International Journal of Research in Agronomy 2024; SP-7(7): 471-473

E-ISSN: 2618-0618
P-ISSN: 2618-060X
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www.agronomyjournals.com
2024; SP-7(7): 471-473
Received: 06-04-2024
Accepted: 15-05-2024

Nidhi Verma
Scientist, Department of Agronomy, JNKVV, Krishi Vigyan Kendra, Narsinghpur, Madhya Pradesh, India

Megha Dubey
Scientist, Department of Agronomy, JNKVV, Krishi Vigyan Kendra, Betul, Madhya Pradesh, India

Anjum Ahemad
Technical Assistant, Department of Agronomy, TCBCARS, Bilaspur, Chhattisgarh, India

Shweta Meshram
Programme Assistant, Department of Agronomy, JNKVV, Krishi Vigyan Kendra, Dindori, Madhya Pradesh, India

SR Sharma
Scientist, Department of Plant Protection, JNKVV, Krishi Vigyan Kendra, Narsinghpur, Madhya Pradesh, India

Corresponding Author:
Nidhi Verma
Scientist, Department of Agronomy, JNKVV, Krishi Vigyan Kendra, Narsinghpur, Madhya Pradesh, India

Impact of improved variety green gram (MH 421) and production technologies in through Cluster frontline demonstrations

Nidhi Verma, Megha Dubey, Anjum Ahemad, Shweta Meshram and SR Sharma

DOI: https://doi.org/10.33545/2618060X.2024.v7.i7Sg.1081

Abstract
KVKs organised farming and extension activities for farmers and extension workers to demonstrate the production potential of newly released technologies on the farmer's fields at a different location in a given farming system, and they conducted Cluster frontline demonstrations (CFLDs) to demonstrate the production potential of newly released technologies on the farmer's fields at a different location in a given farming system. Frontline Cluster Summer moong demonstrations were held by Krishi Vigyan Kendra, JNKVV, For the demonstrations, a Moong type of medium duration MH 421 was used. Farmers used a wide range of techniques, such as IPM practices, biofertilizer treatment, Trichoderma viride, fertilizer administration based on soil test results, and seed rate. Front-line demonstration findings showed that farmers' practices increased moong output by 24 percent. It was also discovered that front-line demonstrations had a larger gross and net return than local checks, according to the statistics. In CFLD, gross and net returns were determined to be Rs. 82685 and Rs. 59185, respectively, whereas in farmer's practises, they were Rs. 68305 and Rs. 46505. It was also observed from the data of front line demonstration recorded higher gross return and net return as compared to local check.

Keywords: Green gram (MH 421), production technologies, Cluster frontline demonstrations

Introduction
Pulses are important for diversification and intensification of agriculture across the globe because of their intrinsic values such as nitrogen fixing ability (15-35 kg N/ha), high protein content and ability to survive in less endowed environment. The per capita availability of pulses is dwindling fast from 70 g in 1959 to 31.6 g/capita/day in 2011 as against the minimum requirement of 84 g/capita/day prescribed by Indian Council of Medical Research, which is causing malnutrition among the growing population. Greengram [*Vigna radiata* (L.) Wilczek], also known as mungbean, is an excellent source of protein (24.5%) with high quality of lysine (460 mg/g) and tryptophan (60 mg/g). India has the distinction of being the top producer of greengram in the world (Ali and Kumar, 2006) [1]. It occupies 29.36 lakh hectare area and contributes 13.90 lakh tonnes in pulse production in the country (Anonymous, 2015- 16) [2].
Front Line demonstrations (FLDs) is a unique approach to provide an direct interface between researcher and farmers as the scientists are directly involved in planning, execution and monitoring of the demonstrations for the technologies developed by them and get direct feedback from the farmers' field about the crops. FLD is a form of applied research through ICAR/SAUs system on latest notified/released varieties along with full package of practices on selected farmers' fields with a view to demonstrate the potentiality of the technologies to (a) participating farmers (b) neighboring farmers and other agencies; (c) to analyze the production (d) performance of the technologies for scientific feedback. India has long been the world's greatest producer, consumer, and importer of pulses (Raj at al., 2013) [8]. The Indian government imports a considerable quantity of pulses to meet domestic demand. In this context, the Department of Agriculture, Cooperation, and Farmers Welfare has sanctioned the project "Cluster Frontline Demonstrations on Summer Pulses to ICAR-ATARI, Jabalpur through the

National Food Security Mission" in order to continue this production and consumption system.

