivated on 0.79 lakhs hectares land with a production of 0.74 lakhs tones in year 2009-10. The fennel seed were exported to the tune of 6800 tones valued worth Rs. 5872.60 lakhs during the year 2009-10 (Anonymous, 1). The main markets for fennel are Japan, USA, U.K., Canada, Singapore, Saudi Arabia and U.A.E. In India, its production is concentrated mainly in the state of Rajasthan, Gujrat, Madhya Pradesh, Maharashtra, Haryana, Punjab, and Uttar Pradesh. Fennel is one of the most important *rabi* seed spices crop in the Rajasthan state. It occupies about 7690 hectare area and 6570 tones production in the state, which is 4.87 per cent and 8.88 per cent of total seed spices area and production is the highest in the country. Rajasthan and Gujarat contribute more than 80 per cent of the total seed spices production in the country. This belt can, therefore, be called as “seed spices bowl” of the country. But the average productivity of fennel crop (1235 kg/ha) in the state is very low as compared to other parts of the country. The reasons for low productivity may

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be the traditional methods of cultivation followed by the farmers. Productivity of the crop can be enhanced by adopting the improved practices as recommended by the Agricultural Universities, Department of Agriculture and ICAR Research Institutes.

The main objective of FLDs are to demonstrate newly released crop production and protection technologies and its management practices in the farmers' fields under different agro-climatic regions farming situations. While demonstrating the technologies in the farmers field, the scientist are required to study the factor contributing higher crop production, field constraints of production and thereby generate production data and feedback information. FLDs are conducted under the close supervision of scientists of the National Agricultural Research System comprising of ICAR Institute, National Research Centers, Project Directorates, Krishi Vigyan Kendras and State Agricultural Universities and its regional research stations. FLDs are organized in a block of 2 to 5 hectares involving all those farmers whose plots fall in the identified demonstration block. Only critical inputs and training are provided from the scheme budget, remaining inputs are supplied by the farmers themselves. The purpose is to convince extension functionaries and farmers together about the potentialities of the technologies for further wide scale diffusion and Front Line demonstration are used as a source of generating data on factors contributing higher crop yield and constraints of production under various farming situation. The present study was carried out with following specific objective to study the on-farm assessment of technological innovation of fennel cultivation.

METHODOLOGY

This study was conducted during the year 2009-10. A total of 120 farmers from different categories were selected purposively from adopted eight villages *viz*, Bittura Kallan, Dayalpura, Sodawas, Hemawas, Chandawal, Hingola, Sonaimanji and Bhagwanpura of Pali district of Rajasthan for conducting frontline demonstrations (FLDs) on their field. The study comprised of five high yielding fennel varieties viz, RF-205, RF-125, RF-145, RF-178 and AF1, with the recommended package of practices. Sowing was done in the month of Mid of October to Mid November, while harvesting in the month of March. Fertilizer schedule was N: 90, P_2O_5:40, K_2O:0 kg/ha for all the varieties except for RF-178. The need based plant protection chemicals were used to control the insect-pests. Locally cultivated variety namely *Deshi* Sonf as practiced by the non-adopted farmers with their own management system was taken as local check. In the present study the data were collected through personal interviews, group discussion and empirical observations with the help of semi-structured interview schedule and field record of Front Line Demonstration plots and local practices. To estimate the technology gap, extension gap and technology index, the following formula were used after Samui et al. (6) and Sagar and Chandra (5).

1. Technology gap: Potential Yield—Demonstration yield
2. Extension gap: Demonstration yield—Farmers yield
3. Technology index: [(Potential yield—Demonstration yield) / Potential yield] X 100

RESULTS AND DISCUSSION

The potential and field performance of the newly, released fennel varieties along with the local check were evaluated and data are presented in Table 1. The percentage increase in the seed yield over the farmers practice was 60.90, 33.98, 41.75, 28.15 and 47.09 for RF-205, RF-125, RF-145, RF-178 and AF1, respectively.

Table 1. Productivity of fennel variety, yield gap and technology

Variety	No. FLDs	Area (ha)	Potential Yield (q/ha)	FLD Yield (q/ha)	Local check Yield (q/ha)	% Increase	Technology Gap (q/ha)	Extension gap (q/ha)	Technology Index
RF-205	20	10.5	21.20	16.50	10.30	60.19	4.70	6.20	22.17
RF-125	15	8.5	20.90	13.80	10.30	33.98	7.10	3.50	33.97
RF-145	10	6.8	20.80	14.60	10.30	41.75	6.20	4.30	29.81
RF-178	10	5.5	20.10	13.20	10.30	28.15	6.90	2.90	34.33
AF1	10	5.5	22.75	17.90	10.30	47.09	4.85	7.60	21.32

