Int.J.Curr.Microbiol.App.Sci (2025) *14*(02): 116-121

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 14 Number 2 (2025)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2025.1402.010

Effectiveness of Frontline Demonstrations on Soil Test-Based Nutrient Management for Enhancing Cotton Yield in Hingoli District, Maharashtra, India

Ravindra T. Bhowate[1*] and Mandar Harishchandra Geete[2]

[1]Sorghum Research Unit, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola 444 104, KVK Hingoli, Maharashtra, India
[2]National Expert, National Mission on Natural Farming, CCA, MANAGE, Hyderabad, India

**Corresponding author*

Keywords

Cotton, Frontline Demonstration (FLD), Soil Test-Based Nutrient Management, Effectiveness of Fertilizer Application

Article Info

Received:
18 December 2024
Accepted:
28 January 2025
Available Online:
10 February 2025

A B S T R A C T

Cotton is a vital cash crop in India, contributing significantly to the agricultural economy. However, its productivity is often limited by the non-adoption of recommended fertilizer doses and application schedules. To address this issue, Krishi Vigyan Kendra (KVK), Hingoli, conducted frontline demonstrations (FLDs) on soil test-based nutrient management in the Hingoli district of Maharashtra. These demonstrations were carried out during the *Kharif* seasons of 2009–2015 at selected farmers' fields in villages such as Dandegaon, Kumbharwadi, Digras, Sukalivir, Yedsi, and Bhategaon of Kalamnuri Taluka. The FLD plots employed a balanced nutrient management approach based on soil test results, incorporating major and micronutrients. Farmers applied the recommended fertilizer dose of 120:65:65 NPK kg/ha along with bio-fertilizer *viz*., Azotobacter and PSB @ 25 g/kg of seed. This resulted in a significantly higher average seed cotton yield of 15.76 q/ha compared to 12.67 q/ha under traditional practices (60:32:16 NPK kg/ha). The FLD plots recorded a 25.28% yield increase over farmers' practices. Despite this improvement, a mean technological gap of 7.24 q/ha, an extension gap of 3.09 q/ha, and a technology index of

Introduction

Cotton is a pivotal commercial crop that significantly contributes to the national economy. Beyond its economic importance, the cotton industry generates employment for thousands of workers in textile mills and millions more in decentralized sectors such as power looms, handlooms, and traditional spinning wheels (charkas).

Krishi Vigyan Kendra (KVK), or Farm Science Centre, is an innovative, science-based institution designed to bridge the gap between agricultural research and farmers. Its primary objective is to reduce the time lag in transferring technology from research institutions to farmers, thereby increasing agricultural productivity and income sustainably. KVKs are grassroots organizations tasked with assessing, refining, and demonstrating

proven technologies under diverse micro-farming conditions in each district (Das, 2007).

Frontline demonstrations (FLDs) are systematic educational initiatives conducted in farmers' fields to showcase the effectiveness of new practices and technologies. Despite advancements in agricultural research, many farmers in India continue to rely on traditional knowledge passed down through generations. This often results in unscientific agronomic, nutrient, and pest management practices, limiting the potential yield of crops and new varieties.

The potential yield of crops is influenced by factors such as solar radiation, temperature, photoperiod, atmospheric carbon dioxide levels, and genetic characteristics, assuming no limitations from water, nutrients, pests, or diseases. In rainfed farming systems, where water supply is beyond the farmer's control, water-limited potential yield becomes a critical benchmark for yield gap analysis. Seasonal variations, particularly in rainfall, further affect this potential yield (Singh *et al.,* 2001).

Although significant strides have been made in agricultural productivity since the mid-1960s, continued efforts are essential to meet the demands of a growing population. Demonstrating recommended improved technologies through FLDs on farmers' fields remains one of the most effective approaches. This study aims to analyze input costs and monetary returns, identify yield gaps, assess technology adoption, and explore reasons for the non-adoption of proven technologies.

Materials and Methods

The study was conducted in the operational area of Krishi Vigyan Kendra (KVK), Hingoli, Maharashtra. The region receives an annual precipitation of 890 mm, primarily between June and the end of September. The maximum temperature in Hingoli district reaches 42.6°C, while the minimum temperature drops to 10.6°C. Fifteen frontline demonstrations (FLDs) on cotton were conducted during the *Kharif* season from 2009 to 2015 across six adopted villages in Kalamnuri block namely Dandegaon, Kumbharwadi, Digras, Sukali (Vir), Yedsi, and Bhategaon and each demonstration covered an area of 0.4 ha. The soils in the study area were slightly alkaline, with low to medium organic carbon, very low to medium available phosphorus, and very high available potassium. Zinc deficiency was observed in up to 72% of the soil samples.