This project was done by Krishi Vigyan Kendra, JNKVV, Narsinghpur, Zone-IX, with the main goal of increasing moong production and productivity using CFLDs and cutting-edge technologies. The FLD is a vital instrument for transferring the most up-to-date package of practises to farmers in its whole, and the program's major goal is to showcase newly released crop production and protection technologies, as well as management techniques, on the farmers' field in a real-world setting. This method allows for the popularisation of freshly improved revolutionary technology with increased production potential under a given farming system while also generating feedback from farmers on the displayed technology (Singh *et al*., 2012) [12]. Greengram crop is generally cultivated on marginal lands having low soil fertility and under rainfed conditions. Moreover, poor agronomic practice with respect to selection of suitable variety, nutrient management, weed management and plant protection measures etc. are responsible for low productivity of greengram crop in India. The available agricultural technology does not serve the very purpose until it reaches and adopted by its ultimate users the farmers. The extent of adoption of improved agricultural technologies is a crucial aspect under innovation diffusion process and the most important for enhancing agricultural production at a faster rate. The gap between recommendations made by the scientists and actual use by farmers is frequently encountered.

Frontline demonstration is an important tool for transfer of latest package of practices in totality to farmers and the main objective of this programme is to demonstrate newly released crop production and protection technologies and management practices at the farmers' field under the real farming situation. Through this practice, the newly improved innovative technology having higher production potential under the specific cropping system can be popularized and simultaneously feedback from the farmers may be generated on the demonstrated technology. Keeping this in view, frontline demonstrations (on farmer's fields) on greengram crop were conducted to demonstrate the production potential and economic benefits of newly released varieties and latest improved technologies to the farmers.

Table 1: Description of technological intervention and farmer's practices under CFLD on summer moong

Particulars	Technological intervention (T_1)	Farmer's Practices (T_2)	Gap
Variety	MH 421	Shikha	Full gap
Seed rate	20-25 kg/ha	30-40 kg/ha	Partial gap
Integrated nutrient management (INM)	N:P:K (20:60:20kg/ha + rhizobium @ 5g/kg seed + PSB @ 5g/kg of seed	No use of fertilizer	Full gap
Integrated post management (IPM)	Seed treatment with Trichoderma virdea@ 5g/kg seed + Thiomethaxom @125 ml/ha for control of white fly	2-3 spray of insecticide with insufficient amount of water	Partial gap
Weed management	One hand weeding	No weeding	Full gap

Methods and Materials

During the year 2021-22, 25 farmers fields (10 ha) in different villages of Madhya Pradesh's Narsinghpur district, namely, Dhawai were used to conduct field trials of 0.40 ha each to evaluate the productive performance of enhanced moong varieties. Farmers were instructed in many elements of cultivation prior to the demonstrations (Kumar *et al*., 2010) [5] to follow the package and procedures for moong production as advised by Krishi Vigyan Kendra Narsinghpur scientists, as well as need-based input materials provided to the farmers. KVK took a soil sample from the demonstration field, tested it, and administered fertiliser based on the results of the soil test. For demonstrations, the Moong variety MH 421 was used. Farmers used a comprehensive set of methods, including seed rate, biofertilizer treatment, Trichoderma viride, fertiliser application based on soil test value, weed and water management, and IPM practises. In the instance of a local check, the farmers followed established procedures in existing varieties. Seed was seeded using a tractor-driven seed cum ferti drill from February 15 to February 28. Rhizobium culture and tricoderma virdae were applied to seed at a rate of 5g per kg of seed. Sprinkler irrigation system applied a precise amount of water at specific times. The yield data was compiled from both the CFLD and the farmers' practise plot (local check). Destructive plant sampling at various growth stages was used to investigate nodulation and root growth. At harvest, data on crop growth, yield attributes, and yield were collected and statistically examined. The net return and cultivation cost in each treatment were used to calculate the B:C ratio. The formulae proposed by Bhargav K. S. *et al*. (2017) [2], Samui *et al*. (2000) [10], and Sagar and Chandra were used to estimate the technology index, extension gap, technology gap, and harvest index (2004) [9]. For the analysis, the following formulas were used:

$$\text{Harvest index (\%)} = \frac{\text{Grain Yield}}{\text{Grain yield + Straw yield}} \times 100$$

