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Assessment of variatal performance, technological gap and productivity gain through front line demonstrations in fenugreek

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ABSTRACT

In all 27 Front Line Demonstrations (FLDs) on fenugreek with three interventions (improved varieties, seed treatment and recommended dose of fertilizers) under National Agricultural Innovation Project (Component-2) were conducted at Farmers' fields of adopted village Bhanwata (Kuchamancity) in district Nagaur (Rajasthan) during winter season of the years 2011-12, 2012-13 and 2013-14. On the basis of three years' overall average, it is attributed that about 26.65% higher grain yield was recorded under FLDs than that of the farmers' traditional check/ practice. The study exhibited mean extension gap of 384 kg/ha, technology gap of 675 kg/ha with mean technology index of 27.00%. An additional investment of Rs. 2100/ha coupled with recommended nutrients, water management, plant protection measures, scientific monitoring and non-monetary factors resulted in additional mean returns of Rs. 17069/ha. On the basis of mean data of three years, overall average Incremental benefit: Cost ratio was calculated as 7.13.

Key words: Economics, Extension gap, Fenugreek, Gap analysis, Grain yield, Technology disseminaton, Technology gap.

INTRODUCTION

In India, fenugreek (*Trigonella foenum graecum* L.), an important self pollinated legume crop, commonly known as *Methi*, is mainly grown in the states of Rajasthan, Madhya Pradesh, Maharashtra, Punjab, Gujarat and Uttar Pradesh. The major districts growing fenugreek in Rajasthan are Sikar, Nagaur, Chittorghar, Jaipur, Pali, and Alwar. India is producing 113000 tonnes fenugreek grain annually from 93000 ha area having average productivity 1215 kg/ha (Tiwari *et al.*, 2013). The seeds are mainly used as flavoring agent in many vegetable preparations and having high medicinal and nutraceutical value. Fenugreek seed contains gums (20.06%), mucilage (28%), trigonelline (0.13-0.30%), and saponin (1.7%) with 370 calories per 100 g calorific value. It also contains good percentage of protein (9.5%), fat (10%), crude fiber (18.5%), carbohydrate (42.3%) and many other minor nutrients and vitamins.

So far the productivity level of fenugreek is very less (1215 kg/ha only) and main factors responsible are low level of awareness among the farming community about area specific recommended package of practices, less availability of high yielding and resistant varieties, lower adoption of recommended plant production and protection technologies besides persistence of several biotic and abiotic stresses. Introduction of high yielding varieties, farm mechanization and appropriate plant protection measures with the recommended package of practices (nutrition, irrigation and intercultural operations etc.) play a crucial role with respect to the productivity of fenugreek. Vis-a-vis effective management of biotic and a-biotic stresses at crucial time with the help of available chemicals and organic means is also very important to increase the productivity and production of the crop, which ultimately enhanced the net returns and benefit cost ratio of the growers.

Several technologies generated and varieties developed by ICAR institutes, SAUs are lying in the sink due to poor transfer of technology to the end user lead to a sizable gap between development and utilization. Hence, concentrate efforts on scientific cultivation of fenugreek are necessary to achieve higher productivity and production of quality produce. Front line Demonstrations (FLD) on farmers' field may be helpful to establish the technology at farming community (Dayanad *et al.*, 2014). Keeping these facts in view, four high yielding varieties of fenugreek with the scientific interventions like seed treatment and recommended doses of fertilizers through front line demonstrations were tested on the farmer's fields by National Research Centre on Seed Spices under National Agricultural Innovation Project

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(NAIP) Component-2 with the objectives to exhibit the performance of high yielding fenugreek varieties with scientific interventions, to compare the yield levels of local (checks) cultivar with farmers practice and FLD fields with scientific interventions and to calculate and compare the economics of scientific interventions and farmers' practice.

MATERIALS AND METHODS

The present study was carried out at National Research Centre on Seed Spices (NRCSS), Ajmer under National Agricultural Innovation Project (NAIP) Component-2 on "Value chain in major seed spices for domestic and export promotion" during *rabi* season from 2011-12 to 2013-14 (03 years) on the farmers' fields of adopted village Bhanwata (Kuchamancity) of Nagaur district of Rajasthan having arid climate. About 09 frontline demonstrations per year in about 4.5 ha area on the fields of different farmers were conducted every year. Each demonstration is of 0.5 ha in area. The soils of the working area is sandy in texture, contains low nitrogen, low to medium phosphorus and medium to high potash having organic carbon from 0.21 to 0.52 % with low water holding capacity.

Four varieties of fenugreek *viz.*, RMt-305, AFg-1, AFg-2 and AFg-3 were tested through Front Line Demonstrations (FLDs) with seed treatment and recommended doses of fertilizers and interventions compared with local variety grown with farmer's practices. The materials and inputs required for the study with respect to front line demonstrations (technologies demonstrated) and farmers' practice are given in Table 1.