The treatment involved the recommended practice of applying 120:65:65 NPK kg/ha along with bio-fertilizer Azotobacter and PSB @ 25 g/kg seed, compared to the existing farmer practice of 60:32:16 NPK kg/ha. An entire dose of nitrogen and phosphorus was applied through diammonium phosphate, potassium through muriate of potash, and 20% of nitrogen, along with full phosphorus and potassium, as a basal dose at sowing. The remaining nitrogen was applied in two equal doses at 30 and 45 days after sowing. Seeds were treated with Azotobacter and phosphorus-solubilizing bacteria at 25 g/kg seed.

Farmer practices often involved imbalanced nutrient management (60:32:16 NPK kg/ha), simultaneous sowing without seed treatment, and lack of proper agronomic practices.

To address these challenges, FLDs aimed to demonstrate the productivity and profitability of improved cotton production technologies under real farm conditions, even in variable weather.

Key diagnostic issues identified during the PRA survey included:

1. Improper nutrient management and lack of soil testing.
2. Low nutrient availability and minimal use of organic manures and biofertilizers.
3. Limited application of secondary and micronutrients.
4. Faulty methods and improper timing of fertilizer application.
5. Inadequate plant protection measures.
6. Lack of intercultural operations, with reliance on chemical weed control.
7. Uncertain market prices, particularly during harvest.
8. Lack of crop rotation practices.

Participating farmers were trained in cotton production technologies, including fertilizer dosage calculations, soil sampling, seed treatments, and recommended agronomic practices. Primary data were collected using interviews and analysed for yield improvement percentages.

Data Analysis

All the participating farmers were trained on various aspects of cotton production technologies. Calculated recommended dose of fertilizer, soil sample collection, seed treatments, and recommended agronomic practices.

The primary data were collected from the selected farmers with the help of interview schedule and interpreted and presented regarding percentage increased yield.

The observation yield and economic performance of front line demonstration, the data on output were collected from FLDs (demonstration) as well as local check plots from all selected farmers and finally the grain yield, cost of cultivation, yield, net returns of different farmers were analyzed by the formula.

Average = (F1+F2+F3..... Fn)/N

F1= Farmer

N= No. of Farmers

Gap Analysis

Technology gap, extension gap, and technology index were calculated using the following formulas (Samui *et al.,* 2000; Sagar and Chandra, 2004).

Technology gap= Potential yield - Demonstration yield

Extension gap= Demonstration yield – Farmer's yield

$$\text{Technology Index (\%)} = \frac{\text{Potential yield} - \text{Demonstration yield}}{\text{Potential yield}} \times 100$$

Results and Discussion

Seed Cotton Yield

The data on seed cotton yield from frontline demonstrations (FLDs) conducted during *Kharif* 2009–2015 are presented in Table 1. The highest yield (22.00 q/ha) in the demonstration plot was recorded during the *Kharif* season of 2011–2012, compared to 18.51 q/ha in the farmers' practice plot. This was followed by yields of 19.21 q/ha in 2012–2013 under recommended technologies, as opposed to 15.32 q/ha in the local check. On average, the demonstration plots yielded 15.76 q/ha, compared to 12.67 q/ha under farmers' practices, representing a 25.28% increase in yield due to the balanced nutrient application based on soil test values.

The findings indicate that balanced fertilization based on soil tests significantly enhances cotton productivity. Farmers are encouraged to avoid imbalanced nutrient applications. These results align with those of Bhowate and Olambe (2017) for wheat FLDs in Hingoli district. The superior performance of technology demonstrations under soil test-based nutrient management highlights its effectiveness under the agro-ecological conditions of the study area. Observing the yield potential motivated farmers to adopt the demonstrated technologies.

Technology Gap

A wide technology gap was observed across the years, with the lowest gap (1.00 q/ha) recorded in 2010–2011 and the highest (11.72 q/ha) in 2013–2014. The mean technology gap for all 60 demonstrations was 7.24 q/ha.

