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Technological knowledge of soybean growers regarding broad bed furrow technology

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Abstract

Broad Bed Furrow (BBF) technology is an important climate-smart land configuration technique that improves soil moisture conservation, drainage, and resource-use efficiency in rainfed agriculture. The present study was undertaken to assess the technological knowledge of soybean growers regarding BBF technology in the Marathwada region of Maharashtra. An ex-post facto research design was adopted, and primary data were collected from 300 soybean growers (150 BBF adopters and 150 BBF non-adopters) selected through a multistage sampling procedure using a pre-tested structured interview schedule. Technological knowledge was assessed using a structured knowledge test, and the data were analyzed using frequency, percentage, mean, standard deviation, and Z-test. The findings revealed that a majority of both BBF adopters (59.33%) and non-adopters (72.67%) belonged to the medium level of technological knowledge. However, BBF adopters recorded a significantly higher mean knowledge score (10.48) than non-adopters (6.29), with a mean difference of 66.70 per cent ($Z = 20.445$, $p < 0.01$). Among the individual knowledge statements, the highest awareness among adopters was observed regarding seed saving under BBF (92.67%), use of furrows for irrigation water conveyance (86.00%), and improved field drainage (82.67%). The study concludes that exposure to BBF technology through training, demonstrations, and extension activities significantly enhances farmers' technological knowledge. Strengthening extension interventions and capacity-building programmes can further improve farmers' knowledge and promote the wider adoption of BBF technology among soybean growers.

Keywords: Broad Bed Furrow (BBF) technology, soybean growers, technological knowledge

Introduction

Agriculture is the backbone of the Indian economy and a major source of livelihood for the rural population. However, climate change, erratic rainfall, prolonged dry spells, temporary waterlogging, and declining soil fertility have increased the vulnerability of rainfed agriculture. As nearly 60.00 per cent of India's cultivated area is rainfed, the adoption of climate-smart agricultural technologies has become essential for improving productivity, enhancing resilience, and ensuring sustainable use of natural resources. Soybean is one of the world's leading oilseed crops due to its high protein and oil content. During 2025-26, global soybean production reached 426.82 million metric tonnes. In India, soybean was cultivated on 123.73 lakh hectares with a

production of 127.20 lakh tonnes, while Maharashtra remained the leading soybean-producing state with 44.68 lakh hectares under cultivation. Despite its importance, soybean production in Maharashtra is largely rainfed and frequently affected by climatic variability, resulting in unstable yields and reduced farm profitability (SOPA, 2025). The Broad Bed Furrow (BBF) system is a proven climate-smart technology that improves soil moisture conservation, facilitates excess water drainage, enhances resource-use efficiency, and increases crop productivity in heavy black soils. However, the successful adoption and effective utilization of BBF technology largely depend on farmers' technological knowledge. Assessing the technological knowledge of soybean growers is therefore essential for

identifying knowledge gaps and designing effective extension strategies to promote the wider adoption of BBF technology. Therefore, the present study was undertaken to assess the technological knowledge of soybean growers regarding Broad Bed Furrow technology.

Methodology

The study was conducted in the Marathwada region of Maharashtra. Latur and Dharashiv districts were purposively selected based on the area under soybean cultivation and the adoption of Broad Bed Furrow (BBF) technology. Using a multistage sampling procedure, three talukas from each district, five villages from each taluka, and ten soybean growers (five BBF adopters and five BBF non-adopters) from each village were selected, constituting a sample of 300 respondents (150 adopters and 150 non-adopters). An ex-post facto research design was adopted. Data were collected through personal interviews using a pre-tested structured interview schedule. Technological knowledge of the respondents regarding BBF technology was assessed using a structured knowledge test based on the recommended

practices of BBF. The data were analyzed using frequency, percentage, mean, standard deviation, and Z-test.

Results and Discussion

The data presented in Table 01 reveal that a majority (59.33%) of the BBF adopters belonged to the medium category of technological knowledge, followed by 28.67 per cent and 12.00 per cent in the low and high categories, respectively. Similarly, among the non-adopters, 72.67 per cent belonged to the medium category, while 16.67 per cent and 10.67 per cent were categorized under the low and high categories, respectively.

