Indian Res. J. Ext. Edu. 25 (5), December-2025 Special e-Issue
doi: 10.54986/irjee/2025/dec_spl/446-453

Indian Research Journal of Extension Education

RESEARCH ARTICLE

Enhancing Productivity and Profitability of Garden Pea (*var.* Arkel) through Front Line Demonstrations in Hill Agro-ecosystem of Phek District, Nagaland

Manjunath K.S[1]., T. Esther Longkumer[2], Hannah K. Asangla[3], and Sanjeev Kumar Singh[4*]

1.SMS, 2&3.CTO and 4. Sr. and Head, ICAR-Krishi Vigyan Kendra, Phek, Nagaland
**Corresponding author's email: sanjeevs99@gmail.com*

HIGHLIGHTS

- The improved garden pea variety Arkel recorded significantly higher yield (93.4–101.2 q/ha) with 58.17–64.47% yield advantage over farmer's practice, along with early flowering (33–35 days), making it suitable for early market supply in hill Agro-ecosystems.
- Adoption of Arkel with recommended package of practices resulted in higher economic returns, with gross return of ₹2.33–2.53 lakh/ha, net return of ₹1.67–1.86 lakh/ha and benefit–cost ratio of 2.54–2.78 compared to farmers' traditional cultivation practices.
- Lower technology index (8.00–15.09%) and higher extension gap (34.7–38.6 q/ha) indicated better adaptability and feasibility of the demonstrated technology under farmers' field conditions, highlighting the need for wider dissemination through extension interventions

GRAPHICAL ABSTRACT

Productivity and Profitability of Garden Pea

ABSTRACT

Context: Garden pea (Pisum sativum L.) is an important cool-season vegetable crop grown in the hill agro-ecosystem of Nagaland. However, productivity in Phek district remains low due to the cultivation of local varieties and poor adoption of improved production technologies. Front Line Demonstrations (FLDs) were conducted to assess the performance of improved variety 'Arkel' under farmers' field conditions.

Objective: The study aimed to evaluate the productivity and profitability of garden pea variety 'Arkel' under Front Line Demonstrations in comparison with farmer's practice (Desi Matar). It also assessed the technology gap, extension gap, and economic feasibility of improved production technologies.

Methods: The study was conducted during 2020–21 to 2024–25 in Thipuzu village of Phek district, Nagaland under NICRA project. A total of 25 FLDs were laid out on 0.5 ha each using improved variety 'Arkel' with recommended package of practices. Demonstration plots were compared with farmers' traditional practices using local varieties. Data on growth, yield attributes, economics, technology gap, extension gap, and technology index were recorded and analyzed.

Results: The improved variety 'Arkel' significantly outperformed farmer's practice in terms of pod length, pod weight, number of pods per plant, seeds per pod, and yield. The variety recorded yields of 93.4–101.2 q/ha with 58.17–64.47% higher yield over local varieties. Economic analysis revealed higher gross return (₹2.33–2.53 lakh/ha), net return (₹1.67–1.86 lakh/ha), and benefit–cost ratio (2.54–2.78) under improved technology. Lower technology index (8.00–15.09%) indicated good adaptability and feasibility under hill agro-ecosystem conditions.

Significance: The study demonstrated that adoption of improved variety 'Arkel' along with recommended production technologies can substantially enhance productivity, profitability, and livelihood security of hill farmers in Nagaland. Wider dissemination of FLD-based interventions through extension agencies can bridge the extension gap and promote sustainable vegetable production in hill regions.

Keywords: Garden pea, Arkel, Front Line Demonstration, Extension gap, Benefit–cost ratio

Received : 18.08.2025 *Accepted :* 11.11.2025

Garden pea (*Pisum sativum* L.) is an important cool-season vegetable crop belonging to the family Leguminosae. It is a self-pollinated diploid species (2n = 14) and is believed to have originated in the Mediterranean region and Central Asia (Vavilov, 1951). The crop is widely cultivated across temperate and subtropical regions due to its adaptability, short duration, and high economic value.

Vegetable pea ranks among the top ten vegetable crops globally owing to its high nutritional value and economic importance (Kumar *et al.*, 2017). It is a rich source of protein (20–25%), carbohydrates, vitamins (A and C), and essential minerals (calcium and phosphorus). It also contains important amino acids like lysine and tryptophan, which are vital for human nutrition (Bhat *et al.*, 2013). Pea is consumed in various forms such as fresh vegetables, soups, canned, frozen and dehydrated products, while the straw serves as nutritious fodder for livestock. As a leguminous crop, pea significantly contributes to soil fertility by fixing atmospheric nitrogen through its symbiotic association with *Rhizobium* bacteria in root nodules. This process enables the crop to fulfil its own nitrogen requirement while also enriching the soil with residual nitrogen (approximately 50–60 kg/ha) for succeeding crops (Kanwar *et al.*, 1990). Consequently, pea cultivation plays an important role in promoting sustainable agricultural systems (Negi *et al.*, 2006) and also a component of food and nutritional security crop (Noopur *et al.*, 2023).

