Yield gap analysis and impact of Broccoli at farmers field of Tirap district of Arunachal Pradesh

Abstract

A front line demonstration (FLD) on broccoli was carried out during 2021-22 and 2022-23 respectively by Krishi Vigyan Kendra (KVK), Tirap, Arunachal Pradesh at ~~farmers~~farmers' field. The Variety- Solan Green head was demonstrated with full package of practices as compared to farmers 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 year's study. Similarly, the net income and B:C ratio was also higher under FLD as compared farmers field due to implementation of improved technologies (Rs. 347000 & 408000 vs. Rs. 215000 & 294000, 3:81 & 4.38 vs. 2.82 & 3.50).

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Key words: Broccoli, Economics, Impact analysis. Solan Green Head

Introduction

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 (2012), Italy is a hub for diversification. According to Thamburaj and Singh (2013), the Italian term "broccoli" comes from the Latin word "brachium," which means an arm or branch. A ~~favorite~~favourite among cole crops, sprouting broccoli is prized for its exquisite ~~flavor~~flavour, 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 (Hazra*et al.* 2011). According to Singh and Nath (2012), 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 because to its lucrative cash crops, extremely

nutritious qualities 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 (2022), the state's average production for broccoli and cauliflower is just 6.12mt/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 regard, Krishi Vigyan Kendra Tirap, Arunachal Pradesh-India, conducted the current 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~~vegetables, gourd crops and different fruit crops.

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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 practices and management practices were applied in demonstrations as per recommendation by CSK HPKV, Palampur 2013. The plot size of FLD and farmer’s field was 0.1 ha each. During both year’s trial under FLD at farmers field was implanted in 02 ha & 10 numbers of farmers each. The FLD was demonstrated in these 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 farmer’s 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 scientists of KVK; from sowing of seeds up-to the marketing.

The yield attributes, economic attributes of FLD and check 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.Samui*etal.*(2000),Renbomo*etal.*(2016) andKale*etal.*(2020)tostudytheimpactoffront-linedemonstrationsovertraditionalpracticesbyfarmers.

Technology Gap $=P_i$(Potentialyield)-D_i(Demonstration yield)

Extension Gap $=D_i$(Demonstrationyield)-F_i(Farmers yield)

$$\text{Technologyindex} = \frac{\text{Potential Yield- Demonstration yield}}{\text{Potential yield}} \times 100$$

$$\text{Benefit Cost ratio (B:C ratio)} = \frac{\text{Netincome(Rsha}^{-1}\text{)}}{\text{Costofcultivation(Rsha}^{-1}\text{)}}$$

$$\text{Percent increase of over farmer's practices} = \frac{\text{Improved practices- Farmers practice}}{\text{Farmerspractices}} \times 100$$

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Table 1: Improved practices vs farmer's practices of Broccoli

Particular	**Technological intervention**	**Existingpractices**	**Gap**
Variety	Soaln Green head	Undescribed	Fullgap
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 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

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Table 2: Production and other extension parameters of Broccoli

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Year	Area	No of Demos.	Potential Yield	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)		Costof Cultivation (Rs/ha)		Gross Return (Rs/ha)		Net Return (Rs/ha)		BenefitCost ratio B:CRatio	
	D	F	D	F	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

Results and Discussion

The results revealed that, Broccoli; variety Solan Green Head under full package of practices (Table 1) recorded higher yield (146 and 167 q/ha) as compared 97 & 126 q/ha

yield under farmers practices (Table 2). That was 50 percent higher over farmers practice during 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 (2018) 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 bydissimilarityinthesoilfertilitystatus,acidity to erratic rainfall and other vagaries of weather conditions (Mukharjee, 2003).

The gap between demonstration yield and farmers practice's 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 be easily filled by the continuous effort of farmer's encouragement to adopt improved technologies. The transfer of 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 (2010) are also supporting this finding.

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The technology index shows the feasibility of the varietyandimprovedtechnologyatthefarmer'sfields 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 is has favored by Lal*etal*.2016;Meena*etal*.2016andPoonia*et al*. 2017.

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 was calculated under FLD Rs. 91000 & 93000 per ha respectively as compared Rs. 76000 & 84000 per ha (farers practice). Due to implementing of recommended dose of fertilizers and other inputs, the cost was higher under FLD. 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). Theseresultsareinlinewithfindingof Meena*etal.* 2016; and Poonia*et al.* 2017.

Conclusion

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 Tirapditrict 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.

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