EPRA International Journal of Agriculture and Rural Economic Research (ARER)- Peer-Reviewed Journal
Volume: 13 | Issue: 7 | July 2025 | Journal DOI: 10.36713/epra0813| Impact Factor SJIF(2025): 8.733| ISSN: 2321 – 7847

ANALYSIS OF CONSTRAINTS IN ADOPTION OF BROAD BED FURROW (BBF) METHOD FOR SOYBEAN CULTIVATION

H. S. Tole[1], R. B. Hile[2], A. J. Amale[3] and A. S. Jangale[4]

[1]*Research Scholar, Department of Agricultural Economics, MPKV, Rahuri Dist.- Ahilyanagar (MS) India-413 722*

[2]*Professor and Head, Department of Agricultural Economics, MPKV, Rahuri Dist.- Ahilyanagar (MS) India-413 722.*

[3]*Senior Research Assistant, CPMCC, Department of Agricultural Economics, MPKV, Rahuri Dist.- Ahilyanagar (MS) India-413 722.*

[4]*Senior Research Fellow, Comprehensive Scheme, Department of Agricultural Economics, MPKV, Rahuri Dist.- Ahilyanagar (MS) India-413 722.*

ABSTRACT

Present study is based on primary data collected from 60 cultivators adopted Broad Bed Furrow method for soybean cultivation through personal interviews, using a specially designed questionnaires in Akola district of Maharashtra, for the agricultural year 2024-25. The analysis was carried out with Garrett's ranking technique. Primary constraints faced by BBF cultivators, with the limited availability of BBF planters emerging as the most significant challenge, ranked first with the highest mean score. Following this, BBF sowing proves effective only in dry soil or under optimal moisture conditions. Similarly, additional constraints including unsuitability for land with uneven slopes, high cost of hiring BBF planters, lack of technical knowledge, unsuitability for light soil with high drainage and lesser plant population compared to traditional methods was also recorded. This all constraints highlights the importance of raising farmer awareness through extension agencies to ensure proper BBF technology adoption. Establishing Custom Hiring Centres (CHCs) at the village level is also effective solution this will improve farmers' access to modern technologies and ultimately increases the BBF technology adoption.

KEY WORDS: *Broad Bed Furrow (BBF), Constraints, Soybean, Garrett's ranking technique, Rainfed*

INTRODUCTION

Soybean (*Glycine max* (L) Merril.) is a remarkable crop that plays a vital role in global agriculture, nutrition, and industry. Belonging to the legume family, it has the unique ability to fix atmospheric nitrogen, enriching the soil and supporting sustainable farming practices. Its small, protein-rich seeds are a powerhouse of nutrition, serving as a fundamental ingredient in human diets, livestock feed and various processed foods. Beyond food, soybeans contribute to industries ranging from biodiesel production to biodegradable plastics, making them a key player in environmental sustainability. As demand for plant-based alternatives and eco-friendly solutions grows, soybean continues to shape the future of agriculture, economy and innovation worldwide. A tiny bean with an extraordinary impact, it remains an indispensable resource across cultures and industries. The most important countries of the world with the highest rate of soybean production include the USA, Brazil, Argentina, China and India (Anonymous, 2024). In India Madhya Pradesh as the top producing state, followed by Maharashtra (Anonymous, 2024). In 2023-24, Maharashtra cultivated soybean on 510.97 thousand hectares, producing 666.81 thousand tonnes with an average yield of 1305 kg/ha. Major soybean growing districts include Latur, Nanded, Buldhana, Dharashiv, Washim, Beed, Amravati, Akola and Yavatmal (Anonymous, 2024).

Rainfed agriculture occupies 67 percent net sown area, contributing 44 percent of food grains and supporting 40 percent of the population. In view of the growing demand for food grains in the country, there is a need to increase the productivity of rainfed areas (Sidar, 2017). Rainfed areas play a vital role in India's agriculture as they provide livelihood to 60 per cent of the country's population and contribute substantially to its GDP. The productivity of rainfed areas is adversely affected by the increasing variability in rainfall. Climate change over the past few years has made rainfed agriculture precarious, with the impact being most harsh on small farmers (Matham *et al.,* 2024).

