International J. Seed Spices 6(2), July 2016:36-39

Performance of front line demonstrations on cumin at farmer's fields in Jalore district of Rajasthan

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Abstract

A field study comprising front line demonstrations on cumin consisting a improved variety (GC-4) with the scientific interventions viz., seed treatment (*Trichoderma viride* @ 8 g kg^{-1} seed to save from soil born fungi) and application of recommended doses of nutrients (40:40:0 kg ha^{-1} NPK) for balanced nutrition with appropriate plant protection schedule (Two sprays of malathion (0.2%), two sprays of dithan M-45 (0.2%) and one spray of karathan (0.1%) for the control of aphids, blight and powdery mildew, respectively) was carried out at farmers' fields in six villages viz., Alwara, Gangwas, Bavtra, Tadwa, Sayala and Keswana in Jalore district of Rajasthan during *Rabi* season of 2014-16. Findings of the study revealed that overall yield (with the maximum yield of 681.33 kg ha^{-1}) under the FLDs of improved cumin variety GC-4 with the technological interventions was increased by 36.27 % over farmers' practice/ check. Further in the study the overall extension gap of 171.49 kg ha^{-1} and technical gap of 355.76 kg ha^{-1} were recorded with 35.58 per cent technology index. The technology demonstrated was found economically viable and profitable and the maximum additional return (Rs. 29361 ha^{-1}) in demonstration with highest effective gain (Rs. 24861 ha^{-1}) and incremental B: C ratio (6.52) was obtained in the year 2014-15. The overall average additional return was Rs. 27696 ha^{-1} with effective gain of Rs. 22946 and incremental B: C ratio of 5.83.

Key words : B: C ratio, cumin, front line demonstration, improved variety, net returns.

Introduction

Cumin (*Cuminum cyminum* L.) belongs family Apiaceae and grown in arid and semi arid regions of India especially Rajasthan and Gujarat (Lal *et al.*, 2011). Annually, it is grown in about 8,89,760 hectares area producing about 4,85,500 tonnes (Anonymous, 2015). Average national productivity of this crop is remaining very less (546 kg ha^{-1}) in spite of making so many efforts by the research and developmental agencies. The major factors responsible for low productivity are: less availability of high yielding and resistant varieties, lower adoption of recommended plant production and protection technologies and low level of awareness among the farming community about area specific recommended package of practices. Introduction of high yielding varieties tolerant to diseases can solve the problem in the growing area up to some extent. Application of appropriate doses of fertilizers at right time with other recommended practices (irrigation and intercultural operations etc.) also play a crucial role with respect to cumin productivity (Lal *et al.*, 2011). Effective management of biotic and a-biotic stresses at crucial time with the help of available chemicals and organic means is very important to increase the productivity and production of the crop, which ultimately enhanced the net returns and benefit cost: ratio of the farmers.

Jalore, situated in the southern part of Thar Desert of Rajasthan, represented by sandy soils with scorching heat (up to 46° C temperature) in summers and receives low rainfall. The district is having underground water at many places and farmers exploiting it by tube wells. Some area of the district is also covered with Narbada Canal Command practicing micro irrigation system. Many farmers of this district were away from the improved agricultural technologies and were doing the farming with available local varieties and practices. Keeping these facts in mind, a high yielding variety of cumin with the scientific interventions like seed treatment and recommended dose of fertilizers with appropriate plant protection schedule through front line demonstrations was tested on 13 farmer's fields by ICAR-National Research Centre on Seed Spices (NRCSS) with the following objectives:

1. To exhibit the performance of improved cumin variety with scientific package of practices in the growing area.
2. To compare the yield levels of FLD fields with farmers practice/ local check.

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3. To compare the economics of farmers' practice and scientific interventions (FLDs).

Materials and methods

This field study was carried out by ICAR-National Research Centre on Seed Spices (NRCSS), Ajmer during Rabi season from 2014-15 to 2015-16 (02 years) on farmers' fields of six villages viz., Alwara, Gangwas, Bavtra, Tadwa, Sayala and Keswana in Jalore district of Rajasthan having arid climate. In all 13 frontline demonstrations about 6.5 ha area in different villages were conducted. Each demonstration is of 0.5 ha in area. The soil of the district is generally sandy in texture, contains low nitrogen, low to medium phosphorus and medium to high potash having organic carbon from 0.20 to 0.27 % with low water holding capacity.

