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Yield Gap Analysis of Field Pea (*Pisum sativum* L.) through Cluster Front Line Demonstration under NFSM Pulses Scheme in Khowai District, Tripura, 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

Enhancing the production potential and socio- economic level of farmers, altogether 325 front line demonstrations on field pea were laid out comprising 325 farmers covering the total area 160 ha with demonstration plots ranging from 0.20 to 1.0 ha during the year 2015- 16 to 2022- 23 in 14 different villages of Khowai district of Tripura to disseminate the production technology of improved varieties viz., Malviya Matar- 15 (HUDP- 15), Prakash (IPFD 1-10), Aman (IPF 5-19). Field diagnostic visits, regular inspection, farmer's trainings, group discussion, field days ensured application of balanced and optimum doses of nutrient, and timely plant protection measures. The productivity ranged from 11.50 to 13.50 q/ ha with average yield under demonstration recorded

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12.21 q/ ha under improved technology on farmers field as against a yield ranged from 6.75 to 8.50 q/ ha with a mean of 7.52 q/ ha recorded under farmers practice. However, in the demonstration plot the yield enhancement due to technological intervention was 62.15% over the farmer's practice. An average net returns of Rs 24,441/- at demonstrations plot, while the average net returns from farmers practice is Rs 7218. The additional cost of Rs 5440 gave additional net return of Rs. 17,223/ ha. The increased cost benefit ratio was also estimated; it ranged from 1.56 to 1.97 in recommended practices and 1.11 to 1.36 in farmers practice. An extension gap of 4.69 q/ ha was found between demonstrated technology and farmers practice, technology gap being observed 12.41 q/ ha, whereas technology index 49.87%. Therefore, cluster front line demonstration of field pea was effective for increasing the productivity of field pea and changing the knowledge, attitude and skill of the farmers. This created greater awareness and motivated the other farmers to adopt improved practices of field pea.

Keywords: Field pea; yield; technology gap; extension gap.

1. INTRODUCTION

"Field pea (*Pisum sativum* L.) of family Leguminosae is a very common crop cultivated throughout the World. It is on self pollinated diploid (2n= 14) most important annual winter season pulse of India. Field pea is the cheapest source of dietary protein (22.5%), carbohydrate (62.1%), fat (1.8%), vitamins (riboflavin, thiamine etc.), minerals (calcium, iron) and having a amino acids" [1-3]. "Field pea crop is the third most important grain legumes in the world and is the third most popular rabi pulse of India. It is an important grain legume crop for human as well as for animal nutrition. Field pea is a winter season crop requires a cool growing season with moderate temperature throughout the life. In Tripura it is cultivated during the rabi season (October to November). In Khowai district of Tripura, it is cultivated in 534 ha area with 507 MT production and the 9.50 q/ ha productivity of field pea has also shown an irregular trend" [4].

"Addressing the concern of significance, the Ministry of Agriculture and Farmers Welfare, Govt of India had initiated a nation- wide cluster frontline demonstration (CFLD) programme on pulses under National Food Security Mission-Pulses (NFSM- Pulses). The basic strategy of the mission is to popularize improved technologies, i.e. seed, micro-nutrients, soil amendments, weed management, integrated pest and disease management, farm machinery and implements, micro irrigation devices along with capacity building of farmers. The ICAR through its Krishi Vigyan Kendras (KVKs) across the country has been implementing this CFLD programme on different pulse crops to boost the production and productivity of pulses which improved varieties and location specific technologies. Despite great scope and better opportunities for pulses production in Khowai district of Tripura for food and nutritional security purpose. The growth rate is low due to many intricate and interrelated factors right from soil, climate related constraints to technological and extension- oriented tribulations. Besides, shrinkage in land holding, growing population pressure, increasing food/ pulse demand and poor soil health are the key constraints" [5,6].

However, field pea crops has given the importance by Government because vast yield gap exists between potential yield and yield under real farming situation. Less or uncertain productivity mainly due to faulty sowing practices, planting density, crop spacing, avoid use of bio- fertilizers, other intercultural operations and climate variability's are predominant reasons for limiting the potential yield. To combat the causes of yield reduction and technology gap, dissemination of recommended technologies of field pea through cluster front line demonstration were conducted at farmers field during 2015- 16 to 2022- 23. Krishi Vigyan Kendra Khowai had given intensive efforts on training on scientific cultivation, demonstration of new variety and other interventions. The study aimed at assessing the impact of CFLDs in terms of yield, economic gains, extension and technological gap in field pea crop in different villages of Khowai district and also conveys the scientific technical message to farmers for increasing the yield of field pea to a considerable amount.

