Yield gap analysis of Fieldpea in Senapati District, Manipur, India

.

ABSTRACT

The purpose of the study was to evaluate field pea performance under cluster frontline demonstrations in terms of grain yield, extension gap, technology gap, and field pea economics in fifteen villages adopted by Krishi Vigyan Kendra-Senapati district of Manipur from 2015–16 to 2022–23 during the rabi season. Aman (IPF5-19) and Prakash (IPFD 1-10) varieties were the emphasis of the study, which involved 325 farmers and covered 130 hectares. By implementing enhanced production technology, the cluster frontline demonstration produced an average field pea yield of 1315.62 kg/ha, which was 32.42 percent greater than farmers' practices, which were 993.5 kg/ha. The technology index, technological gap, and extension gap were 35.69 percent, 759.37 percent, and 322.12 percent, respectively. The net return was Rs.36574/ha in demonstration plots whereas it was Rs. 20923/ha in farmer practices.

Keywords: Fielpea, extension gap, technology gap, technology index

1. INTRODUCTION

Pulses are the poor man's meat because of their substantial protein, vitamin, and mineral content, as well as their natural biological fixation ability, which improves soil [1,2]. For these reasons, they have played a critical part in sustainable crop production systems. Peas are third in importance among pulse crops worldwide, behind dry beans and chickpeas. In India, they are the third most popular Rabi pulse, behind lentils and chickpeas. Around the world, peas (Pisum sativum L.), a member of the Leguminosae family, are a widely grown crop. More protein (21.2–32.9%) with important amino acids, especially lysine, is present [3,4].The cultivation of fieldpeas during rice fallow improves the biological, chemical, and physical characteristics of the soil, hence raising its general quality. The government has placed a great deal of emphasis on field pea crops due to the large output difference between potential and actual farming. A novel method for facilitating direct communication between researchers and farmers for technology transfer and gathering firsthand input from the farming community is the use of cluster front line demonstrations (CFLDs).It was launced by the Ministry of Agriculture and Farmers Welfare of the Government of India under the National Food Security Mission-Pulses (NFSM-Pulses) in 2015-16. Under the direction of scientists from Krishi Vigyan Kendras, the program seeks to target the designated areas by providing improved technologies such as the promotion of Integrated Nutrient Management (INM), Integrated Pest Management (IPM), micronutrients/biofertilizers, irrigation devices and capacity building programmes of farmers.

The key factors limiting the potential yield include poor sowing techniques, planting density, crop spacing, avoiding the use of biofertilizers, other cross-cultural operations, and climate unpredictability, which all contribute to lower or uncertain productivity. Cluster front line demonstrations of suggested field pea technologies were carried out at farmers' fields from 2015–16 to 2022–23 in an effort to address the factors contributing to yield reduction and the technology gap. In light of the aforementioned information, the current study was conducted to showcase farm technology in field pea through Cluster Frontline Demonstration (CFLDs). The study's goals were to evaluate the effectiveness of CFLDs on field pea in terms of grain yield, extension gaps, technological gaps, and economic gains for farmers of Senapati district, Manipur,India.

2. MATERIAL AND METHODS

From 2015–16 to 2022–23, the Krishi Vigyan Kendra-Senapati, Manipur, conducted the current study at farmers' fields during the rabi seasons. In a 130-hectare area, 325 CFLDs were carried out using the Prakash and Aman field pea varieties. For the chosen variety, all technical interventions were implemented in accordance with the package of practices (Table 1).

Table 1 : Technical interventions showing package of practices

Technologies	Recommended practices	Farmers practices
Variety	Prakash and Aman	Local
Sowing method	Line sowing @ 30cm × 10cm	Broadcasting
Time of sowing	November - December	November - December
Seed rate	80kg/ha	100kg/ha
Seed treatment	Bavistin @ 2 g/ kg + 20 g rhizobium and PSB 20 g/ kg Seed	Nil
Nutrient Management	Soil test based application of NPKS @ 20:40:20:20	Nil
Disease Management	Wettable sulphur 90% WDG @ 3 g/ litre of water for powdery mildew	Application of wood ashes

Farmers training, field visits, field days, group discussion group meeting were also organized. The important steps like selection of site, selection of farmers, layout of demonstrations, etc. were followed as suggested by Kirar et.al., [5]. The yield data was gathered from the farmers' demonstration and practice plots, and the benefit/cost ratio, net income, and cultivation costs were calculated. The technology gap, extension gap, and technology index were calculated in accordance with Samui et al., [6].

