



Yield Gap Analysis and Impact Assessment of Frontline Demonstrations on Green Gram in Arunachal Pradesh, India

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The Krishi Vigyan Kendra Tirap, Arunachal Pradesh, India conducted frontline demonstrations (FLD) on green gram at 30 ha area of farmers' field to exhibit latest production technologies and compared it with farmer's practice during Kharif season of 2022. The study in total 75 frontline demonstrations were conducted on farmers' fields in villages viz., Deomali, Namsang, Soha, Makat, Paniduria, Sipini and Chomoithung of Tirap district of Arunachal Pradesh state during 2022-23 to

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demonstrate production potential and economic benefit of improved technologies. The FLD recorded a average yield of 640 kg/ha which was 20.75% higher than obtained with farmers' practice (530 kg/ha). The better mean net income of Rs. 17500/ha with a Benefit: Cost ratio of 1.76 was obtained with FLD in comparison to farmers' practices (Rs. 10300/ha). The farmers' should be encouraged to adopt the recommended package of practices realizing for higher returns.

Keywords: Adoption; economics; frontline demonstration; green gram; rainfed condition.

1. INTRODUCTION

"The pulses have very important role in human health; specially for vegetarian population due to good amount of protein" [1]. "India sharing 25–28 per cent pulse production at global level and it is the largest producer and consumer of pulses in the world. In total pulse production, chick pea stands first with 48%, followed by red gram with 17%, black gram with 10%, and green gram with 7%. The remaining quantity is contributed by other pulses. In India during 2022, green gram was cultivated in an area of 4.50 million hectares with a production of 2.50 million tons, resulting in a productivity of 548 kg ha⁻¹" [2]. This productivity gain could be attribute to improved cultivars and the use of inputs.

"The green gram belongs to family *leguminosae*. It is a tropical and sub-tropical grain legume, adapted to different types of soil conditions and environments (*kharif*, spring, summer). It ranks third in India after chickpea and pigeon pea" [3]. "It has strong root system and capacity to fix the atmospheric nitrogen into the soil and improves soil health and contributes significantly to enhancing the yield of subsequent crops" [4]. "Green gram yield is also affected by insect- pests and diseases, especially by green gram yellow. mosaic virus (MYMV) and *Cercospora* leaf spot" [5]. "There is a strong need to develop the lines/ varieties which give outstanding and consistent performance in *kharif* season over diverse environment. Development of varieties with high yield and stable performance is a prime target of all green gram improvement programs" [6].

"The seed is the primary and pivotal link in the food production chain. The food security is mainly dependent on crop production. The population projections confirm that agriculture will need to feed 9 billion people by 2050. Of the several factors vital for enhancing the production and productivity of crops, seed (a living product that must be grown, harvested, and processed appropriately to make the best use of its viability

and consequent crop productivity) is a vital factor for ensuring sustainable agriculture" [7]. "A vital component of all crop production, seeds are essential to the sustainability of green value chains, rural development, global food security, and farmer livelihoods. Each farmer has different standards for what constitutes "good seed," therefore freedom of choice and sustainable seed availability are important issues for all farmers. It is essential for guaranteeing food security and a fundamental need for each planting season" [8].

"The FLD is a very important tool for dissemination of any technology at farmer's field. Under FLD programme; farmers learn latest technologies of oilseeds and pulses production under real farming situation at farmer's field. The prime objective of the Front line Demonstration is to demonstrate newly released crop production and protection technologies and management practices at the farmers' field under different agro climatic regions and farming situations" [8]. After considering all facts, the present study was carried out to analyze the performance and to promote the Frontline Demonstration (FLD) on green gram production.

2. MATERIALS AND METHODS

This study was conducted on FLD green gram in rainfed condition in Tirap district of Arunachal Pradesh, India. In total 75 frontline demonstrations were conducted on farmers' field in villages of Deomali, Namsang, Soha, Makat, Paniduria, Sipini and Chomoithung of Tirap district of Arunachal Pradesh state during *kharif* season 2021 under rainfed condition. "Each demonstration was conducted on an area of 0.4 ha and demonstration plot was having plot of farmers' practices with parallel. The improved package of practices like viz. line sowing, nutrient management, seed treatment and whole package were used in the demonstrations" [8]. The variety of green gram IPM125 included in demonstrations methods used for the present study with respect to FLDs and farmers' practices are given in Table 1.

Table 1. The improved and farmers practices in details of green gram

Particular	Technological intervention	Existing practices	Gap
Variety	IPM 125	Local or unknown variety	Full gap
Seed rate	18 kg/ha	10 kg /ha	Full gap
Seed treatment	Seed was treated	Not treated	Full gap
Sowing method	Line sowing	Broadcasting	Full gap
Spacing	30 cm x 10 cm	Not maintained	Full gap
Application of recommended dose of manure	5 kg/ meter ²	Nil/without recommendation	Partial gap
Application of Bio fertilizer	Soil application of Azospirillum & PSB @ 2 kg/ha mix with FYM	No application	Full gap
Harvesting	Manual	Manual	No Gap

Under local check plots, farmer’s practices were followed. In general, soils of the area under study were acidic soil, medium in fertility status. The spacing was 30 cm between rows and 10 cm between plants in the rows. Thinning and weeding was done; 35 days after sowing maintain spacing (10 cm) within a row (30 cm) because excess population adversely affects growth and yield of crop [9]. Seeds were sown during second week of August, 2021 with a seed rate of 18 kg/ha. The full package of practices was applied during the course of demonstration.

