**Effect of Advanced Production Technologies on Summer Greengram Yield through Cluster Frontline Demonstrations in Bihar**

**ABSTRACT**

The present study was conducted to promote summer greengram production technologies from 2018-19 to 2020-21 in farmer’s fields across the agro-climatic regions of Bihar through Cluster Frontline Demonstrations (CFLDs). A total of 4,075 demonstrations were conducted on an area of 1,548 ha using scientific production technologies to evaluate the performance of improved greengram varieties on productivity and profitability. Greengram is a vital pulse crop in Bihar, cultivated on over 156,772 ha with an average productivity of 6.95 q/ha, lower than the state average of 9.25 q/ha and the national average of 9.7 q/ha. The unavailability of improved varieties and non-adoption of scientific cultivation practices are among the reasons for this low productivity. Improved varieties such as IPM 02-03, HUM-16, PDM-139, Pusa Vishal, Samrat, IPM-2-14, IPM 205-07, and SML 668 were evaluated alongside practices such as line sowing, seed treatment with fungicides and insecticides, Integrated Nutrient Management (INM), Integrated Crop Management (ICM), Integrated Pest Management (IPM), weed management, and seed inoculation with Rhizobium culture and phosphorus-solubilizing bacteria (PSB).

The yield of greengram under CFLD ranged from 8.5 to 8.9 q/ha, while the extension gap and technological index ranged between 2.0 to 3.2 q/ha and 34.07 to 37.03%, respectively. The technology gap highlighted the encouraging cooperation of farmers in adopting the demonstrated practices, leading to improved results in subsequent years. The maximum gross return (INR 51,949/ha) and net return (INR 32,088/ha) were achieved during the observation years. The benefit-cost ratio ranged from 2.5 to 2.7 under demonstration, indicating that improved varieties and scientific practices significantly enhanced productivity and profitability. These results emphasize the need for disseminating improved technologies through training and demonstrations to encourage farmers to adopt recommended practices for higher returns.

**Keywords:** Adoption, frontline demonstration, greengram, gap analysis

**INTRODUCTION**

Greengram (*Vigna radiata* L.), commonly known as moong, is an important pulse crop that requires minimal water and has a short growing duration. It is adaptable to rainfed and irrigated conditions, making it an ideal contingent crop during the early Southwest monsoon. Proper irrigation during flowering and pod-filling stages significantly enhances yield (Kumar et al., 2016). Cultivated primarily in Asia, Australia, and the Americas, greengram is a significant legume crop in India, particularly in Uttar Pradesh, Punjab, Rajasthan, Tamil Nadu, Bihar, and Karnataka.

In India, greengram occupies an area of 4.24 million ha with a production of 2.02 million tonnes and productivity of 477 kg/ha (Anonymous, 2022-23). In Bihar, it is primarily a summer crop, grown on 156,772 ha, producing 108,955 tonnes with a productivity of 695 kg/ha (Anon., 2022-23). Greengram contributes to soil health by fixing atmospheric nitrogen and is grown for seeds, green manure, and forage. Despite its versatility, production and productivity remain low due to resource-poor lands, minimal inputs, and susceptibility to pests and diseases such as yellow mosaic virus (MYMV) and Cercospora leaf spot (CLS).

Frontline Demonstration (FLD) is a critical method for transferring advanced technologies to farmers. This approach aims to demonstrate improved crop production and protection practices in real farming situations. FLDs also study factors contributing to higher crop production and constraints, providing valuable feedback for further improvements.

**MATERIALS AND METHODS**

A total of 4,075 frontline demonstrations were conducted in Bihar during the summer seasons of 2018 to 2021 under irrigated conditions. Each demonstration covered an area of 0.4 ha, with an adjacent 1.0 ha plot maintained under farmers’ practices for comparison. Improved production technologies included:

* Line sowing with a spacing of 30 cm x 10 cm.
* Seed treatment using Bavistin (2 g/kg of seed), insecticides, and inoculation with Rhizobium and PSB.
* Nutrient management and weed management practices.
* Improved varieties such as IPM 02-03, HUM-16, PDM-139, and Samrat.