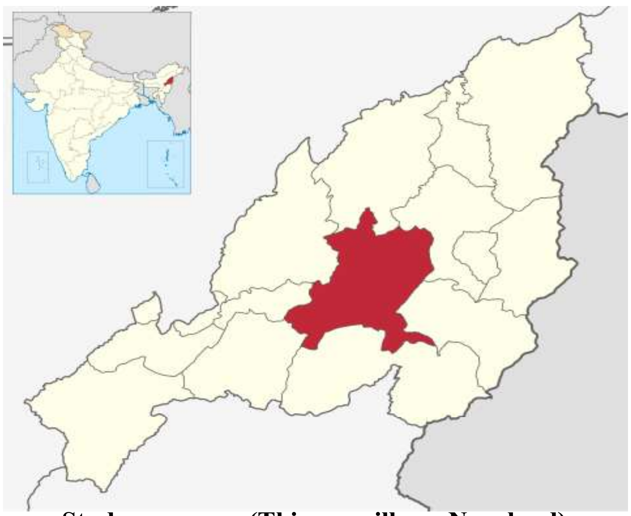
In India, vegetable pea is cultivated over an area of about 615 thousand hectares, with a total production of approximately 7.086 million tonnes and an average productivity of 11.5 t/ha. Among the states, Madhya Pradesh records the highest area and production under vegetable pea cultivation. In Nagaland, the crop occupies about 1.48 thousand hectares with a production of 8.85 thousand tonnes (NHB, 2024–25). In Phek district of Nagaland, vegetable pea is cultivated over an area of about 120 hectares with a production of 751 metric tonnes (Nagaland Statistical Handbook, 2025).

Vegetable crops are known to provide higher returns compared to traditional food crops, often generating 4 times more income per unit area (Noopur *et al.*, 2021; Thakur *et al.*, 1994). Therefore, diversification towards vegetable cultivation can significantly enhance farmers income and livelihood security (Panwar *et al.*, 2024; Maurya *et al.*, 2001; Sharma *et al.*, 2000). However, limited research on location-specific practices and weak technology transfer mechanisms hinders the realization of higher productivity (Raghav *et al.*, 2021; Chauhan *et al.*, 2023; Prasad *et al.*, 1987).

Despite its significance, the productivity of garden pea is often limited by several factors such as poor soil fertility, lack of awareness regarding improved varieties, and inadequate adoption of recommended production technologies (Noopur *et al.*, 2023). The gap between potential and actual yield is largely attributed to technological and extension constraints, particularly in remote and hilly regions. In the hill agro-ecosystem of Phek district, Nagaland, garden pea is an important crop grown during the cool season from October to February; however, its productivity remains low due to limited adoption of improved practices. Keeping this in view, the present study was undertaken to evaluate the performance of garden pea (*var*. Arkel) through Front Line Demonstrations with the objective of enhancing productivity, profitability, and economic sustainability of the farming system.

METHODOLOGY

The study was conducted during the rabi seasons from 2020–21 to 2024–25 at Thipuzu village, Kikruma Block, Phek district, Nagaland, under the National Innovations on Climate Resilient Agriculture (NICRA) project implemented by ICAR–Krishi Vigyan Kendra, Phek (ICAR-National Research Centre on Mithun, Medziphema, Nagaland) under ICAR-ATARI Zone VII, Umiam. Thipuzu village is geographically located at (25.62° N and 94.26° E). The village was purposively selected as it represents the hill agro-ecosystem of Nagaland where garden pea productivity is low due to poor adoption of improved technologies. The study



Study area map (Thipuzu village, Nagaland)

