Indian Research Journal of Extension Education
RESEARCH ARTICLE

Assessing the Impact of Soybean Crop on Yield and Income of The Farmers in Kolhapur District of Maharashtra

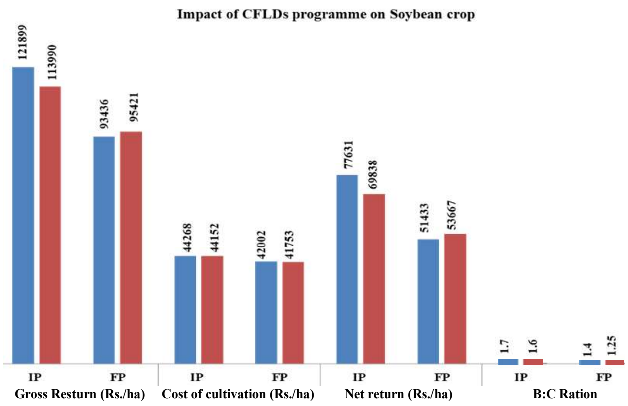
Ravindra Singh[1], Pandurang A. Kale[2] and Sunil Kumar[3]

1. Sr. Scientist & Head, 2. SMS (Agro), 3. SMS (Agril. Ext.),
ICAR-Shri Siddhagiri Krishi Vigyan Kendra, Kaneri, Kolhapur, Maharashtra
Corresponding author's email: ravindrasingh94125@gmail.com

HIGHLIGHTS

- Introduction of new varieties *of* Soybean (Phule Kimaya (KDS-753) and Phule Sangam (KDS-726)) through cluster frontline demonstration during 2021-22 to 2023-24.
- The extension gap was found to be with an average of 592 kg/ha for solo crop and 375 kg/ha for Inter Cropping.
- The technology index of demonstrations ranged from 15.54 (Solo crop) to 40.97 (Intercrop) per cent with an average of 28.75 (Solo crop) 35.86 Kg/ha (Intercrop) to per cent.
- Yield gap can be bridged with quality seed resulting soybean crop more remunerative through the wide publicity of the improved practices by with technology backup need to be implemented

GRAPHICAL ABSTRACT



ARTICLE INFO

Editor:
Dr. Amod Sharma.

Key words:
Soybean, Cluster front line demonstrations CFLDs, Yield Gap, Extension Gap and Technology Gap

Received : 27.02.2024
Accepted : 20.05.2024
Online published : 01.07.2024

doi: 10.54986/irjee/2024/jul_sep/56-60

IRJEE METRICS

Google citations - 8695
h-index - 43
i10-index - 291
NAAS rating - 4.99

ABSTRACT

Context: Soybean (Glycine max L.) is one of the most important oilseed crop cultivated in Kolhapur district of Maharashtra. The present investigation was carried out at KVK, Kaneri, Kolhapur during 2021-22 to 2023-24, to demonstrate the improved variety Phule Kimaya (KDS-753) and Phule Sangam (KDS-726) and performance in intercrop with the scientific package and practices to improve the production of soybean.

Objective: Introduction of new varieties of Soybean (Phule Kimaya (KDS -753) and Phule Sangam (KDS-726)) was demonstrated and their yield performance was assessed for further adoption for more yields.

Methods: The beneficiaries were selected through Participatory Rural Appraisal (PRA) technique. A total of 150 demonstrations were conducted in two consecutive *rabi* seasons. The technology gap, extension gap, technology index, and economic parameters were compared with farmers' practice.

Results & Discussion: The extension gap was ranged from 366-750 kg/ha with an average of 592 kg/ha for solo crop and 375 kg/ha for Inter Cropping. The technology gap varied from 1475 to 575 kg/ha followed by technology index varied from average of 28.75 (Solo crop) 35.86 Kg/ha. The higher average cost of cultivation (Rs.45925/ha), gross returns (Rs. 1,21,899/ha for sole crop and Rs. 1,13,990 for intercrop) and net returns (Rs. 77,631/ha for sole crop and Rs. 69838 for Intercrop) were recorded with benefit-cost ratio of 1.7 for sole crop and 1.6 for intercrop. *Significance*: There is a need for additional training to optimize overall outcomes in oilseed production.