Technology gap = Potential yield-Demonstration yield
Extension gap = Demonstration yield-Farmers practice yield
Technology index (%) = Technology gap ÷Potential yield x 100
Benefit cost ratio = Gross return ÷ Gross cost

3. RESULTS AND DISCUSSION

Grain Yield: It was found during the study that the productivity of the demonstration plots was higher than that of the corresponding farmer's practice. Grain yield improved by 27.77-34.88% compared to local practices. The average yield of CFLD plots pooled over eight consecutive years was 1315.62 kg/ha as compared to farmer's practice i.e. 983.5 kg/ha. 1232 kg/ha was the greatest yield in the demonstration plot in 2022–2023 and 1143 kg/ha was the lowest in 2021–2022. The average production of the demonstration plots increased by 32.14% over the course of eight years compared to the farmer's practice. Adoption of the suggested package of practices was mostly responsible for the demonstration plots' greater average yield over time when compared to the local check. The results above concurred with those of Singha et al., Ojha et al., and Suresh et al. [2,7,8]

Extension Gap: During the eight years study the extension gap ranges from 287 to 430 kg/ha and average extension gap was 332.12 kg/ha. A greater extension yield gap suggests that, in order to buck the current trend, farmers must be educated and encouraged to adopt better oilseed farming methods over current local practices through a variety of extension channels [9]. The extension gap was lowest (287kg/ha) during 2021-22 and highest (430 kg/ha) during 2020-21 (Table 2). This discrepancy may be explained by the demonstrations of new technology, which produced a higher grain output than the conventional farming methods.

Technology Gap: There was a significant technological gap across the years, with the lowest being 416 kg/ha in 2015–16 and the maximum being 1097 kg/ha in 2021–2022. Over the course of the study, the average technology gap was 759.37 kg/ha (Table 2). Dissimilarities in soil fertility state, rainfall distribution, disease and pest attacks, and shifting demonstration plot placements, among other factors, could be the cause of the observed technology gap. Raj et al. [10]. also reported on the technological yield gap of crops caused by variations in soil fertility and meteorological conditions.

Technology Index: The technology index for each demonstration throughout time showed the technological gap. The range of the technology index was 23.11 to 48.97 percent (Table 2). The year 2015–16 had the lowest technology index, at 23.11 percent, while the year 2021–22 had the highest, at 48.97 percent. The technology index indicates whether advanced technology is feasible for farmers to use; the lower the index value, the more feasible the technology is [2,7,11].

Economic Analysis: Gross return, cost of cultivation, net return, and benefit cost ratio were calculated using the input and output prices of the commodities that were most prevalent during the demonstrations. The primary causes of the higher cultivation costs in demonstration fields compared to local check are the use of expensive seeds for crop sowing, seed treatment, the recommended dosage of chemical fertilizers, appropriate insect management, etc. The average cultivation cost throughout the eight-year study period under demonstration was Rs.36741/ha, which is higher than farmers' practices, which are Rs.33487/ha. When field peas were grown using better technology, the average net return was greater at Rs.36574/ha, compared to Rs.21173/ha when farmers used traditional methods. Field pea benefit-cost ratios under better technology averaged 1.98, whereas those under farmers' practices averaged 1.61. These results (Table 3) were consistent with those of Singh et al., Raghav et al., Ojha et al., and Singha et al., [2,7,11,12].

T**able 2:** Grain yield and gap analysis of Cluster front line demonstrations on Field pea at farmers field from 2015-16 to 2022-23.

Year	**No. of Demonstration**	**Area (ha)**	**Variety**	**Potential yield (kg/ha)**	**Demonstration yield (kg/ha)**	**Farmer practice (kg/ha)**	**%increase over FP (check)**	**Extension gap (kg/ha)**	**Technology gap (kg/ha)**	**Technology Index (%)**
2015-16	25	10	Prakash (IPFD 1-10)	1800	1384	1052	31.55	332	416	23.11
2016-17	75	30	Prakash (IPFD 1-10)	1800	1362	1066	27.77	296	438	24.33
2017-18	50	20	Prakash (IPFD 1-10)	1800	1340	1020	31.37	320	460	25.55
2018-19	50	20	Aman (IPF5-19)	2240	1356	1021	32.81	335	884	39.46
2019-20	25	10	Aman (IPF5-19)	2240	1392	1032	34.88	360	848	37.85
2020-21	25	10	Aman (IPF5-19)	2240	1316	886	33.46	430	924	41.25
2021-22	25	10	Aman (IPF5-19)	2240	1143	856	33.52	287	1097	48.97
2022-23	50	20	Aman (IPF5-19)	2240	1232	935	31.76	297	1008	45.00
Total	**325**	**130**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Mean	**-**	**-**	**-**	**-**	**1315.62**	**983.5**	**32.14**	**332.12**	**759.37**	**35.69**

Table 3: Economics of field pea cultivation under CFLD and Farmers practice

Year	**Economics of Farmers' practice (Rs./ha)**				**Economics of Demonstration (Rs./ha)**			
	Gross Cost	**Gross return**	**Net return**	**BC ratio**	**Gross Cost**	**Gross return**	**Net return**	**BC ratio**