2. MATERIALS AND METHODS

The present study was carried out by Krishi Vigyan Kendra (Divyodaya) Khowai Tripura in winter season at the farmers fields of fourteen villages viz. RC Ghat, Batapora, Tuchindrai,

Hrankhwal para, Ratia, Namapara, Chebri, Ghilatali, Krishnapur, Peknichera, Laxmi Narayanpur, Ganki, South Singichera, NK Hrankhwal para in Khowai district of Tripura state during the period of 2015- 16 to 2022- 23 (8 consecutive years). The district lies between latitude 23.8974^0 N and Longitude 91.6372^0 E. The soils of the demonstration area was sandy loam and acidic in nature (p^H 5.1 to 6.2), available N 286.5 kg/ ha, P 14.3 kg/ ha, K 135 kg/ ha and 0.98% organic C. The data on Fig. 1 evident that the minimum temperature in the Khowai district is 9.72° Celsius (February) and highest temperature is 32.83° Celsius (April). The mean average maximum atmospheric temperature is 29.97^{0}C and the minimum 19.93^{0}C. The annual average rainfall of Khowai district is 1874.20 mm besides, humidity between 82 to 47% was also observed during the demonstration years. FLD on Malviya Matar- 15 (HUDP- 15) variety during 2015-16 to 2017-18; Prakash (IPFD 1-10) variety during 2018- 19 to 2021- 22; and variety Aman (IPF 5-19) in 2022-23 were taken and demonstrated to the farmers field. Front line demonstrations (325) on field pea were laid out comprising 325 farmers covering the total area 160 ha with demonstration plots ranging from 0.20 to 1.0 ha. The required inputs like variety, seed quantity, seed treatment, sowing method, spacing, time of sowing, application of nutrient, weed and disease management etc are presented in Table 1. Regular visits to the demonstration fields by the KVK Scientists ensured proper guidance to the farmers. Farmers training, field days, group discussion group meeting were also organized to provide the opportunities for other farmers to witness the benefits of demonstrated technologies. Production and protection technologies except the interventions were followed in similar manner in recommended as well in farmers practices. All other steps like farmer's selection, site selection, farmers participation etc was followed as suggested by Kirar et al. [7]. The yield data were collected from the farmers practice and demonstration plots and cost of cultivation, net income and benefit/ cost ratio were computed. The technology gap, extension gap and technology index were a work out as suggested by Samui et al. [8].