followed an experimental and participatory Front-Line Demonstration (FLD) design in which improved variety 'Arkel' along with recommended package of practices was demonstrated and compared with farmers' traditional practices (Table 1). A purposive sampling method was adopted and 25 farmers were selected, with each FLD covering 0.5 ha area. Primary data were collected during 2020–21 to 2024–25 through field observations, personal interviews, crop-cutting methods, farmer meetings, and field visits, while secondary data were collected from KVK records and published literature. Growth, yield, and economic parameters were measured using standard agronomic and economic procedures, and technology gap, extension gap, and technology index were calculated using standard formulas. The null hypothesis assumed no significant difference between improved and farmers' practices, whereas the alternative hypothesis assumed significant improvement in yield and profitability under improved technology. Data were analyzed using mean, percentage increase, coefficient of variation (CV%), and critical difference (CD at 5%) to test the significance of treatment differences. The garden pea variety Arkel was introduced from England in the early 20th century, around 1930.It is an early maturing garden pea variety (60–65 days) suitable for October sowing. To address these issues, a full package of recommended practices for garden pea cultivation was introduced, including the use of improved high-yielding variety 'Arkel', recommended seed rate and seed treatment, line sowing instead of broadcasting, balanced application of manures, timely intercultural operations, organic pest and disease management, and harvesting at proper maturity stage. In contrast, farmers' practices involved the use of local varieties, higher seed rate, and traditional crop management practices. Participating farmers were trained prior to the demonstrations, and the selection of sites, layout, and implementation were carried out following the methodology suggested by Choudhury (1999). Regular field visits, farmer–scientist interactions, and field days were organized to promote awareness and adoption of improved technologies. Data on yield and yield attributes were recorded from both demonstration and control plots, and economic parameters such as cost of cultivation, gross returns, net returns, and benefit–cost ratio were calculated. The impact of FLDs was evaluated using indicators such as percentage increase in yield, extension gap, technology gap, and technology index, which were computed following the method suggested by Samui *et al*. (2000), using the following formulas:

Technology gap = Potential yield – Demonstration yield

Extension gap = Demonstration yield – Yield under farmers' practices

Technology index (%) = (Technology gap / Potential yield) × 100

RESULTS

The results presented in Table 2. clearly demonstrated that the improved variety Arkel performed significantly better than farmer's practice (Desi variety) for all growth and yield parameters across five years (2020–21 to 2024–25). The mean plant height of Arkel ranged from 57.6 to 61.2 cm, which was significantly

Table 1. Comparison of recommended practices (var. Arkel) and farmers' existing practices under garden pea Front Line Demonstrations (FLDs).

Particulars	Recommended practices (Arkel)	Farmers practice
Farming situation	Rain-fed high hill conditions	Rain-fed high hill conditions
Variety	Arkel (improved variety)	Local variety (Desi Matar)
Sowing time	15th September to 1st week of October	2nd week of October
Spacing and sowing method	Line sowing (30 × 10 cm)	Broadcasting with no proper spacing
Land preparation	Ridge method	Flatbed method
Seed rate and seed treatment	75 kg/ha (with proper seed treatment)	95 kg/ha without treatment
Organic manure application	Pig/Poultry manure @ 3 t/ha + Vermicompost @ 0.5 t/ha	No application
Soil acidity management	Lime application @ 1 t/ha	Not practiced
Plant protection	Spray of tobacco leaf extract @ 2 ml/l or chilli–ginger–garlic extract@ 3 ml/l	No proper plant protection measures
Weed management	One hand weeding at 25 DAS + paddy straw mulching	Two hand weeding's at 25 and 45 DAS
Mechanical support (staking)	Not required	Staking with bamboo sticks (2m)

Table 2. Year-wise comparison of Arkel and farmer's practice (Desi) for growth and yield parameters in garden pea.

Year wise		Plant height (cm)	No. of branches/ plant	Days to first flowering	Pod length (cm)	Pod weight (g)	Number of Pods/plants	No.of Seeds/ pods	Yield (q/ha)
2020-21	Arkel	59.80	11.90	34.40	7.60	5.65	18.08	8.67	98.47
	FP	118.77	17.27	51.13	5.67	3.99	12.33	6.47	59.87
	CV %	3.05	3.39	0.91	2.52	2.85	5.05	2.55	3.25
	CD (5%)	6.12	1.06	0.99	0.39	0.33	2.67	0.53	5.39
2021-22	Arkel	59.8	11.9	33.83	7.5	5.6	18.9	8.7	96.8
	FP	118.5	17.4	50.6	5.5	4	12.6	6.3	61.2
	CV %	1.87	2.98	1.96	3.2	3.05	3.3	2.9	2.25
	CD (5%)	2.96	0.86	1.8	0.5	0.37	1.33	0.53	4.5
2022-23	Arkel	61.2	12.3	34.9	7.8	5.7	19.4	8.9	101.2
	FP	121.6	17.8	52.1	5.7	4.1	12.9	6.5	63.8
	CV %	1.49	3.7	2.07	3.3	3.6	3.9	3.05	2.73
	CD (5%)	3.08	1.28	2.03	0.5	0.4	1.44	0.53	5.11
2023-24	Arkel	57.6	11.5	35.6	7.3	5.4	17.6	8.5	93.4
	FP	115.9	16.9	53.2	5.4	3.9	11.8	6.2	58.7
	CV %	2.38	3.86	2.1	3.4	3.8	3.8	3.2	2.7
	CD (5%)	3.63	1.28	1.8	0.49	0.47	1.28	0.53	4.56
2024-25	Arkel	60.5	12.1	34.2	7.7	5.8	19.1	8.8	100.6
	FP	119.8	17.6	51.5	5.6	4.2	12.7	6.4	62.9
	CV %	1.62	2.97	2.03	2.75	3.25	3.25	2.75	2.58
	CD (5%)	3.31	1.08	1.99	0.47	0.47	1.3	0.47	5.77

