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Yield Gap Analysis and Impact Assessment of Broccoli in Tirap District of 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

A frontline demonstration (FLD) on broccoli was carried out during 2021-22 and 2022-23 respectively by Krishi Vigyan Kendra (KVK), Tirap, Arunachal Pradesh at farmer's field. The improved variety- Solan Green head was demonstrated with full package of practices. The FLD plots was recorded 146 & 167 q/ha yield as compared to 97 & 126 q/ha respectively under farmer's practice. The technology gap was 34 & 13 q/ha, extension gap was 49 & 41 q/ha and technology index was 18 & 7 respectively, during the both the years of study. Similarly, the net income (Rs.34700 and 408000) and B:C ratio (3.81 and 4.38) was also higher under FLD as compared farmer's practice (Rs.215000 and 294000, 2.82 and 3.50) due to implementation of improved production technologies.

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Keywords: Broccoli; economics; impact analysis; solan green head.

1. INTRODUCTION

Tirap district covers a total area of 2362 sq. km. The district's soil is primarily clay loam, with a pH range of 4.46 to 5.60, making it acidic. In terms of vegetable cultivation, cole crops, leafy vegatables, gourd crops and different fruit crops. The broccoli is getting popularity in the district due to its high nutritious values.

The eastern Mediterranean region is home to sprouting broccoli, or Brassica oleracea var. italica L., which is descended from earlier varieties of the plant. According to Singh and Nath [1]. Italy is a hub for diversification. According to Thamburaj and Singh [2] the Italian term "broccoli" comes from the Latin word "brachium," which means an arm or branch. A favorite among cole crops, sprouting broccoli is prized for its exquisite flavor, taste, and highest protein and vitamin content. It has a vitamin A content that is 130 times higher than that of cauliflower and cabbage, respectively, as well as high levels of thiamine, riboflavin, niacin, vitamin C, minerals (Ca, P, K, and Fe), and selenium, which functions as an antioxidant.

It contains glycosinolates, a potent anticancer agent (40–80 mg/100 g fresh) that protects against bowl cancer. Additionally, it contains a lot of sulphoraphane, a substance linked to a lower risk of cancer [3]. According to Singh and Nath [1] each 100 g of edible portion from a broccoli head contains the following nutrients: 89.9 g of moisture, 5.5 g of carbohydrates, 0.2 g of fat, 3.3 g of protein, 3500 IU of vitamin A, 0.05 mg of thiamine, 0.12 mg of riboflavin, 79 mg of phosphorous, 80 mg of calcium, 17 mg of iron, 137 mg of ascorbic acid, and 37 g of calories.

In the industrialized world, broccoli is widely grown, and in Arunachal Pradesh, it is becoming more and more popular as a commercial crop becausedue to its lucrative cash crops, extremely nutritious and potential health benefits, including a potential reduction in the incidence of human cancer through intake. According to Technical Bulletin No. 26, Vegetable Statistics & Horticulture Statistical, Directorate of Horticulture Govt. of Arunachal Pradesh [4] the state's average production for broccoli and cauliflower is just 6.12 mt/ha, which is less than twice as much as the national average of 17.34 mt/ha; Lack of technological expertise, inability to choose an appropriate variety (hybrid or high yielding), lack of know-how, interventions, and unbalanced and careless use of input are the main reason behind its low productivity.

Frontline demonstration (FLD) is a field demonstration concept that the ICAR developed with the launch of the Technology Mission on Oilseeds in the middle of the 1980s. Its goal is to demonstrate to farmers how new varieties, along with suggested production technologies, perform in actual farming conditions on their fields in order to increase returns and productivity. In this continuation, Krishi Vigyan Kendra (KVK)- Tirap, Arunachal Pradesh decided to conduct FLD on Broccoli, variety0 Solan green head at farmer’s field. In this regard, Krishi Vigyan Kendra Tirap, Arunachal Pradesh-India, conducted the frontline demonstration in farmers' fields to introduce farmers and extension workers to the high-yielding novel varieties in order to facilitate further, widespread dissemination of the technology.

Tirap district covers a total area of 2362 sq. km. The district's soil is primarily clay loam, with a pH range of 4.46 to 5.60, making it acidic. In terms of vegetable cultivation, cole crops, leafy vegatables, gourd crops and different fruit crops.

2. MATERIALS AND METHODS

The Krishi Vigyan Kendra, Tirap conducted FLD on Broccoli, variety Solan Big Head; during Rabi season of 2021-22 and 2022-23 respectively. The full cultivation and management practices were applied in demonstrations as per recommendation by Chaudhary Sarvan Kumar Himanchal Pradesh Krishi Vishwavidyalaya (CSK HPKV), Palampur 2013. The plot size of FLD and farmer’s field was 0.1 ha each. The total area under FLD was 02 ha in which the total 10 numbers of farmers field were selected. During under FLD at farmers field was implanted in 02 ha & 10 numbers of farmers each. The FLD was demonstrated in five villages of Tirap district-Kheti, Lapnana, thingsa, Kapu and Bari-basip.