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

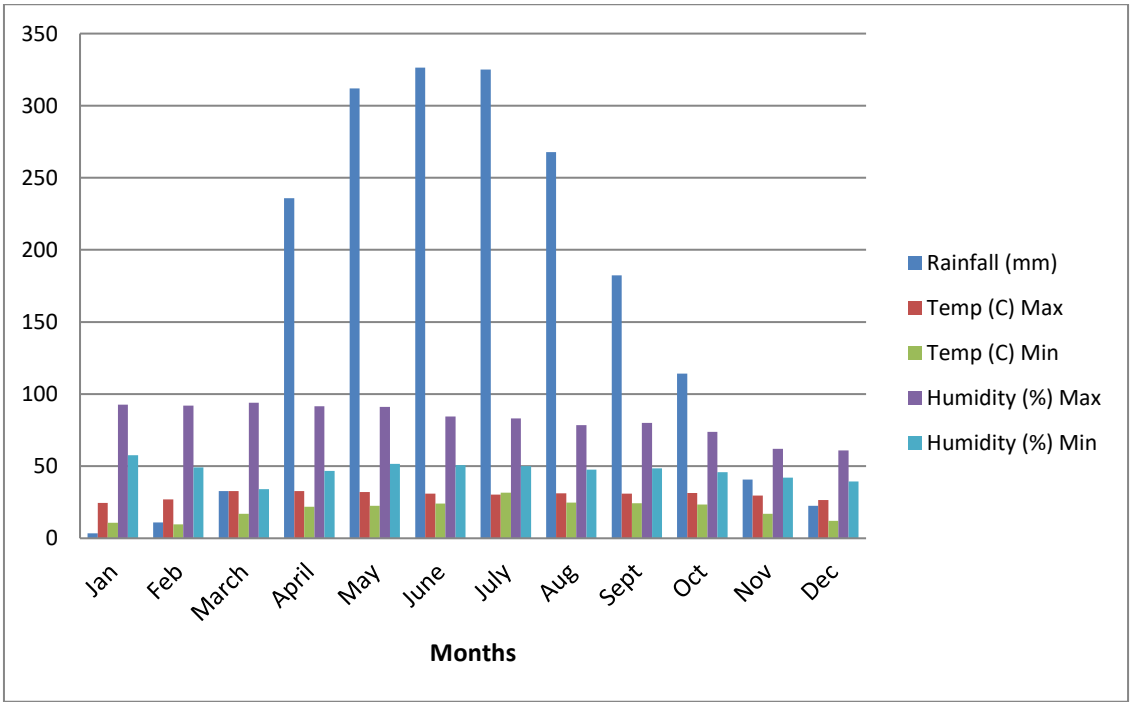

Fig. 1. Metrological Information

Table 1. Details of recommended practices and existing practices under field pea FLD

Crop operations	Recommended practices	Farmers practices
Variety	Malviya Matar- 15 (HUDP- 15); Prakash (IPFD 1-10); Aman (IPF 5-19)	Local or old variety
Seed rate	80 kg/ ha	110 kg/ ha
Seed treatment	Bavistin @ 2 g/ kg + 20 g Rhizobium and PSB 20 g/ kg Seed	No seed treatment
Sowing method and spacing	Line sowing, 30 X 10 cm row to row and plant to plant	Line sowing
Time of sowing	October- November	October- November
Nutrient management	Application of 25 kg N, 50 kg P_2O^5 and 20 kg sulphur/ ha	Use of under dose of fertilizers
Weed control	Pre- emergence application of Pendimethalin 30 EC 3.3 litter/ ha followed by manual weeding one at 30 DAS	2 to 3 hand weeding
Irrigation	One light irrigation at flowering stage and after poding if winter rain not noticed	Uncontrolled irrigation
Plant protection	Wettable sulphur 90% WDG @ 3 g/ litter of water for powdery mildew	No measurement adopted

3. RESULTS AND DISCUSSION

During the period of 8 consecutive years, demonstrations conducted by Krishi Vigyan Kendra in the district are shown in Table 2. In each Cluster Frontline Demonstration (CFLD), latest varieties with scientific package of practices of field pea crop were compared with control/ farmers practice with traditional cultivation practices. A total of 325 demonstrations on improved varieties of field pea viz., Malviya Matar- 15 (HUDP-15), Prakash (IPFD 1-10) and Aman (IPF 5-19) covering 160 ha area were conducted at farmers field in 14 villages during 2015- 16 to 2022- 23 (Table 2).

The results of Cluster Frontline Demonstration revealed that under the demonstrated plots, performance of field pea yield was comparatively higher than the farmers practice during the period 2015- 16 to 2022- 23. The productivity of field pea ranged from 11.50 to 13.50 q/ ha with average yield under demonstration recorded 12.21 q/ ha under improved technology on farmers field as against a yield ranged from 6.75 to 8.50 q/ ha with a mean of 7.52 q/ ha recorded under farmers practice. However, in the demonstration plot the yield enhancement due to technological intervention was to the tune of 38.34% over the farmers practice. The higher productivity was found in the recommended practices as compared to the farmers practice during reporting period which might be due to continuous use of integrated nutrient management and integrated disease management practices. The higher yield of field pea under recommended practices was due to the use of latest high yielding varieties, integrated nutrient and pest management. Similar results have been reported by Verma, [9]; Das et al., [10]; Das et al., [11].

The input and output prices of commodities prevailed during each year of demonstration were considered for calculating cost of cultivation, gross return, net return, and cost benefit ratio (Table 4). The year wise net return for recommended practices ranged from Rs 19,075 to Rs 36,670 with mean net return of Rs 24,441/ ha. On the other hand the net return under farmers practice ranged from Rs 3450 to Rs 12,000 with average net return Rs 7218. The additional cost of Rs 4480 to Rs 7800 gave additional net return, ranging from Rs. 11,000 to Rs. 24,670 per hectare. The increased benefit cost ratio ranged from 1.56 to 1.97 in recommended practices and 1.11 to 1.36 in farmers practice. Thus, it reveals from the findings that the demonstration of field pea with scientific technology was better than the farmer's practices. Similar results have been reported by earlier by Das et al., [10], Sachan [12], Singh et al., [13].

An extension gap of 3.50 to 5.50 q/ ha was found between demonstrated technology and farmers practice during different eight years and on average basis the extension gap was 4.69 q/ ha (Table 3). Such gap might be attributed to adoption of improved technology in demonstrations which resulted in higher yield than the traditional farmer's practices.