To enhance productivity of rainfed farming system, it should be accompanied by suitable soil and water conservation practices to mitigate moisture demand when needed. Rainfed Farming system has to eliminate two major rainfall conditions of dry spell which creates moisture stress and heavy rains which creates water logged condition hence there is a vast scope for Broad Bed Furrow planting technique hence there is a vast scope for

Broad Bed Furrow (BBF) planting technique (Bomble, 2020). The Broad Bed Furrow (BBF) strategy is one of the in-situ moisture conservation techniques and is renowned for its water conservation, automated weeding, fertiliser placement, available moisture conservation, decreased lodging, and improved crop stand (Swapna *et al.,* 2020). Soybean cultivation using the Broad Bed Furrow (BBF) method of sowing under rainfed conditions is vital option in getting the better crop growth, yield, conserving the moisture, reduction in the cost of cultivation, saving the time and increasing the net returns over traditional flat bed method of cultivation. The results of the experiment showed that the BBF method can achieve higher productivity with a higher Benefit Cost (B:C) ratio of soybean cultivation in rainfed condition. The use of BBF to change land configuration is the better option in in-situ moisture conservation and to drain out the excess rainwater under rainfed cultivation. In comparison to the conventional method, the sowing of soybean with BBF method found to be superior in seed yield and average soybean productivity with BBF planter (Raghuveer, 2021). Growth character (plant height, number of branches per plant and number of root nodules per plant) and yield contributing character *viz.,* number of pods per plant, seed yield weight per plant, seed index, seed yield, straw yield and harvest index (%) were found higher in broad bed furrow compared to the normal flat bed sowing which subsequently resulted in yield enhancement to the extent of 28.38 per cent for soybean crop (Solanki *et al.,* 2018).

In Maharashtra, soybean cultivation has steadily expanded over the past decade. However, there are several challenges which are faced by farmers particularly in rainfed area which limit the productivity of soybean crop. To address this challenge, the study focuses on improving soybean yields through optimized land configurations and effective stress management techniques. By adopting innovative agricultural practices, researchers aim to enhance crop resilience and maximize productivity despite climatic uncertainties.

MATERIALS AND METHODS

Collection of Data : The study was deliberately carried out in Akola district, Maharashtra, as the region falls under rainfed cultivation and has climatic conditions favourable for the adoption of the Broad Bed Furrow (BBF) method. Two tehsils were selected for the study, with three villages chosen from each based on sample availability. Primary data was collected from sixty soybean cultivators practicing the BBF method. To bridge literacy gaps and ensure effective communication, structured questionnaires were used in an interview format. Farmers shared their experiences and ranked the challenges they faced in soybean cultivation under the BBF method. A quantitative approach was employed to analyse these rankings, utilizing Garrett's Ranking Technique to convert constraints, advantages and preferences into numerical scores. Unlike simple frequency distribution, this technique arranges constraints based on their severity from the farmers' perspective, allowing identical respondent numbers for multiple constraints to yield distinct rankings.

Application of the Garret's Ranking Technique : An attempt was made to recognized the constraints faced by the cultivators in the cultivation of soybean by BBF method. The identified constraints of cultivators in the cultivation of soybean are ranked by making use of Garret's Ranking Technique. The technique was used to rank the preference mentioned by the respondents on different factors and aspects of the cultivation process. It is used to find the most significant factor which had influenced the respondent in their practices. Founded on the Garret's Ranking technique, the study had the respondents rank different problems and outcome based on their impact thereby converting into score value and rank with the help of the following formula:

$$\textbf{Percent position} = \frac{\mathbf{100 \times (Rij\ -\ 0.5)}}{\mathbf{Nj}}$$

Where,

R_{ij} = Rank given for the i^{th} variable by j^{th} respondents

N_j = Number of variable ranked by j^{th} respondents

With the help of Garrett's Table, the percent position estimated is converted into scores by referring to the table given by Garret and Woodworth (1969). Then for each factor, the scores of each individual are added and then total value of scores and mean values of score is calculated. The factors having highest mean value is considered to be the most important factor. Below is the tabular representation of the problems faced by the cultivators.

