Indian Research Journal of Extension Education
ISSN: 0972-2181 (Print), 0976-1071 (e-Print)
NAAS Rating : 5.22
Journal homepage: seea.org.in
RESEARCH ARTICLE
https://doi.org/10.54986/irjee/2022/apr_jun/85-90

Popularization of Coriander Production Technology through Front Line Demonstrations in the Arid Zone of Gujarat

Arvind Singh Tetarwal[1] and Ramniwas[2]

1.SMS, Krishi Vigyan Kendra, Pali-Marwar (Rajasthan), 2. SMS, Krishi Vigyan Kendra, Kukma, Bhuj-Kutch (Gujarat)

Corresponding author e-mail : astetarwal@gmail.com

Received on March 29, 2022, Accepted on June 12, 2022 and Published Online on June 20, 2022

ABSTRACT

ICAR-CAZRI, Krishi Vigyan Kendra, Kukma, Bhuj did a field study on the performance of frontline demonstrations (FLDs) for increasing coriander productivity in different villages of Bhuj, Anjar, and Rapar Talukas in Kutch, Gujarat from 2016-17 to 2020-21. The improved technologies consist improved variety (Gujarat coriander 2), micro nutrient (Zn and S) application and integrated disease management using bio-pesticide Trichoderma viridae etc. Yield attributes of improved practice (IP) and farmers' practice (FP) were recorded, and percent yield increase, technology gap, extension gap, technology index, and FLD economics were examined. The average yield of demonstration plots was 1935.4 kg ha^{-1} compared to the local check (1695 kg ha^{-1}), an increase of 14.21% in average output. The average extension gap, technology gap and technology index were 240.4 kg ha^{-1}, 264.6 kg ha^{-1} and 12.03%, respectively. Demonstration plots had a greater average gross return (Rs. 1,02,606) and B: C ratio (3.19) than farmer's practice where it was Rs. 89939 and 2.91, respectively. The current findings clearly suggest that by implementing the proposed technique, the production and economics of coriander can be enhanced.

Key words : *Coriander Production Technology; Frontline demonstration; Technology gap; Technology index.*

Coriander (Coriandrum sativum L.) is a popular green vegetable and a seed spice crop with a pleasing aroma and flavour. Coriander is a member of the Apiaceae family and is native to Egypt, Turkey, and the eastern Mediterranean Sea. This is a remunerative cash crop planted primarily in India's arid and semi-arid regions during the winter season. India, Morocco, Bulgaria, Romania, Canada, China, and Syria are the main producers. Coriander production in India accounts for more than 80 per cent of total production. In India, annual coriander seed production was 7,56,000 tonnes in 2019-20, grown on 6,29,000 ha with a productivity of 1202 kg ha^{-1} (*Anonymous, 2019-20*). Madhya Pradesh, Rajasthan, Gujarat, Andhra Pradesh, Telangana, Karnataka, Maharashtra, and Assam are the states of Madhya Pradesh, Rajasthan, Gujarat, Andhra Pradesh, Telangana, Karnataka, Maharashtra, and Assam are the major coriander producing states in India. Gujarat came in third place in coriander production, with 2,18,093 tonnes produced on 1,41,221 acreages at a productivity of 1540 kg ha^{-1}. The major districts in Gujarat where this crop is commercially farmed in considerable areas are Junagadh, Rajkot, Devbhoomi Dwarka, Porbandar, Jamnagar, Amreli, Surendranagar, Kutch, Morbi, and Gir Somnath. Coriander is grown on 2700 ha in the Kutch district, with a yield of 5130 MT and a productivity of 1540 kg/ha (*Anonymous, 2020-21*). In the fiscal year 2020-21, India exported coriander seeds worth 43.27 million USD to over 140 countries, earning foreign cash.

Coriander is a tiny aromatic plant with a wide range of culinary applications around the world. It is high in fibre, which aids digestion and promotes regular bowel movements. It is well-known for its therapeutic benefits, which include being anti-diabetic and being used to treat allergies, eye infections, anaemia, and lowering bad cholesterol while promoting good cholesterol in the body. Copper, zinc, iron, and other vital minerals found in seeds help to raise RBC and enhance heart health.