The mean technological knowledge score of BBF adopters was 10.48, whereas it was 6.29 among non-adopters. The per cent mean difference was found to be 66.70 per cent, indicating a substantially higher level of technological knowledge among adopters than non-adopters. Further, the calculated Z-value (20.445**) was positive and highly significant, revealing a significant difference between BBF adopters and non-adopters with respect to technological knowledge.

Table 1: Distribution of the respondents according to their level of technological knowledge (n=300)

Sr. No.	Categories	BBF adopters			Non-adopters			'Z' Value
		Range	Freq.	%	Range	Freq.	%	
1	Low	Up to 8.76	43	28.67	Up to 4.46	25	16.67	20.445**
2	Medium	8.77 to 12.19	89	59.33	04.47 to 08.11	109	72.67	
3	High	Above 12.20	18	12.00	Above 8.12	16	10.67	
	Total		150	100		150	100	% Mean Diff.
	Mean	10.48			6.29			
	SD	1.72			1.83			66.70

The findings suggest that the adoption of BBF technology significantly enhanced the technological knowledge of soybean growers. The higher knowledge level among adopters may be attributed to their greater exposure to extension activities, training programmes, demonstrations, and interactions with agricultural experts regarding the use of BBF technology. Increased knowledge enables farmers to understand and implement improved crop production practices more effectively, thereby enhancing farm productivity and profitability. Therefore, BBF technology appears to have contributed positively to the technological empowerment and capacity building of the respondent farmers.

Statement wise technological knowledge of respondents regarding BBF

A perusal of the table 02 indicates that BBF adopters possessed a higher level of knowledge regarding various technical and operational aspects of BBF technology compared to non-adopters. Significant differences were observed for all the knowledge statements included in the study. The highest level of awareness among BBF adopters was observed regarding the statement that BBF technology saves 20-25 per cent seed rate compared to flat sowing, with 92.67 per cent of adopters responding correctly as against 56.00 per cent of non-adopters. The difference was highly significant ($Z = 7.98^{**}$). This may be attributed to the direct experience of adopters with reduced seed requirements under BBF cultivation. Similarly, 86.00 per cent of adopters were aware that BBF furrows can be used for irrigation water

conveyance and temporary storage compared to 50.67 per cent of non-adopters, with a significant difference ($Z = 7.09^{**}$).

A large proportion of adopters (82.67%) knew that BBF is primarily designed to improve field drainage and reduce waterlogging, whereas only 60.67 per cent of non-adopters were aware of this aspect ($Z = 4.35^{**}$). Likewise, 80.00 per cent of adopters recognized that adoption of BBF can lead to better yield and higher gross returns compared to 56.00 per cent of non-adopters ($Z = 4.60^{**}$). Awareness regarding the role of BBF in reducing topsoil erosion during heavy rains was also considerably higher among adopters (78.00%) than non-adopters (44.67%), and the difference was significant ($Z = 6.29^{**}$). About three-fourths (76.67%) of the adopters were aware that BBF layout requires specific bed-to-bed spacing distinct from flat sowing, while only 42.67 per cent of non-adopters possessed similar knowledge ($Z = 6.38^{**}$). Similarly, 75.33 per cent of adopters knew that BBF often improves the benefit-cost ratio through combined savings and yield gains compared to 47.33 per cent of non-adopters ($Z = 5.18^{**}$).