In India, soybean is predominantly grown as a rainfed crop covering the states of Madhya Pradesh, Maharashtra and Rajasthan; on vertisols and associated soils. Extreme variation in rainfall both in time and space acts as a major impediment in successful cultivation of soybean and realizing higher productivity coupled with level of technology adoption and other factors (Verma *et. al.,* (2021). Soybean crop has been considered important for meeting the requirement of balanced diet in human being (Singh *et al.,* (2012)). With uses ranging from culinary to industrial purposes such as oil extraction and animal feed, soybean has become a crucial component of Indian agriculture, playing a pivotal role in enhancing both nutritional diversity and economic prosperity. Frontline demonstration is an important tool to disseminate new technology at farmer's field. The constraints faced by the farmers in obtaining higher productivity is documented and the frontline demonstrations are designed to overcome the problems in a scientific way in order to show the worth of the new evolved variety and improved package of practices for enhancing the soybean productivity (Saravanakumar, 2018). The agricultural research system has generated location specific technology and develops the package of practices of soybean production technology to satisfy the needs of farmers (Kumar *et al*., 2012). To disseminate scientific knowledge among soybean growers and engage directly with farmers, ICAR has proposed a project on frontline demonstrations through the National Mission on Oilseeds and Oil Palm (NMOOP) in a cluster approach. The primary goal of the Cluster Frontline Demonstrations (CFLDs) on Oilseeds, facilitated by extension centers such as KVKs and State Agricultural departments, is to showcase the productivity potential and profitability of the latest and improved soybean production technology in actual farm conditions. CFLDs are appropriate tool to demonstrate recommended technologies among the farmers in a cluster approach and a powerful tool of extension because farmers in a group in general are driven by the perception that 'seeing is believing'. Hence, KVK, Kolhapur, Maharashtra had started conducting CFLDs on Soybean (variety: Phule Sangam (KDS-726) & Phule Kimaya (KDS-753)) from the year 2016-17. With a focus on enhancing the area, production, and productivity of soybean using improved technology, cluster frontline demonstrations (CFLDs) on oilseeds were conducted under the NMOOP scheme in Kolhapur district.

METHODOLOGY

Cluster Frontline Demonstrations (CFLDs) were conducted by Krishi Vigyan Kendra, Kaneri, Kolhapur District, Maharashtra (Longitude: 74.123996; Latitude: 16.5764489) with the latest improved crop production technologies in soybean from 2021-22 to 2023-24. The CFLDs were conducted in six selected talukas in Kolhapur District *i.e*. Kagal, Karveer, Gadhinglaj, Ajara Chandgad and Bhudargad of different farming situations. The beneficiaries were selected through Participatory Rural Appraisal (PRA) technique, baseline survey, later active meetings and group discussions. A total of 150 demonstrations were conducted in two consecutive *rabi* seasons i.e. from 2021-22 to 2023-24 (375 No.). The percent yield comparison of improved practice with local check, district and state averages were calculated and also assessed the yield impact, impact of adoption and horizontal area spread. The technology gap, extension gap, technology index, and economic parameters were compared with farmers' practice.

$$\text{Impact Yield} = \frac{\text{Yield of Improved practice} - \text{Yield of Farmer's practice}}{\text{Yield of Farmers' practice}} \times 100$$

Extension gap = Improved practice Yield – Farmers' practice Yield

Technology Gap= Potential Yield – Improved Yield

$$Technology\ Index = \frac{\text{Potential Yield} - \text{Improved Practices Yield}}{\text{Potential Yield}} \times 100$$

Location of study area district Kolhapur

RESULTS

Adoption gap : The adoption gap is an important factor influencing productivity of Soybean. The yield gap analysis was evaluated through extension gap, technology gap and technology index. The extension gap was ranged from 750 to 366 kg/ha during the investigation period with an average of 592 kg/ha for solo crop and 375 kg/ha for Inter Cropping (Table 1).

Table 1. Performance of improved technology on yield, extension gap, technology gap and technology index in Soybean during 2021-22 to 2023-24.