These differences are attributed to varying feasibility levels of the recommended technologies across years, influenced by factors such as soil fertility and erratic rainfall. The gap between potential yield and demonstration yield highlights the need for location-specific recommendations to minimize the technology gap.

Extension Gap

The extension gap, representing the difference between FLD and farmers' practice yields, ranged from 1.74 to 4.20 q/ha, with an average of 3.09 q/ha. The lowest gap (1.00 q/ha) was recorded during *Kharif* 2013–2014, while the highest (4.20 q/ha) was observed in 2014–2015. The higher extension gap underscores the need to educate farmers on adopting improved practices, particularly soil test-based nutrient management, to optimize yields.

Technology Index

The technology index, which indicates the feasibility of technology at farmers' fields, was recorded at 4.35% (Table 1), indicating a high suitability of the recommended technology for the Hingoli district. These findings are consistent with those of Bhowate and Olambe (2017) for wheat production technology in the same region.

Table.1 Productivity, technology gap, extension gap and technology index of Btcotton under Front Line Demonstrations on Farmers fields

Year	Area (ha)	No of farmers	Seed cotton yield (q/ha)					Per cent increase over FP	Techno logy gap (q/ha)	Extension gap (q/ha)	Technolo gy index
			Poten tial	Recommended Practice			Farmer practic e				
				highest	lowest	average	average				
2009-10	6.00	15	23	15.20	9.00	13.50	9.30	45.00	7.70	3.40	33.48
2010-11	4.8	12	23	17.90	9.20	15.30	11.90	28.57	1.00	3.49	4.348
2011-12	4.8	12	23	26.00	17.50	22.00	18.51	18.85	3.79	3.89	16.48
2012-13	4.8	12	23	22.00	16.50	19.21	15.32	25.39	9.71	1.84	42.22
2013-14	4.8	12	23	15.10	11.20	13.29	11.45	15.62	11.72	1.74	50.96
2014-15	4.8	12	23	13.70	9.20	11.28	9.54	18.25	9.50	4.20	41.30
Total/ mean	**5.00**	**12.50**	**23**	**18.32**	**12.10**	**15.76**	**12.67**	**25.28**	**7.24**	**3.09**	**31.46**

Figure.1 Bar graph showing the productivity (seed cotton yield under recommended practice and farmer practice), technology gap, and technology index for Bt cotton across the years. The technology index is represented as a line graph on a secondary y-axis for clarity.