A few critical inputs in the form of quality seed, balanced fertilizers, agro-chemicals for plant protection measures were provided in demonstration plots, and non-monetary inputs like timely sowing in lines and timely weeding and irrigation were also performed. Whereas, traditional practices were maintained in case of local practice or local checks. The demonstration farmers were facilitated by the NRCSS scientists in performing field operations like field preparation, sowing, sprays, weeding, harvesting etc. during the course of trainings and visits. Two On-campus and three Off-campus trainings have been organized for the group of beneficiaries.

Seed treatment was done with *Trichoderma viride* (6 g/kg) and Bavistin (2.5 g/kg) in a closed container and then shade dried for some time before sowing. For balanced nutrition, 30 kg/ha N, 40 kg/ha P_2O_5 and 20 kg/ha potassium through urea (46% N), DAP (18 % N and 46% P_2O_5) and Muriate of Potash (60% K_2O) were applied as recommended doses of fertilizers to the crop. Half dose of nitrogen and full dose of phosphorous and potassium applied at the time of seed sowing. The remaining half dose of nitrogen was given in standing crop after 30 days of sowing as top dressing. Two sprays of malathion (0.2%) at 15 days interval for the control of aphids (with the incidence) and one spray of dinocap (0.1%) for the control of powdery mildew (with the initial appearance of symptoms) were given. Growing of locally available seed of fenugreek without seed treatment and only 50 kg/ha DAP application with indiscriminate use of pesticides and fungicides is the farmer's practice prevailing in the area. The sowing was done during third week of October. The demonstrations were conducted to study the gaps between the potential and demonstration yield, extension gap and technology index. Data with respect to yield and output for demonstration plots and on local practices commonly adopted by the farmers of the area under study were collected and evaluated.

The grain yields of demonstration units were recorded and analyzed. Different parameters as suggested by Yadav *et al.* (2004) were used for gap analysis, and calculating economics. The details of different parameters and formulae adopted for analysis are as under:

Extension Gap = Demonstration Yield (DY) – Farmers' Practice Yield (FPY)

Technology Gap = Potential Yield (PY) – Demonstration Yield (DY)

$$\text{Technology Index} = \frac{PY - DY}{PY} \times 100$$

Additional Cost = Demonstration Cost – Farmers' Practice Cost

Effective Gain = Additional Returns – Additional Cost

Additional Returns = Demonstration Returns – Farmers' Practice Return

TABLE 1: Details of existing farmers' practices and scientific interventions for fenugreek cultivation.

Intervention	Farmers' practice	Scientific proven technology demonstrated
Use of seed	Locally available seed	RMt-305, AFg-1, AFg-2 and AFg-3 as improved varieties 1st from SKNCOA (SKRAU), Jobner and 2nd, 3rd & 4th from NRCSS, Ajmer
Seed treatment	No seed treatment	Seed treatment by Bavistin (2.5g/kg seed) and *Trchoderma viride* (6g/kg seed)
Fertilizer application	Application of DAP (50 kg/ha)	Application of nitrogen (30 kg/ha), phosphorus (40 kg/ha) and potassium (20 kg/ha)

Incremental B: C Ratio = Additional Returns / Additional Cost

RESULTS AND DISCUSSION

Grain yield: Performance of the interventions given revealed (Table 2) that significant increase in the yield was recorded in all the FLDs in all the years of the study period. Adoption of improved varieties of fenugreek exhibited 20.37% to 60.30% more yield over the local check. Seed treatment with bavistin exhibited 22.29% and *Trichoderma* 33.14% higher yield over local practice i.e. sowing without seed treatment. Similarly application of recommended dose of fertilizers gave 24.80% more yield than that of the farmers' practice. Scientific interventions with improved varieties and recommended package of practices are the factors responsible to exploit higher yields over traditional checks/ practices. Further, it is very much clear from the study (Table 3) that, in fenugreek grain yield, significant improvement was recorded with the interventions (improved varieties, seed treatment and recommended dose of fertilizers) given in demonstrations as compared to farmers' existing practices. Maximum yield (2041 kg/ha) under FLDs was recorded in the year 2013-14, which was 33.40 per cent higher than the yield (1530 kg/ha) obtained under farmers' practice. The increase in grain yield under demonstrations was 22.35 to 33.40 per cent higher than farmers' local practices. On the basis of the above study, it is inferred that an overall yield advantage of 26.65 per cent over farmers' practices was recorded with per hectare yield of 1825 kg under demonstrations carried out with improved varieties and scientific cultivation practices (Table 3). Similar findings have also been reported by Lal *et al.* (2013) and Singh *et al.* (2011).

Gap analysis: Evaluation of findings of the study (Table 3) stated that an extension gap of 301 – 484 kg/ha was found between demonstrated technology and farmers' practice and on average basis the extension gap was 384 kg/ha. The extension gap was highest (484 kg/ha) during 2013-14 and lowest (301 kg/ha) during 2011-12. Such gap might be attributed to adoption of improved technology especially high yielding varieties sown with the help of seed cum fertilizer drill with balanced nutrition and appropriate plant protection measures in demonstrations which resulted in higher grain yield than the traditional farmers' practices.

