International J. Seed Spices 10(1), January 2020:20-26

Technological interventions' impact of the performance of coriander through FLDs in TSP area of Banswara

G. Lal[1], N.K. Meena[*1], R.S. Meena[1] and B.S. Bhati[2]

[1]ICAR-National Research Centre on Seed Spices, Tabiji, Ajmer- 305 206, Rajasthan

[2]Krishi Vigyan Kendra (MPUA&T), Borvat, Banswara, Rajasthan

Abstract

A total 63 Front Line Demonstrations (FLDs) on coriander (*Coriandrum sativum* L.) were organized on the farmers' field in tribal hamlets of Banswara district-a 'Mewar Wagar' region of Rajasthan for demonstrating the production potential in form of complete package of practices comprising improved variety ACr-1 during *Rabi* seasons from 2014-15 to 2017-18 under irrigated farming conditions. The improved practices (FLDs) recorded an average yield ranging from 12.40 to 13.71 q ha^{-1} with an average yield 13.07 q ha^{-1} and average potential yield 15.44 q ha^{-1}. The per cent increase in yield under improved practices (FLDs) ranged from 28.45 to 40.38 per cent with an average of 33.77 per cent. Net return (ha^{-1}) was obtained in range between ₹ 27025 to ₹ 54160 in improved practices. The average extension gap, technology gap and technology index were 3.50 q ha^{-1}, 2.37 q ha^{-1} and 15.26 per cent, respectively. The improved practices gave higher benefit cost ratio ranging from 1.8 to 2.5 with a mean of 2.1 compared to local checks (1.6) being grown by the tribal farmers under locality with farmers practices. It is considered as success story for the region, hence the variety ACr-1 of coriander with scientific package of practices is recommended for Banswara district of Rajasthan

Key words : Banswara, *coriandrum sativum* L., front line demonstrations, gap analysis, TSP area, scientific package of practices

Introduction

Coriander (*Coriandrum sativum* Linn.), is an important and valuable seed spice crop next to cumin, belongs to family Apiaceae, genetically influence with chromosome number 2n= 22. Plants are soft, erect to bushy type, growing to 50 cm to 170 cm tall. The leaves are variable in shape, broadly lobed at the base of the plant, and slender and feathery higher on the flowering stems. It is mainly grown in India, Russia, Mexico, Iran, Syria, China, Bulgaria, Turkey, Egypt, Morocco, Ukraine, Afghanistan, Italy and Canada. In India, it is mainly growing in Rajasthan, Madhya Pradesh, Gujarat, Haryana, Uttar Pradesh, Bihar, Andhra Pradesh and Tamil Nadu. In the country it is growing in an area of 535.55 thousand hectare, producing 715.65 thousand tonnes of seeds along with average annual productivity of 1336 kg ha^{-1} in 2017-18 (Anonymous, 2019 and Lal *et al*., 2018 a) reflecting as largest producer, consumer and major exporter country in the world (Lal *et al*., 2020 a). It is cultivated mainly as a winter season crop for seed production; however, in some part of Rajasthan, Gujarat and North Eastern states, it is growing in summer for leafy purpose. Coriander is primarily used for flavoring, seasoning and imparting aroma in variety of food items and beverages (Meena *et al*., 2017). Besides importance in food industry, it has several medicinal properties, used in various pharmaceutical preparations and also in cosmetic industry (Lal *et al*., 2018 c). The seeds are used in thickening and flavoring soups, curries and liquors (Lal *et al*., 2020 b) It has massive nutritional properties of which matured dry seeds contain 6.3–8.0% moisture, 0.3–1.7% volatile oil, 19.6% non-volatile oil, 1.3% protein, 24.0% carbohydrates, 5.3% mineral matter and vitamin A 175 IU per 100 g. Its green leaves contain 87.9% moisture, 1.7% mineral matter, 3.3% protein, 6.5% carbohydrates and 0.6% fat.

