Influenceof FrontLine Demonstrationson yield, yield gap and economics offield pea under hill region ofArunachal Pradesh, India

Abstract

Krishi Vigyan Kendra Yachuli, Lower Subansiri district, gave a front-line field pea demonstration in 06 villages across two blocks with 44 farmers during the 2019-20 and 2020-21 seasons. FLD on the VL Matar 42 variety of field pea was carried out over the course of two years in a 15 ha area using the recommended improved practices. Additionally, a control plot with farmer practices was maintained. The yield in the farmers' plot (1110 $kgha^{-1}$) and demonstration plot (1510 $kgha^{-1}$) in the year 2020-21 was higher than in the year 2019-20. In the years 2019-20 and 2020-21, respectively, the demonstration plots' mean yield exceeded that of the farmers' plot by 35.23 and 36.03 percent. The VL Matar 42 variety of field pea had a mean yield of 1465 kg ha^{-1}, which was lower than the potential yield of 1868 $kgha^{-1}$. The yield gap of 403 $kgha^{-1}$ indicates that there is a technology gap. Interestingly, the average extension yield gap was lower (385 kg ha^{-1})during the study period. The technology index varied from 19.16 to 23.98 percent, showing the feasibility of the evolved technology at the farmer's fields. Cultivating field pea using improved technologies resulted in an average higher net return of Rs. 59,050ha^{-1}compared to Rs 34,500ha^{-1} from local farming practices. The benefit cost ratio of field pea was higher (2.16) when using improved technologies compared to (1.83) when using farmers' practices.

Keywords:*Front Line Demonstration, Yield, Yield gap,technologygap, economics.*

Introduction

Field Pea (*Pisum sativum* L) is a popular pulse crop in India. India is the largest producer, consumer and importer of pulses. (Kirar*et. al.,* 2018). Pulses played a crucial role in sustainable crop production systems due to their natural biological fixation ability which subsequently enhanced the soil fertility, and as a rich source of proteins, vitamins and minerals which makes them the poor man's meat (Singh and Singh, 2020).

Field pea is generally grown for dry seeds which are used for a variety of culinary and pulse. According to Reddy, (2010), dry pea is highly nutritive containing high proportion of digestive protein (22.5 %) carbohydrates (62.1%) fat (1.8%) minerals (calcium, Iron) and vitamins (riboflavin, thiamine).

India is the largest producer (26%) and consumer (30%) of pulses in the world (Singha *et.al.,* 2020). Out of all the pulses, field peas are grown extensively in the North eastern region especially Assam. Every year, a variation in area, production and productivity of pulses has been observed, due to which the projected demand of pulses varies from 30.9 million tons to 42.5 million tons by different scholars in 2030 (Mittal 2006; IIPR, 2011). The major field pea growing states are Uttar Pradesh Madhya Pradesh, Bihar and Maharashtra (Kirar *et. al.,* 2018).

Field pea is cultivated mainly during the *rabi* season in the North East region under rainfed conditions (Devi *et. al.,* 2023). Field pea a winter crop requires a cool growing season with moderate temperature throughout the life. During this Rabi season almost 50 per cent of medium textured medium Sali rice (*Oryza sativa* L.) lands remain fallow. These areas bear tremendous potential for field pea cultivation under rainfed conditions with the objective of popularizing improved technologies of field pea among the farmers (Das *et.al.,* 2021). The results ofother demonstrations showed that farmers could increase the field pea productivity notably by switching over to improved variety and adoption of good agriculture practices.

Field pea crops have been given vast importance by the government becauseof high yield gap between potential yield and yield under realfarming. Front line demonstration Field pea was conducted by the Indian Council of Agricultural Research, New Delhi under CFLD, pulses. Field demonstration conducted under the close supervision of scientist of the Krishi Vigyan Kendra.

MaterialandMethods

Field pea was previously cultivated on a large scale and held significant value for farmers in Lower Subansiri. However, the productivity and net return have consistently remained low. To investigate the reasons behind this, an intensive Rapid Rural Appraisal was conducted, along with multiple group meetings with field pea growers. The outcome of these meetings revealed several gaps in the adoption of technology. The constraints in production were assessed through matrix ranking, with the active participation of farmers.

In the annual action plan of Krishi Vigyan Kendra Yachuli, Lower Subansiri district for the year 2019-20, a proposal was made to conduct a front line demonstration on field pea in six villages of Ziro and Yachuli blocks based on matrix ranking and problem prioritization.

During 2019-20 and 2020-21, the FLD program included 44 field pea growers and covered a total area of 15 ha, with individual demonstration areas ranging from 0.4 to 0.8 ha. In addition, most participating farmers maintained a control plot for comparison purposes.

The cropping period was divided into various growth periods, and all the farmers received practical training in the specific operations of field pea cultivation. This approach garnered significant enthusiasm, with full participation from the farmers.

