

## International Journal of Agriculture Extension and Social Development

Volume 9; Issue 6; June 2026; Page No. 426-431

Received: 14-03-2026  
Accepted: 19-04-2026

Indexed Journal  
Peer Reviewed Journal

### An analysis of production and marketing constraints in sugarcane-based cropping systems in Baghpat District of Western Uttar Pradesh

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DOI: <https://www.doi.org/10.33545/26180723.2026.v9.i6f.3719>

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#### Abstract

Sugarcane is one of the most important commercial crops in India and plays a vital role in supporting farmers' livelihoods and supplying raw material to the sugar industry. The present study was conducted to analyze the production and marketing constraints faced by farmers under sugarcane-based cropping systems in Baghpat district of Western Uttar Pradesh. Primary data were collected from 180 sugarcane farmers selected through a multistage sampling technique during the agricultural year 2024–25. The identified constraints were prioritized using Garrett's Ranking Technique. The study revealed that unavailability of labour during peak agricultural operations was the most severe constraint across all cropping systems, with Garrett scores of 59.89, 64.85, and 62.28 in Sugarcane Sole (CS-I), Sugarcane–Wheat (CS-II), and Sugarcane–Mustard (CS-III), respectively. Untimely availability of fertilizers, scarcity of family labour, high wages of hired labour, and high cost of production were other major production constraints. Among marketing constraints, low remunerative prices, delay in payment, and inadequate storage facilities emerged as important concerns. The study suggests that timely input supply, promotion of farm mechanization, improved marketing infrastructure, and prompt payment systems are essential for enhancing the productivity and profitability of sugarcane-based cropping systems.

**Keywords:** Sugarcane, sugarcane-based cropping systems, production constraints, marketing constraints, Garrett ranking technique

#### 1. Introduction

Sugarcane is one of the most important commercial crops in India and plays a significant role in the agricultural economy by providing livelihood support to millions of farmers and serving as a major raw material for the sugar industry. It is a versatile crop with multiple uses, including the production of sugar, jaggery, kandsari, fodder, and various by-products such as molasses, bagasse, and press mud. In recent years, sugarcane has also emerged as an important source of renewable energy through the production of bioethanol and other bio-based products, thereby contributing to the country's energy security and sustainable development.

India is the second-largest producer of sugarcane in the world and occupies a prominent position in the global sugar economy. During 2023–24, sugarcane was cultivated on 5.74 million hectares with a total production of 453.16 million tonnes. Among the major sugarcane-producing states, Uttar Pradesh ranked first with 2.65 million hectares under cultivation and a production of 215.81 million tonnes. Maharashtra occupied the second position with 1.44 million hectares and a production of 112.09 million tonnes, followed by Karnataka with 0.54 million hectares and 41.81 million tonnes of production (DA&FW, 2024). The crop continues to be a major source of income for farmers and an important contributor to rural employment generation.

Within Uttar Pradesh, sugarcane cultivation is concentrated in the western and central regions of the state. Major sugarcane-producing districts include Kheri, Bijnor, Muzaffarnagar, Sitapur, Saharanpur, Meerut, Bareilly, Gonda, Amroha, Baghpat, Pilibhit, Kushinagar, Shamli, Bulandshahr, Moradabad, Balrampur, Basti, Hapur, Shahjahanpur, and Hardoi (Department of Agriculture, U.P., 2022) [3]. Among these districts, Kheri recorded the largest area under sugarcane cultivation (239,090 ha), followed by Bijnor (201,591 ha) and Muzaffarnagar (72,164 ha). Similarly, Kheri registered the highest sugarcane production (20.48 million tonnes), followed by Bijnor (17.85 million tonnes) and Muzaffarnagar (16.06 million tonnes). The highest productivity was recorded in Shamli district (1,014.16 quintals per hectare), followed by Muzaffarnagar (933.08 quintals per hectare).