The coriander yield is adversely affected by incidence of several diseases like stem gall, wilt, powdery mildew and sclerotium rot as well as insect's infestation of aphid, jassids and thrips. It can be cultivated in all types of soils but well drained red loam and black cotton soils are more suitable for the crop. Banswara district is the southern part of Rajasthan, pronounces in the name of '*Mewar Wagar*' region. The district is lying between 23° 30' N latitude and 74° 24' E longitude, receives annual average rainfall of 1000 to 1200 mm. Banswara district has more than 70 per cent tribal population living in rural hamlets. The area is having heavy soils with high carbon and organic matter, good for coriander cultivation. Tribal farmers of

*Corresponding author email: narottammeena@gmail.com

the district have small land holding with undulated fields. The farmers in tribal area of Banswara district are growing coriander in small pockets both for leaf and seed purpose since long back using local or farmer's varieties with broadcasting method of seed sowing. There is no standard package for seed treatment, irrigation pattern, insect-pests, diseases and weed management for getting higher yield. There are no seed supplying agencies working in the area to provide quality seed of improved varieties this crop to the farmers and also lacking in mechanization for seed sowing, weeding, harvesting, threshing and packaging. The front line demonstrations programme was an effective tool for increasing the productivity of crop and changing knowledge, attitude and skill of tribal farmers. This created greater awareness and motivation among farmers to adopt improved practices of coriander cultivation. The main objective of FLDs is to demonstrate newly released crop variety, production and protection technologies and its management practices in the farmer's field under different agro-climatic regions and farming situations. While demonstrating the technologies at the farmer's fields, the scientists are required to study the factors constraints of production and there by generate production data and feedback information. Although, several factors and conditions are responsible for the existence of such yield gaps but the nature and extent of adoption of the improved technology is primarily concerned with such gaps and has direct bearing on the farmers production output. Keeping these points in view, such study was conducted in tribal area of Banswara district of Rajasthan to examine some important aspects related to the utilization of the recommended package of practices technology. These aspects include adoption of improved practice of seed spices production particularly coriander by the tribal farmer's.

Materials and methods

The present study on impact assessment of front line demonstrations (FLDs) of stem gall resistant coriander variety ACr-1 (Lal *et al*., 2015 c, Lal *et al*., 2018 b, and Lal *et al*., 2020 b) developed and released by ICAR-NRCSS, Ajmer was carried out on farmers' field at tribal hamlets in Banswara district of Rajasthan. The rural hamlets having more than 70 per cent population of tribal farmers were selected for this study. Farmers' selection for FLDs was made with the help Krishi Vigyan Kendra (MPUA&T), Banswara as well as few farmers were directly selected by NRCSS. All type of large, medium and small size farmers were included in the study. Causes of low yield of coriander were identified and prioritized through preliminary survey and discussion with the selected farmers before initiation of front line demonstrations and based on the major causes, technological interventions were finalized. Front line demonstrations were conducted under TSP Scheme of ICAR-NRCSS, Ajmer for four consecutive years during *Rabi* season of 2014-15, 2015-16, 2016-17 & 2017-18. A total of 15.75 hectare area was covered under 63 front line demonstrations in four years, contributing 0.25 hectare area in individual demonstration. The main objective of FLDs is to demonstrate newly released crop variety, production and protection technologies and its management practices on farmer's field under different agro-climatic regions and farming situations for prompt dissemination of technologies among farming communities. Through the front line demonstration programme, economic feasibility of technology transfer and adoption was also evaluated. The crop was sown from 2nd week of October to 1st week of November of every year. During this period various extension activities like farmers' capacity building program, workshop, scientist-farmer interaction, field visits and exposure visits were undertaken which benefitted the beneficiaries. The whole package approach demonstrated to farmers through front line demonstrations including the components such as improved variety, seed rate, seed treatment, crop geometry and method of sowing, recommended dose of fertilizers, irrigation schedule, weed management and plant protection measures (Table-1). During cropping period from seed sowing to harvesting, systematic supervision was done by the scientists of ICAR-NRCSS, Ajmer as well as KVK, Borvat, Banswara.

