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Maximizing *Rabi* jowar productivity and economic benefits through front-line demonstrations

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Abstract

Rabi sorghum is valued mainly for direct human food consumption and fodder for livestock. It is mostly grown in dryland conditions on residual soil moisture of rainy season. The productivity of sorghum is dependent on quantity of rains during pre-season monsoon and water holding capacity of soil, soil moisture conservation practices, use of high yielding cultivars on the basis of soil types and available production technologies. One of the major constraints of local *rabi* sorghum cultivation is low productivity due to non-adoption of recommended package of practices and improved varieties. To overcome this UAS Dharwad, Karnataka ICAR- Krishi Vigyan Kendra, Haveri were conducted frontline demonstrations in farmers' fields at various villages in the district with high yielding and SPV-2217 and applying scientific practices in cultivation. The *rabi* sorghum- productivity and economic returns under improved technologies were calculated and compared with the prevailing farmers' practice. The data obtained was average for three years. It was observed that on an average 25.16 percent higher grain yield was recorded in demonstration plots than the local check. The extension gap, technology gap and technology index were 4.08 q/ha, 7.34 q/ha and 11.71 percent, respectively. Average of ten demonstration data revealed that SPV-2217 variety under improved practices recorded higher yield of 25.16 the recommended practice gave higher net returns of Rs. 51,482 ha⁻¹ and B:C ratio of 4.12 respectively as compared to farmer's practice. An additional investment of Rs. 750 ha coupled with scientific monitoring of demonstration and non-monetary factors resulted in additional return of Rs. 15,750 ha over the farmers practices. Fluctuating minimum selling price of *Rabi* jowar during different years influenced the economic returns per unit area.

Keywords: *Rabi* sorghum, nutrient, variety, productivity, economic returns

Introduction

An new science-based organization called Krishi Vigyan Kendra is crucial in facilitating direct communication between farmers and research scientists. Krishi Vigyan Kendra's primary goal is to shorten the time gap between technological advancements at the research institute and its dissemination to farmers, hence boosting agricultural output and revenue on a long-term basis. According to Patel *et al.* (2009) [6], KVKs are grassroots groups designed to apply technology through evaluation, improvement, and display of tested produce technologies in various micro farming scenarios within a district.

A front-line demonstration is a methodical, long-term instructional program that farmers use to demonstrate the value of new technologies or practices. India's farmers continue to grow crops using information passed down from their ancestors, which results in agronomic, nutritional, and pest management techniques that are blatantly incorrect. They frequently fall short of achieving the targeted potential yield of different crops and novel kinds as a result of them. The soil is medium in P and K content and poor in organic carbon. *Rabi* sorghum productivity is currently insufficient for a number of reasons, including inadequate crop management techniques brought on by ignorance of and failure to implement advised production measures, and the delayed availability of high-quality seeds of better varieties.

Sorghum can produce grains while having little rainfall and enduring unfavorable agroclimatic conditions. It is a staple cuisine in the Indian states of Gujarat, Andhra Pradesh, Karnataka, Madhya Pradesh, Tamil Nadu, and Maharashtra. In India, sorghum is grown in the kharif (rainy) and *rabi* (post-rainy) seasons. According to Gopalan *et al.* (2010) [3], sorghum is a rich source of energy and has a good number of minerals, especially iron (4.1 mg/100 g) and zinc (1.6 mg/100

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g). It also includes 349 kcal, 10.4 g of protein, 1.9 g of fat, and 72.6 g of carbohydrates. According to Gopalan *et al.* (2010)^[3], sorghum is a rich source of energy and has a good number of minerals, especially iron (4.1 mg/100g) and zinc (1.6 mg/100g). It also includes 349 kcal, 10.4 g of protein, 1.9 g of fat, and 72.6 g of carbohydrates. Cereals are being modified by modern genetic changes to boost their nutritious content. These strategies could significantly reduce the malnourishment of populations whose diets consist primarily of one type of cereal. Since sorghum is a popular grain consumed by most people and an excellent source of nutrients, it can be effectively used to counteract nutrient deficiencies. Therefore, improved nutrient content encourages those who rely on sorghum as a staple diet to become more nutritionally empowered.