RESULTS AND DISCUSSION

Comparing Broad Bed Furrow (BBF) method with traditional method, BBF offers notable economic and environmental advantages, yet cultivators face several challenges in its adoption. Based on first hand experiences of sampled BBF farmers, various constraints have been systematically ranked according to the severity of difficulty encountered, highlighting key concerns in knowledge dissemination, input costs, accessibility and climatic uncertainties. These rankings, summarized in Table 1 Out of 60 BBF cultivators 18 cultivators recorded first rank to limited number of BBF planter, similarly 15 respondent reported that BBF sowing effective only in dry soil or when there is optimum moisture in field as rank first, in contrast 32 respondent give their last preference to the constraint lesser plant population in BBF method as compared to traditional method.

Table 1 Preferences and ranking of constraints faced by BBF cultivators

Sr. No.	Constraints	Rank Given By The Respondents						
		I	II	III	IV	V	VI	VII
1	Lack of technical knowledge	3	2	6	9	13	19	8
2	Unsuitable for light soil having high drainage	2	4	7	7	9	12	19
3	Lesser plant population as compared to traditional method	0	1	2	0	6	19	32
4	BBF sowing effective only in dry soil or when there is optimum moisture in field	15	13	12	12	5	3	0
5	Limited number of BBF planters	18	15	16	8	3	0	0
6	High cost of hiring for BBF planters	9	8	10	11	14	8	0
7	Unsuitable for land having uneven slope	12	16	9	11	8	3	1

The Garrett value was determined using the Garrett ranking conversion table. In Table 2, the percentage positions are provided along with their corresponding Garrett scores. The closest matching percentage position was identified from the table and the respective Garrett score was assigned accordingly. Based on these values, a structured table of Garrett scores was created. Subsequently, rankings are allocated to different constraints according to the preferences of cultivators, using the mean Garrett score as the basis for evaluation. This systematic approach ensures a precise and reliable ranking of challenges faced by farmers, reflecting their relative significance.

Table 2 Per cent position and Garret value of constraints faced by BBF cultivators

Sr. No.	$100\times(R_{ij}-0.5)/N_j$	Per cent Position	Garret Value
1	100×(1-0.5)/7	7.14	78
2	100×(2-0.5)/7	21.43	66
3	100×(3-0.5)/7	35.71	57
4	100×(4-0.5)/7	50.00	50
5	100×(5-0.5)/7	64.29	43
6	100×(6-0.5)/7	78.57	35
7	100×(7-0.5)/7	92.86	22

The average score and ranks of different problems are depicted and results highlights the primary constraints faced by BBF cultivators, with the limited availability of BBF planters emerging as the most significant challenge, ranked first with the highest mean score of 63.92. Following this, BBF sowing proves effective only in dry soil or under optimal moisture conditions, which was ranked second based on farmers experiences. Similarly, additional constraints have been ranked according to their severity *i.e.* unsuitability for land with uneven slopes was assigned rank III, while the high cost of hiring BBF planters and lack of technical knowledge are recorded at rank IV and V, respectively. Additionally, unsuitability for light soil with high drainage was ranked VI and lesser plant population compared to traditional methods was categorized at rank VII.