Sugarcane occupies a unique position in the farming systems of Western Uttar Pradesh, where it is cultivated under diverse cropping patterns. Sugarcane-based cropping systems are characterized by the cultivation of sugarcane either as a sole crop or in association with companion crops such as wheat and mustard. These systems play a vital role in improving land-use efficiency, cropping intensity, employment generation, and farm income. The integration of sugarcane with other crops enables farmers to diversify their production, reduce risks associated with

monocropping, and ensure a more stable flow of income throughout the year. Consequently, sugarcane-based cropping systems have become an important component of the agricultural production system in the region.

Baghpat district is one of the prominent sugarcane-growing districts of Western Uttar Pradesh, where sugarcane serves as the backbone of the rural economy. The district is endowed with fertile alluvial soils, favorable climatic conditions, and well-developed irrigation facilities, making it highly suitable for sugarcane cultivation. In addition, the presence of sugar mills and jaggery processing units provides assured market opportunities to farmers. During 2022–23, the area under sugarcane cultivation in Baghpat district was 85.49 thousand hectares, with a total production of 7.64 million tonnes and a productivity of 894.01 quintals per hectare (Directorate of Agricultural Statistics and Economics, Baghpat, 2024) [5]. Owing to these favorable conditions, sugarcane-based cropping systems are widely adopted by farmers across the district.

Despite their economic importance, sugarcane-based cropping systems are confronted with several production and marketing constraints that adversely affect their productivity, profitability, and long-term sustainability. Farmers frequently face challenges such as labour scarcity during peak agricultural operations, untimely availability of fertilizers and other inputs, increasing cost of cultivation, pest and disease incidence, and inadequate mechanization facilities. In addition, marketing-related problems including low remunerative prices, delayed payments, inadequate storage facilities, and high transportation costs further reduce the economic viability of sugarcane cultivation. The nature and severity of these constraints may vary across different sugarcane-based cropping systems, thereby influencing farm performance and resource-use efficiency. Therefore, the present study was undertaken to identify, analyze, and prioritize the major production and marketing constraints faced by farmers under different sugarcane-based cropping systems in Baghpat district of Western Uttar Pradesh.

## 2. Materials and Methods

### 2.1 Study Area and Sampling Design

The present study was conducted in Baghpat district of Western Uttar Pradesh, India, which is one of the major sugarcane-producing districts of the state. The district was purposively selected due to the predominance of sugarcane cultivation and its significant contribution to the regional agricultural economy. The district also possesses a strong sugarcane-processing infrastructure, including cooperative and private sugar mills, which provides assured marketing opportunities for sugarcane growers. The district is characterized by fertile alluvial soils ranging from sandy loam to clay loam, favorable agro-climatic conditions, and a well-developed irrigation network comprising tube wells and canal systems.

A multistage sampling technique was employed for the selection of sample respondents. In the first stage, Binauli and Baraut blocks were purposively selected from the six development blocks of Baghpat district on the basis of their largest area under sugarcane cultivation. In the second stage, three villages were randomly selected from each of the

chosen blocks, leading to the selection of a total of six sample villages. The selected villages included Jiwana-Goliyan, Bamnauli, and Begmabad Garhi from Binauli block, and Bijrol, Malakpur-Loyan, and Barwala from Baraut block.

In the final stage, a comprehensive list of sugarcane-growing farmers was prepared for each selected village with the assistance of Pradhans and local agricultural authorities. The Probability Proportionate to Size (PPS) sampling technique was used to ensure adequate representation of different farm-size categories. A total of 180 sugarcane farmers were selected, comprising 30 respondents from each village. The selected respondents were classified into four operational landholding categories, namely marginal farmers (below 1.0 ha), small farmers (1.0–2.0 ha), medium farmers (2.0–4.0 ha), and large farmers (above 4.0 ha).