Prominent variety of cumin, GC-4 was tested through Front Line Demonstrations (FLDs) with seed treatment, application of phosphate and nitrogen fertilizers and appropriate plant protection schedule as scientific interventions compared with local variety grown with farmer's practices. Materials and inputs needed for the study with respect to farmers' practice and technologies demonstrated (FLDs) are presented in Table 1.

A few critical inputs in the form of quality seed, balanced fertilizers, agro-chemicals were provided and non-monetary inputs like timely sowing in lines and timely weeding and irrigation were also performed in demonstration plots. Whereas, traditional practices were maintained in case of local practice or local checks. The farmers under demonstrations were facilitated by the scientists of ICAR-NRCSS, Ajmer and ARS, Jalore in performing different field operations like field preparation, sowing, sprays, weeding, harvesting etc. during the course of the trainings and visits.

Cumin seed was treated with *Trichoderma viride* (8g kg^{-1}) in a closed container and then shade dried for some time before sowing. Line sowing was performed with the help of seed cum fertilizer drill. The phosphorous was supplied through DAP (46% P_2O_5) before sowing at the time of field preparation. The nitrogen was given in three split doses. First through DAP (18 % N) before sowing in the field as basal dose (15.65 kg N) and remaining two doses through urea (46% N) after 40 and 65 days of sowing as top dressing. Two sprays of malathion (0.2%) at 15 days interval (with the incidence of aphids), two sprays of dithan M-45 (0.2%) at 15 days interval (at 60 and 75 DAS) and one spray of karathan (0.1%) with the initial appearance of symptoms of blight and powdery mildew, respectively were applied. Growing of locally available variety of cumin without seed treatment and application of only 23 kg ha^{-1} nitrogen at 60-65 days after sowing with indiscriminate use of pesticides and fungicides is the farmer's practice prevailing in the area. The sowing was done during second week of November. The FLDs 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 FLD 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 analysed. Different parameters as suggested by Yadav *et al.* (2004) were used for calculating gap analysis, costs and returns. The details of different parameters are as under :

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

Table 1. Details of scientific interventions and existing farmer's practices for cumin cultivation.

S. No.	Intervention	Farmers' practice	Scientific proven technology demonstrated
1.	Use of seed	Locally available seed	GC-4 as improved variety from CRRS (SDAU), Jagudan
2.	Sowing method	Broadcasting	Line sowing by tractor operated seed cum fertilizer drill
3.	Seed treatment	No seed treatment	Seed treatment by *Trchoderma viride* (8gkg^{-1} seed)
4.	Fertilizer application	23:0:0 kg NPK ha^{-1}	40:40:0 kg NPK ha^{-1})
5..	Plant protection measures	Irregular use of chemicals	Two sprays of malathion (0.2%), two sprays of Dithan M-45 (0.2%) and one spray of karathan (0.1%) for the control of aphids, blight and powdery mildew, respectively

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

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

Additional Cost = Demonstration Total Cost – Farmer's Practice Total Cost

Effective Gain = Additional Return – Additional Cost

Additional Return = Demonstration Return – Farmer's Practice Return

Net returns = Total (Gross) Returns – Total Cost of Production

Incremental B : C Ratio = Additional Return / Additional Cost

Results and discussion

Seed yield

Results of the present study revealed that significant enhancement in the seed yield of cumin was recorded with the scientific interventions given in demonstrations as compared to farmers' existing practices. Maximum yield (681.33 kg ha^{-1}) under FLDs was recorded in the year 2014-15 which was 37.50 per cent higher than that of the yield (495.50 kg ha^{-1}) obtained under farmers' practice. Yield increase under demonstrations was 34.92 to 37.50 per cent higher than farmers' local practices/ check. An overall yield advantage of 36.27 per cent over farmer's practices was recorded with per hectare yield of 644.24 kg ha^{-1} under demonstrations carried out with improved variety GC-4 and scientific cultivation practices (Table 2). Similar results have also been reported by Lal *et al*. (2015 b & c) in fenugreek and Singh *et al.* (2011) on seed spices.

Gap analysis

It is clear from the data (Table 2) that an extension gap of 157.14 – 185.83 kg per hectare was recorded between demonstrated technology and farmer's practice and on average basis the extension gap was 171.49 kg per hectare. The extension gap was highest (185.83 kg ha^{-1}) during 2014-15 and lowest (157.14 kg ha^{-1}) during 2015-16. Such gap might be attributed to adoption of improved technology especially high yielding variety 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.