Table 3 Garret Score and Ranking of constraints faced by BBF cultivators

Sr. No.	Constraints	Garret Score								Mean Score	Rank
		I	II	III	IV	V	VI	VII	Total		
1	Lack of technical knowledge	234	132	342	450	559	665	176	2558	42.63	**V**
2	Unsuitable for light soil having high drainage	156	264	399	350	387	420	418	2394	39.90	**VI**
3	Lesser plant population as compared to traditional method	0	66	114	0	258	665	704	1807	30.12	**VII**
4	BBF sowing effective only in dry soil or when there is optimum moisture in field	1170	858	684	600	215	105	0	3632	60.53	**II**
5	Limited number of BBF planters	1404	990	912	400	129	0	0	3835	63.92	**I**
6	High cost of hiring for BBF planters	702	528	570	550	602	280	0	3232	53.87	**IV**
7	Unsuitable for land having uneven slope	936	1056	513	550	344	105	22	3526	58.77	**III**

Above results of the constraints, also found in conformity with the previous findings of Singh *et al*. (2012) and Khandagale *et al.* (2023) suggesting the need for strengthening of extension services and provision of mechanization for soybean cultivation. On further in depth interviewing and use of ethnographic approach a lucid view of the problems presented below.

Limited number of BBF planters

Limited availability of BBF planters, which directly impacts the adoption rate of this technology. Despite the benefits of BBF technology due to limited availability of BBF planters it is impossible for farmers to adopt BBF method for soybean cultivation. The action should be needed to strengthen the village level Custom Hiring Centres (CHCs). This would increases the planter availability to farmers especially small and marginal farmers who can't direct invest in expensive implements.

BBF sowing effective only in dry soil or when there is optimum moisture in field

Furthermore, the sowing time for soybean using the BBF method plays a crucial role in its effectiveness, as proper timing is essential for optimal results. Sowing time is critical in the Broad Bed Furrow (BBF) method because it directly impacts seed germination, crop establishment and overall yield. Optimum moisture in the field is essential at the time of sowing because it ensures proper seed soil contact, allowing seeds to absorb sufficient moisture for uniform germination. If sowing done when soil too much moisture in field then it can impact on working of planter and sowing will not occurs properly. Hence the proper time of sowing is very important.

Unsuitable for land having uneven slope

The topography of the land is another critical factor, with uneven slopes often leading to severe crop failures when employing the BBF approach. The Broad Bed Furrow (BBF) method is unsuitable for land with an uneven slope due to challenges in water distribution, soil erosion and crop establishment. BBF relies on uniform furrows and beds to regulate moisture and prevent waterlogging, but uneven terrain disrupts this balance, causing irregular water flow that can lead to excessive runoff in some areas and water stagnation in others. Additionally, sloped land increases the risk of soil erosion, washing away seeds and nutrients, which negatively impacts crop growth. BBF is best suited for flat or gently sloping land, where moisture conservation and erosion control can be effectively managed.

High cost of hiring for BBF planters

Additionally, farmers' financial conditions influence their ability to adopt BBF technology, as the cost of hiring BBF planters is higher compared to traditional methods. This increased expense is primarily due to the extended sowing time required for BBF method, which raises operational costs and also the limited availability of planter serve another reason for same. This constraint can also be solved by establishing Custom Hiring Centres (CHCs) at village level and from there the farmers can hired BBF planters at lower cost.

Lack of technical knowledge

Lack of technical knowledge, including proper sowing techniques, is a significant constraint in adopting the Broad Bed Furrow (BBF) method. Many farmers lack awareness of correct adjustments in planter, proper use of plates specific to particular crops, seed placement, furrow construction and moisture management, leading to poor crop establishment. Without proper training, mistakes in sowing depth and spacing can reduce germination rates and yield potential. Additionally, inadequate knowledge of timing and field preparation results in inefficient moisture utilization, affecting plant growth. Limited access to expert guidance and extension services further hinders farmers from adopting BBF effectively. Addressing these challenges through education, demonstrations and farmer training can improve implementation and enhance agricultural productivity.

Unsuitable for light soil having high drainage

Soil type is another vital consideration, as land with high drainage is unsuitable for BBF planting, given that the technology relies on the principle of in-situ moisture conservation. This becomes challenging to conserve more moisture in light soil. In India, the system has been used mainly on deep vertisols (Singh *et al.,* 2014). BBF can help manage moisture in vertisols by improving drainage and reducing waterlogging, which is a common issue in these soils.