A field survey was carried out before starting of FLD to know the ground reality as well as farmers’ practices of Broccoli in Tirap district of Arunachal Pradesh (Table 1). The selected farmers were also trained through group discussions and farmers training about scientific cultivation practices of Broccoli. Further, the demonstrations were regularly monitored by

Table 1. Improved practices vs farmers' practices of Broccoli

Particular	Technological intervention	Existing practices	Gap
Variety	Soaln Green head	Undescribed	Full gap
Seed rate	600 g/ha	400 kg /ha	Full gap
Seed treatment	Seed was treated with carbendazim.	Not treated	Full gap
Sowing method	Line sowing	Line sowing	Partial gap
Spacing	45 cm x 45 cm	60 x 40 cm	Partial gap
Application of recommended dose of manure	4-5 Kg/m^2	Nil/without recommendation	Full gap
Fertilizer	As per recommended dose 75:40:30 Kg/ha NPK	Not applied	Full gap
Application of Bio fertilizer	Soil application of Azospirillum & PSB @ 2 kg/ha mix with FYM	No application	Full gap
Weed management	Done at 20 and days after transplanting	One weeding 25 Days after transplanting	Full gap
Spraying of Biopesticide	Neem oil @ 5ml/litre of water	Not sprayed	Full gap
Harvesting	Manual	Manual	No Gap

scientists of KVK; from sowing of seeds up-to the marketing.

The yield attributes, economics of FLD and Tirap district covers a total area of 2362 sq. km. The district's soil is primarily clay loam, with a pH range of 4.46 to 5.60, making it acidic. In terms of vegetable cultivation, cole crops, leafy vegatables, gourd crops and different fruit crops. plots were collected regularly and analyzed. By using of these collected data, the different parameters viz. yield gap, extension gap, technology index etc. were analyzed. According to Samui et al*.* [5] Renbomo et al .[6] and Kale et al. [7] the following formulas were used in the study.

Technology Gap (q/ha) = P_i (Potential yield)- D_i (Demonstration yield)

Extension Gap (q/ha0) = D_i (Demonstration yield)- F_i (Farmers yield)

Technology index (%) = Potential Yield- Demonstration yield / Potential yield x 100

Benefit Cost ratio (B:C ratio) = Net income (Rs ha^{-1}) / Cost of cultivation (Rs ha^{-1})

Percent increase of over farmer's practices = Improved practices- Farmers practice / Farmers' practices x 100

3. RESULTS AND DISCUSSION

The results revealed that, Broccoli; variety Solan Green Head under full package of practices (Table 1) recorded higher yield (146 q/ha and 167 q/ha) as compared to 97 q/ha & 126 q/ha yield under farmers practices (Table 2). That There was 50 percent higher over farmers farmers' practice during the first year of demonstration and while 32 percent during the second's year.

The potential yield was found 180 q/ha of Solan Green Head variety under Tirap's climatic conditions. Similar findings also reported by Santosh Kumar, [8] under Aizawl district' conditions, Mizorum. The differences between potential yield and demonstrations yield known as technology gap. During the first years of FLD, the technology gap was 34 q/ha while it was reduced upto 13 q/ha during second year (Table 2). The technological gap may be influenced by dissimilarity in the soil fertility status, acidity to erratic rainfall and other vagaries of weather conditions [9].

The gap between demonstration yield and farmersfarmers' practice practicees yield is known as extension gap. That was 49 q/ha during first year of demonstration and 41 q/ha during the second year (Table 2). This gap may

Table 2. Production and other extension parameters of Broccoli

Year	Area (ha)	No of Demos.	Potential Yield (q/ha)	Average Yield (q/ha)		% increase over Check	Technology gap (q/ha)	Extension gap (q/ha)	Technology index (%)
				D	C				
2021-22	2	10	180	146	97	50	34	49	18
2022-23	2	10	180	167	126	32	13	41	7

Where D stands for Demonstration and C stands for Check

Table 3. Economics of broccoli cultivation

Year	Yield (q/ha)		Cost of Cultivation (Rs/ha)		Gross Return (Rs/ha)		Net Return (Rs/ha)		Benefit Cost ratio B:C Ratio	
	D	F	D		D	F	D	F	D	F
2021-22	146	97	91000	76000	438000	291000	347000	215000	3.81	2.82
2022-23	167	126	93000	84000	501000	378000	408000	294000	4.38	3.50

Where D stands for Demonstration and C stands for Check

be easily filled by the continuous effort of farmer's encouragement to adopt improved technologies. The transfer of improved production technologies among farming community is the key point to minimize this gap. The high yielding variety are the major chunk in this sector. Hiremath and Nagaraju [10] are also supporting this finding.

The technology index shows the feasibility of the variety and improved technology at the farmers' fields is known as technology index. If the value of technology index is lower means its feasibility is more and if its value is higher then its feasibility is less. It was 18 and 7 (Table 2) respectively during both the years study which shows its higher rate of feasibility in Tirap district of Arunachal Pradesh. This result has favored by Lal et al. [11] Meena et al. [12] and Poonia et al. [13,14].