Table 3. Year-wise % Increase of Arkel over Farmer Practice (Desi) in Garden Pea

Year	Plant height (cm)	No. of branches/ plant	Days to first flowering	Pod length (cm)	Pod weight (g)	No. of Pods/ plants	No. of Seeds/ pods	Yield (q/ha)
2020–21	-49.65	-31.10	-32.72	34.04	41.60	46.63	34.00	64.47
2021–22	-49.54	-31.61	-33.14	36.36	40.00	50.00	38.10	58.17
2022–23	-49.67	-30.90	-33.01	36.84	39.02	50.39	36.92	58.62
2023–24	-50.30	-31.95	-33.08	35.19	38.46	49.15	37.10	59.11
2024–25	-49.50	-31.25	-33.59	37.50	38.10	50.39	37.50	59.94
Mean	-49.73	-31.36	-33.11	35.99	39.44	49.31	36.72	60.06

lower than farmer's variety (115.9–121.6 cm). Similarly, Arkel recorded less branches but exhibited early flowering (33.83–35.60 days) compared to farmer's practice (50.6–53.2 days).Yield attributing characters such as pod length (7.3–7.8 cm), pod weight (5.4–5.8 g), number of pods per plant (17.6–19.4) and number of seeds per pod (8.5–8.9) were significantly higher in Arkel compared to farmer's practice. Consequently, Arkel achieved substantially higher green pod yields ranging from 93.40 to 101.20 q/ha, whereas farmers variety yielded only 58.70 to 63.80 q ha, representing an average yield advantage of 58.17–64.47 per cent. The lower coefficient of variation (CV%) values across years indicates good experimental precision, while the significant CD (5%) values confirm the statistical superiority of Arkel over the existing farmers' variety.

Table 3 presents the year-wise percentage increase (or decrease) the yield of garden pea *cv.* Arkel over the farmers' practice (Desi variety) during the period 2020–21 to 2024–25 of study. The negative values observed for plant height, number of branches and days to first flowering. Arkel exhibited approximately 50 per cent

Table 4. Year-wise cost of cultivation, returns and benefit-cost ratio of garden pea under improved and farmer's practices.

Year	Cost of cultivation (Rs/ha)		Yield (q/ha)		Gross return (Rs/ha)		Net return (Rs/ha)		B:C ratio	
	Arkel	*Desi matar* (Local)	Arkel	Desi matar (Local)	Arkel	*Desi matar* (Local)	Arkel	*Desi matar* (Local)	Arkel	*Desi matar* (Local)
2020–21	65,200	46,500	98.47	59.87	2,46,175	1,37,701	1,80,975	91,201	2.77	1.96
2021–22	66,500	47,000	96.8	61.2	2,42,000	1,40,760	1,75,500	93,760	2.64	1.99
2022–23	67,000	48,000	101.2	63.8	2,53,000	1,46,740	1,86,000	98,740	2.78	1.98
2023–24	66,000	47,500	93.4	58.7	2,33,500	1,35,010	1,67,500	87,510	2.54	1.84
2024–25	68,000	48,500	100.6	62.9	2,51,500	1,44,670	1,83,500	96,170	2.7	1.98
Mean	66,540	47,500	98.09	61.29	2,45,235	1,41,776	1,78,695	93,276	2.69	1.95

Table 5. Technology gap, extension gap and technology index of garden pea (arkel) in Phek district (Potential Yield = 110 q/ha)