The data were collected and assessed about grain yield from FLD plots and farmer’s fields using regional techniques used by the local farmers. The potential production was evaluated using the standard plant population of 404440 plants/ha and the average yield per plant of 22.5 gm/plant under the recommended package of procedures with a crop geometry of 30 X 10 cm [9].

Different parameters as suggested by [10] was used for gap analysis, technology index and calculating the eco- nomics parameters of green gram. 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 = Potential yield - Demonstration yield/Potential yield x 100

Gross cost = Total cost of cultivation

Gross return= Total yield multiplied by Current market price

Net return = Gross return – cost of cultivation

3. RESULTS AND DISCUSSION

Seed yield (kg/ha): The productivity of green gram under improved production technology ranged between 620-660 kg/ha with mean yields of 640 kg/ha (Table 2). While the range of farmers practice was 485-503 kg/ha with mean yield of 503 kg/ha (Table 2).

“The increased grain yield with improved technologies was mainly because of line sowing use of nutrient management and weed management. The present findings confirm the findings” of [11,9,12,3] and [13]. They found more gain yield of FLD plots than the existing practices.

Gap analysis: “As per the result of gap study (Table 3); extension gap of 137 kg ha⁻¹ was found between demonstrated technology and farmers’ practice. Such gap might be attributed to adoption of improved technology especially high yielding variety (IPM125) sown with the help of seed cum fertilizers drill with balanced nutrition, weed management and appropriate plant protection measures in demonstrations which resulted in higher grain yield than the traditional farmers’ practices” [6]. The study further exhibited a wide technology gap of 140 kg/ha. The difference in technology gap in is due to better performance of recommended varieties [14] with different interventions and more feasibility of recommended technologies during the course of study.

The technology index in the study (17.94) was in accordance with technology gap (Table 3). Higher technology index reflected the inadequate transfer of proven technology to growers and insufficient extension services for transfer of technology [15].

Table 2. Yield attributes of green gram

Year	area	No of demonstrations	Yield kg/ha		Additional yield (kg) over farmers practice	Yield increment (%) over farmer's practice
			D	F		
2021	30	75	640	503	137	20.75

Where D denotes: demonstration plots and F denotes: farmer's practice plot

Table 3. Technology gap analysis

Potential yield (kg/ha)	FLD Yield (kg/ha)	Farmer's practice yield (kg/ha)	% increased	Extension gap (kg/ha)	Technological gap (kg/ha)	Technology Index
780	640	503	20.75	137	140	17.94

Table 4. Economics of Green gram cultivation

Year	Yield(q/ha)		Cost of Cultivation (Rs/ha)		Gross Return (Rs/ha)		Net Return (Rs/ha)		Benefit Cost ratio B:CRatio	
	D	F	D	F	D	F	D	F	D	F
2021	640	503	23,000	21,700	40,500	32,000	17,500	10,300	1.76	1.47

As per the result of technology index, it can be assumed that the awareness and adoption of improved varieties with recommended scientific package of practices have impacted positively. These findings are in the conformity of the results of study carried out by [9,16,3,11,17,18] and [19].

Economics: The Rs. 23,000/ recorded as gross cost of cultivation under Demonstration while Rs. 21,700/ was recorded under farmer's practice (Table 4). The cost of cultivation includes total expenses during the span of crop viz. ploughing cost, irrigation cost, cost of seeds, chemicals, fertilizers, labor cost etc [20-22].

The gross return was recorded under demonstration was Rs. 40,500/ as compared of Rs. 32,000/ under farmer's practices. The gross return was Rs. 8500/ha was higher as compared farmer's practices. The Net return under demonstration was Rs.17,500/ as compared Rs. 10,300/under farmer's practices; which was also higher as Rs. 7200/ha. Similarly, the Benefit cost ratio was higher under demonstration plots (1.76) as compared to farmer's practices (1.47). The higher economic parameters indicates that the scientific package of practices was implemented very nicely at farmer's field [10].

4. CONCLUSION

It is evident from the demonstration findings that Front Line Demonstrations (FLD) were a successful strategy for raising green gram productivity. Adoption of enhanced technology raised production and net returns to farmers significantly, according to frontline demonstrations of green gram conducted at farmers' fields.

The demonstrations and farmers training, field visits, advisories etc. were the pivotal factors for enhancing the yield of green gram. Thus, the need of moments to disseminate improved technologies at farmers field effectively for economic prosperity of farming community.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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