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Performance of improved varieties and technological interventions at farmers' fields for cumin cultivation

G Lal*, R S Mehta, P Chand[1], A S Godara[2] & H Cheriyan[3]

ICAR-National Research Centre on Seed Spices,
Tabiji, Ajmer-305 206, Rajasthan.
**E-mail: glal67@yahoo.co.in*

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Abstract

Front line demonstrations on cumin consisting of two improved varieties (GC-4 and RZ-209) with scientific interventions *viz*., seed treatment (Bavistin @2.5 g kg^{-1} seed and *Trichoderma viride* @4 g kg^{-1} seed), and pre-emergence application of oxadiragil (Raft) @75 g a.i. ha^{-1} for effective weed management and application of recommended doses of nutrients (40:40:0 kg ha^{-1} NPK) for balanced nutrition and 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)] were carried out at farmers' fields in two villages (Kajipura and Bhadal) of Jaipur and one village (Karad) of Sikar district of Rajasthan during *Rabi* season of 2011–12 and 2012–13. Study revealed that overall yield was increased by 21.09% over farmers' practice due to the technological interventions with average yield of 536.50 kg ha^{-1}. Overall extension gap of 112.50 kg ha^{-1} and technical gap of 463.50 kg ha^{-1} were recorded in the study with 46.35% technology index. Maximum additional return (Rs. 15,875 ha^{-1}) with highest effective gain (Rs. 10,775 ha^{-1}) and incremental B: C ratio (3.11) were obtained in the year 2011–12. However, the overall average additional return was Rs. 14601 ha^{-1} with effective gain of Rs. 9,401 ha^{-1} and incremental B: C ratio of 2.81.

Keywords: cumin, improved varieties, technological gap, technology

Cumin (*Cuminum cyminum* L.) is one of the important seed spices grown in arid and semi arid regions of India especially Rajasthan and Gujarat (Lal *et al*. 2011). The area and production of cumin in Rajasthan has increased from 1,69,142 ha and 42,728 tonnes in 2008–09 to 3,30,634 ha and 1,14,925 tonnes in 2010–11 (DGCI & S, Calcutta). Similarly the productivity of cumin in Rajasthan increased from 253 kg ha^{-1} (2008–09) to 348 kg ha^{-1}

[1]Krishi Vigyan Kendra, Chomu (Jaipur), Rajasthan.
[2]ATC, Ajmer, Rajasthan.
[3]Directorate of Arecanut and Spices Development, Kozhikode, Kerala.

(2010–11). However, there is a scope to improve the yield in Jaipur and Sikar districts, which are situated in eastern and northern part of Rajasthan, respectively and represented by sandy to sandy loam soils with temperature range of -2°C in winter and 48°C in summer and receives from 450 to 550 mm annual rainfall. Many farmers in these districts grow cumin with available local varieties and practices without adopting improved technologies. Keeping these facts in mind, two high yielding varieties, seed treatment, weed management and recommended dose of fertilizer application with appropriate plant protection schedule through front line demonstrations were tested in three villages by ICAR-National Research Centre on Seed Spices (ICAR-NRCSS), Ajmer with the help of KVK, Chomu (Jaipur).

The study was carried out during *rabi* season from 2011–12 and 2012–13. A total of 10 farmers were selected from three villages *viz*., Kajipura and Bhadal of Jaipur district and Karad of Sikar district of Rajasthan to test two high yielding varieties of cumin (GC-4 and RZ-209). In demonstration plots, a few critical inputs in the form of quality seed, weedicide, balanced fertilizers, agro-chemicals were provided (Table 1) and non-monetary inputs like timely sowing in lines and timely weeding and irrigation were also performed. Sowing was done during second week of November and harvesting in the second week of March. Locally cultivated variety called *Deshi Jeera* as practiced by non-adopted farmers with their own management system was taken as the local check. The data in the study were collected through personal interviews, group discussion and empirical observations with the help of semi structured interview schedule and field records of FLD plots and local practices. To estimate the technology gap, extension gap and technology index, the following formulae were used (Yadav *et al.*, 2004).

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

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

Technology Index = [(PY – DY) / (PY)] × 100

Additional Cost = (Demonstration Total Cost) – (Farmers' Practice Total Cost)

Effective Gain = (Additional Return) – (Additional Cost)

Additional Return = (Demonstration Return) – (Farmers' Practice Return)

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

Incremental B: C Ratio = (Additional Return) / (Additional Cost)

The potential and field performance of the improved varieties of cumin along with the local

Table 1. Scientific interventions under FLDs and existing farmers' practices for cumin