Lesser plant population as compared to traditional method

Although BBF cultivation results in lower plant populations compared to traditional methods, this limitation has a positive impact, as it promotes vigorous plant growth and improves the development of yield-contributing characteristics. This is reason for having lower preferences for that particular problem. However, many farmers remain hesitant to adopt BBF technology due to the farmers perception that reduced plant population could lead to lower yields. Contrary to this belief, BBF has demonstrated the potential to achieve higher yields. Supported by previous finding of Sharma *et al.* (2020) reported that the yield enhancement with BBF planters was 18.65 per cent higher than the flat-bed method, reinforcing the benefits of this technique.

CONCLUSION

Constraints analysis examined that major constraints faced by BBF cultivators was limited number of BBF planters followed by BBF sowing effective only in dry soil or when there is optimum moisture in field, unsuitable for land having uneven slope, high cost of hiring for BBF planters, lack of technical knowledge, unsuitable for light soil having high drainage, lesser plant population as compared to traditional method. This key constraints highlights the importance of raising farmer awareness through State Agricultural Universities (SAUs), Krishi Vigyan Kendras (KVKs) and other extension agencies to ensure proper BBF technology adoption. Among the constraint identified the limited availability of BBF planters emerged as a significant constraint. To overcome this, establishing Custom Hiring Centres (CHCs) at the village level is also a solution. This will improve farmers' access to modern technologies and ultimately increase BBF technology adoption.

REFRENCES

1. *Anonymous, (2024). Area, production and productivity of soybean in India. Retrieved from indiastat.com*
2. *Anonymous, (2024). Area, production and productivity of soybean in Maharashtra. Retrieved from Krishi.maharashtra.gov.in*
3. *Anonymous, (2024). World soybean production scenario. Retrieved from ipad.fas.usda.gov*
4. *Bomble, V. (2020). Use of Broad Bed Furrow Planter to Enhance Productivity of Soybean Crop. International Research Journal of Engineering and Technology, **7**(10): 2395-0072.*
5. *Garett H. E and Woodworth R. S. (1969) Statistics in psychology and education. Vakils, Feffer and Simons Pvt. Ltd., Bombay. p.329.*
6. *Khandagale, R. J., More, S. S. and Bharati, S. V. (2023). Constraints faced by BBF technology adopters and non-adopters recommended by VNMKV on soybean crop in Parbhani district of Maharashtra in Marathwada region (M.S). IJRTI, **8**(12):2456-3315.*
7. *Matham, P. K., Pattanayak, S., Kolagani, N. and Shankari, U. (2024). Rainfed agriculture and use of groundwater: Winners and losers – A review of literature of experiences in India. Current Agriculture Research Journal,* ***12***(2):515-529.
8. *Raghuveer, M., Charan, G. S., Kumar, Y. P., Kumar, M. S., Ramadevi, A., Poshadri, A. and Mamatha, K. (2021). Impact of frontline demonstrations of Broad Bed Furrow (BBF) on yield and economics of soybean (Glycine max (L.) Merrill) under rainfed conditions of Nothern Telangana Zone, India. Eco. Env. & Cons., **28**(2):702-706.*
9. *Sharma, P., Dupare, B. U. and Khandekar, N. (2020). Economic impact assessment of broad-bed furrow seed drill for soybean. Agric Res, **9**(3):392–399.*
10. *Sidar, R. S. (2017). Importance of rainfed agriculture.* Journal of Pharmacognosy and Phytochemistry, ***6****(6): 2385-2388.*
11. *Singh, I., Singh, K. K. and Gautam, U. S. (2012). Constraints in adoption of soybean production technology. Indian Research Journal of Extension Education, **2**(Special Issue):169-171.*
12. *Singh, Piara, Pathak Pranab, Wani Suhas and Sahrawat Kanwar. (2014). Integrated Water Resource Management for Increasing Productivity and Water Use Efficiency in the Rain-fed Areas of India.*
13. *Solanki, S. N., Thakare, S. H. and Ramteke, R. T. (2018). Raised bed planting through broad bed furrow. International Journal of Agricultural Engineering,* ***11***(2):400-408.