The study further exhibited a wide technology gap during different years. It was lowest (459 kg/ha) during 2013-14 and highest (852 kg/ha) during 2011-12. The average technology gap of all the years was 675 kg/ ha. The difference in technology gap in different years is due to better

TABLE 2: Yield performance of different varieties of fenugreek and scientific intervention as compared to local practices during 2011-14

Interventions		Yield (kg/ha)				Yield increase over local check or practice (%)
		2011-12	2012-13	2013-14	Mean	
Improved varieties	RMt-305	1570	1645	-	1607	20.37
	AFg-1	1600	1750	2031	1794	34.38
	AFg-2	-	1780	2078	1929	44.49
	AFg-3	-	-	2140	2140	60.30
	Local check	1220	1300	1486	1335	-
Seed treatment	Bavistin (2.5g kg^{-1})	1550	1660	1860	1690	22.29
	Trichoderma (6g kg^{-1})	1640	1860	2020	1840	33.14
	No seed treatment	1250	1430	1465	1382	-
Fertilizer application	NPK (30:40:20 kg/ha)	1878	2016	2114	2003	24.80
	DAP (50 kg/ha)-Farmers' practice	1570	1608	1638	1605	-

TABLE 3: Technological gap analysis of front line demonstrations on fenugreek at farmers' fields

Year	No. of FLDs	Potential yield (kg/ha)	FLD yield (kg/ha)	Farmers' practice yield (kg/ha)	Yield increase (%)	Extension gap (kg/ha)	Technology gap (kg/ha)	Technology index (%)
2011-12	09	2500	1648	1347	22.35	301	852	34.08
2012-13	09	2500	1785	1446	23.44	339	715	28.60
2013-14	09	2500	2041	1530	33.40	484	459	18.36
Overall average	09	2500	1825	1441	26.65	384	675	27.00

TABLE 4: Economic analysis of technological interventions on fenugreek at farmers' field

Year	Cost of cash input (Rs./ha)		Add. Cost in FLD (Rs./ha)	Sale price of grain (Rs./kg)	Total returns (Rs./ha)		Add. Returns in FLD (Rs./ha)	Effective gain (Rs./ha)	INC B:C ratio (IBCR)
	FLD	FP			FLD	FP			
2011-12	5100	3000	2100	30	49440	40410	9030	6930	4.30
2012-13	5100	3000	2100	40	71400	57840	13560	11460	6.46
2013-14	5100	3000	2100	56	114296	85680	28616	26516	13.63
Overall average	5100	3000	2100	42	78379	61310	17069	14969	7.13

FLD: Front Line Demonstration, FP: Farmers' Practice, INC: Incremental

performance of recommended varieties with different interventions and more feasibility of recommended technologies during the course of study. Similarly, the technology index for all demonstrations in the study was in accordance with technology gap. Higher technology index reflected the inadequate proven technology for transferring to growers and insufficient extension services for transfer of technology. On the basis of three years study, overall 27.00% technology index was recorded, which was reduced from 34.08% (2011-12) to 18.36% (2013-14). Hence, it can be inferred that the awareness and adoption of improved varieties with recommended scientific package of practices have increased during the advancement of study period. These findings are in the conformity of the results of study carried out by Meena and Singh (2011) and Dayanand *et al*. (2012).

Economic analysis: Variables like seed, fertilizers and pesticides were considered as cash inputs for the demonstrations as well as farmers' practices. Data of economic analysis presented in Table 4 exhibited that, an average additional amount of Rs. 2100/ha was incurred under demonstrations (FLDs) than FP. Economic yield as a function of grain yield and sale price were taken into consideration. Maximum additional returns (Rs. 26516/ha) were obtained in the year 2013-14 due to higher grain yield. The higher additional returns and effective yield obtained under demonstrations could be due to improved variety, scientific proven technology, non-monetary factors, timely operations of crop cultivation and scientific monitoring. The lowest and highest incremental benefit: cost ratio (IBCR) was 4.30 and 13.63 in the year 2011-12 and 2013-14, respectively depends on produced grain yield. Overall average IBCR was found as 7.13. The results of the study corroborate the findings of front line demonstrations carried out by Lal *et al*. (2013) on cumin and Singh *et al*. (2011) on seed spices.

CONCLUSION

Introduction and adoption of high yielding varieties with scientific recommended package of practices through front line demonstrations exhibited 26.65 higher yield over local check/ practice on the extra expenditure of Rs. 2100 only. This is a very meager amount can be borne by small and marginal farmers. Hence, it is clear from the study that cost is not the constraint here with respect to the adoption of the technology but unawareness and ignorance is the basic reason called extension gap. The average extension gap recorded in the investigation was 384 kg/ha. The incremental benefit cost ration (IBCR) was sufficiently high to motivate the growers for technology adoption. The program of Front Line Demonstration on fenugreek was quite effective in changing knowledge, skill and attitude of growers for scientific cultivation practices. It has been verified that yield advantage can be attained by the use of improved varieties, seed treatment, application of balanced nutrition with appropriate plant protection measures on farmer' fields. Four varieties of fenugreek (RMt-305, AFg-1, AFg-2 and AFg-3) can be recommended for central arid Rajasthan with technological interventions like seed treatment with *Trichoderma* viride (6g/kg) or bavistin (2.5g/kg) and with recommended dose of fertilizers.

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