Yield data of coriander was recorded both for FLDs as well as local cultivar with farmers' practices. The yield appreciation was calculated for individual FLD as well as a whole and percentage of yield increase was calculated. The generated data were utilized for calculating the technology gap, extension gap and technology index. The extension gap, technology gap and technology index were calculated using the formula as suggested by Samui *et al*. (2000)

Technology gap = Potential yield – Demonstration yield

Extension gap = Demonstration yield – Farmers yield

Technology index (%) =

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

Results and discussion

The results of 63 front line demonstrations, conducted in 15.75 hectare areas on farmers field at tribal hamlets in

Banswara district of southern Rajasthan during *Rabi* 2014-15 to 2017-18 for overall performance of coriander variety ACr-1 in the region, showed in Tables 1 to 4. The interventions applied in the field, both for demonstrations and farmers practices right from field preparation to crop harvesting are presented in Table 1. It includes the divergence in adoption of front line demonstrations (improved practices) and local farmer's practices (local cultivars) for coriander production technologies. It measured as per recommended package of practices in which the major differences was observed to improved variety, seed rate, seed treatment, line sowing, recommended dose of fertilizers and insect-pests, diseases and weed management (Table 1). These were considered as cultivation practices under FLDs *viz.*, use of improved and recommended varieties ACr-1 in all four consecutive years. Seed rate was kept @ 12kg ha^{-1}, seed splited for sowing, seed treatment with bavistin @ 2 g kg^{-1} followed by *Trichoderma* @ 6 g kg^{-1} seed for control of soil borne and early infection diseases. For nutrient management, well decomposed FYM @ 10 tones ha^{-1} was applied in addition RDF 60:40:20 kg N:P:K ha^{-1} provided through urea, DAP and MOP. Seeds were sown in lines as per crop geometry of 30 x 15 cm adopted. Under farmers practice, farmers used their own seed or the seeds of local variety at higher seed rate and without following standard package of practices. These differences in the packages of practices were in line with the findings of Singh and Varshney (2010), Lal (2014 a) and Lal *et al.*, (2014 b).

Yield performance of coriander (ACr-1)

The results of yield performance of coriander variety ACr-1 was obtained for four years from 2014-15 to 2017-18, are presented in the Table 2, revealed that during *Rabi*, 2014-15, the average yield 13.71 q ha^{-1} of coriander variety ACr-1 was obtained in front line demonstration plots with improved practices, which was 33.80 per cent advanced than local cultivars with farmers' practices (yield 10.25 q

Table 1. Details of scientific interventions in FLDs and farmers' practices followed in coriander cultivation at tribal area of Banswara, Rajasthan

Sl. No.	Particulars of interventions	Improved practice (Demonstrations)	Farmers practices (Local practices)
1.	Variety	ACr-1	Local
2.	Seed rate	12 kg hectare^{-1} (split seed)	20-25 kg hectare^{-1}
3.	Seed treatment	Seed treatment by bavistin (2g kg^{-1} seed) followed by *Trichoderma viride* (6g kg^{-1} seed)	No seed treatment
4.	Method of sowing	Line sowing	Broadcasting
5.	Fertilizer dose	N:P:K (60:40:20 kg ha^{-1}) applied through Urea, DAP and MOP	Urea & DAP (lower dose without knowledge)
6.	Weed management	Oxadiargyl (Pre-emergence) @ 1 lit. ha^{-1} & hand weeding in standing crop	Hand weeding
7.	Crop protections (Insects & Diseases)	Need based spray of recommended insecticide & fungicides	No use of insecticides & fungicides

Table 2. Yield performance of coriander variety ACr-1 in FLDs at tribal area of Banswara, Rajasthan

Year (*Rabi*)	Number of demonstrations	Area under demonstrations (ha)	Average yield (q ha^{-1})		Yield appreciation (%) over farmers practices
			Farmer practices	Demo. practices	
2014-15	10	2.50	10.25	13.71	33.80
2015-16	13	3.25	9.46	13.28	40.38
2016-17	20	5.00	9.23	12.90	28.45
2017-18	20	5.00	9.36	12.40	32.48
Total	**63**	**15.75**	**9.57 (Av.)**	**13.07 (Av.)**	**33.77 (Av.)**