Kutch district is located in Gujarat's north western region, bordered on the south and west by the Gulf of Kutch and the Arabian Sea, and on the north and east by the Great and Little Rann (seasonal wetlands). Soils are usually saline and alkaline in nature, and their texture ranges from sandy to sandy loam. The main limiting constraints in coriander production include low soil fertility, shortage and poor-quality irrigation water, high prevalence of soilborne diseases, and a lack of adoption of improved coriander production techniques. The crop is susceptible to aphids, seed midges, and leaf-eating caterpillars, as well as diseases (fusarium wilt, stem gall, and powdery mildew), which result in yield reductions.

Farmers' poor or partial acceptance of an enhanced package of practices appears to be a gap between the scientist's proposed technology and its altered form at the farmer's level. Even while farmers are eager to accept improved varieties and technology, many coriander growers continue to use local cultivars and traditional methods of cultivation. Poor adoption of high yielding varieties and indiscriminate use of chemical pesticides and fertilisers increased cultivation costs and reduced farmers' net profits. Many viable technologies have been developed by scientists with great efforts, but they have not yet reached the farming community at a sufficient rate. In general, there is a time lag between the emergence of new ideas and their implementation.

The productivity of coriander could be increased by adopting recommended scientific and sustainable management production practices (*Lal et al., 2013* and *Meena et al., 2016*). Frontline demonstration (FLD) is one of these programmes, which focuses on increasing productivity by providing vital inputs as well as improved packages of practices that have been tested by scientists from ICAR Institutes and State Agricultural Universities (SAUs). The yields are higher when high yielding variety seed, recommended seed rate, seed treatment, planting time, appropriate fertiliser dose, weed control, and integrated pest and disease management are used, as opposed to farmer's practices. Other key aspects of this initiative include promoting the farming of improved varieties, receiving feedback from farmers concerning barriers to adoption of recommended improved technologies for further research, and maximising the technology diffusion process among farmers (*Nagarajan et al.*, 2001).

In light of these considerations, we conducted FLDs in farmers' fields to encourage the adoption of the high-yielding variety Gujarat Coriander-2 as well as an improved package of practices in the arid Kutch, with the goal of increasing productivity and increasing net profit from this spice crop. With this in mind, the current study seeks to investigate the Yield Gap, Technological Gap, Extension Gap, Technology Index, and Yield Gap between FLD plots and farmers' practices, as well as the level of technology adoption and economics of the technology. The following objectives were undertaken in present study;

i. To compare the yield level of improved practice (FLD plot) with conventional or farmers' practice
ii. To exhibit the performance of high yielding variety with improved package of practices by comparative economic analysis
iii. To generate feedback information for further strengthening of research and extension system.

METHODOLOGY

The current study was conducted by the ICAR-CAZRI, Krishi Vigyan Kendra, Bhuj-Kutch (Gujarat) during the rabi, 2016-17 to 2020-21 at farmer's fields. A total of 86 frontline demonstrations were held throughout a 34.4 ha area in various villages namely Kukma, Kotda Chakar, Jambhudi, Nana Reha, Chapredi, Atalnagar, Vavdi, Dhaneti, Chandiya and Ratnal of the Kutch district in Gujarat's Arid Zone. Table-1 lists the materials for the current study in terms of frontline demonstrations (FLDs) comprising high yielding variety with improved package of practices, where existing farming techniques were viewed as a local check or farmers practice (FP). The soils in the study area were primarily saline and alkaline with pH value 8.5 to 9.2 and EC ranging from 0.9 to 2.6 dSm^{-1}, a sandy to sandy loam texture having low levels of important micronutrients and organic carbon. The FLDs were used to look at the differences in potential yield and demonstration yield, as well as the extension gap and technology index. In this impact study, yield data was obtained from FLD plots along with local farming practices widely used by farmers in this region, for comparative analysis. Under demonstration plots, we have provided critical inputs such as seeds of variety Gujarat coriander-2,

Table-1 shows the cultivation practices used in FLD plots and farmers' practice.