Table 2. Year wise details of variety, area, demonstrations and villages covered under FLD on field pea

Year	Variety	No of demo.	No of farmers	Area covered (ha)	No. of village covered	Name of villages
2015- 16	Malviya Matar- 15 (HUDP-15)	38	38	10	3	RC Ghat, Batapora, Tuichindrai
2016- 17	Malviya Matar- 15 (HUDP-15)	32	32	20	3	RC Ghat, Hrankhwal para, Ratia
2017- 18	Malviya Matar- 15 (HUDP-15)	46	46	30	4	RC Ghat, Batapora, Nama Para, Ratia
2018- 19	Prakash (IPFD 1-10)	28	28	20	7	RC Ghat, Batapora, Nama Para, Chebri, Ratia, Ghilatali, Krishna Pur
2019- 20	Prakash (IPFD 1-10)	60	60	30	6	Batapora, Nama para, Peknicherra, Ratia, Laxmi Narayan Pur, Krishna Pur
2020- 21	Prakash (IPFD 1-10)	50	50	20	5	Nama para, Ganki, Ratia, Laxmi Narayan Pur, South Singhicherra
2021- 22	Prakash (IPFD 1-10)	21	21	10	2	Batapora, Nama Para
2022- 23	Aman (IPF 5-19)	50	50	20	1	NK Hrankhwal para
Total		**325**	**325**	**160**		**14**

Table 3. Yield performance and gap analysis of frontline demonstrations of field pea at farmers field from 2015- 16 to 2022- 23

Year	Potential Yield (q/ ha)	Demo. Yield (q/ ha)	FP Yield (q/ ha)	(%) increase over FP	Extension gap (q/ ha)	Technology gap (q/ ha)	Technology index (%)
2015- 16	28.00	12.20	7.50	62.67	4.70	15.80	56.43
2016- 17	28.00	11.50	8.00	43.75	3.50	16.50	58.93
2017- 18	28.00	11.75	6.75	74.07	5.00	16.25	58.03
2018- 19	22.50	13.00	8.50	52.94	4.50	9.50	42.22
2019- 20	22.50	11.50	7.50	53.33	4.00	11.00	48.88
2020- 21	22.50	11.75	6.75	74.07	5.00	11.25	50.00
2021- 22	22.50	12.50	7.00	78.57	5.50	10.00	44.44
2022- 23	22.50	13.50	8.20	64.63	5.30	9.00	40.00
Average	**24.56**	**12.21**	**7.52**	**62.15**	**4.69**	**12.41**	**49.87**

Table 4. Economic indicators of frontline demonstrations of field pea at farmers field from 2015- 16 to 2022- 23

Year	Cost of cultivation (Rs/ ha)		Gross return (Rs/ ha)		Net return (Rs/ ha)		B: C ratio		Additional Cost (Rs)	Additional net return (Rs)
	Demo.	FP	Demo.	FP	Demo.	FP	Demo.	FP		
2015- 16	30,700	25,800	54,900	33,750	24,200	7950	1.79	1.31	4900	16,250
2016- 17	32,100	27,350	51,750	36,000	19,650	8650	1.61	1.32	4750	11,000
2017- 18	33,800	26,000	52,875	30,375	19,075	4375	1.56	1.17	7800	14,700
2018- 19	33,400	28,433	58,500	38,250	25,100	9817	1.75	1.35	4967	15,283
2019- 20	34,670	30,000	57,500	37,500	22,830	7500	1.66	1.25	4670	15,330
2020- 21	36,350	30,300	58,750	33,750	22,400	3450	1.62	1.11	6050	18,950
2021- 22	36,900	31,000	62,500	35,000	25,600	4000	1.69	1.13	5900	21,600
2022- 23	37,580	33,100	74,250	45,100	36,670	12,000	1.97	1.36	4480	24,670
Average	**34,438**	**28,998**	**58,878**	**36,216**	**24,441**	**7218**	**1.71**	**1.25**	**5440**	**17,223**

Wide technology gap was observed during different years and this was lowest (9.00 q/ ha) during 2018- 19 and was highest 16.50 q/ ha during rabi 2016- 17 followed by 16.25 in the year 2017- 18. On eight years average basis the technology gap of total 325 demonstrations was found to be 12.41 q/ ha (Table 2). The observed technology gap may be attributed dissimilarity in soil fertility status, rainfall distribution, disease and pest attacks as well as the change in the locations of demonstration plots every year. The difference in technology gap during different years could be due to more feasibility of recommended technologies during different years. Technological yield gap of crops due to variation in the soil fertility and weather conditions is reported by Raj et al., [14]; Sachan [15]; Das et al., [11].