Year	No. of Demos		Variety IP	Variety FP	Mean Yield (Kg/ha) IP	Mean Yield (Kg/ha) FP	Increase of yield over the control (%)	Ext Gap (Kg/ha)	Tech. Gap (Kg/ha)	Tech. ndex (Kg/ha)
2021-22	Sole Crop	25	Phule Sangam (KDS-726)	Local	3125	2375	31.57	750	575	15.54
2022-23	Sole Crop	225	Phule Kimaya (KDS-753)	Local	2125	1475	44.07	650	1475	40.97
	Inter Cropping with Sugarcane	50			2213	1847	19.9	366	1387	38.52
2023-24	Sole Crop	60	Phule Kimaya (KDS-753)	Local	2445	2071	18.2	374	1155	32.08
	Inter Cropping with Sugarcane	15			2405	2021	19	384	1195	33.19
Mean	Sole Crop	310	Phule Sangam & Phule Kimaya		2565	1973.6	29.9	592	1035	28.75
	Inter Cropping with Sugarcane	65	Phule Kimaya (KDS-753)+ Sugarcane		2309	1934	19.38	375	1291	35.86

IP = Improved Practices; FP = Farmers practice

Table 2. Impact of improved technologies on economics of Soybean during 2021-22 to 2023-24

Year	Cropping pattern	Gross return (Rs./ha)		Cost of cultivation (Rs./ha)		Net return (Rs/ha)		B:C ratio	
		IP	FP	IP	FP	IP	FP	IP	**FP**
2021-22	Sole Crop	140625	106875	44500	42500	96125	64375	2.1	1.5
2022-23	Sole Crop	112625	78175	42379	40225	70246	37950	1.8	1.5
	Inter Cropping with Sugarcane	117336	97891	42379	40225	74957	57666	1.8	1.4
2023-24	Sole Crop	112447	95258	45925	43282	66522	51976	1.4	1.2
	Inter Cropping with Sugarcane	110645	92951	45925	43282	64720	49669	1.4	1.1
Mean	Sole Crop	121899	93436	44268	42002	77631	51433	1.7	1.4
	Inter Cropping with Sugarcane	113990	95421	44152	41753	69838	53667	1.6	1.25

Need arisen to educate the farmers on adoption of improved technologies as a wide gap between improved practice *vs* farmers' practice was observed. The technology gap varied from 1475 to 575 kg/ha during the study period (Table 1). The technology index is dependent on the technology gap, and it is expressed in percentage (%). The higher value of technology index shows lower adoption of improved technologies by the farmers. The technology index of demonstrations ranged from 15.54 (Solo crop) to 40.97 (Inter crop) per cent with an average of 28.75 (Solo crop) 35.86 Kg/ha (Intercrop) to per cent (Table 1).

Economic returns : The economics returns mainly depend on yield, variable cost, and fluctuations between minimum support price and market price. The values of input cost and labour wages varied from time to time. The higher average cost of cultivation (Rs. 45925/ha for sole crop and Intercrop), gross returns (Rs. 1,21,899/ha for sole crop and Rs. 1,13,990 for intercrop) and net returns (Rs. 77,631/ha for sole crop and Rs. 69838 for Intercrop) were recorded in improved practices with an average benefit-cost ratio of 1.7 for sole crop and

1.6 for intercrop when compared to farmers' practice (Rs. 42,002 sole crop and Rs. 41,753 for intercrop, Rs. 93,436 (Solo crop) Rs. 95,421 (intercrop) and 51433 (Sole crop) and Rs. 53,667/ha (intercrop) respectively) with an average benefit-cost ratio of 1.4 (Sole crop) and 1.25 (intercrop).

DISCUSSION

In the study the technology gap was higher and reflecting on farmers' due to non-cooperation on demonstration of improved technologies and poor extension activities. This might be attributed to different parameters, viz. soil fertility status, crop suitability, and variations among dates of sowing and weather parameters. Similar observations were reported by Singh *et. al.,* (2014) Strengthening of extension programs and location-specific on-farm research, encouragement and adoption of the improved package of practices lower the technology gap. Lakshmi *et. al.* (2020) reported that the yield gap can be bridged with quality seed to make the soybean crop more remunerative through the wide publicity of the improved practices by adoption of front line demonstrations with technology backup need to be implemented. Timely and need based suggestions by KVK scientists, extension personnel, favorable climatic conditions and low incidence of pests and diseases favoured lower technology index. These findings were in conformity with Singh *et. al.,* (2014), Kumar e*t al.,* (2018), Shaktawat *et. al.,* (2021); Sri *et. al.,* (2022); Kirar *et. al.* (2005) and Rathod *et. al.* (2016) in soybean crop.