Operation	Farmer's practice	Improved technology demonstrated
Seed & seed rate	Local seed @ 20-25 kg/ha in broadcasting method	Gujarat coriander-2 (Improved variety from SDAU, Dantiwada) @ 20 kg/ha
Seed treatment	None	Trichoderma 10g/kg seed
Sowing time	15-30th November	1st week of November
Sowing method	Broadcasting	Line sowing: 30 x 15 cm (R x P)
Manure & Fertilizer application	FYM: None 55 :23: 0 (Kg. N: P: K/ha)	FYM: 10-12 t/ha 40:20:00 (Kg N: P: K/ha) Zn 33% @ 12.5 kg/ha
Irrigation	6-7 irrigation	6-7 irrigations (1-2 extra irrigations in sandy soils)
Weeding	Generally, one hand weeding at 25-30 DAS	Two hand weeding 20 and 35 days after sowing (DAS)
Integrated pest and disease management	Broadly used chemicals fungicide mancozeb (Dithane M45)	• Use of bio-pesticide Trichoderma viridae as seed treatment @10g/kg seed and soil application @ 2.5 kg Trichoderma mixed with 25 kg FYM before sowing for the management of Fusarium wilt. • Application of Neem oil 2% as precautionary measure followed by two foliar sprays of flonicamid 50WG @ 5g/15 litre water at 15 days interval to manage the aphid population • Foliar spray of wettable sulphur/Kerathane @ 0.2% at 60 DAS (50 % of flowering stage) to manage the powdery mildew incidence

micro nutrients (Zinc sulphate 33%) @ 12.5 kg ha^{-1}, application of bio-pesticides Trichoderma as seed treatment @ 10g/kg seed and soil application @ 2.5 kg ha^{-1} for *Fusarium* wilt management and technical inputs on integrated crop management (ICM) practices such as seed treatment, lines sowing, irrigation scheduling for precise water use by compensating the water requirement at critical stages of the crop, weed management, balanced fertilisation, proper harvesting time and methods, and so on. Farmers, on the other hand, were allowed to continue with their conventional techniques in the event of a local check.

During the off-campus trainings and field trips, KVK scientists assisted the demonstration farmers by demonstrating methods such as seeding in rows, spraying, weeding, and harvesting. Table-1 shows the cultivation practices used in FLD plots and farmers' practice. Statistical tools such as frequency and percentage were used to collect, tabulate, and analyse the data. The extension gap, technology gap, and technology index were calculated using the *Samui et al. (2000)* equations.

Technology gap = Potential yield - Demonstration yield

Extension gap = Demonstration yield - yield under existing practice

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

$$BCR = \frac{\text{Gross return (Rs ha}^{-1})}{\text{Total cost of cultivation (Rs ha}^{-1})}$$

TI = Technology index

BCR = Benefit cost ratio

RESULTS AND DISCUSSION

Seed yield performance : The yield data shown in Table 2 revealed that FLD plots produced an average seed yield of 1935.4 kg ha^{-1} in comparison to local check (1695 kg ha^{-1}) over five years, where the potential yield of coriander (Gujarat coriander 2) was 2200 kg ha^{-1}. It was recorded that the additional average yield over local check was 240.4 kg ha^{-1}, with a percent increase yield over local check of 14.21 percent. The results clearly demonstrated that the higher average seed yields in demonstration plots over time compared to farmer's practice were achieved due to knowledge and adoption of the improved package of practices, including high yielding variety seed, sowing time, seed rate, seed treatment, sowing method, spacing, weed management, irrigation management, and need-based plant protection measures. *Tetarwal* (2021), *Meena et al.* (2016), *Poonia et al. (2017), Singh et al. (2013), Kumar et al. (2010), Dhaka et al. (2010)* and *Jaitawat (2006)* all found similar yield enhancement in coriander crops by implementing frontline demonstrations on improved coriander cultivation technology.