### 2.2 Data Collection

The study was based on primary data. Primary data were collected during the agricultural year 2024–25 through personal interviews using a pre-tested and structured schedule. Information pertaining to socio-economic characteristics of farmers, landholding pattern, cropping systems, and production and marketing constraints was collected from the selected respondents. Relevant secondary data on area, production, and productivity of major crops for the period 2001–02 to 2022–23 were obtained from various published and unpublished sources, including the Directorate of Economics and Statistics, Government of Uttar Pradesh, the Ministry of Agriculture and Farmers Welfare, Government of India, the UPDES and UPAG portals, district agricultural offices, and relevant research publications.

### 2.3. Identification of Sugarcane-Based Cropping Systems

Field investigation and farm-level survey revealed the existence of three predominant sugarcane-based cropping systems in the study area. These were: (i) Sugarcane Sole (CS-I), (ii) Sugarcane–Wheat (CS-II), and (iii) Sugarcane–Mustard (CS-III).

### 2.4. Analytical Techniques

Descriptive statistical tools such as averages, percentages, and frequency distributions were employed to analyze the socio-economic characteristics of sample farmers and the distribution of cropping systems.

### 2.5. Analysis of Production and Marketing Constraints

The production and marketing constraints encountered by sugarcane farmers were identified and prioritized using Garrett's Ranking Technique. Respondents were asked to rank the constraints according to their perceived severity. The ranks assigned by individual farmers were converted into percent positions using the following expression:

$$\text{Percent position} = \frac{100 (R_{ij} - 0.5)}{N_j}$$

Where,

$R_{ij}$  = Rank given for  $i_{th}$  constraint by the  $j^{th}$  individual

$N_j$  = Number of constraints ranked by  $j^{\text{th}}$  individual

The calculated percent positions were transformed into Garrett scores using Garrett's conversion table. The mean score for each constraint was subsequently computed, and the constraints were ranked according to their average Garrett scores. The constraint receiving the highest mean score was considered the most severe constraint affecting the production and marketing of sugarcane in the study area.

### 3. Results and Discussion

In this section, the major production and marketing constraints faced by sugarcane farmers under different sugarcane-based cropping systems were analyzed using Garrett's Ranking Technique.

#### 3.1 Constraints faced by sugarcane farmers in CS-I

The major constraints faced by sugarcane farmers in CS-I (Sugarcane sole) are presented in Table 1.

**Table 1:** Constraints faced by sugarcane farmers in CS-I

| Sl. No. | Constraint                                  | Mean Garrett Score | Garrett Ranking |
|---------|---------------------------------------------|--------------------|-----------------|
| 1.      | Unavailability of labour during peak period | 59.89              | I               |
| 2.      | Delay in payment                            | 59.43              | II              |
| 3.      | Low remunerative price                      | 58.97              | III             |
| 4.      | Non-availability of fertilizer on time      | 56.16              | IV              |
| 5.      | Scarcity of family labour                   | 53.53              | V               |
| 6.      | High wages of hired labour                  | 51.23              | VI              |
| 7.      | Lack of storage facility                    | 50.18              | VII             |
| 8.      | High-cost transportation                    | 49.08              | VIII            |
| 9.      | High cost of production                     | 45.85              | IX              |
| 10.     | Pest and disease infestation                | 44.16              | X               |
| 11.     | Damage by stray/wild animals                | 43.79              | XI              |
| 12.     | Uncertainty in purchase schedules           | 42.83              | XII             |
| 13.     | Expenses of improved technology             | 35.44              | XIII            |

It was observed from Table 1 that the respondents under CS-I (Sugarcane sole) faced thirteen major constraints related to labour availability, input supply, cost of cultivation, and marketing. Among all the constraints, unavailability of labour during the peak period was identified as the most severe problem with a mean Garrett score of 59.89 and was placed at Rank-I. It was followed by delay in payment (59.43) at Rank-II and low remunerative price (58.97) at Rank-III.

Further, non-availability of fertilizer on time (56.16) was positioned at Rank-IV, emphasizing the necessity of timely input supply for sustaining crop productivity.