The objectives of study were as follows:

- To contrast the yield levels of the Front-Line demonstration and the local cheque (farmer methods).
- To determine the crop's economic viability (local check vs. Front Line demonstration).
- To gather input so that the research and extension program can be improved even more.
- Limitations on the spread of technology.

Materials and Methods

The Front Line demonstration of how to evaluate the effects of switching to a better set of techniques over farmers' methods on millets' yield and economics. An effort was undertaken to investigate how the district's economy might be affected by this technology transfer using a participatory method. The study was carried out in Karnataka's Haveri district, which is located in the Northern Transitional Zone, or Agro-climatic Zone-8. For the study, all seven of the Haveri district's blocks were taken into account. Thirty randomly chosen respondents, including Rabi

Jowar, made up the study's sample. After organising the list of all recipients by year and village, the necessary sample was chosen at random for the study. The KVK in Haveri District conducted front line demonstrations (FLDs) to raise awareness of superior small millet cultivation methods. These demonstrations have enhanced the crops' output levels and increased their usefulness for domestic use. Worth noting effects were found in the study to evaluate the economic impact of the FLDs on the district economic scenario. During the kharif season of 2021–2022, Krishi Vigyan Kendra, Haveri, conducted this FLD in ten demonstrations. To guarantee their active involvement, responsive progressive farmers from every village were chosen to conduct the trial. Each farmer's 0.5 hectares were used for the demonstration of the new technology. These cultivars were used as a control and compared to farmers' practices. The outcome was contrasted with the entire practice bundle. In addition to the primary data on millets yield output from the chosen farmers in FLD plots, information on local practices frequently used by farmers in this area was also gathered with the aid of an interview schedule and presented as a percentage. The qualitative data was transformed into quantitative form and expressed as a percentage of increased yield using a formula.

The results were interpreted using the benefit cost ratio (B:C), gross return, net return, cultivation cost, and average yield of each FLD and farmer's practices. The following formula, recommended by Singh *et al.* (2011), was used to compute the extension gap, technology gap, and technology index.

Extension gap = Demonstration yield - Local check yield

Technology gap = potential yield - Demonstration yield

Technology index = Potential yield - Demonstration yield x 100/Potential Yield

$$\% \text{ Increase over farmers practice} = \frac{\text{Improved practice} - \text{Farmer's practice}}{\text{Farmer's practice}} \times 100$$

Two suggested plots and one control plot (farmer practice) were used to get the yield statistics. Their economic viability and variability were assessed, and the trial was planned under four key presumptions.

- When the technology requires only modest adjustments, refinements, or changes and is not suitable for farmers in its recommended form.
- It requires the incorporation of the farmers' indigenous knowledge in conjunction with scientific recommendations throughout the refining or modification process. Additionally, this process is ongoing, encompassing a variety of technical options tailored to each microclimate.
- The cooperation of farmers who have been trying independently to discover solutions to the limitations on their farm and in the extension system, which is essential to the advancement of technology.
- The technologies or methods developed through Front Line Demonstrations are recommended by farmers as the best way to handle problems and include a variety of after-natures techniques. With the aforementioned in mind, front-line demonstrations were carried out. Economic and performance indicators were taken into consideration when conducting the study.

To evaluate mustard's performance in the 2019–20 fiscal year, farmer's fields in the Haveri district hosted front-line demonstrations. The district's soil is typically sandy to sandy loam in texture, with medium to high levels of potash, accessible phosphorus (14–17 kg/ha), and low levels of organic carbon (0.2–0.3%). Critical inputs were applied in accordance with the package of practices for each demonstration, which covered an area of 0.4 hectares. FLD was carried out using high-quality seed of the rabi jowar variety during the entire study period. October was the sowing month, while March was the harvest month (Table 1). With the aforementioned in mind, front-line demonstrations were carried out. Economic and performance indicators were taken into consideration when conducting the study.

Results and Discussion Grain yield

Grain yield increased by 20.52 percent on average in the plots that were displayed (Table 2). The year 2019–20 saw the largest rise in grain yield, which may have been caused by enhanced variety seeds and other technology that the farmers were unaware of (Samui *et al.*, 2000)^[8].