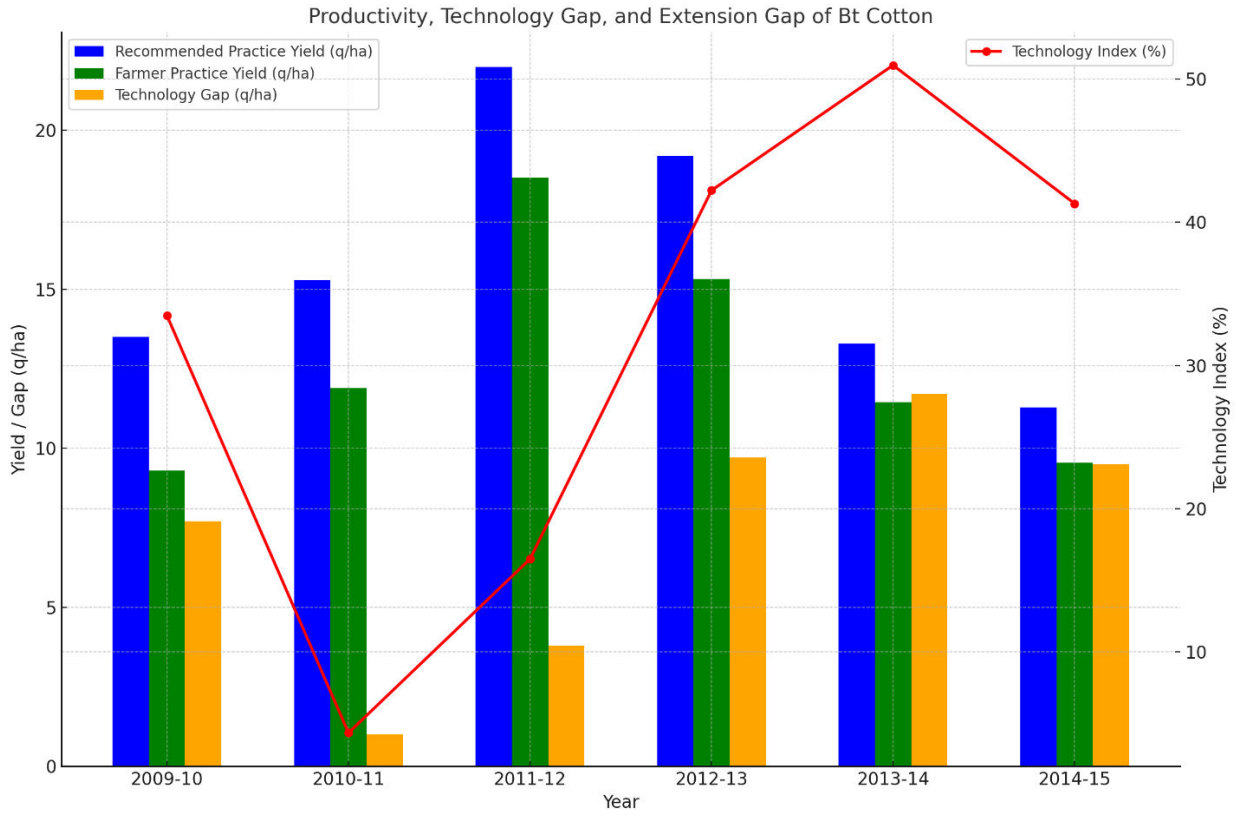
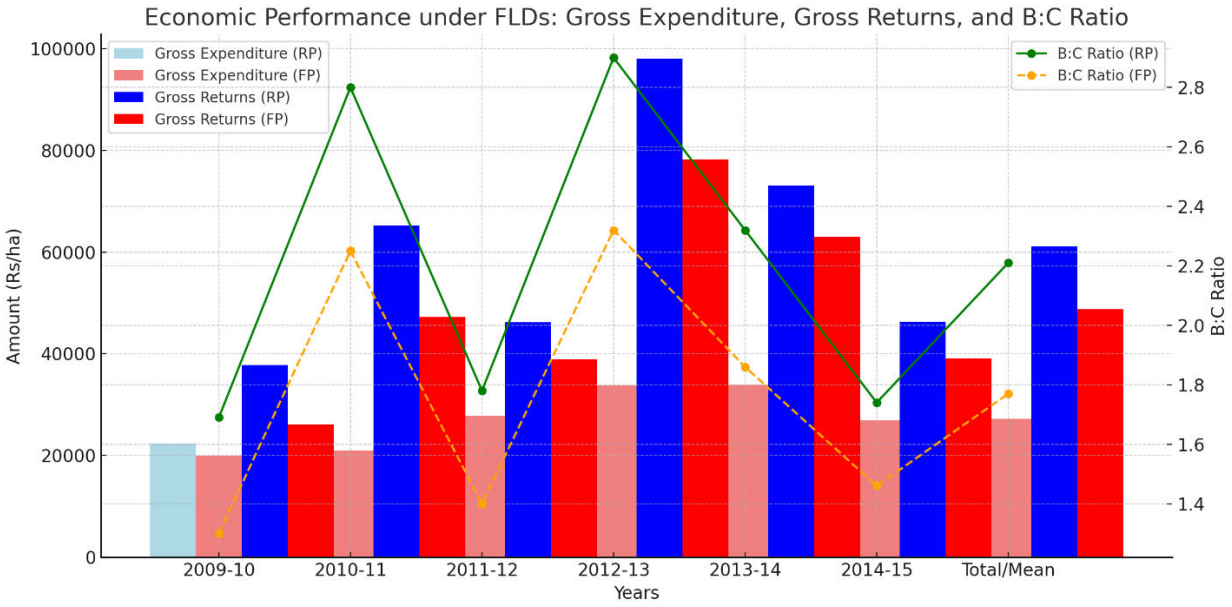


Table.2 Gross return, cost of cultivation, net return and B:C ratio as affected by improved and local technology under FLDs onfarmers' fields