Year	Potential Yield (q/ha)	Demonstration Yield (Arkel)	Farmer Yield (FP)	Technology Gap (q/ha)	Extension Gap (q/ha)	Technology Index (%)
2020–21	110	98.47	59.87	11.53	38.60	10.48
2021–22	110	96.80	61.20	13.20	35.60	12.00
2022–23	110	101.20	63.80	8.80	37.40	8.00
2023–24	110	93.40	58.70	16.60	34.70	15.09
2024–25	110	100.60	62.90	9.40	37.70	8.55
Mean	110	98.09	61.29	11.91	36.80	10.83

lower plant height, 31 per cent fewer branches per plant, and 33 per cent fewer days to first flowering than the farmers' variety, reflecting its compact growth habit and earliness. In contrast, substantial improvements were recorded in yield-attributing traits. Pod length increased by 34.04–37.50 per cent, pod weight by 38.10–41.60 per cent, number of pods per plant by 46.63–50.39 per cent, and number of seeds per pod by 34.00–38.10 per cent over the farmers' practice. These improvements collectively translated into a significant yield advantage, with Arkel producing 58.17–64.47 per cent higher green pod yield than the local variety across the five years. The consistency of these gains over successive years demonstrates the superior performance, stability, and adaptability of cv. Arkel, highlighting its potential for enhancing garden pea productivity and profitability under farmers' field conditions.

The economic analysis of garden pea cultivation over five years (2020–21 to 2024–25) revealed that the improved variety Arkel was considerably more income generating than the farmers' local variety (*Desi Matar*). Although the cost of cultivation for Arkel (₹65,200–68,000 ha^{-1}) was slightly higher than that of the local variety (₹46,500–48,500 ha^{-1}), the substantially higher yields obtained from Arkel (93.4–101.2 q/ha) resulted in markedly greater economic returns (Table 4). The gross returns from Arkel ranged from ₹2,33,500 to ₹2,53,000/ha compared to ₹1,35,010 to ₹1,46,740 ha from the local variety. Consequently, Arkel generated significantly higher net returns, varying from ₹1,67,500 to ₹1,86,000/ ha, whereas the farmers' variety provided only ₹87,510 to ₹98,740 ha. On an average basis, Arkel recorded a mean gross return of ₹2,45,235/ ha and a net return of ₹1,78,695/ha, which were substantially higher than the corresponding values of ₹1,41,776/ha and ₹93,276/ha obtained from the local variety. Similarly, the benefit–cost (B:C ratio) ratio was consistently superior in Arkel (2.54–2.78) compared with the local variety (1.84–1.99), with mean values of 2.69 and 1.95, respectively. These findings clearly demonstrate that the adoption of cv. Arkel not only enhances productivity but also significantly improves farm profitability and economic sustainability under farmers' field conditions.

The assessment of technology and extension gaps in garden pea cultivation during 2020–21 to 2024–25 revealed the superior performance of the improved variety Arkel under frontline demonstrations (Table 5). The demonstration yield of Arkel ranged from 93.40 to 101.20 q/ha, with a mean yield of 98.09 q/ha, compared to the farmers' practice yield of 58.70 to 63.80 q/ha (mean 61.29 q/ha). The technology gap, which represents the difference between the potential yield (110 q/ha) and the demonstration yield, varied from 8.80 to 16.60 q/ha, with an average of 11.91 q/ha. The extension gap, indicating the yield difference between the demonstrated technology and farmers' practice, ranged from 34.70 to 38.60 q/ha, averaging 36.80 q/ha. The technology index, which reflects the feasibility and performance of the demonstrated technology under farmers' field conditions, ranged from 8.00 to 15.09 per cent, with a mean value of 10.83 per cent. The relatively low technology index indicates the high adaptability and practical suitability of cv. Arkel in the target area.

DISCUSSION

The results of the present study clearly demonstrated the superiority of the improved garden pea variety 'Arkel' over farmers' practice under the hill agro-ecosystem of Phek district, Nagaland. The improved variety recorded significantly higher pod length, pod weight, number of pods per plant, number of seeds per pod, and overall yield compared to the local variety. The higher productivity of Arkel may be attributed to its superior genetic potential, early flowering behaviour, efficient nutrient utilization, and adoption of recommended crop management practices. . Lepcha *et al.,* (2015) and Kumar *et al*., (2004) also reported superior performance of the variety Arkel over farmer's practice, recording higher pod weight (7.9 g), number of pods per plant (9.6) and number of seeds per pod (9.5). The yield advantage of 58.17–64.47 per cent over farmer's practice indicated the effectiveness of Front-Line Demonstrations (FLDs) in promoting improved technologies among farmers. The lower plant height and early flowering observed in Arkel are desirable traits that reduce lodging and facilitate early harvesting for better market opportunities. Earliness is a particularly important trait in vegetable pea cultivation as it enables farmers to capture premium market prices during the early marketing season. Mukherjee (2003) observed that the adoption of innovative interventions can significantly enhance crop productivity. Dwivedi *et al.* (2010); Husain *et al.,* (2019) and Das *et al*., (2017) also reported that adoption of improved technologies plays a crucial role in enhancing crop productivity. Similar observations have been documented by several researchers, including Mishra *et al.* (2009), Tiwari *et al.* (2003), Tomar *et al.* (2003), Tiwari and Saxena (2001) and Haque (2000) across different crops.