S. No.	Intervention	Farmers' practice	Scientific proven technology demonstrated
1.	Use of seed	Locally available seed	GC-4 and RZ-209 as improved varieties from CRRS (SDAU), Jagudan and SKNCOA (SKRAU), Jobner
2.	Sowing method	Broadcasting	Line sowing by tractor operated seed cum fertilizer drill
3.	Seed treatment	No treatment	Seed treatment by Bavistin (2.5g kg^{-1} seed) & *Trchoderma viride* (4 g kg^{-1} seed)
4.	Use of herbicides	No treatment	Pre-emergence application of oxadiragil (Raft) @75g a.i. ha^{-1}
4.	Fertilizer application	20:0:0 kg NPK ha^{-1}	40:30:0 and 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

check were evaluated and data are presented in Table 2. The grain yield was significantly improved with the interventions given in demonstrations as compared to farmers' existing practices. Maximum yield (556 kg ha^{-1}) was recorded in the year 2012–13, which was 17.62% higher than the yield (458 kg ha^{-1}) obtained under farmers' practice. The increase in grain yield under demonstrations was up to 24.56% higher than farmers' local practices. On the basis of the above study, it was inferred that an overall yield advantage of 21.09% over farmers' practices was recorded under demonstrations carried out with improved varieties and scientific cultivation practices. The data (Table 2) further revealed that an extension gap of 98–127 kg ha^{-1} was found between demonstrated technology and farmers' practice and on average basis the extension gap was 112.50 kg ha^{-1}. The extension gap was highest (127 kg ha^{-1}) during 2011–12 and lowest (98 kg ha^{-1}) during 2012–13. 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 investigation further exhibited a wide technology gap during both the years. It was lowest (444 kg ha^{-1}) during 2012–13 and highest (483 kg ha^{-1}) during 2011–12. The average technology gap of both the years was 463.50 kg ha^{-1}. The difference in technology gap in the years is due to better performance of recommended varieties with different interventions and more feasibility of recommended technologies. Similarly, the technology index for all demonstrations in the study was in accordance with technology gap. On the basis of this study, technical index of 46.35 was recorded, which was reduced from 48.30 (2011–12) to 44.40 (2012–13). Hence, it can be inferred that the awareness and adoption of improved package of practices has increased during the study period. Different variables like seed, weedicides, fertilizers and pesticides were considered as cash inputs for the demonstrations as well as farmers' practices. Data of economic analysis presented in Table 3 exhibited that on overall average basis, an amount of Rs. 22,600 ha^{-1} was incurred under demonstrations and Rs. 17,400 ha^{-1} under Farmers' practice (FP). An average additional amount of Rs. 5,200 ha^{-1} was incurred under demonstrations than FP. Economic yield as a function of grain yield and sale price were taken into consideration. The overall average additional return (Rs. 14,601 ha^{-1}) was obtained due to higher grain yield in demonstrations than the FP. 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 2.51 and 3.11 in the year 2012–13 and 2011–12, respectively. Overall average IBCR was found as 2.81. The results of the study confirmed the findings of front line demonstrations by Lathwal (2010) on black gram, Singh *et al.* (2011) on seed spices and Dayanand *et al.* (2012) on mustard.

It can be concluded from the study that the average yield of the FLDs with improved varieties and scientific technologies was 21.09%

Table 2. Grain yield and gap analysis of frontline demonstrations on cumin at farmers' field

Year	Area (ha)	No. of FLDs	Potential yield (kg ha^{-1})	Demo yield	FP yield (kg ha^{-1})	Yield increase over FP (%)	Ext. gap	Tech. gap	Tech. index (%)
2011–12	2.5	5	1000	517.0	390	24.56	127.0	483.0	48.30
2012–13	2.5	5	1000	556.0	458	17.62	98.0	444.0	44.40
Overall average	2.5	5	1000	536.5	424	21.09	112.5	463.5	46.35

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

Table 3. Economic analysis of front line demonstrations on cumin at farmers' field

Year	Cost of cash inputs	Fixed cost	Total cost (Rs ha^{-1})		Add. cost in demo (Rs ha^{-1})	Sale price of grain (Rs q^{-1})	Total returns(Rs ha^{-1})		Additional returns in demo	Effective gain	INCB:C ratio (IBCR)
	(Rs ha^{-1})		Demo	FP			Demo	FP	(Rs ha^{-1})		
2011–12	6400	16000	22400	17300	5100	12500	64625	48750	15875	10775	3.11
2012–13	6800	16000	22800	17500	5300	13600	75616	62288	13328	8028	2.51
Overall average	6600	16000	22600	17400	5200	13050	70120	55519	14601	9401	2.81

Demo=Demonstration; INC=Incremental; FP=Farmers' practice

higher than the yield under farmers' practice. Front line demonstration programme was effective in changing attitude, skill and knowledge by using improved varieties and recommended package of practices. Both the varieties of cumin (GC-4 and RZ-209) can be recommended for semi-arid conditions of Rajasthan with technological interventions like seed treatment with bavistin (2.5 g kg^{-1}), use of oxadiragil (pre-emergence) @75g a.i. ha^{-1} and application of 40 kg ha^{-1} each of N and P with two sprays of malathion (0.2%), two sprays of dithane M-45 (0.2%) and one spray of karathan (0.1%).

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