Year	No. of farmers	Gross expenditure (Rs/ha)		Grass returns (Rs/ha)		Net returns (Rs/ha)		Additional net returns (Rs./ha)	B:C Ratio	
		RP	FP	RP	FP	RP	FP		RP	FP
2009-10	15	**22390.00**	**19970.00**	**37800.00**	**26040.00**	**15410.00**	**6070.00**	**9340.00**	**1.69**	**1.30**
2010-11	12	**23320.00**	**20970.00**	**65200.00**	**47200.00**	**41980.00**	**26230.00**	**15750.00**	**2.80**	**2.25**
2011-12	12	**25905.00**	**27800.00**	**46200.00**	**38871.00**	**20295.00**	**11071.00**	**9224.00**	**1.78**	**1.40**
2012-13	12	**33800.00**	**33750.00**	**97993.00**	**78176.00**	**64192.00**	**44426.00**	**19766.00**	**2.90**	**2.32**
2013-14	12	**31480.00**	**33900.00**	**73105.00**	**62998.00**	**41624.00**	**29098.00**	**12526.00**	**2.32**	**1.86**
2014-15	12	**26675.00**	**26875.00**	**46296.00**	**39121.00**	**19621.00**	**12246.00**	**7375.00**	**1.74**	**1.46**
Total/mean	12.50	**27261.67**	**27210.83**	**61099.00**	**48734.33**	**33853.67**	**21523.50**	**12330.17**	**2.21**	**1.77**

RP – Recommended Practice, FP- Farmers' Practice

Figure.2 Above is the Bar graph illustrating the economic performance under Front Line Demonstrations (FLDs). It shows the comparison of gross expenditure, gross returns, and B:C ratio for Recommended Practices (RP) and Farmers' Practices (FP) across the years.



- The bar sections represent the financial metrics (expenditure and returns).
- Line plots highlight the B:C ratio trends for RP and FP.

Economics

The economic analysis (Table 2) revealed that adopting improved cotton cultivation technology resulted in higher profitability. The average net return from demonstration fields was ₹33,853.57/ha, compared to ₹21,523.50/ha from farmers' practices.

The mean benefit-cost (B:C) ratio was 2.21 for demonstration plots and 1.77 for farmers' practices. These results highlight the substantial potential of improved technology to enhance farmers' income and livelihoods in the Hingoli district.

Author Contributions

Ravindra T. Bhowate: Investigation, formal analysis, writing—original draft. Mandar H. Geete: Validation, methodology, writing—reviewing.

Data Availability

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethical Approval Not applicable.

Consent to Participate Not applicable.

Consent to Publish Not applicable.

Conflict of Interest The authors declare no competing interests.

References

Bhowate, R. T., and Olambe, A. P. 2017. Nutrient management in wheat through front line demonstration in Hingoli district. J. Krishi Vigyan 2017,6 (1) : 138-140. https://doi.org/10.5958/2349-4433.2017.00065.4

Das, P., Proceedings of the Meeting of DDG(AE), ICAR, with Officials of StateDepartments, ICAR Institutes and Agricultural Universities, NRC Mithun, Jharmapani; Zonal Coordinating Unit, Zone-III, Barapani, Meghalaya, India Quoted by V. Venkatasubramanian, Sanjeev M. V. and A. K. Singha in Concepts, Approaches and Methodologies for Technology Application and Transfer- a resource book for KVKs IIndEdition.pp.6 (2007).

Sagar, R. L. and Chandra, G. 2004. Evaluation of front line demonstrations on mustard in Sunderbah, West Bengal. Indian J. Exten.Edu., 40: 96-97.

Samui, S. K., Maitra, S., Roy, D. K., Mondal, A. K., and Saha, D. 2000. Evaluation on front line demonstration on groundnut (*Arachis hypogeal* L.).J. IndianSoc. Coastal Agric. Res., 18: 180-183.

Singh, P., Vijaya, D., Chinh, N. T., Pongkanjana, A., Prasad, K. S., Srinivas, K. and Wani, S. P., Potential Productivity and Yield Gap of Selected Crops in the Rainfed Regions of India, Thailand, and Vietnam. Natural Resource Management Program Report no. 5, 50. International Crops Research Institute for the Semi-Arid Tropics,pp.1-25 (2001).

How to cite this article:

Ravindra T. Bhowate and Mandar H. Geete. 2025. Effectiveness of Frontline Demonstrations on Soil Test-Based Nutrient Management for Enhancing Cotton Yield in Hingoli District, Maharashtra, India. *Int.J.Curr.Microbiol.App.Sci.* 14(02): 116-121. **doi:** https://doi.org/10.20546/ijcmas.2025.1402.010