The yield advantage ranged from 58.17 to 64.47 per cent across years. Similar findings regarding the per cent increase in yield of Arkel over farmer's practice were reported by Lepcha *et al.* (2015) in green pea and Kirar *et al.* (2018) in field pea. Negative values observed for plant height and days to flowering indicate desirable traits such as reduced plant height and earliness. The consistent improvement in yield and yield attributes may be attributed to the genetic superiority of the variety coupled with better nutrient utilization and improved crop management practices. The substantial enhancement in pod length, pod weight, number of pods per plant and number of seeds per pod indicates that the higher yield of Arkel was the cumulative effect of improvements in multiple yield-contributing traits.

Economic analysis revealed that although the cost of cultivation under improved practices was comparatively higher, the increased investment resulted in substantially higher gross returns, net returns, and benefit–cost ratio. The higher profitability under Arkel cultivation may be due to increased yield and better marketable produce obtained through improved management practices. On average, Arkel generated a net return of ₹1,78,695/ha compared to ₹93,276/ha under farmers' practice, while the mean benefit–cost ratio increased from 1.95 to 2.69, indicating the economic viability of adopting the improved technology. Singh *et al.* (2020) reported a mean benefit–cost ratio of 3.48. Similar findings have been reported by Mishra *et al.* (2009) in potato, Sharma (2003) in moth bean, and Gurumukhi and Mishra (2003) in sorghum.

The technology gap and extension gap observed during the study indicated that considerable scope still exists for improving garden pea productivity through effective dissemination of improved technologies. The average technology gap of 11.91 q/ha suggests that the full yield potential of the variety could not be realized under farmers' field conditions due to variations in environmental conditions and management practices. Likewise, the average extension gap of 36.80 q/ha highlights the immense scope for increasing productivity through wider adoption of improved varieties and recommended production technologies. Raj *et al.* (2013) reported that the technological yield gap in crops is mainly attributed to variations in soil fertility and prevailing weather conditions. The lower technology index values suggested good feasibility and adaptability of the demonstrated technology under local conditions. The findings emphasize the importance of FLDs as an effective extension approach for enhancing farmers' knowledge, adoption of improved practices, and overall productivity in hill farming systems. Similar findings were reported by Singh *et al.* (2019), Singh *et al.* (2020), Patel *et al.* (2013) and Sharma and sharma (2004).

The study clearly demonstrates that the improved variety Arkel is superior than farmer's practice in terms of productivity, profitability and adaptability. The higher yield, better economic returns and lower technology index indicate that adoption of improved variety along with recommended package of practices can significantly enhance garden pea production in Phek district of Nagaland.

CONCLUSION

The results revealed that Arkel significantly outperformed the farmers' local variety (*Desi matar*) in terms of growth, yield attributes, yield, and economic returns. The variety exhibited early flowering (33.83–35.60 days), longer pods (7.30–7.80 cm), higher pod weight (5.40–5.80 g), greater number of pods per plant (17.60–19.40), and more seeds per pod (8.50–8.90), resulting in a higher green pod yield ranging from 93.40 to 101.20 q/ha compared to 58.70 to 63.80 q/ha under farmers' practice. The yield advantage of Arkel varied from 58.17 to 64.47 per cent over the local variety. Economic analysis demonstrated the profitability of the improved technology, with Arkel recording an average gross return of ₹2,45,235/ha, net return of ₹1,78,695/ha, and benefit–cost ratio of 2.69, compared to ₹1,41,776/ha, ₹93,276/ha, and 1.95, respectively, under farmers' practice. The mean technology gap, extension gap, and technology index were 11.91 q/ha, 36.80 q/ha, and 10.83 per cent, respectively, indicating good adaptability of the demonstrated technology and substantial scope for enhancing productivity through wider adoption of improved varieties and recommended production practices.

Funding: This research was supported by the NICRA project funded by ICAR-Central Research Institute for Dryland Agriculture and implemented through ICAR-Krishi Vigyan Kendra, Phek (ICAR-National Research Centre on Mithun, Medziphema) under ICAR-ATARI Zone VII, Umiam.

Declaration of competing interest: The authors declare no competing interests.

Data availability: Data would made available on request.

Acknowledgement: The authors are thankful to ICAR–Krishi Vigyan Kendra, Phek, ICAR–National Research Centre on Mithun, Medziphema and ICAR-ATARI Zone VII, Umiam for providing necessary facilities and support under the NICRA project funded by ICAR–CRIDA, Hyderabad. The authors also acknowledge the cooperation and active participation of the farmers of Thipuzu village, Phek district, Nagaland during the study.