The results of the study in case of economic returns of new varieties of soybean (KDS-753 & KDS-753 with intercrop) were in conformity with that of Sorokhaibam*, et al.,* (2022), Raghav *et al.,* (2021) & Meena *et al.,* (2018) who reported the higher net returns and high benefit cost ratio in soybean. Mehtre, *et al.,* (2023) that different cultivars of soybean recorded higher gross returns, net return and benefit cost ratio in improved technologies as compared to the plots where farmers using traditional practices in their cultivation. The average soybean yield in FLD plot was higher than the farmers practice field and suggested that location-specific improved production technology with improved variety would be needed to bridge the productivity gap of soybean in Marathwada region of Maharashtra. Garud *et al.,* (2022) reported that the improved technology recorded higher average seed yield per hectare over farmers practice in rainfed condition. The improved technology gave higher average gross return, average net return with higher benefit cost ratio as compared to farmers' practices. The results clearly indicated that the beneficial impact of front line demonstrations over the farmers practices towards enhancing the productivity of soybean cultivation under rainfed condition in Beed district of Maharashtra. Saikia, *et al.,* (2024) observed that the CFLDs has given a positive and significant impact over the farming community as they were motivated by the new agricultural technologies applied in the demonstrations which were superior in every aspect compared to existing practices, followed by Verma *et. al.,* (2021), Singh, *et al.,* (2018) & Tiwari *et. al.* (2023) also observed higher benefit-cost ratio through improved technologies in soybean.

CONCLUSION

Leveraging scientific production and protection technologies holds the potential to enhance both crop productivity and economic returns in soybean cultivation. The improved benefit-cost ratio, signifying economic viability, convincingly motivated farmers to adopt the demonstrated interventions. The study highlighted the high effectiveness of Cluster Front Line Demonstrations (CFLDs) programs in inspiring and influencing the attitudes of fellow farmers toward embracing improved cultivation practices and crop management. Moreover, there is a requirement for additional training and an expansion of cultivated areas to optimize overall outcomes. To enhance the profitability of soybean cultivation, widespread promotion of interventions through the adoption of various extension methodologies, increasing the number of these demonstrations with adequate supervision is crucial for closing the extension gap and achieving self-sufficiency in oilseed production in the Kolhapur District.

Funding: The funding support received from Indian Council of Agricultural Research, New Delhi.

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

Data availability: Data would be made available on request.

Acknowledgement: The Authors duly acknowledge the ATARI, Zone VIII, Pune and participating farmers of CFLD of Kolhapur district for cooperation and help for conducting research.

Appendix: The supplementary data, table format for online visibility to the readers are submitted as an appendix.

Authors' contribution: The first conceptualized, and encouraged, supervised the findings of the manuscript. The second author collected and analyzed the data. The third author analyzed data and preparation draft manuscript. All authors discussed the results and contributed to the final manuscript. The authors approve of the content of the manuscript and agree to be held accountable for the work.

REFERENCES

Garud, H.S.; Surpam, T.B.; Gaikwad, B.B.; Patgaonkar, D.C. and Jagtap, K.L. (2022). Impact of front-line demonstration on yield and economics of soybean under rainfed condition in Beed district of Maharashtra, India. *Int. J. Trop. Agri.*, **40** (3-4): 277-281.

Kirar, B.S.; Mahajan, S.K.; Nashine, R.; Awasthi, A.K. and Shukla, R.K. (2005). Impact of technological practices on the productivity of soybean in front line demonstration. *Indian Res. J. Ext. Edu.*, **5**(1):47-48.

Kumar, A.; Rathod, M.K. and Kalantri, L.B. (2012). Behaviour of farmers in adoption of recommended technology for soybean. *Indian Res. J. Ext. Edu.*,**2** : 223-227.