ha^{-1}). It was also evident from the study that the similar trend was observed in second year, where, the average yield 13.28 q ha^{-1} was obtained for same variety ACr-1 under demonstration field and 9.46 q ha^{-1} yield was recorded in local cultivar with farmer practices. It showed yield appreciation of 40.38 per cent higher in FLDs over local cultivars and practices during 2015-16. In subsequent year 2016-17, an average yield (12.90 q ha^{-1}) of coriander variety ACr-1 recorded under demonstration plots was 28.45 per cent higher than the yield (9.23 q ha^{-1}) of control plots or local cultivar with farmer's practices. Similarly, the average yield 12.40 q ha^{-1} of coriander variety ACr-1 was recorded in demonstration plots, which appreciated 32.48 per cent yield than local cultivars with farmer's practices (9.36 q ha^{-1}) during Rabi, 2017-18. On an overall basis, four year's average yield 13.07 q ha^{-1} was obtained in demonstration plots at farmer's field of tribal farmers in Banswara district which appreciated 33.77 per cent over local cultivars with farmer's practices (9.57 q ha^{-1}). This appreciation in yield was obtained through adoption of improved scientific cultivation of coriander in the form of FLDs provided by NRCSS. Although, some variation in yield varied from location to location due to varying in climatic conditions as well as variations in existing agricultural practices adopted. These results indicated that the front line demonstrations have given a good impact among farming community for adoption of coriander cultivation in tribal hamlets of Banswara district because these tribal farmers also taken green leaves for sale in local markets and earned some cash amount before harvesting of coriander for seed. Findings of Verma *et al*. (2016), Lal *et al*. 2015 b and Lal *et al*. (2019) also confirm the effects under the present study.

Economic performance of coriander

The economic performance of FLDs of coriander variety ACr-1 was worked out and presented in Table 3, revealed that the cost of cultivation (₹ ha^{-1}), gross return (₹ ha^{-1}), net return (₹ ha^{-1}), additional return (%) and benefit cost ratio for demonstration plots (improved practice) and local cultivars (farmers practice) were analyzed. It inferred that the cost of cultivation for front line demonstrations placed higher than farmers practices followed. It was also found that net return was higher in FLD plots for all the years ranged from ₹ 27025 ha^{-1} (2014-15) to ₹ 54160 ha^{-1} (2016-17) as compared to local cultivars with farmer practices (₹ 13885 ha^{-1} to ₹ 31030 ha^{-1}) exhibited in same years. This was due to yield obtained as well as market price of the produce/coriander seed. Additional return was obtained in range between ₹ 13140 ha^{-1} in year 2014-15 to ₹ 23130 ha^{-1} in 2016-17. The B: C ratio was also higher in the case

Table 3. Economic performance of frontline demonstrations of coriander variety ACr-1 at tribal area of Banswara, Rajasthan

Year (*Rabi*)	Cost of cultivation (₹ ha^{-1})		Gross return (₹ ha^{-1})		Net return (₹ ha^{-1})		Additional return (₹ ha^{-1})	Benefit cost ratio	
	FP	FLD	FP	FLD	FP	FLD		FP	FLD
2014-15	32240	34670	46125	61635	13885	27025	13140	1.4	1.8
2015-16	32945	34990	50138	70384	17193	35394	18201	1.5	2.0
2016-17	33580	36140	64610	90300	31030	54160	23130	1.9	2.5
2017-18	34470	37179	56160	74400	21690	37221	15531	1.6	2.0
Average	**33309**	**35745**	**54258**	**74195**	**20950**	**38450**	**17500**	**1.6**	**2.1**

FP= Farmers practice; FLD= Front Line Demonstrations

Table 4. Yield and gap analysis of Rabi coriander variety ACr-1 on farmer's field at tribal area of Banswara, Rajasthan

Year (*Rabi*)	Crop & variety	Potential yield (q ha^{-1})	Average yield (q ha^{-1})		Technology gap (q ha^{-1})	Extension gap (q ha^{-1})	Technology index (%)
			FP	FLDs			
2014-15	Coriander (ACr-1)	15.25	10.25	13.71	1.54	3.46	10.09
2015-16	Coriander (ACr-1)	16.10	9.46	13.28	2.82	3.82	17.51
2016-17	Coriander (ACr-1)	15.80	9.23	12.90	2.90	3.67	18.35
2017-18	Coriander (ACr-1)	14.60	9.36	12.40	2.20	3.04	15.07
Average		**15.44**	**9.58**	**13.07**	**2.37**	**3.50**	**15.26**