Authors' contribution: Fiest author conceived and designed the study, conducted field demonstrations, analyzed data, and prepared the manuscript. second & third authors assisted in field implementation, data collection, and documentation. Fourth author contributed to data analysis and manuscript editing.

REFERENCE

Bhat, T.A.; Gupta, M.; Canai, M.A.; Ahanger, R.A. and Bhat, H.A. (2013). Yield, soil health and nutrient utilization of field pea (*Pisum sativum* L.) as affected by phosphorous and biofertilizers under subtropical conditions of Jammu. *Int. J. Mod. Plant Anim. Sci.*, **1**(1): 1–8.

Chauhan, J.K.; Noopur, K.; Panwar, S.S. and Kumar, L. (2023). Vegetable seedlings based agri-entrepreneurship development. *Indian Res. J. Ext. Edu.,* **23** (4):1-6.

Choudhury, B.N. (1999). Krishi Vigyan Kendra —A Guide for KVK Managers. New Delhi: Publication, Division of Agricultural Extension, ICAR

D.K. Raghav; Indrajeet; Dharmjeet Kherwar; Anjani Kumar; A.K. Singh and Jitendra K. Chauhan (2021). role of frontline demonstration on chick pea for enhancing the production in district Ramgarh of Jharkhand. *Indian Res. J. Ext. Edu.,* **21** (1): 30 – 34

Das, A.; Chowdhury, S.; Layek, J.; Ramkrushna, G I.; Panwar, A. S.; Ngachan, S. V. and Buragohain, J. (2017). Agro-physical assessment of different pea (*Pisum sativum*) cultivars in lowland rice (*Oryza sativa*) fallow under no-till system for enhancing cropping intensity and productivity in mid hills of northeast India. *Indian J. Agri. Sci.,* **87** (12), 1612-8

Dwivedi, A.P.; Dwivedi, V.; Singh, R.P.; Singh; Mamta, and Singh, D.R. (2010). Effect of front-line demonstration on yield of field pea in Ghazipur District of Uttar Pradesh. *Indian J. Ext. Edu*.**46**(3&4):129–131.

Gurumukhi, D.R. and Mishra, S. (2003). Sorghum front line demonstration—A success story. *Agric. Ext. Rev.* **15**(4):22-23.

Haque, M.S. (2000). Impact of compact block demonstration on increase in productivity of rice. *Maharashtra J. Ext. Edu.,* **19**(1):22-27.

Husain, J.; Kashyap, P.; Prusty, A.K.; Dutta, D.; Sharama, S.S.; Panwar, A.S. and Kumar, S. (2019). Effect of phosphorus fertilisation on growth, yield and quality of pea (*Pisum sativum*.L). *Indian J. Agri. Sci.,* **89** (8): 1303.

Kanwar, J.S. (1990). Punjab *Veg. Grower*, 25: 12–15.

Kirar, N. (2018). Impact of front-line demonstration of field pea in Bundelkhand region of Madhya Pradesh. *Int. J. Chem. Stud.* **6**(4):878-880.

Kumar, V.; Singh, H.P. and Panwar, A.S. (2004). Effect of irrigation and fertilization on growth and yield of Field pea (*Pisum sativum* L.). *Envir. Ecol.,* **17**(1/2):91-95

Kumar, V.; Singh, M.K.; Kumar, M. and Kumari, U. (2017). Growth and yield of pea (*Pisum sativum* L.) cv. Azad P-1 as influenced by NADEP compost prepared by using different raw materials. *Int. J. Curr. Microbio. App. Sci.*, **6**(11): 2260–2267.

Lepcha, B.; Avasthe, R.; Singh, R., and Yadav, A. (2015). Impact of front-line demonstrations on productivity and profitability of green pea (*var.* TSX-10) under mid hills of Sikkim. *Indian Res. J. Ext. Edu.*, **15**(4), 157-160.

Maurya, O.P.; Singh, G.N., and Kushwaha, R.K. (2001). An economic analysis of production and marketing of potato in district Varanasi (UP). *In.- Encyclopaedia of Agricultural Marketing,* Vol.8, *Ed: J.*Prasad. New Delhi: Mittal Publications. pp.229-238.

Mishra,D.K.; Paliwal, D.K.; Tailor, R.S., and Deshwal, A.K. (2009). Impact of front-line demonstrations on yield enhancement of potato. *Indian Res. J. Ext. Edu.,***9**(3):26-28.

Mukherjee, N. (2003). Participatory Learning and Action. New Delhi: Concept Publishing Company.

Nagaland Statistical Handbook 2025, Government of Nagaland. (2025). Directorate of Economics and Statistics, Govt. of Nagaland, Kohima, Nagaland.