Yield gap analysis : Prior to the study period, it was discovered that the majority of farmers did not use high yielding variety seeds and optimised packages of practices for coriander cultivation, resulting in an extension gap between demonstrated technology and farmers' exercise, resulting in lower yields than the district average yield. To bridge that gap, KVK Bhuj demonstrated improved coriander cultivation technology in various farmers' fields as FLDs, which included some critical inputs such as seeds of the improved cultivar Gujarat coriander-2, use of *Trichoderma viridae* as soil application and seed treatment for wilt disease management, micro nutrients and technical inputs such as timely and line sowing, balanced fertilization, and appropriate plant protection measures for insect-pests (aphid, seed midge) and diseases (wilt, stem gall and powdery mildew) which resulted in increased grain yield over the local practice. The data presented in the Table-3 showed the wide extension gap between improved and conventional practice varied between 214 and 282 kg ha^{-1}, with an average of 240.4 kg ha^{-1}, according to data acquired from the FLDs. This large extension gap indicated that there was a need to raise awareness about the use of high-yielding varieties in conjunction with a better package of techniques in order to increase productivity. The extension gap was recorded at its lowest (214 kg ha^{-1}) in the concluding year 2020-21, indicating the greater adoption of superior technologies of the KVK. The findings of *Bhoraniya et al. (2017), Lal et al. (2013),* and *Singh et al. (2011)* corroborate the conclusions of this study. The technology gap was

Table 2. Year wise details and yield performance of frontline demonstrations (Average of five years)

Year	No. of Demo.	Area (ha)	Yield (kg ha^{-1}) Potential Yield (PY)	Yield (kg ha^{-1}) Demo Yield (IP)*	Yield (kg ha^{-1}) Check Yield (FP)	Additional yield over local check (kg ha^{-1})	Increased yield over local check (%)
2016-17	15	6.0	2200	1816	1573	243	15.45
2017-18	20	8.0	2200	2000	1718	282	16.41
2018-19	20	8.0	2200	1980	1736	244	14.06
2019-20	15	6.0	2200	1926	1707	219	12.83
2020-21	16	6.4	2200	1955	1741	214	12.29
Average			2200	1935.4	1695	240.4	14.21

*IP=Improved Practice; FP= Farmers Practice

Table 3. Extension gap, technology gap and technology index of coriander under FLDs

Year	Extension Gap (Kg ha^{-1})	Technology Gap (Kg ha^{-1})	Technology Index (%)
2016-17	243	384	17.45
2017-18	282	200	9.09
2018-19	244	220	10.00
2019-20	219	274	12.45
2020-21	214	245	11.14
Average	240.4	264.6	12.03

Table 4. Economic analysis of front-line demonstrations on coriander

Year	Cost of cultivation (Rs/ha)		Gross Return (Rs/ha)		Net Return (Rs/ha)		Additional Return (Rs/ha)	B:C Ratio	
	IP*	FP	IP	FP	IP	FP		IP	FP
2016-17	27750	26500	90800	78650	63050	52150	10900	3.27	2.97
2017-18	30400	29000	100000	85900	69600	56900	12700	3.29	2.96
2018-19	33600	32500	99000	86800	65400	54300	11100	2.95	2.67
2019-20	34200	33000	105930	93885	71730	60885	10845	3.10	2.85
2020-21	35000	33700	117300	104460	82300	70760	11540	3.35	3.10
Average	32190	30940	102606	89939	70416	58999	11417	3.19	2.91

*IP=Improved Practice; FP= Farmers Practice also investigated in order to determine the difference between the demonstration and the potential yield. Other factors such as variability in soil fertility, quality of irrigation water, surrounding microclimate, insect-pests and disease risk, level of crop management by farmer, and others are responsible for the changes in this gap. Throughout the study period, the technology gap ranged between 200 kg ha^{-1} (2017-18) and 384 kg ha^{-1} (2016-17). The technology gap was 264.6 kg ha^{-1} on average (Table 3). As a result, location-specific enhanced technologies must be developed to overcome such gaps in coriander cultivation in order to increase production. The acceptability and practicality of a technology are always inversely proportional to the technology index; the higher the acceptability of the demonstrated technology, the lower the technology index value (Sagar and Chandra, 2004). According to the data collected, the technology index peaked at 17.45 percent in 2016-17 and at lowest 9.09 percent in 2017-18. Over the years, the average technology index was 12.03 percent. During the study period, the technology index showed that the intervened technology was widely accepted and viable by the farmers. The findings of *Choudhary et al. (2018), Mishra et al. (2009), Raj et al. (2013), Dayanand et al. (2012)* and *Chauhan et al. (2020)* on the impact of FLDs in different crops are in agreement with the current studies.