Findings of the above study further exhibited a wide technology gap during both the years. It was lowest (318.67 kg ha^{-1}) during 2014-15 and highest (392.86 kg ha^{-1}) in during 2015-16. The average technology gap of both the years was 355.76 kg ha^{-1}. The difference in technology gap in different years is due to better performance of GC-4 variety with different interventions and more feasibility of recommended technologies during the course of study. Similarly, the technology index for all demonstrations in the above study was in accordance

Table 2. Yield and gap analysis of front line demonstrations on cumin.

Year	Area (ha)	No. of FLDs	Potential yield (kg ha^{-1})	Demo. yield (kg ha^{-1})	F.P. yield (kg ha^{-1})	Yield increase over F.P. (%)	Ext. gap (kg ha^{-1})	Tech. gap (kg ha^{-1})	Tech. index (%)
2014-15	3.0	06	1000	681.33	495.50	37.50	185.83	318.67	31.87
2015-16	3.5	07	1000	607.14	450.00	34.92	157.14	392.86	39.29
Overall average	3.25	6.5	1000	644.24	472.75	36.27	171.49	355.76	35.58

Demo.= Demonstration, FP=Farmers' practice, Ext.= Extension, Tech.= Technology

Table 3. Economic analysis of front line demonstrations on cumin.

Year.	Cost of cash inputs (kg ha^{-1})	Fixed cost (kg ha^{-1})	Total cost (kg ha^{-1})		Add. cost in demo. (kg ha^{-1})	Sale price of grain (Rs/qt)	Total returns (kg ha^{-1})		Additional returns in demo. (kg ha^{-1})	Effective gain (kg ha^{-1})	INC B:C ratio (IBCR)
			Demo.	FP			Demo.	FP			
2014-15	7000	16000	23000	18500	4500	15800	107650	78289	29361	24861	6.52
2015-16	7500	16000	23500	18500	5000	16500	100178	74250	25928	20928	5.19
Overall average	7250	16000	23250	18500	4750	16150	104045	76349	27696	22946	5.83

Demo. = Demonstration, INC = Incremental, FP = Farmers' practice

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 two years study over all 35.58 technology index was recorded. These results are in the corroboration of the findings of Lal *et al.,* (2013 and 2015a) in cumin and Lal (2014) in fenugreek.

Economic analysis

In the above study variables like seed, fertilizers and pesticides were considered as cash inputs for the FLDs as well as farmer's practices. Economic analysis data presented in Table 3 revealed that on overall average basis, an amount of Rs. 23250 ha^{-1} was incurred under demonstrations and Rs. 18500 ha^{-1} under Farmer's practice (FP). An average additional amount of Rs. 4750 ha^{-1} was incurred under demonstrations than FP. Economic yield as a function of seed yield and sale price were taken into consideration. Maximum additional returns (Rs. 29361 ha^{-1}) were obtained in the year 2014-15 due to higher seed 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 5.19 and 6.52 in the year 2015-16 and 2014-15, respectively depends on produced seed yield. Overall average IBCR was found as 5.83. The findings of this study is in the confirmation of the results of earlier studies carried out by Lal *et al.,* (2013), and Lal *et al.,* (2015a) on cumin, Lal (2014) in fenugreek and Singh *et al.,* (2011) on seed spices.

Conclusion

It is concluded from the above study that average yield of cumin FLDs with improved variety GC-4 and scientific technologies was 36.27 per cent higher than the yield obtained under farmer's practice. Further, it is obvious from this study that technology transfer through front line demonstration programme was effective in changing attitude, knowledge and skill of the growers by using improved variety and recommended package of practices of cumin cultivation. This study verified that yield advantage can be attained by the use of improved variety, seed treatment, application of balanced nutrition with appropriate plant protection schedule on farmer fields. Cumin variety GC-4 can be recommended for south western arid Rajasthan with technological interventions like seed treatment with *Trichoderma* (8.0g kg^{-1}) and application of 40 kg ha^{-1} each of nitrogen and phosphorous with two sprays of malathion (0.2%), two sprays of dithan M-45 (0.2%) and one spray of karathan (0.1%).

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Received : January 2016; Revised : March 2016; Accepted : May 2016.