The improved field pea variety "VL Matar 42" was utilized with a row spacing of 30 cm and a seed rate of 80 kg ha^{-1}. Details technology adopted mentioned in Table-1. Primary data was collected from selected FLD Farmers using the random crop cutting method, and personal interview schedules were conducted to assess technology performance and acceptance.In accordance with (Kadian *et al.,* 1997; Samui *et al.,* 2000): the qualitative data was transformed into quantitative form and expressed as a percentage increased yield extension gap and technology index.

Table-1-The details of Technology adopted in Demonstration

Technology	Demonstration plot	Farmers practice
Variety	VL Matar 42	Local
Sowing method	Line sowing @30x10 cm	Broadcasting
Time of sowing	November-Dec	November
Seed Rate	80 Kg ha-1	100 kg ha-1
Seed treatment	Seed treatment with rhizobium culture @50 g/kg seed, Bavistin @ 2.0 g/kg seed.	Nil
Nutrient management	Organic Nutrient Management	Nil

Technology gap=Potential yield–demonstration yield

Extension gap =Demonstration yield -farmer's yield

$$\text{Technology index (\%)} = \frac{\text{Technology gap} \times 100}{\text{Potential yield}}$$

% Yield increase over farmers' practice

$$= \frac{\text{Avg. yield in demonstration plots- average yield in farmer's field x 100}}{\text{Average yield in farmer's field}}$$

ResultandDiscussion

The Table 2 displays data spanning two years. The yield in the farmers' plot (1110 kg ha^{-1}) and demonstration plot (1510kg ha^{-1}) in the year 2020-21 was higher than in the year 2019-20. Nonetheless, in 2019-20 and 2020-21, the farmers plot's mean yield was surpassed by the demonstration plots' mean yield by 35.23 and 36.03 percent, respectively. The data shows that the yield can be raised by using the suggested field pea production technology. According to Singha *et al.* (2020), adopting technology is essential to raising crop productivity. Compared to farmers' practices, which yielded 1085kg ha^{-1}, the two-year demonstration produced a mean yield of 1465kg ha^{-1}.

TechnologyGap

Compared to the VL Matar 42 variety of field pea, which has a potential yield of 1868kg ha^{-1}, the demonstration's mean yield was only 1465kg ha^{-1}. A technological gap has ended, as indicated by the yield gap of 403kg ha^{-1}. The VL Matar 42 variety of field pea was created for plain as well as hill region fertile and irrigated areas, but the demonstrations took place in the rainfed conditions. Thus, development managers shouldn't be surprised by such a yield gap. Nonetheless, efforts should be made to close the current technological disparity even more. This could be resolved by on-farm experiments with various soil types in Lower Subansiri district, with guaranteed irrigation. Singha *et al.* (2020)report a technological yield gap in crops caused by variations in soil fertility and weather.

Table2: PerformanceoftheFLDduring2019-20 and 2020-21

Year	Crop (variety)	No. of FLD	Area (ha)	Yield (kg ha^{-1})			% increased yield over localcheck	Technology gap (kg ha^{-1})	Extension gap(kg ha^{-1})	Technology index (%)
				Potential yield of variety	FLD yield	Farmers Practices				
2019-20	Field Pea(VL Matar 42)	43	15.00	1868	1420	1050	35.23	448	370	23.98
2020-21	Field Pea(VL Matar 42)	45	15.00	1868	1510	1110	36.03	358	400	19.16
	Average	44	15.00	1868	1465	1085	35.63	403	385	21.57

ExtensionGap

It's interesting to note that during the study period, the extension yield gap, which ranged from 370 to 400kg ha-1 (average 385), was less than the technological yield gap. This highlights the need for field agricultural extension workers to receive short-term in-service training, visit research stations, or receive skilled-based field training to enhance their knowledge of field pea production technology. The field agricultural extension workers must also receive training in technology transfer skills in order to effectively translate knowledge into crop yield potential. A different strategy would be to regularly involve farmers in Krishi Vigyan Kendra's field pea production, since this crop is crucial to the impoverished farmers of hill region. Popularization of latest production technologies like high yielding varieties will subsequently change and fill the extension gap. This finding is in corroboration with the findings of Raju *et. al.*, 2017.

TechnologyIndex

According to Singh *et al.*, 2020, there was a slight discrepancy between the adoption of evolved technology and farmers' fields. The technology index illustrates the viability of evolving technology in these settings. The lower the technology index, the more feasible the technology appears to be. The results clearly show that applying various inputs, such as better seed varieties, fungicides, and biofertilizers to the seed, significantly increases the growth and yield of field peas grown in rainfed conditions.

