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Impact of FLD Intervention on Awareness and Skill to Adopt Good Agricultural Practices of Isabgol Crop in Kachchh District of Gujarat

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Abstract: Frontline demonstration (FLD), aims to boost productivity by offering necessary inputs as well as enhanced production and good agricultural techniques that have been tested by the researchers. Krishi Vigyan Kendra (ICAR-CAZRI), Kukma, Bhuj organised front-line demonstrations (FLDs) on isabgol in various villages in the Anjar, Bhuj and Nakhatrana Talukas of Kachchh from 2018-19 to 2020-21. The front line demonstration program were successfully examined the shatter-resistant high-yielding variety Gujarat Isabgol-4 in a farmer's fields (FLDs). Fifty pro-tests against farming practises were staged in a 20 ha area at a farmers' field in the arid region of Kachchh. The average grain yield under the enhanced practise grew significantly by 11.75% of the average of the farmers' practise output, from 950 kg ha^{-1} to 1061.67 kg ha^{-1}. The extension gap, technology gap and technology index were averaged as 111.67 kg ha^{-1}, 238.33 kg ha^{-1} and 18.33%, respectively. Farmers received higher average returns of Rs 11943.33 ha^{-1} and a B:C ratio of 3.04 as a result of improved practises. The KVK (Kachchh-II) successfully carried out extension activities during that time period to assist the targeted farmers right away, comprising farmer training, literature distribution, diagnostic visits, etc. The Frontline demonstrations program created greater awareness, attitude and skill to adopt good agricultural practises in isabgol, which therefore, increased their production and economics.

Key words: Impact analysis, isabgol, technology gap, index, Kachchh, Gujarat.

Isabgol (*Plantago ovata* Forsk.) is one of the most important medicinal crop belongs to family Plantaginaceae and mainly grown for its husk (epicarp of seed) which is used for the treatment of stomach disorders, tridosa, burning sensation, habitual constipation, gastritis, chronic diarrhea, dysentery and colonalgia. It is also being used in modern food industries for the preparation of ice cream, candy etc. Isabgol is also called *Psyllium*, originated from a Greek word for a flea, referring to the size, shape and whitish color of the seed, which is the commercially important part of this plant.

India is the only provider of seeds and husk on the global market and ranked first in the manufacture of isabgol (98%). Isabgol has a sizable market in the US, China, Japan and Australia, which has primarily exported by India. Isabgol seeds and husks are frequently employed as laxatives in pharmacology. The husk, which makes up around 25 to 30% of the seed, has the ability to absorb and retain water (40-90%), which makes it effective as an anti-diarrhea medication. The husk is also used in the manufacturing of gum and jelly, agar-agar media preparation, calico printing, dyeing, tablet binding, ice cream, confectionery, and cosmetics. It is also used as a thickener and fixative (Dhar *et al*., 2011). Isabgol seeds consist of 6.85% ash, 23.5% crude fibre, 8.7% protein and 50.65% carbohydrates (Pendse *et al*., 1976). The mucilage content in isabgol seeds cultivated in India is high (Dalal and Sriram, 1995). The mucilage of isabgol is colloidal in nature which is composition of Xylose, Arabinose, Galacturonic acid, Rhamnose and Galactose (Salyers *et al*., 1978). Isabgol contains a significant amount of proteins and husk yields colloidal mucilage which is valued for medicinal application and used in Aryuvedic, Unani and Allopathic systems of medicines.

After the husk is removed, the remaining seed content is utilised as food for animals, birds, and livestock. Isabgol has been grown under a variety of agro-climatic conditions, but it does best in warm temperate regions and needs chilly, dry weather during its growing season, hence it is typically sown in the winter. Its cultivation is not ideal for locations with considerable rainfall. For enhanced seed germination, temperatures of

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Table 1. Particulars showing the difference between farmers practice and improved demonstrated technology of isabgol

Operation	Farmer's practice	Improved demonstrated technology
Seed & seed rate	Local seed @ 8-10 kg ha^{-1} in broadcasting method	Gujarat Isabgol-4 (Improved variety from SDAU, Dantiwada) @ 4-5 kg ha^{-1} line sowing
Seed treatment	None	Trichoderma 10 g kg^{-1} seed, PSB + Azotobactor 500 g ha^{-1}.
Sowing time	15-30th November	1st week of November
Sowing method	Broadcasting	Line sowing: 30 x 5 cm (R x P)
Manure & Fertilizer application	FYM: None 50 :25: 0 (Kg. N: P: K ha^{-1})	FYM: 5-6 t ha^{-1} 40:20:00 (Kg N: P: K ha^{-1})
Irrigation	6-7 irrigation	6-7 irrigations
Weeding	Generally, one hand weeding at 30-35 DAS	Soil application of isoproturon @500 g ha^{-1} as pre-emergence followed by one hand weeding at 35 DAS.
Integrated pest management	No use of insecticides	Application of Neem oil 2% as precautionary measure followed by two foliar sprays of flonicamid 50WG @ 3g 10 litre^{-1} water at 15 days interval to manage the aphid population.