FP= Farmers practice; FLD= Front Line Demonstrations

of FLDs plot as compared to local cultivars in all four years. The highest B: C ratio (2.5) was obtained in the year 2016-17 and lowest B: C ratio (1.8) was recorded in year 2014-15 for FLD plots, whereas, it was ranged from 1.4 to 1.9 in cultivation of coriander's local cultivar with farmer's practices. This may be due to higher yields obtained under improved technologies compared to local cultivars (farmer's practices). The above findings are in conformity with the findings of Sharma *et al.* (2013), Verma *et al.* (2016), Lal *et al.* (2015 a) and Lal *et al.* (2019) .

Yield and gap analysis

In this study, gap analysis was worked out for extension gap, technology gap and technology index of which data are presented in Table 4. It was found that the technology gap was existed in ranged between 1.54 q ha^{-1} (2014-15) to 2.90 q ha^{-1} (2016-17) with an average of 2.37 q ha^{-1} during the period of study. It was also evident from the study that the extension gap was recorded in the range of 3.04 q ha^{-1} to 3.82 q ha^{-1}, whereas, average extension gap 3.50 q ha^{-1} was apparent under demonstration plots, which emphasized the need to educate the farmers through various extension means like FLDs, on farm trials, scientists farmers interaction meets, field days and method of demonstrations for adoption of improved agricultural technologies to revert the trend of extension gap. More use of latest coriander production technologies with high yielding variety will subsequently change this alarming trend of galloping extension gap. The new technologies will eventually lead to the farmers to discontinue the old technology and adopt new technologies. The technology index showed the feasibility of evolved technology at farmer's field in a particular region. In present study, the technology index was ranged from 10.09 to 18.35 per cent with a mean of 15.26 per cent indicate higher scope for further improvement in productivity of coriander in tribal area of Banswara district of Rajasthan. The findings of this study are also in the line of the results already reported by Lal *et al.* (2014 a) and Lal *et al.* (2015 a).

Conclusions

The coriander production in Banswara district was lacking behind due to lack of awareness among farmers particularly tribal population as well as non availability resources like seed of improved variety, technological components including package of practices for seed spices and its marketing in the district. Due to above deficit resources and conventional method of cultivation, its productivity was attained at low. At that stage, ICAR-National Research Centre on Seed Spices, Ajmer initiated the front line demonstration programmes in tribal hamlets in the district

with the help of KVK (MPUA&T), Borvat, Banswara. Through FLDs of seed spices particularly coriander with complete package of practices developed by NRCSS were applied for four consecutive years enhanced the productivity of coriander variety ACr-1 under FLDs over traditional practice of coriander cultivation created greater awareness among farmers and also motivated the other farmers to adopt such appropriate production technology for getting higher yield in the tribal area of Banswara district of Rajasthan. The selection of specific technology like improved varieties, seed rate, seed treatment, line sowing, recommended dose of fertilizers and plant protection measures were undertaken in a proper way. It is concluded that the front line demonstrations programme was an effective tool for increasing the productivity of crops and changing knowledge, attitude and skill of farmers. Overall 28.45 to 40.38 per cent (2014-15 to 2017-18) yield appreciation in FLDs was recorded over farmer's traditional practice. These demonstrations also built the relationship & confidence between farmers and scientists. Looking to the yield performance and income enhancement of cultivators, variety ACr-1 of coriander with scientific package of practices is recommended for Banswara district of Rajasthan.

References

Anonymous. Estimate of area, production and productivity of spices in India, DASD, Calicut, Kerala. 2019.

Lal, G. 2018 a. Scenario, importance and prospects of seed spices: A review. *Current Investigations in Agriculture and Current Research,* 4(2): 491-498.

Lal, G. and Meena, S.S. 2018 c. Medicinal and Therapeutic Potential of Seed Spices. *Biomedical J. Scientific & Technical Research* (BJSTR), 5(4): 1-21.