Economic analysis : To assess their profit above existing technology, it is essential to comprehend the economic viability of any technique exhibited on farmers' fields. The cost of inputs and output statistics for coriander production under frontline demonstrations were gathered and analysed to determine gross return, net return, additional income, and the benefit cost (B:C) ratio. The outcomes of the economic analysis (Table 4) of coriander cultivation revealed a higher gross return of Rs. 90800, Rs. 100000, Rs. 99000, Rs. 105930 and Rs. 117300 ha^{-1} compared to Rs. 78650, Rs. 85900, Rs. 86800, Rs. 93885 and Rs. 104460 ha^{-1} in the years 2016-17, 2017-18, 2018-19, 2019-20 and 2020-21, respectively, with an average of Rs. 102606 ha^{-1} from FLD plots compared to farmers' practices (Rs. 89939 ha^{-1}). Furthermore, the FLD plots produced an average additional return of Rs. 11417 ha^{-1} and a higher average benefit cost ratio of 3.19 with just an additional input cost of Rs. 1250 ha^{-1}.

The results of the economic study point to the shown technology's increased profitability and economic feasibility. *Tetarwal (2021) in cumin, Poonia et al. (2017), Meena et al. (2016) and Singh et al. (2013) in coriander, Choudhary et al. (2018)* in fennel and *Singh et al. (2011)* in seed spices found similar results. *Bhargav et al. (2015)* and *Dhaka et al. (2010)* all reported similar findings.

CONCLUSION

The production enhancement and quality improvement under frontline demonstrations can be beneficial in improving growers' attitudes, knowledge, and competence. The use of Trichoderma and micronutrients can contribute to high-quality coriander production at low cost. It can be concluded that FLDs conducted under the close supervision of scientists are an important extension tool for illustrating newly released crop production and protection technologies in the farmer's field in various agro-climatic regions and farming situations. FLDs serve a critical role in pushing farmers to adopt modern agricultural technology, resulting in increased output and income. Farmers can attain a higher additional return with a lower additional input cost by using this technology. Furthermore, it is recommended that strong ties be established with line departments and other agencies in order to organise FLDs and large-scale capacity development programmes to overcome the extension gap for better coriander productivity by transferring improved technology to the growers.

CONFLICTS OF INTEREST

The authors have no conflicts of interest.

REFERENCES

Anonymous (2019-20). Area and production statistics of horticultural crops, National Horticulture Board, Govt. of India.

Anonymous (2020-21). District-wise area and production of Horticultural crops, Directorate of Horticulture, Farmers Welfare and Co-operation Department, Government of Gujarat, Gandhinagar. http://www.doh.gujarat.gov.in/statistics.

Bhargav, K.S.; Pandey, A.; Sharma, R.P.; Singh, A. and Kumar, M. (2015). Evaluation of front-line demonstration on chickpea in Dewas District. *Indian J. Ext. Edu.,* **51**(3&4):159-161.

Bhoraniya, M.F.; Chandawat, M.S. and Bochalya, B.C. (2017). Assessment of frontline demonstration on yield enhancement and economics of coriander (GC-4) in Surendranagar district of Saurashtra region of Gujarat. *Gujarat Indian J. Ext. Edu.,* **28** (1): 14-17.

Chauhan, R.S.; Singh, R.K.; Singh, P. and Singh. S.R.K. (2020) Impact analysis of FLDs in mustard on technology transfer and productivity in Shivpuri district of M.P. *Indian Res. J. Ext. Edu.* **20** (2&3): 79-82.