Table 2. Economics of cultivation of fennel

Sl. No.	Variety	Yield q/ha	Cost of cultivation (Rs/.ha)	Gross return (Rs/ha)	Net return (Rs./ha)	B:C ratio	% of additional yield over FP (q/ha)	Additional return over FP (Rs./ha)
1	RF-205	16.50	13600	41080	27480	2.02	6.02	16000
2	RF-125	13.80	16458	43245	26787	1.63	3.39	14579
3	RF-145	14.60	18987	40900	21913	1.15	4.18	16890
4	RF-178	13.20	17700	39700	22000	1.24	2.81	17120
5	AF1	17.90	13900	44600	30700	2.21	4.71	18000
	Average	15.20	16129	41905	25776	1.60	4.22	16518
6	Local check		14110	19500	5390	0.38	-	-

The technology gap was large that ranged from 4.70 q/ha for RF-205 to 7.10 q/ha for RF- 125, which corroborates to the gap in demonstrated yield over potential yield. The technology gap observed may be attributed to variation in the soil fertility, weather conditions and implementation of management practices. Though the technology among the varieties did not vary widely, development of location specific technology appears to be necessary to achieve the expected yields from different fennel varieties. The lowest yield but one, was recorded in the demonstration plot for the variety RF-178, which did not perform up to the mark indicating a technology gap of 6.90 q/ha. RF-145 and AF1 and showed the technology gap of 6.20 q/ha and 4.85 q/ha respectively, which need some more efforts from the extension agencies to bridge.

Comparatively higher extension gap (7.60 q/ha) was recorded for variety AF-1, followed by RF-205 (6.20 q/ha) and RF-145 (4.30 q/ha). It is indicated that there is need to educate the farmers through various means for optimizing the seed yield by adopting the improved fennel technology practices as technology gap is realizable under on-farm conditions. More use of newly released high yielding varieties by the farmers will subsequently change existing trend of extension gap as to reverse. The new technology will eventually motivate the farmers to adopt the promising technology with use of proper management practices for increasing the profitability. The technology index shows the feasibility of the evolved technology at the farmer's field. The lower value of technology index more is the feasibility of the technology. The technology index of variety AF1 (21.32 %) is closely followed by RF-205 (22.17%). The higher technology index of variety RF-178 (34.33%), RF-125 (33.97%) and RF-145 (29.81%) indicate existence of a considerable gap between the technology performance at research station and the farmers' field.

The technology index of three fennel varieties are AF1, RF-205 and RF-125 point that these varieties are performing quite well in the arid conditions and will help to increase the productivity of fennel in this area through the adoption of improved practices. It is also supported with performance of the variety, AF1 and RF-178 in terms of economic returns than the others varieties, except local check (Table 2). The findings are in line with the findings of Meena and Singh (4).

Return-cost analysis of the Front Line Demonstrations

It is important to know the economical yardstick of the demonstrated fennel technology as compared to the existing practices of the farmers. All the input-output cost data, except fixed cost were recorded during the season and analyzed. The comparative benefit cost analysis data are presented in Table 2.

Highest net return was obtained from AF1 variety (Rs. 30700/ha) followed by RF-205 (Rs.27480/ha), RF-125 (Rs.26787/ha), RF-178 (Rs. 22000/ha), RF-145 (Rs.21913/ha) and Local Soaf (Rs.5390/ha). On an average cost of cultivation per hectare was Rs. 16129, giving a net return of Rs.25776 per hectare due to high price of the seed in year 2010, which ranged from Rs. 5500 to Rs. 6000 per quintal. In terms of benefit-cost ratio, the variety NRCSS-AF1 ranked first (2.21) followed by RF-205 (2.02), RF-125 (1.63), RF-178 (1.24), RF-145 (1.15), and Local

check (0.38), respectively. The Local variety did not give comparatively encouraging results in terms of benefit cost and net return.

Variety-wise comparison of additional gain showed that the demonstrated improved varieties gave more yield under FLDs that ranged from 2.82 per cent from the variety FR-178 to 6.02 per cent from the variety RF-205 over farmers' practice. Besides that, the additional economic return obtained ranged from Rs.14589/ha from the variety RF-125 to Rs.18000/ha from the variety above data that the AF1 gave more benefit due to less involvement in cost of cultivation and AF1 gave more yield as the variety is well fitted under the agro-climatic conditions. The findings are confirmed with the findings of Khan *et al.* (2), Meena *et al*. (3) and Singh *et al*. (7).

CONCLUSION

Under diversified agro-climatic conditions, three varieties of fennel viz., AF1, RF-205 and RF-125 have given encouraging results over local check and have potential to perform well with timely management practices in arid condition of Rajasthan. These varieties may be popularized with full package of practices to explore the potential in field conditions and mitigate the extension gap simultaneously efforts need to be made to reduce the large technology gap described in this paper. In economic view, an additional cost mainly for inputs was increased slightly in FLDs over local check. However, it was recovered by increasing gross and net return substantially and resulted in more benefits cost ratio than the local check. The use of latest production technologies with timely systematic management would increase productivity of fennel and income of the small and margerd farmers who are mainly associated with this crop. There is need to implement multi-pronged strategy, which includes vertical and horizontal productivity growth through better adoption.

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