Knowledge regarding the suitability of BBF for heavy clay soils (Vertisols) prone to waterlogging was reported by 66.00 per cent of adopters and 38.67 per cent of non-adopters ($Z = 4.91^{**}$). More than half of the adopters were aware of the recommended furrow depth (56.00%), increased water use efficiency (56.00%), and the possibility of reducing pest incidence and pesticide use (56.00%), whereas only about one-third of non-adopters possessed such knowledge. The differences were statistically significant. Half of the adopters

(50.67%) were aware that BBF reduces the frequency of irrigation compared to flat-bed sowing, while 30.67 per cent of non-adopters reported similar knowledge ($Z = 3.59^{**}$). Further, 48.67 per cent of adopters knew that the recommended broad bed width is around 180 cm compared to 28.00 per cent of non-adopters ($Z = 3.75^{**}$). Awareness

regarding the role of BBF in stabilizing crop stands during irregular rainfall was reported by 46.00 per cent of adopters and 24.67 per cent of non-adopters ($Z = 3.95^{**}$). The findings are found similar with Shete (2014)^[7], Gadmale *et al.* (2023)^[3] & Yande (2025)^[12].

Table 2: Distribution of the respondents according statement wise technological knowledge

Sr. No.	Statement	BBF adopter		Non-adopters		Z Value
		Freq.	%	Freq.	%	
1.	Is BBF primarily designed to improve field drainage and reduce waterlogging	124	82.67	91	60.67	4.35**
2.	Can BBF help stabilize crop stands during irregular rainfall	69	46.00	37	24.67	3.95**
3.	Do you consider BBF as a climate-smart agricultural technology	87	58.00	53	35.33	4.03**
4.	Is the commonly recommended broad bed width for BBF systems around 180 cm	73	48.67	42	28.00	3.75**
5.	Is furrow depth in BBF for soybean typically about 15–20 cm	84	56.00	46	30.67	4.56**
6.	Does BBF technology save 20–25% seed rate compared to flat sowing	139	92.67	84	56.00	7.98**
7.	Does BBF layout require specific bed-to-bed spacing distinct from flat sowing	115	76.67	64	42.67	6.38**
8.	Can BBF furrows be used for irrigation water conveyance and temporary storage	129	86.00	76	50.67	7.09**
9.	Is BBF adaptable to heavy clay soils (Vertisols) prone to waterlogging	99	66.00	58	38.67	4.91**
10.	Does BBF allow access for small machinery between beds for timely operations	59	39.33	34	22.67	3.16**
11.	Does BBF typically increase water use efficiency (yield per unit of water)	84	56.00	46	30.67	4.56**
12.	Does BBF reduce the frequency of irrigation compared to flatbed sowing	76	50.67	46	30.67	3.59**
13.	Can adoption of BBF lead to better yield and higher gross returns	120	80.00	84	56.00	4.60**
14.	Does BBF help reduce topsoil erosion during heavy rains	117	78.00	67	44.67	6.29**
15.	Does BBF often improve the benefit-cost ratio due to combined savings and yield gains	113	75.33	71	47.33	5.18**
16.	Can proper BBF management decrease pest incidence and reduce pesticide use	84	56.00	47	31.33	4.43**

The consistently higher proportion of correct responses among BBF adopters indicates that adoption of BBF technology was associated with greater technical knowledge and understanding of its agronomic, economic, and environmental benefits. The significant differences observed between adopters and non-adopters suggest that practical experience, training, and exposure to BBF technology played an important role in enhancing farmers' knowledge regarding its effective utilization and advantages.

Conclusion

The study clearly demonstrated that soybean growers who adopted Broad Bed Furrow (BBF) technology possessed significantly higher technological knowledge than non-adopters. Although the majority of respondents in both groups belonged to the medium knowledge category, BBF adopters recorded a substantially higher mean knowledge score, indicating that practical exposure to BBF technology enhances farmers' understanding of its recommended practices and benefits. Significant differences observed across all knowledge statements further confirm the positive influence of BBF adoption on farmers' technical competence. The findings emphasize that technological knowledge is a key prerequisite for the effective adoption and utilization of climate-smart agricultural technologies. Therefore, strengthening farmer-oriented extension services through need-based training programmes, field demonstrations, exposure visits, and ICT-enabled advisory services is essential to bridge existing knowledge gaps and accelerate the wider dissemination of BBF technology, thereby contributing to climate-resilient, sustainable, and profitable soybean production in rainfed regions.

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