The economic parameters of the study reveal that due to higher under FLD, the farmers received higher gross and net income as compared to farmers' practice (Table 3). The cost of cultivation calculated under FLD was Rs. 91000 & Rs.93000 per ha respectively as compared to farmers' practice (Rs.76000 & Rs.84000). Due to implementing of recommended dose of fertilizers and other inputs, the cost was higher under FLD.

Due to the impact of improved variety and package of practices, the FLD plots recorded higher yield (146 q/ha and 167 q/ha), higher gross return (Rs.438000 and Rs. 501000), higher net return (Rs.347000 and Rs. 408000) and higher benefit cost ratio (3.81 and 4.38) as compared farmer's practice (97 q/ha and 126 q/ha, Rs. 291000 and Rs. 278000, Rs. 215000 and Rs. 274000, 2.82 and 3.50 respectively).

Due to the higher yield under FLD plots, the gross, net return and benefit cost ratio (B:C ratio) were higher than farmer practice (Rs. 438000 & 501000 vs. Rs. 291000 & 378000, Rs. 347000 & 408000 vs. Rs. 215000 & 294000, 3:81 & 4.38 vs. 2.82 & 3.50). These results are in line with finding of Meena et al. [12,15] and Poonia et al. [13,16].

4. CONCLUSION

The results of demonstration are proving that the FLD has proven its superiority over farmers practice in Tirap district of Arunachal Pradesh. The 50 % and 32 % higher yield during the study has resulted better economic return for farmers. Thus, it is the need of hour for proper dissemination of technology at farmers field for betterment of farming community.

The result of FLD programme reveals that this is an essential tool to dissemination of improved technologies among farming community. With the proper implementation of technology, farmers knowledge, attitude and skill about farming can changes by seeing and believing concept in their own field/village/area. And as a result farm yield enhanced which results into better economic output as well as better livelihood of farming community. In Tirap ditrict the enhancement of yield under FLD was 41 percent (average of both year) over farmers practice which was motivated to farmers for adoption of new agricultural technologies at their own field.

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.

REFERECNES

1. Singh DN, Nath V. Winter vegetables: Advances and developments. Satish Publishing House, Delhi (India). 2012;360.
2. Thamburaj S, Narendra S. Textbook of vegetables, Tuber crops and Spices. Indian Council of Agricultural Research, New Delhi (India). 2013;136.
3. Hazra P, Chattopadhyay A, Karmakar K, Dutta S. Modern technology in vegetable production. 2011:168-169.
4. Horticulture statistical book. Directorate of horticulture, government of Arunachal Pradesh. 2022; 34.
5. Samui SK, Maitra S, Roy DK, Mondal AK, Saha D. Evaluation on frontline demonstration on groundnut (*Arachis hypogaea* L.). Journal of Indian Society of Coastal Agricultural Research. 2000; 18(2):180-183.
6. Renbomo N, Biswas P. Impact of front line demonstration on the yield of chilli

(Capsicum annuum L.), Agric. 2016;11(3):283-287.
7. Kale SM, Barikar Umesh, Mahesh C. Popularization of Tomato Hybrid (Arka Rakshak) for Yield and Economic Analysis in Kalyan Karnatka Region. Int.J.Curr. Microbiol. App. Sci. 2020;9 (06):1675-1679.
8. Santosh Kumar. Economics and impact of FLD on broccoli yield at armers filed of Aizawl District Mizoram. Agro Economist - An International Journal. 2018;5(2):81-86.
9. Mukherjee N. Participatory, learning and action. concept, publishing company, New Delhi. 2016; 63-65.
10. Hiremath SM, Nagaraju MV. Evaluation of frontline demonstration trials on onion in Haveri district of Karnataka. Karnataka Journal of Agricultural Sciences. 2009;22(5):1092-1093.
11. Lal G, Mehta RS, Meena RS, Meena NK, Choudhry ML. Impact of front line demonstration (FLDS) on yield enhancement of coriander: A case study in TSP area of Pratapgarh. E News Letter ICAR- National Research Centre on Seed Spices. 2016;8(3):5-6.
12. Meena KC, Singh DK, Gupta IN, Singh B, Meena SS. Popularazation of coriander production technologies through frontline demonstrations in Hadauti region of Rajasthan. International Journal of Seed Spices. 2016;6(2):24-29.
13. Poonia MK, Mahendra Singh BL, Dhaka RK. Bairwa, Bheru Lal Kumhar. Impact of frontline demonstration on the yield and economics of coriander in Kota District of Rajasthan, India. International Journal of Current Microbiology and Applied Sciences. 2017;6(3):2344-2348.
14. Dhaka BL, Poonia MK, Meena BS, Bairwa RK. Yield and economic viability of coriander under front line demonstrations in Bundi district of Rajasthan. Journal of Horticultural Sciences. 2015: 10(2):226-28.
15. Singh J, Hundal RK, Dhillon BS. Comparison for yield potential of chickpea in front line demonstrations and farmer's practices in the Amritsar District of Punjab. Current Agriculture Research Journal. 2017;5(2):239-243.
16. Vanitha SM, Chaurasia SNS, Singh PM, Naik PS. Vegetable statistics. Technical Bulletin No. 51, IIVR, Varanasi. 2013;250.

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