Kumar, S. and Sharma, N.K. (2018). Level of attitude towards Soybean cultivation practices by the farmers. *Indian Res. J. Ext. Edu.*,, **18**(2):41-45.

Lakshmi, V. (2020). Soybean Productivity Enhancement through Cluster Front Line Demonstrations. *Chem.Sci. Revi.and Letters*, **9** (35):704-708.

Meena, D.S.; Chaman, J.; Meena, C.B.; Meena, B.S., Meena, B.L. and Patidar, B.K. (2018). Impact assessment of improved technology on Soybean productivity in South Eastern Rajasthan, India. *Int. J. Cur.Microbi. and Appl. Sci.*, **7**(7) : 728-732.

Mehtre, S.; Jadhav, R.; Ghuge, V. and Patange, M. (2023). Impact of frontline demonstrations on yield of soybean under rainfed condition in Marathwada region of Maharashtra. *J. Oilseeds Res.*, **40** (Special issue).

Raghav, D.K.; Indrajeet, D.K.; Kumar, A.; Singh, A.K. and Chauhan, Jitendra Kumar (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.

Rathod, M.K.; Tidke, G.R. and Mandve, R.P. (2016). Impact of frontline demonstration on adoption of seed treatment in Soybean. *Indian Res. J. Ext. Edu.*, **13** (2): 72-77.

Saikia, P.; Deka, B.C. and Das, P. (2024). Impact assessment of cluster frontline demonstrations (CFLDs) programme on oilseed crops in Golaghat district of Assam. *Indian Res. J. Ext. Edu.*,**24**(2) : 80-85.

Saravanakumar, S. (2018). Impact of cluster frontline demonstration on Black gram in Western Zone of Tamilnadu. *J.Kr. V.ig*, **7**(1) : 136-139.

Shaktawat, R.P.S. and Chundawat, G.S. (2021). Technological and extension yield gaps in oilseeds crops in Mandsaur district of Madhya Pradesh. *J. Kr. Vig.*, **9**(2):234-237.

Singh, A.K.; Singh, K.C.; Singh, Y.P. and Singh, D.K. (2014). Impact of frontline demonstration on adoption of improved practices of oilseed crops. *Indian Res. J. Ext. Edu.*, 14 (3):75-77.

Singh, I.; Singh, K. K. and Gautam, U.S. (2012). Constraints in adoption of soybean production technology. *Indian Res. J. Ext. Edu.*,**12** (4): 169-171. Sp. Iss. (Vol. II).

Singh, S.B. (2018). Impact of frontline demonstrations on yield of Soybean (Glycine max L. Merril) under rainfed conditions in Uttarakhand, India. *Int. J. Cur. Microb. and App. Sci.*, **7**(5) : 986-992.

Singh, S.R.K.; Mishra, A.; Gautam, U.S.; Dwivedi, A.P. and Chand, P. (2014). Scouting technological vis-a vis extension gaps in Soybean production in Madhya Pradesh. *Indian Res. J. Ext. Edu.*,**14**(2) : 41-5.

Sorokhaibam, S.; Meetei, K.B.; Singh, N.A.; Singh, K.M. and Singh, P. B. (2022). An appraisal of cluster frontline demonstrations on soybean crop in Bishnupur district of Manipur. *The Phar. Inno. J.*; SP-**11**(10): 2284-2287.

Tiwari, G.P.; Tripathy, S.; Bhandari, J.; Kumar, S.; Bhadauria, R.S.; Ghaswa, R. and Mishra, S. (2023). Role of cluster demonstration in enhancement of soybean production in Ratlam district of Madhya Pradesh. *Legu. Res.*, **46**(8) :1059-1063.

Verma, A.K.; Yunus, M.; Nagar, A.; Rundala, S.R., and Kumari, S. (2021). Enhancement of soybean productivity through cluster front line demonstrations in Jhalawar district of Rajasthan state, *Int.J. Trop. Agri.*, **39** (3),235-239.

Sri, G.A.L.; Kumar, G.D.S., and Khan, M. A. (2022). Farmers' characteristics effecting the yield gap in oilseed crops. *Indian Res. J. Ext. Edu.*,**22**(5), 59-62.

• • • • •