Choudhary, M.L.; Ojha, S.N. and Roat, B.L. (2018). Assessment of frontline demonstration on yield enhancement of fennel (Abu Sonf) under TSP area in Dungarpur, Rajasthan, *Int. j. seed spices.,* **8** (1):46-49.

Dayanand; Verma, R.K. and Mehta, S.M. (2012). Boosting the mustard production through front line demonstration. *Indian J. Ext. Edu.*, **12** (3):121-123.

Dhaka, B.L.; Meena, B.S. and Suwalika, R.L. (2010). Popularization of improved maize technology through Front Line Demonstration in South-eastern Rajasthan. *J. Agric. Sci.,* **1**(1):39-42.

Jaitawat, V.S. (2006). Knowledge and adoption of improved coriander production technology in Jodhpur region of Rajasthan. Ph.D. Thesis, R.A.U., Bikaner, Campus: SKN, COA, Jobner.

Kumar, A.; Kumar, R; Yadav, V.P.S. and Kumar, R. (2010) Impact assessment of Frontline Demonstrations of Bajra in Haryana State. *Indian Res. J. Ext. Edu*. **10** (1): 105-108.

Lal, G.; Mehta R.S.; Singh, D. and Chaudhary M.K. (2013). Effect of technological interventions on coriander yield at farmers' field. *Int. J. Seed Spices.,* **3** (2): 65-69.

Meena, K.C.; Singh, D. K.; Gupta, I. N.; Singh, B. and Meena, S. S. (2016). Popularization of coriander production technologies through front line demonstrations in Hadauti region of Rajasthan. *Int. J. Seed Spices.,* **6** (2): 24-29.

Meena, M.L. and Singh, D. (2016). Productivity enhancement and gap analysis of moth bean, *Vigna acontifolia* (Jacq.) through improved production technology on farmers participatory mode. *Indian J. Dryland Agric. Res.* **31**(1): 68-71.

Mishra; D.K., Paliwal; D.K., Tailor; R.S. and Deshwal; AK (2009) Impact of Frontline Demonstrations on Yield Enhancement of Potato. *Indian Res. J. Ext. Edu.* **9** (3): 26-28.

Nagarajan, S.; Singh, R.P.; Singh, R.; Singh, S.; Singh, A.; Kumar, A. and Chand, R. (2001) Transfer of technology in wheat through front line demonstration in India, A comprehensive report, 1995- 2000, directorate of wheat Research Karnal-132001, *Research Bulletin*, 6: p 21.

Poonia, M.K.; Singh, M.; Dhaka, B. L.; Bairwa, R. K. and Kumhar, B.L. (2017). Impact of Front-Line demonstration on the yield and economics of coriander in Kota district of Rajasthan, India. *Int. J. Curr. Microbiol. App. Sci.* **6**(3): 2344-2348.

Raj, A.D.; Yadav, V. and Rathod J.H. (2013). Impact of front-line demonstration (FLD) on the yield of pulses. *Int. J. Sci. Res.,* **3**(9):1-4.

Sagar, R.L. and Chandra, R. (2004). Front line demonstration on sesame in West Bengal. *Agric. Ext. Review*, **16** (2): 7-10.

Samui, S.K.; Maitra, S.; Roy, D. K.; Mandal, A.K. and Saha, D. (2000). Evaluation of front-line demonstration on groundnut. *J. Indian Soc. Coast. Agric. Res.,* **18** (2): 180-183.

Singh D.; Meena M.L. and Choudhary M.K. (2011). Boosting seed spices production technology through front line demonstrations. *Int. J. Seed Spices.,* **1** (1), 81- 85.

Singh D.; Meena M.L.; Chaudhary M.K. and Tomar P.K. (2013). Improved Package of Practices for coriander farmers: Impact of Training and FLDs. *Int. J. Seed Spices.,* **3** (1) : 52-57.

Tetarwal, A.S. (2021). Impact of front-line demonstrations on productivity of cumin in arid Kutch of Gujarat. *Ann. Agric. Res.,* **42** (3): 325-331.

• • • • •