The technology index for all the demonstrations during different years were in accordance with technology gap. The highest technology index percent of 58.93 was recorded in the year 2016- 17 and the lowest was observed in the year 2022- 23 in rabi season which is 40.00%. The technology index shows the feasibility of the evolved technology at the farmer's fields and lower the value of technology index more is feasibility of the technology (Table 3).

4. CONCLUSION

Thus it may be concluded that the yield enhancement due to technological intervention was 62.15% over the farmer's practice. An average net returns of Rs 24,441/- at demonstrations plot, while the average net returns from farmers practice is Rs 7218. The additional cost of Rs 5440 gave additional net return of Rs. 17,223/ ha. The increased cost benefit ratio was estimated; it ranged from 1.56 to 1.97 in recommended practices and 1.11 to 1.36 in farmers practice. An extension gap 4.69 q/ ha; technology gap 12.41 q/ ha and technology index 12.41 q/ ha were found between demonstrated technology and farmers practice. The productivity enhancement of the demonstration over traditional farmers practice created greater awareness and motivated the other farmers of the locality to adopt appropriate production technology for the field pea cultivation in the Khowai district of Tripura state. The dissemination of scientific cultivation practices, improved variety, bio-fertilizer inoculation of seed, plant protection measures, application of lime etc were found to be the main reason for increase in yield. Thus, identified yield enhancing technologies needs to be disseminated for wider adoption among the farming community in their respective farming systems and enhancing production and productivity of field pea in the Khowai district of Tripura state.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Nawab NN, Subhani GM, Mahmood K, Shakil Q, Saeed A. Genetic variability, correlation and path analysis studies in Garden pea (*Pisum sativum* L). J. of Agril. Res. 2008;46(4):333-340.
2. Dahl WJ, Foster LM, Tyler RT. Review of the health benefits of peas (*Pisum sativum* L). British J. of Nutrition. 2012;108:S3-S10.
3. Bhat TA, GuptaM,Ganai MA, Ahangar RA, Bhat HA. Yield, soil health and nutrient utilization of field pea (*Pisum sativum* L.) as affected by phosphorus and bio-fertilizers under sub- tropical conditions of Jammu. Intn. J. of modern Pl. & Animal Sci. 2013;1(1):1-8.
4. Anonymous. Economic review of Tripura, 2019- 20. Directorate of Agriculture (Govt of Tripura), Krishi Bhawan, Agartala; 2020.
5. Vijay Laxmi D, Vijay Kumar P, Padmaveni C. Impact of cluster frontline demonstration to transfer of technologies in pulses production under NFSM. Bulletin of Envir. Pharm. And Life Sci. 2017;6(1):418- 421.
6. Singh AK, Rikhari YC, Chauhan R, Kumar P. Enhancing yield and economics of field pea through front line demonstration. Indian J. Ext. Edu. 2020;20(4):78- 81.
7. 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.

8. 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.
9. Verma DP. A study on Impact of frontline demonstrations on pulses by Krishi Vigyan Kendra, Panna MP. M.Sc. (Ag) Thesis, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur MP; 2013.
10. Das S, Pagaria P, Morwal BR, Singh M. Yield gap analysis for chickpea (*Cicer arietinum* Linn) through cluster front line demonstration under NFSM scheme in Barmer district of Rajsthan, India. Int. J. Curr. Microbiol. App. Sci. 2018;7(9):129-133.
11. Das S, Deka N, Phukan R, Bhagwati S, Bezbarua R. Impact assessment of cluster front line demonstration on relay field pea (*Pisum sativum* L.) production on rice fallows in the Naogaon district of Central Brahmaputra Zone. Int. J. Curr. Microbiol. App. Sci. 2021;10(01):1299-1304.
12. Sachan MS. Productivity enhancement in rapeseed (Toria) through frontline demonstration. Ad. Plant Sci. 2015b;28(1): 181-182.
13. Singh N, Singh AK. Yield gap and economics of cluster front line demonstrations (CFLDs) on pulses under rainfed- fed condition of Bundelkhand in Uttar Pradesh. Int. J. Adv. Res. Biol. Sci. 2020;7(8):1-7.
14. 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.
15. Sachan MS. Yield gap analysis of soybean through frontline demonstration. Ad. Plant Sci. 2015a;28(1):179-180.

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