Extension gap

In four different years, the extension gap between farmers' practices and shown technology varied from 3.6 to 1.31 q/ha; on average, it was 2.45 q/ha (Table 2). The implementation of improved technology in demonstrations, which produced a larger grain output than conventional farmer practices, may be the cause of this discrepancy.

Technology gap

There was a significant technology disparity in several years, with the lowest being 18.85 q/ha and the highest being 25.16 q/ha in 2019–20. 4.08 q/ha was the average technology gap return that was discovered. The variation in the technological gap between years may be the result of other years' recommended technologies being more feasible. Likewise, the technology index for every year that was shown matched the technological gap identified by Pritam *et al.* (2020) [7] and Asiwal *et al.* (2015) [1]. Inadequate extension services for technology transfer and higher technology for farmers.

Technology index (%)

The technology index increased by 11.71 percent on average, according to the plots that were displayed (Table 2). Khan and Chouhan (2005) [5] found that the technology index increased the most in 2019–20. it, which could be the result of farmers not

knowing about new variety technologies and seed.

Economic gap

In addition to farmers' methods, several factors like as seed, fertiliser, biofertilizer, and pesticides were deemed essential inputs for the demonstration. On average, an extra Rs. 16,450/ha was invested under demonstrations. In 2019–20, the incremental benefit:cost ratio was 4.12. The outcomes support the conclusions of frontline demonstrations on oilseed and pulse crops conducted by Lathwal (2010) [4] and Choudhary *et al.* (2014) [2]. The Frontline demonstration program was successful in influencing farmers' perspectives on mustard farming. Farmers' expertise has grown as a result of growing rabi jowar on demonstration plots using advanced technologies. Additionally, FLD assisted in substituting better suggested kinds for local non-recommended ones. Additionally, this enhanced the rapport and confidence between farmers and scientists. In addition to serving as the main source of knowledge for other farmers regarding better methods of growing rabi jowar, the farmers who displayed improved technology also served as a source of high-quality, pure seeds for the following crop in their area. All farmer types, especially progressive farmers, can use the front-line demonstration idea to quickly and widely spread the suggested methods to other members of the farming community.

Table 1: Particulars showing the details of Rabi jowar grown under front line demonstrations and farmers practices

S. No.	Particulars	Farmers practice (Local Check)	Frontline demonstration
1	Variety	Local var.	SPV-2217
2	Seed rate (kg/ha)	5	8
3	Seed treatment	No treatment	Imadacholoropid60 WP @ 5.0 gm/kg Seed
4	<i>Azospillum</i> and <i>Trichogramma</i>	No treatment	Seed treatment with <i>Azospillum</i> @40 gram/kg Seed and <i>Trichogramma</i> @12 gram/kg Seed.
5	Line spacing	22.5 cm	30 cm
6	Sowing time	Mid Oct. –Nov.	15 September. – 30 oct.
7	Nutrient Management (NPK kg/ha)	60:30:0	100:75:25 and 15 kg Zinc Sulphate
8	Pest management	No use of plant protection measures	Foliar spray of chlorpyrifos @ 0.33 ml/liter of water at flowering stage

Table 2: Grain yield and gap analysis of frontline demonstration on Rabi jowar at farmer's field

Year	Var.	No. of Demo.	Area (ha)	Yield (q/ha)		Increase (%)	Extension gap (q/ha)	Technology gap (q/ha)	Technology index (%)
				Demon.	Local check				
2021-22	SPV-2217	10	2.25	25.16	21.08	19.35	4.08	7.34	11.71

Table 3: Economic analysis of demonstrated plots and farmers practice in Rabi Sorghum

Year	Thematic area	Var.	Demo area (ha)	Farmers (No.)	Yield (q/ha)			Net returns (Rs. /ha)		B:C	
					Demo	Check	Increase (%)	Demo	Check	Demo	Check
2021-22	Verity introduces	SPV-2217	10	10	25.16	21.08	19.35	51482	41066	4.12	3.59

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