Scarcity of family labour (53.53) and high wages of hired labour (51.23) were assigned Rank-V and Rank-VI, respectively, which shows that both family and hired labour constraints adversely affect farm operations.

The next important constraints were lack of storage facility (50.18) at Rank-VII, high-cost transportation (49.08) at Rank-VIII, and high cost of production (45.85) at Rank-IX,

reflecting the infrastructural and economic pressures experienced by farmers. Moreover, pest and disease infestation (44.16), Damage by stray/wild animals (43.79), and uncertainty in purchase schedules (42.83) were placed at Rank-X, Rank-XI, and Rank-XII, respectively, indicating moderate but noteworthy challenges in sugarcane cultivation.

The least severe constraint reported by the respondents was expenses of improved technology, which obtained a mean Garrett score of 35.44 and was placed at Rank-XIII.

From the above discussion, it may be concluded that unavailability of labour during field operation was identified as an important constraint which was probably due to high labour wages and limited availability of agricultural labour during peak periods.

#### 3.2 Constraints faced by sugarcane farmers in CS-II

The major constraints faced by sugarcane farmers in CS-II (Sugarcane-wheat) are presented in Table 2.

**Table 2:** Constraints faced by sugarcane farmers in CS-II

| Sl. No. | Constraint                                  | Mean Garrett Score | Garrett Ranking |
|---------|---------------------------------------------|--------------------|-----------------|
| 1.      | Unavailability of labour during peak period | 64.85              | I               |
| 2.      | Scarcity of family labour                   | 58.91              | II              |
| 3.      | Non-availability of fertilizer on time      | 58.37              | III             |
| 4.      | High wages of hired labour                  | 56.34              | IV              |
| 5.      | High cost of production                     | 56.16              | V               |
| 6.      | Lack of storage facility                    | 50.87              | VI              |
| 7.      | Lack of advanced Mechanization Facilities   | 49.77              | VII             |
| 8.      | Pest and disease infestation                | 47.46              | VIII            |
| 9.      | High-cost transportation                    | 46.49              | IX              |
| 10.     | Delay in payment                            | 42.79              | X               |
| 11.     | Low remunerative price                      | 42.22              | XI              |
| 12.     | Damage by stray/wild animals                | 40.98              | XII             |
| 13.     | Expenses of improved technology             | 35.05              | XIII            |

It was observed from Table 2 that the respondents under CS-II (Sugarcane-Wheat) faced thirteen major constraints related to labour availability, input supply, cost of cultivation, and farm management. Among all the constraints, unavailability of labour during the peak period was identified as the most severe problem with a mean Garrett score of 64.85 and was placed at Rank-I. It was followed by scarcity of family labour (58.91) at Rank-II and non-availability of fertilizer on time (58.37) at Rank-III. Further, high wages of hired labour (56.34) and high cost of production (56.16) were placed at Rank-IV and Rank-V, respectively, suggesting that increasing cultivation expenses continue to affect farm profitability. Lack of storage facility (50.87) secured Rank-VI, while lack of advanced mechanization facilities (49.77) was placed at Rank-VII, highlighting infrastructural limitations in the study area. The other important constraints included pest and disease infestation (47.46) at Rank-VIII, high-cost transportation

(46.49) at Rank-IX, delay in payment (42.79) at Rank-X, and low remunerative price (42.22) at Rank-XI. In addition, Damage by stray/wild animals (40.98) was assigned Rank-XII, indicating production risks faced by the respondents. The least severe constraint reported was expenses of improved technology, which obtained a mean Garrett score of 35.05 and was placed at Rank-XIII.

From the above discussion, it may be concluded that unavailability of labour during field operations emerged as the most important constraint faced by the respondents. High wage rates and limited availability of agricultural labour during peak periods may be the probable reasons for this problem.

### 3.3 Constraints faced by sugarcane farmers in CS-III

The major constraints faced by sugarcane farmers in CS-III (Sugarcane-Mustard) are presented in Table 3.