Lal, G., 2014 a. Impact of adoption of scientific interventions in fenugreek on grain yield and farmers income: An assessment by FLD's in Arid Zone of Rajasthan, India. *African J. Agricultural Research,* 9(31): 2391-2396.

Lal, G., Meena, N.K., Meena, R.S. and Kanojia, Y. 2019. Impact of technological interventions of seed spices through FLDs in TSP area of Pratapgarh-A success story. *International J. Seed Spices*, 9 (2): 1-5.

Lal, G., Meena, S.S., Dubey, P.N., Lal, S. and Meena, M.D. 2020 b. Coriander (*Coriandrum sativum* L.) In: Seed Spices. Published by Daya Publishing House: A Division of Astral International Pvt. Ltd., New Delhi. (ISBN: 978-93-89605-85-3 HB), 61-77.

Lal, G., Meena, S.S., Meena, N.K. and Meena, R.D. 2018 b. Stem gall occurrences on coriander, symptomatology and management strategies. *Indian J. Arecanut, Spices & Medicinal Plants,* 20(2):10-15.

Lal, G., Meena, S.S., Singh, R., Verma, A.K. and Aishwath, O.P. 2020 a. Good agricultural practices for export oriented seed spices production in arid regions. In: Facets of good agricultural practices for domestic and export promotion of clean and safe seed spices (Eds. Lal, G., Saxena, S.N., Kant, K., Mishra, B.K., Dubey, P.N. and Verma, A.K.), published by Director, ICAR-NRCSS, Ajmer and Director, DASD (GOL), Calicut, Kerala (ISBN: 978-81-89435-58-5), 27-35.

Lal, G., Mehta, R.S., Chand, P., Godara, A.S. and H. Cherian. 2015 b. Performance of improved varieties and technological interventions at farmers' fields for cumin cultivation. *J. Spices and Aromatic Crops,* 24(2): 145-148.

Lal, G., Mehta, R.S., Godara, A.S., Mahala, H.R., Maheria, S.P. and Singh, B. 2014 b. Performance of cumin varieties and technological interventions at farmers fields in Jaisalmer district of Rajasthan. *Int. J. Seed Spices,* 4 (1): 9-13.

Lal, G., Singh, B., Khan, M.A., Singh, D.K., Gupta, I.N. and Cheriyan, H. 2015 c. Coriander variety ACr-1 safe against Stem Gall and Natural Hazards: A success story. Indian *J. Arecanut, Spices and Medicinal Plants, 17(1): 24-27.*

Lal, G., Singh, B., Singh, R., Mehta, R.S., Sharma, Y.K., Meena, R.S. and Maheria, S.P. 2015 a. Assessment of varietal performance, technological gap and productivity gain through front line demonstrations in fenugreek. *Legume Research,* 38 (5): 616-620.

Meena, N.K., Lal, G., Meena, R.S., Harisha, C.B. and Meena, S.R. 2017. Pest scenario of coriander (*Coriandrum sativum* L.) and population dynamics in semi-arid region of Rajasthan. *International J. Tropical Agriculture*, 35 (4): 779-783.

Samui, S.K., Maitra, S., Roy, D.K., Mondal, A.K. and Saha, D. 2000. Evaluation of front line demonstrations on groundnut (*Arachis hypogea* L.) in Sundarbans. *J. Indian Society of Coastal Agricultural Research*, 18 (2):180-183.

Sharma, R., Arora, D., Choudhary, P.C. and Porwal, R. 2013. Improvement of productivity of coriander (*Coriandrum sativum* L.) through front line demonstrations. *International J. Seed Spices*, 3(1):68-69.

Singh, P.K. and Varshney, J.G. 2010. Adoption level and constraints in coriander production technology. *Indian Research J. Extension Education*, 10 (1): 91-94.

Verma, A.K., Singh, M., Singh, N., Jeengar, K.L. and Verma, J.R. 2016. Dissemination of improved practices of coriander (*Coriandrum sativum* L.) through FLDs in Zone V of Rajasthan province. *International J. Science, Environment and Technology*, 5 (5): 3320 – 3327.

Received : October 2019; Revised : November 2019; Accepted : December 2019.