20°C are necessary. In the dry Kachchh region of Gujarat, it may grow successfully in salty soils with inadequate water quality. Because it requires less water than traditional crops, it is appropriate for these regions. Kachchh is the main producer of isabgol in Gujarat state and grows on 6965 ha. and produces about 5098 M.T. with a productivity of about 731.95 kg ha^{-1} (Anonymous, 2019).

Adopting advised scientific and sustainable management production practises would boost isabgol's productivity because varieties and INM have an impact on it (Pagaria and Kantwa, 2014 and Salimath *et al*., 2019). Frontline demonstration (FLD), aims to boost productivity by offering necessary inputs as well as enhanced production and good agricultural techniques that have been tested by the researchers of ICAR Institutes and State Agricultural Universities (SAUs). The promotion of the cultivation of better varieties, gathering feedback from farmers regarding obstacles to the adoption of suggested enhanced technologies for additional study, and maximising the process of technological diffusion among farmers are other important components of this program (Nagarajan *et al*., 2001). The study's primary goal is to present newly released crop production and protection technologies, and document the management practices prevails in farmers of various agro-climatic areas (Singh and Varshney, 2010). The goal of the current study is to better understand the yield gap, technological gap, extension gap, yield gap, and yield gap between FLD plots and farming techniques, as well as the level of technology adoption and economics of the technology.

Methodology

The current study was carried out in farmer's fields during the Rabi, 2018-19 to 2020-21, by the ICAR-CAZRI, Krishi Vigyan Kendra, Bhuj-Kachchh (Gujarat). Over 20.0 hectare in a region, 50 frontline pro-tests were organised in various villages in the Kachchh district's Anjar, Bhuj, and Nakhatrana Talukas. High-yielding cultivars with an improved package of practises are listed in Table 1 for the current study, where existing farming methods were seen as a local check or farmers' practise (FP).

The studied area's soils were predominantly saline and alkaline, with a pH range of 8.5 to 9.2 and EC values between 0.9 and 2.6 dS m^{-1}. They also had a sandy to sandy loam texture soil which had low organic carbon. The extension gap, technology index, and disparities between potential yield and demonstration yield were evaluated using the FLDs. In this impact study, yield data from FLD plots and widely-used regional farming techniques were collected for comparative analysis.

During the off-campus training 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 on FLD plots and farmers' practice. Statistical tools such as frequency and percentage were used to collect, tabulate, and

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

Year	No. of Demo	Area (ha)	Yield (kg ha^{-1})			Increased yield over local check (%)
			Potential Yield (PY)	Demo Yield (IP)*	Check Yield (FP)	
2018-19	10	4.0	1300	1075	960	11.98
2019-20	20	8.0	1300	1050	940	11.70
2020-21	20	8.0	1300	1060	950	11.58
Average			1300	1061.67	950	11.75

*IP=Improved Practice; FP= Farmers Practice

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 - Farmers practice yield

Additional return = Demonstration return- Farmers practice return

Technology index = [(Potential yield - Demonstration yield)/ Potential yield] x 100

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

Results and Discussion

Seed Yield Performance

According to Table 1 of the study, demo plots produced an average seed output of 1061.67 kg ha^{-1} over the period of three years, compared to the local check's 950 kg ha^{-1}, despite the potential yield of Gujarat Isabgol-4 cultivar was recorded 1300 kg ha^{-1}, respectively (Table 2). Additionally, it was noted that the extra average yield over local check was 111.67 kg ha^{-1}, which was significantly greater than local check by 11.75%. It was evident from the yield levels recorded in demonstrations that the improved package of practices can boost the yield significantly. The results clearly indicated that the higher average seed yields in demonstration plots 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. These findings are consistent with the findings of Singh *et al.* (2013), Jain (2014), Pagaria and Kantwa (2014), Naagar *et al.* (2017) and Jain (2018) and found similar results in yield enhancement in various crops by implementing frontline demonstrations on improved cultivation technology.