Soils were sandy loam with medium to low fertility. Sowing was conducted in the first week of July using a seed rate of 15-20 kg/ha. Data on grain yield from both FLD and farmers’ plots were collected and analyzed for yield gaps and economics using standard methodologies (Yadav *et al*., 2004).

The details of different parameters and formula adopted for analysis are as under:

Extension gap = Demonstration yield Farmers’ practice yield

Technology gap = Potential yield Demonstration yield

Technology index = $\frac{PotentialYield-DemonstrationYield}{PotentialYield}×$ 100

Incremental B: C ratio = $\frac{Gross Return}{Gross Cost}$

**RESULTS AND DISCUSSION**

**Yield Attributes:**

Under improved technology, the number of productive pods per plant was 24.2 compared to 18.6 under farmers’ practices, representing a 29.8% increase. The findings align with those of Yadav et al. (2022) and Meena *et al.* (2019).

**Seed Yield:**

The mean productivity under improved technology was 9.3 q/ha, ranging between 8.5-10.0 q/ha over the years, compared to 6.3-7.0 q/ha under farmers’ practices. Yield increased by 43.9%, 36.8%, and 34.9% during 2019, 2020, and 2021, respectively, confirming findings by Singh and Meena (2011) and Gaur and Jadav (2020).

**Gap Analysis:**

The extension gap ranged from 2.2 to 3.0 q/ha, with an average of 2.6 q/ha, indicating the need for better dissemination of proven technologies. The technology gap varied from 3.5 to 5.0 q/ha, with an average of 4.2 q/ha, reflecting differences in adoption and performance of improved practices. The average technology index was 31.1%, indicating scope for improved technology transfer.

**Economics:**

Demonstration plots recorded a maximum gross return of INR 51,949/ha and a net return of INR 32,088/ha. The average BCR was 2.6, demonstrating economic feasibility. The findings align with studies by Yadav et al. (2004) and Parashar *et al.* (2022).

**CONCLUSION**

Frontline demonstrations revealed that adopting improved technologies significantly enhanced greengram yield, yield attributes, and economic returns. Therefore, these technologies should be disseminated widely through training and extension activities. Farmers must be encouraged to adopt scientific practices to achieve higher productivity and profitability.

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**Table 1: Particulars under trials**

|  |  |  |
| --- | --- | --- |
| **Operation** | **Existing practice** | **Improved practices demonstrated** |
| Line sowing | Broad casting of seed  | Spacing 40 cm between rows and 10 cm between plants in the rows  |
| Seed treatment | No seed treatment  | Seed treatment with *Bavistin* 2gm/kg seed |
| Variety  | IPM 02-03, HUM-16, PDM-139, PUSAVISHAL SAMART, VIRAT, IPM-02-14, IPM 205-07 | Conventional variety/Local Variety/own seed |
| Weed management  | No weed management | Weeds control by using herbicide *Pendimethaline* 1kg/ha in 500 liter of water as pre-emergence treatment for effective control of weeds within two days after sowing.  |
| Nutrient management | Only FYM and no fertilizer application | 10 tons/ha farm yard manure and 20kg/ha nitrogen  |
| Whole package | Farmers are cultivating the greengram crop without adoption of any improved technology | All the crop (production and protection) management practices as per the package of practices for summercrop by DAO, Bihar, were followed for raising the crop |
| Plant protection | Trichogrammachlionis at weekly intervals @1.5 lakh/ha/ week for four times.Oxyflurofen 23.5 EC @ 400 ml/ha at 2 to 3 DAS andQuizalofopethyal 5%EC @ 1 ltr/ha at 20 DAS.For control of Bihar hairy caterpillar Apply carbaryl dust or chloropariphousdust @ 0.15% suspension, if pests are observed in serious proportions.For control of whitefly, aphids and hopper spray imidachlopid 17.8 SL @ 50mlmixed with 200 ltr of water/acre | Insecticide and pesticides |