**Table 3:** Constraints faced by sugarcane farmers in CS-III

| Sl. No. | Constraint                                  | Mean Garrett Score | Garrett Ranking |
|---------|---------------------------------------------|--------------------|-----------------|
| 1.      | Unavailability of labour during peak period | 62.28              | I               |
| 2.      | Non-availability of fertilizer on time      | 61.46              | II              |
| 3.      | High wages of hired labour                  | 60.49              | III             |
| 4.      | Scarcity of family labour                   | 58.91              | IV              |
| 5.      | Lack of storage facility                    | 58.80              | V               |
| 6.      | High cost of production                     | 50.01              | VI              |
| 7.      | Pest and disease infestation                | 48.73              | VII             |
| 8.      | Lack of advanced Mechanization Facilities   | 43.72              | VIII            |
| 9.      | Damage by stray/wild animals                | 43.22              | IX              |
| 10.     | Low remunerative price                      | 43.12              | X               |
| 11.     | Delay in payment                            | 43.02              | XI              |
| 12.     | Expenses of improved technology             | 41.72              | XII             |
| 13.     | High-cost transportation                    | 32.74              | XIII            |

It was observed from Table 3 that the respondents under CS-III (Sugarcane-Mustard) faced thirteen major constraints related to labour availability, input supply, cost of cultivation, and farm management. Among all the constraints, unavailability of labour during the peak period was identified as the most severe problem with a mean Garrett score of 62.28 and was placed at Rank-I. It was followed by non-availability of fertilizer on time (61.46) at Rank-II and high wages of hired labour (60.49) at Rank-III, indicating that labour shortage and timely input availability were the primary concerns of the farmers.

Further, scarcity of family labour (58.91) and lack of storage facility (58.80) were placed at Rank-IV and Rank-V, respectively, suggesting that both labour resources and storage infrastructure significantly influence farm operations. High cost of production (50.01) secured Rank-VI, reflecting the rising expenses associated with cropping system-III.

The other important constraints included pest and disease infestation (48.73) at Rank-VII, lack of advanced mechanization facilities (43.72) at Rank-VIII, and Damage

by stray/wild animals (43.22) at Rank-IX, indicating production-related risks faced by the respondents. Moreover, low remunerative price (43.12) and delay in payment (43.02) were placed at Rank-X and Rank-XI, respectively, highlighting marketing and financial challenges. Expenses of improved technology (41.72) was assigned Rank-XII. The least severe constraint reported was high-cost transportation, which obtained a mean Garrett score of 32.74 and was placed at Rank-XIII.

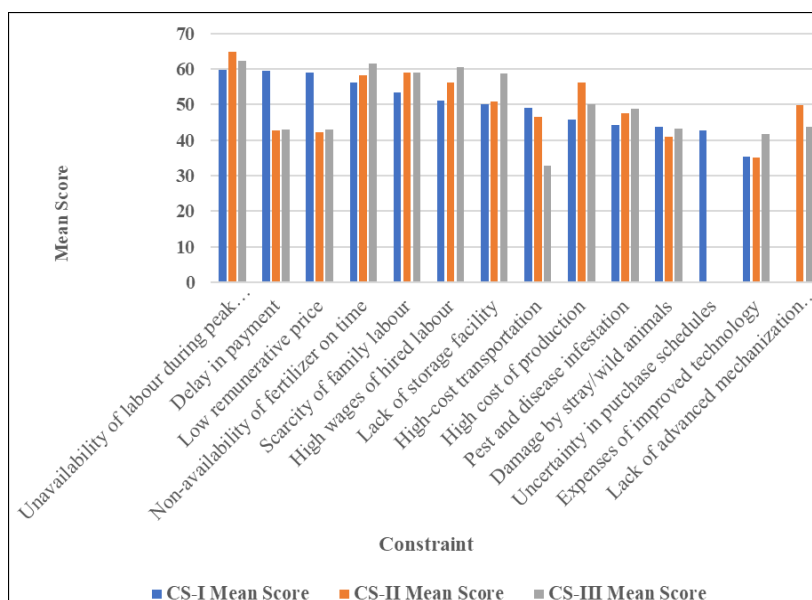
From the above discussion, it may be concluded that unavailability of labour during field operations emerged as the most important constraint faced by the respondents. High wage rates and limited availability of agricultural labour during peak periods may be the probable reasons for this problem.