Yield Gap Analysis

Technology gap is of great significance than other cultivation parameters as it indicates the constraints in implementation and drawbacks in our package of practices with respect to environmental or varietal change. 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 Isabgol 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 demonstrated improved Isabgol cultivation technology on various farmers' fields as FLDs, which resulted in increased seed yield over the farmers' practice. An extension gap of 115 and 110 kg ha^{-1} was found between FLD and farmers' practice during the different time lines (Table 3). This gap could be explained by the demonstrations' adoption of upgraded technology, which led to adoption of technology with higher seed

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 (%)
2018-19	115	225	17.31
2019-20	110	250	19.23
2020-21	110	240	18.46
Average	111.67	238.33	18.33

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

Year	Cost of cultivation (Rs ha^{-1})		Gross Return (Rs ha^{-1})		Net Return (Rs ha^{-1})		Additional Return (Rs ha^{-1})	B:C Ratio	
	IP*	FP	IP	FP	IP	FP		IP	FP
2018-19	25160	25000	101960	85840	76800	60840	15960	3.42	3.07
2019-20	34000	33760	99750	89300	65750	55540	10210	2.93	2.65
2020-21	34500	34260	95400	85500	60900	51240	9660	2.77	2.50
Average	31220.0	31006.7	99036.7	86880.0	67816.7	55873.3	11943.3	3.04	2.74

*IP=Improved Practice; FP= Farmers Practice

yield than conventional farmers' practices. The findings of the present study are in line with the findings of previous workers in the coriander Bhoraniya *et al.* (2017), Lal *et al.* (2013) and Singh *et al.* (2011). This gap could be explained by the demonstrations' adoption of upgraded technology, which led to adoption of technology with higher seed yield than conventional farmers' practises. The technology gap was 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 micro-climate, insect-pests and disease risk, level of crop management by farmers, and others are responsible for the changes in this gap. Throughout the study period, the technology gap ranged between 225 kg ha^{-1} to 250 kg ha^{-1} and, on average, 238.33 kg ha^{-1} (Table 3). As a result, location-specific enhanced technologies must be developed to overcome such gaps in Isabgol cultivation in order to enhance the yield 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 lowest technology was 17.31% in 2018-19 and highest at 19.23% during 2019-20, therefore, the average technology index was 18.33%. During the study period, the lowest technology index in 2018-19, could been recorded due to better monitoring of the farmers' fields due to less number of FLDs allocated to the farmers in respective area.

In addition to this, soil and climatic conditions are also responsible factors in that year. 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 on different crops are in agreement with the current studies.

Economic Analysis

To evaluate profit from the improved production technology over existing technology, it is critical to understand the economic viability of any technique demonstrated on farmers' fields. The net return varies year to year due to changes in input costs, labour charges, and produce sale price rate. The cost of inputs and output statistics for isabgol production during frontline demonstrations were collected and analysed to determine gross return, net return, additional income, and the benefit cost (B:C) ratio. The results of the economic analysis (Table 4) of isabgol cultivation revealed an average gross and net return of Rs. 99036.67 and Rs. 67816.67 ha^{-1} compared to farmers' practice of Rs. 86880 and Rs. 55873.33, respectively. Furthermore, the demonstration plots generated an average additional return of Rs. 11943.33 ha^{-1} and a higher average benefit cost ratio of 3.04. Only improved technology, timely crop cultivation operations, and scientific crop management have been identified as responsible factors for achieving greater incremental results in demonstrations.

The findings of the economic analysis illustrated the increased economic viability and profitability of the demonstrated technology. Similar findings were made by Rathore and Mathur (2020), Jain (2018), Choudhary *et al.* (2018), Choudhary *et al.* (2013) and Singh *et al.* (2011) for isabgol, fennel, cumin and seed spices, respectively.

Conclusions

The production enhancement and quality improvement under frontline demonstrations would be very much beneficial in improving growers' attitudes, skill, knowledge, and competence. The FLDs always help us in developing the harmonious and friendly relationship between farmers and scientists, which is a very unique attribute of Krishi Vigyan Kendra. The beneficiary farmers always play an important role as source of information and dissemination of the high-yielding variety of isabgol for other nearby farmers. This will help in the removal of the cross-sectional barriers among the farming community. Furthermore, it is recommended that strong ties should be established with line departments and other agencies in order to organize FLDs and large-scale capacity development programs to overcome the extension gap for better coriander productivity by transferring improved technology to the growers. Therefore, assessing the worthiness of any technologies in farmers' field, the FLDs are an important tool for assessing the performance of any package of practices under the close supervision of KVK scientists which help to achieve profitable farming practices.

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