**Table 2: Impact of trials on Yield attributes of greengram**

|  |  |  |  |
| --- | --- | --- | --- |
| **Year**  | **Number of pods/plants** | **Number of seeds/pods** | **Seed weight** **(in 100 pods gm)** |
| **IT** | **FP** | **% increased** | **IT** | **FP** | **% increased** | **IT** | **FP** | **% increased** |
| 2019 | 25.8 | 19.7 | 30.9 | 10.5 | 6.7 | 56.7 | 55.7 | 39.8 | 39.9 |
| 2020 | 22.6 | 17.3 | 30.6 | 9.0 | 5.9 | 52.5 | 60.0 | 42.7 | 40.5 |
| 2021 | 24.2 | 18.9 | 28.0 | 9.5 | 6.5 | 46.1 | 55.0 | 35.4 | 55.4 |
| **Average** | **24.2** | **18.6** | **29.8** | **9.7** | **6.4** | **51.8** | **56.9** | **39.3** | **45.3** |

IT= Improved Technology; FP = Farmers Practice

**Table 3 Impact of trials on yield of greengram**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Year**  | **Area (ha)** | **Demonstration (No.)** | **Yield q/ha** | **Additional yield (Q/ha) over farmer practice** | **% increase in yield over farmers’ practice** |
| **TI**  | **FP** |
| 2019 | 1756 | 640 | 10.0 | 7.0 | 3.0 | 42.9 |
| 2020 | 1398 | 568 | 9.3 | 6.8 | 2.5 | 36.8 |
| 2021 | 921 | 340 | 8.5 | 6.3 | 2.2 | 34.9 |
| **Average** | **1358** | **516** | **9.3** | **6.7** | **2.6** | **38.2** |

**Table 4: Impact of technological on gap recovery**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Years**  | **Number of FLDs** | **Potential yield** **(Qha-1)** | **FLD** **yield****(Qha-1)** | **FP** **yield (Qha-1)** | **% increased** | **EG****(Qha-1)** | **TG (Qha-1)** | **TI****(Qha-1)** |
| 2019 | 640 | 13.5 | 10.0 | 7.0 | 42.9 | 3.0 | 3.5 | 25.9 |
| 2020 | 568 | 13.5 | 9.3 | 6.8 | 36.8 | 2.5 | 4.2 | 31.1 |
| 2021 | 340 | 13.5 | 8.5 | 6.3 | 34.9 | 2.2 | 5.0 | 37.0 |
| **Average**  | **516** | **13.5** | **9.3** | **6.7** | **38.2** | **2.6** | **4.2** | **31.1** |

EG= Extension gap; TG= Technology gap; TI= Technology index; FP= Farmers practices

**Table 5 Impact of trials on Economical status**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Years**  | **Gross cost** **(Rs. /ha)** | **Additional cost in demo.****(Rs. /ha)** | **Gross returns****(Rs. /ha)** | **Net Return** **(Rs. /ha)** | **BC Ration** |
| **IT** | **FP** | **IT** | **FP** | **IT** | **FP** | **IT** | **FP** |
| 2019 | 19860 | 18112 | 1748 | 51949 | 36529 | 32088 | 18418 | 2.6 | 1.9 |
| 2020 | 19746 | 18518 | 1228 | 49739 | 37085 | 29993 | 18567 | 2.5 | 1.8 |
| 2021 | 19154 | 17914 | 1240 | 51186 | 37981 | 32016 | 20067 | 2.7 | 1.7 |
| **Average** | **19587** | **18181** | **1406** | **50958** | **37198** | **31366** | **19017** | **2.6** | **1.8** |

IT= Improved Technology; FP= Farmers Practices