EconomicReturn

The cost of cultivation, gross return, net return, and benefit-cost ratio were determined using the input and output prices of the commodities that were most popular during the demonstration study (Table -3). When field peas were grown using improved technologies, the average net return was higher at Rs. 59,050/ha as opposed to Rs. 34,500/ha when farmers used traditional methods. When field pea was grown using improved technologies, the benefit-cost ratio increased to 2.16 from 1.83 when grown using farmer practices. This result is consistent with that of Mokidue*et al.*,2011.

Table-3: EconomicsofFLDand farmerspractices

Year	Costofcultivation(Rs. ha^{-1})		Grossreturn(Rs. ha^{-1})		NetReturn(Rsha^{-1})		B:CRatio	
	Farmer's practice	UnderFLD	Farmer'spractice	UnderFLD	Farmer'spractices	UnderFLD	Farmer'spractices	UnderFLD
2019-20	39400	48250	73500	106500	34100	58250	1.86	2.20
2020-21	42800	53400	77700	113250	34900	59850	1.81	2.12
Average	41100	50825	75600	109875	34500	59050	1.83	2.16

Conclusion

In can be concluded from the findings that in both years (2019-20 and 2020-21), respectively, the demonstration plots' mean yield exceeded that of the farmers' plot by 35.23 and 36.03 percent. Cultivating field pea using improved technologies resulted in an average higher net return of Rs. 59,050 ha^{-1} compared to Rs 34,500 ha^{-1} from local farming practices. The benefit cost ratio of field pea was higher (2.16) when using improved technologies compared to (1.83) when using farmers' practices. Therefore, the variety VL Matar 42 of field pea may be recommended to farmers with improved practices for enhancing the productivity of pulses.

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 the writing or editing of this manuscript.

References

1. Das, S., Deka, N., Phukan, Bhagawati, R. S. and Bezbarua, R. (2021). Impact Assessment of Cluster Front Line Demonstration on Relay Field Pea (*Pisum sativum* L.) Production on Rice Fallows in the Nagaon district of Central Brahmaputra Valley Zone. *Int.J.Curr.Microbiol.App.Sci*(2021) *10*(01): 1299-1304
2. Devi, M. Thoithoi,· Kumar, Bagish, Boruah, Munmi, Tripathi, A.K., Bordoloi, R.M., Kumar, Rajesh, and Sinha, Pankaj Kumar ((2023). Field Pea (*Pisum sativum L.*) yield gap analysis: A study from Assam, India. *Indian Journal of Hill Farming* Vol. 36: 23-29

3. IIPR Vision 2030 (2011). Printed & Published by the Director. Indian Institute of Pulses Research (ICAR), Kanpur, Uttar Pradesh.
4. Kadian, K.S., Sharma, R., Sharma, A.K. (1997). Evaluation of frontline demonstration trials on oilseeds in Kangra valley of Himachal Pradesh. *Annals of Agric. Res., 18 (1): 40-43.*
5. Kirar, B.S., Jaiswal, R.K. Kirar, Neha Singh and Yadav, Ravi (2018). Impact of front line demonstration of field pea in bundhekhand region of Madhya Pradesh. *International Journal of Chemical Studies* 2018; 6(4): 878-880
6. Mittal, S. (2006). Structural Shift in Demand for Food: India's prospects in 2020. ICRIER Working aper. pp 42.
7. Mokidue I, Mohanty AK, Sanjay K. Correlating growth Yield and adoption of Urd bean technologies. *Indian J Ex. Edu.* 2011; 11(2):20-24.
8. Raju, G., Teggelli, S., Suresh, S. M. and Ahamed, Z. B. (2017) Increasing Yield of Chickpea (Cicer arietinum Linn.) through Improved Production Technology in Kalaburagi District of *Karnataka. J. Krishi Vigyan*., 5(2): 83-86.
9. Reddy, A. A. (2010). Regional Disparities in Food Habits and Nutritional intake in Andhra Pradesh, India, Regional and Sectoral Economic Studies Vol. 10-2.
10. Samui SK, Maitra S, Roy DK, Mondal Ak, Sahan D.(2000). Evaluation of front line demonstration on groundnut (*Arachis hypogea* L). *J of Indian Soc. of Coastal Agriculture Research. 18:180-183*
11. Singh, N., Singh, A.K., (2020). Yield gap and economics of Cluster Frontline Demonstrations(CFLDs) on pulses under rain-fed condition of Bundelkhand in Uttar Pradesh, *Int. J. Adv. Res. Biol. Sci.* 7(8):1-7.
12. Singh, A.K., Rikhari, Y.C., Chauhan,R. and Kumar,P. (2020). Enhancing Yield and Economics of Field Pea through Front Line Demonstration. *Indian Res. J.Ext. Edu*., 20 (4).
13. Singha, A.K., Deka, B.C., Parisa, D., Nongrum, C. andSingha, A. (2020). Yield gap and economicanalysis of cluster frontline demonstrations(CFLDs) on pulses in Eastern Himalayan Region ofIndia. *J. of Pharmacognosy and Phytochemistry*., 9(3): 606-610