Technology Gap = Potential Yield – Demonstration Yield (RP)

Extension Gap = Demonstration Yield (RP) – Farmer's Yield (FP)

$$\text{Technology Index (\%)} = \frac{\text{Technology Gap}}{\text{Potential Yield}} \times 100$$

Observations and Analysis

The results of front-line demonstrations showed that the CFLD cultivation practises of using improved varieties, proper seed rate, seed inoculation by Rhizobium and PSB culture, soil test based fertiliser application, integrated pest management, irrigation, and hand weeding produced a 24 percent higher yield of moong than farmer's practises. The findings demonstrated that the CFLD had a positive influence on the Narsinghpur farming community, as they were inspired by the enhanced agricultural technology used in the demonstration plots. The technological gap, defined as the difference between the demonstration yield and the potential yield, was determined to be 1.8 qt/ha, while the extension gap was 2.0 qt/ha. Due on climatic circumstances and soil fertility level, the technological gap was discovered to be different. As a result, it appears that location-specific recommendations are required to close the yield gap. However, to close the extension gap, farmers must be educated through multiple channels to encourage greater adoption of improved high-yielding varieties and suggested practises. The technology index demonstrates the viability of advanced technology on the farm. The lower the technology's value, the more likely it is to be feasible. The technology index was found 4.16% indicating the performance of this variety in Narmada Valley region was satisfactory. The data presents in Table 3 indicated that adoption of improved technology of moong not only gives the opportunity of higher yield, but also provides higher benefit cost ratio i.e. 3.51 as compared to 3.31 in the farmer's practices. This may be due to higher yield obtained under recommended practices compared to farmer's practices. Similarly result has earlier being reported on moong by Bhargav *et al*. (2017) [2], Bhan *et al*. (2014) [1] and on chickpea by Tomar *et al*. (1999) [13]; Tomar (2010) [14]; Mokidue *et al*. (2011) [6] and Singh *et al*. (2014) [11]. It was also observed from the data of front line demonstration recorded higher gross return and net return as compared to local check (Table 3). The gross and net returns were found Rs. 82685 and Rs. 59185 in CFLD while in farmer's practices these were found Rs. 68305 and Rs. 46505 respectively.

Table 2: Grain yield, harvest index, technology gap, extension gap & technology index of demonstrations

Grain yield (q/ha)			% increase over FP	Straw yield (q/ha)		Harvest index (%)		Technology gap (q/ha)	Extension gap (q/ha)	Technological index (%)
Potential	RP	FP		RP	FP	RP	FP			
1	2	3	4	5	6	7	8	9	10	11
12	11.5	9.5	21.0	19.5	17.0	37.0	35.8	0.5	2.0	4.16

Table 3: Gross expenditure, gross return, net return and B:C ratio of summer moong production under CFLDs

Yield (q/ha)		% increase over FP	Gross expenditure (Rs./ha)		Gross return (Rs./ha)		Net return (Rs./ha)		B:C ratio	
RP	FP		RP	FP	RP	FP	RP	FP	RP	FP
1	2	3	4	5	6	7	8	9	10	11
11.5	9.5	21.0	23500	21800	82685	68305	59185	46505	1:3.51	1:3.31

Conclusion

The Cluster Frontline Demonstrations (CFLD) on summer moong were undertaken in various villages around the Narsinghpur district, with the greatest yield of 10.2 q/ha in the demonstration plots and 8.2 q/ha in the control plots. On comparison to farmers' practise, the yield in the demonstration plot increased by 24.00%. It was shown that increasing potential production can be accomplished by providing farmers with scientific knowledge, high-quality, need-based inputs, and proper management. Horizontal dissemination of better technologies can be done by successful frontline demonstrations and various extension activities such as training programmes, field days, and exposure visits arranged under CFLDs programmes in farmers' fields.

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