### 3.4 Comparative Study of Constraints under Different Cropping Systems

The comparison of constraints faced by sugarcane farmers under different cropping systems is presented in Table 4.

**Table 4:** Comparative Study of Constraints under Different Cropping Systems

| Sl. No. | Constraint                                  | CS-I Mean Score | Rank | CS-II Mean Score | Rank | CS-III Mean Score | Rank |
|---------|---------------------------------------------|-----------------|------|------------------|------|-------------------|------|
| 1.      | Unavailability of labour during peak period | 59.89           | I    | 64.85            | I    | 62.28             | I    |
| 2.      | Delay in payment                            | 59.43           | II   | 42.79            | X    | 43.02             | XI   |
| 3.      | Low remunerative price                      | 58.97           | III  | 42.22            | XI   | 43.12             | X    |
| 4.      | Non-availability of fertilizer on time      | 56.16           | IV   | 58.37            | III  | 61.46             | II   |
| 5.      | Scarcity of family labour                   | 53.53           | V    | 58.91            | II   | 58.91             | IV   |
| 6.      | High wages of hired labour                  | 51.23           | VI   | 56.34            | IV   | 60.49             | III  |
| 7.      | Lack of storage facility                    | 50.18           | VII  | 50.87            | VI   | 58.80             | V    |
| 8.      | High-cost transportation                    | 49.08           | VIII | 46.49            | IX   | 32.74             | XIII |
| 9.      | High cost of production                     | 45.85           | IX   | 56.16            | V    | 50.01             | VI   |
| 10.     | Pest and disease infestation                | 44.16           | X    | 47.46            | VIII | 48.73             | VII  |
| 11.     | Damage by stray/wild animals                | 43.79           | XI   | 40.98            | XII  | 43.22             | IX   |
| 12.     | Uncertainty in purchase schedules           | 42.83           | XII  | —                | —    | —                 | —    |
| 13.     | Expenses of improved technology             | 35.44           | XIII | 35.05            | XIII | 41.72             | XII  |
| 14.     | Lack of advanced mechanization facilities   | —               | —    | 49.77            | VII  | 43.72             | VIII |

**Fig 1:** Comparative Study of Constraints under Different Cropping Systems

It was observed from Table 4 that sugarcane farmers under different cropping systems faced several production and marketing constraints with varying levels of severity. Unavailability of labour during peak agricultural operations emerged as the most severe common constraint across all cropping systems, receiving Rank-I in CS-I, CS-II, and CS-III. The problem may be attributed to increasing labour costs and the limited availability of agricultural labour during peak seasons. Non-availability of fertilizers on time was another major production constraint, particularly in CS-II and CS-III. Other important constraints included scarcity of family labour, high wages of hired labour, lack of storage facilities, high cost of production, pest and disease infestation, low remunerative prices, and inadequate mechanization facilities. These constraints collectively affect the productivity and profitability of sugarcane-based cropping systems in the study area.

#### 4. Conclusion

The study concludes that labour scarcity during peak agricultural operations and untimely availability of fertilizers are the most critical constraints affecting sugarcane-based cropping systems in Baghpat district. Addressing these constraints through farm mechanization,

timely input distribution, improved storage infrastructure, efficient marketing channels, and prompt payment mechanisms can significantly enhance productivity, profitability, and sustainability of sugarcane farming in the region. Policy interventions aimed at strengthening institutional support and rural infrastructure are therefore essential for improving the overall performance of sugarcane-based cropping systems.

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