National Horticulture Board (NHB). (2024–25). Indian Horticulture Database 2024–25. National Horticulture Board, Ministry of Agriculture & Farmers Welfare, Government of India.

Negi, S.; Singh, R.V. and Dwivedi, O.K. (2006). Effect of biofertilizers, nutrient sources and lime on growth and yield of garden pea. *Legume Res.*, **29**(4): 282–285.

Noopur, K.; Chauhan, J.K.; Walia, S.S.; Verma, M.R.; Dhar, U.; Choudhary, S. and Chikkeri, S.S. (2023). Constraints in vegetable production in India: A review. *Indian Res. J. Ext. Edu., **23*** (3): 14-19.

Noopur, K.; Subhash, B. and Somasundaram, E. (2021). On-farm assessment of French bean (*Phaseolus vulgaris*) cultivars for seeds production in the Nilgiri hills of Tamil Nadu. *Ind. J. Hill. Farm*. **34** (1): 158-161.

Panwar, S.S.; Chauhan, J.K.; Noopur, K.; Panwar, N.; Pradhan, K.; Kumar, L. and Panwar, A.S. (2024). Diseases prevention in human through bioactive medicinal molecules of vegetables: A review. *Indian Res. J. Ext. Edu.,* **24**(2):95-105

Patel, M.M.; Jhajharia, A.K.; Khadda, B.S, and Patel, L.M. (2013). Front line demonstration: An effective communication approach for dissemination of sustainable cotton production technology. *Ind. J. Ext. Edu***., 21**:60–62.

Prasad, C.; Chaudhary, B. N. and Nayar, B. B. (1987). First line transfer of technology project. New Delhi, ICAR.

Raj, A.D.; Yadav, V.Y. and Rathod, J.H. (2013). Impact of front-line demonstration (FLD) on the yield of pulses. *Int. J. Sci. Res*., **3**(9):1–4.

Samui, S.K.; Maitra, S.; Roy, D.K.; Mondal, A.K. and Saha, D. (2000). Evaluation of front-line demonstration on groundnut (*Arachis hypogaea* L.) in Sundarbans. *J. of Indian Society of Coastal Agric. Res*., **18** (2): 180–183.

Sharma, O. P. (2003). Moth bean yield improvement through front line demonstration. *Agriculture Ext. Review,***15**(5):11-13.

Sharma, R.N. and Sharma, K.C. (2004). Evaluation of Front-Line Demonstration on groundnut (*Arachis hypogaea* L.). J. *Indian Society Coastal Agric. Res*., **18**: 180–188.

Sharma, V.K., Inder Sain and Singh, G. (2000). Income and employment from summer vegetables vis-à-vis paddy in Punjab. *J. Agric. Dev. Policy,***12**:38-43.

Singh, A. K.; Rikhari, Y. C.; Chauhan, R. & Kumar, P. (2020). Enhancing yield and economics of field pea through front line demonstration. *Indian Res. J. Ext. Edu*. **20**(4), 78-81.

Singh, S.; Sahu, A. & Kumari, A. R. (2019). Impact of front-line demonstration on vegetable pea yield improvement in eastern Uttar Pradesh.*J. AgriSearch* **6**(2):99-101.

Thakur, D.S.; Sanjay, Thakur, D.R. and Sharma, K.D. (1994). Economics of off-season vegetable production and marketing in hills. *Indian J. Agric. Mark.* **8**:72-82.

Tiwari, K.B. and Saxena, A. (2001). Economic analysis of FLD of oilseeds in Chindwara. *Bhartiya Krishi Anusandhan Patrika.***16**(3and4):185-189.

Tiwari, R.B.; V, Singh. And Parihar, P. (2003). Role of front-line demonstration in transfer of gram production technology. *Maharashtra J. Ext. Educ.***22**(3):19.

Tomar, L.S.; Sharma, P.B. and Joshi, K. (2003). Study on yield gap and adaptation level of potato production technology in grid region. *Maharashtra J. Ext. Educ.***22**(1):15-18.

Vavilov, N.I. (1951). The Origin, Variation, Immunity and Breeding of Cultivated Plants. Chronica Botanica, Waltham, USA.

• • • • •

How to cite:

Manjunath, K.S.; Longkumer, T.E.; Asangla, H.K., and Singh, SK. .(2025). Enhancing productivity and profitability of garden pea (***var.*** Arkel) through front line demonstrations in hill agro-ecosystem of Phek district, Nagaland.. Indian Res. J. Ext. Edu., 25 (5): 446-453. December-2025. Special issue. doi: 10.54986/irjee/2025/dec_spl/446-453