2015-16	25200	42080	16880	1.66	29626	55360	25734	1.86
2016-17	27700	43840	16140	1.58	30226	54480	24254	1.80
2017-18	31700	51000	19300	1.60	35926	67000	31074	1.86
2018-19	32855	51050	18195	1.55	36785	67800	31015	1.84
2019-20	35780	61920	26140	1.73	37213	83520	46307	2.24
2020-21	37864	62020	24156	1.63	40321	92120	51799	2.28
2021-22	38256	59920	21664	1.56	41855	80010	38155	1.91
2022-23	38540	65450	26910	1.69	41980	86240	44260	2.05
Mean	**33487**	**54660**	**21173**	**1.62**	**36741**	**73316**	**36574**	**1.98**

4.CONCLUSION

The study found that Aman and Prakash yields higher in recommended practice (CFLD) than farmers' practices in Senapati District of Manipur. Variations in weather, soil health, management techniques, etc., could be the cause of the large discrepancy between field pea potential and demonstration yield. The grain yield and economic return of field peas are positively impacted by the use of better technology in their cultivation, such as appropriate varieties, fertilizers, and pest control, as well as the active involvement of farmers. Cluster Frontline Demonstrations yielded a noteworthy good outcome and offered a chance to illustrate the profitability and production potential of the newest technology in an actual farming setting. Therefore, in order to increase field pea production and productivity in the Senapati district of Manipur state, the farming community must apply the identified yield-enhancing technologies more widely in their different farming systems.

ACKNOWLEDGEMENTS

The authors express their gratitude to the Director of ICAR ATARI, Zone VII, Umiam, Meghalaya, for funding the CFLD on pulses under the NFSM Scheme. We also thank the district's farming community for their assistance and support, as they have responded positively and kindly provided information to enable us to conduct CFLD on field peas.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

AUTHORS' CONTRIBUTIONS

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

REFERENCES

1. Gireesh, S., Kumbhare, N.V., Nain, M.S., Kumar, Pramod., Gurung, Bishal. Yield gap and constraints in production of major pulses in Madhya Pradesh and Maharashtra, Indian J. Agric. Res., 2019; 53(1):104-107

2. Singha, A.K., Deka, B.C., Parisa, D., Nongrum, C. and Singha, A. Yield gap and economic analysis of cluster frontline demonstrations (CFLDs) on pulses in Eastern Himalayan Region of India. J. of Pharmacognosy and Phytochemistry., 2020; 9(3): 606-610.

3. Nawab, N.N., Subhani, G.M., Mahmood, K., Shakil, Q. and Saeed, A. Genetic variability, correlation and path analysisstudies in garden pea (Pisum sativum L.). J.of Agril. Res., 2000;46 (4): 333-340.

4. Dahl W.J., Foster L.M. and Tyler R.T. Review of the health benefits of peas (*Pisum sativum L*.) British Journal of Nutrition. 2012;108: S3S10. Doi:10.1017/S0007114512000852.

5. Kirar BS, Mahajan SK, Nashine R. Impact of technology practices on the productivity of soybean in FLD. Ind. Res. J. Ext. Edu. 2004; 5(1):15-17.

6. Samui SK, Maitra S, Roy DK, Mandal AK, Saha D. Evaluation of frontline demonstration on groundnut. J. of the Ind. Soc. of Coastal Agril. Res. 2000; 18(2):180-183.

7. Ojha, R. K. and Bisht, H. Yield potential of Chickpea through cluster frontline demonstrations in Deoghar district of Jharkhand. Int. J of Sci. Environment. and Technology., 2020; 9 (6): 947 – 95.

8. Suresh, M., Naaiik, B. R. V. T., Kumar, K., Vijaykumar, P. Swetha, M., Vijayalaxmi, D., Rajkumar, B. V., Manjari, M.B. and Padmaveni, C. Cluster Front Line Demonstration Evaluation Programme on Bengal Gram (Cicer arietinum L.)Variety (NBeG-3) in Nizamabad District of Telangana. Current Journal of Applied Science and Technology.2020; 39(48): 312-317.

9. Kumar, S., Mahajan, V., Sharma, P., Kumar and Parkash, S. Impact of front line demonstrations on the production and productivity of moong (Vigna radiata L), mash (Vigna mungo L), rajmash (Phaseolus vulgaris L), lentil (Lens culinaris L) and chickpea (Cicer aeritinum L) under rainfed ecology in mid hills of J & K, India. Legume Research, 2016; LR (3816):1-7, ISSN:0250-5371.

10. Raj AD, Yadav V, Rathod HJ. Impact of front line demonstrations (FLD) on the yield of pulses. Intn. J. of Scientific & Res. Publ. 2013; 3(9):1- 4.

11. Singh, A.K., Rikhari, Y.C., Chauhan,R. and Kumar,P. Enhancing Yield and Economics of Field Pea through Front Line Demonstration. Indian Res. J. Ext. Edu., 2020; 20 (4). 78-81.

12. Raghav, D K., Kumar, U., Kumar, A. and Singh, A.K. (2020). Impact of cluster frontline demonstration on pigeon pea for increasing production in rain fed area of district Ramgarh (Jharkhand) towards Self-Sufficiency of Pulses Indian Res. J.of Ext. Edu. 2020; 20 (4) : 34-39.