

UNVEILING AND PRIORITIZING CROP CONSTRAINTS FACED BY SCHEDULED CASTE HOUSEHOLDS

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ABSTRACT

India, the most populous nation in the world, depends mostly on agriculture and related industries to support rural livelihoods. Agriculture is a major source of income in Rajasthan, an arid state with a sizable Scheduled Caste (SC) population. However, several production and market-related obstacles prevent SC farmers from improving their standard of living. In the arid regions of Bikaner and Hanumangarh in Rajasthan, the current study sought to identify and prioritise the challenges faced by SC households involved in crop farming. Data from 240 respondents chosen from six villages were gathered using an ex post facto study design. The Analytical Hierarchy Process (AHP) was used to determine the relative significance of constraints through pairwise comparisons, while consistency ratios were assessed to ensure the reliability of responses. The findings showed that production-related issues were the most common, followed by marketing limitations. Financial and informational constraints ranked third in influencing the adoption and continuation of crop farming practices. The study highlights that it is imperative to mitigate vulnerability and foster sustainable livelihood security in arid regions by strengthening climate-resilient agricultural practices, enhancing extension services, ensuring timely payments, expanding inclusive credit systems, and improving market efficiency.

Keywords: scheduled caste farmers, crop constraints, arid agriculture, analytical hierarchy process, livelihood security.

INTRODUCTION

India is the most populous country in the world, accounting for one-sixth of the global population with 1.428 billion people (Hertog *et al.*, 2023). Agriculture remains the backbone of India's socio-economic framework, providing a livelihood for approximately 42.00 per cent of the national workforce and contributing 18–20 per cent to the national Gross Value Added (GVA) (Government of India, 2023). Despite the structural transition toward the secondary and tertiary sectors, agriculture remains the primary economic stabilizer for rural and socially marginalized populations (State of Rural & Agrarian India Report, 2020). However, the sector is currently grappling with systemic challenges, including increasing population pressure, climate variability, low socioeconomic status (Chakraborty, 2016), and unequal distribution of productive resources such as land, water, and institutional credit (Barbier & Hochard, 2018). These factors have collectively intensified agrarian distress, particularly in communities with limited adaptive capacity.

Scheduled Castes (SCs) represent one of the most vulnerable social strata in India, historically subjected to social exclusion and economic stratification. This systemic

marginalization has manifested in persistent disparities across human development indicators, including asset ownership and access to formal institutional support (Deshpande, 2010; Munshi, 2019). As per the Census of India (2011), SCs constitute 16.6 per cent of the total population, yet they possess significantly lower landholding sizes compared to the national average. Dependency on agriculture remains exceptionally high within this group; approximately 74.50 per cent of the SC population is engaged in the sector, with 49.06 per cent working as agricultural laborers and 25.44 per cent as cultivators (NCSC, 2022). Most SC cultivators are marginal farmers whose resource constraints restrict the adoption of modern, climate-resilient agricultural practices (Raghavendra & Suresh, 2020; BIRTHAL *et al.*, 2021; Pokiya *et al.*, 2024).

Rajasthan provides a critical empirical landscape for evaluating these challenges. As India's largest state, it is characterized by harsh arid and semi-arid conditions, with 61 per cent of its area classified as dryland (Venkateswarlu & Prasad, 2012). Agriculture and allied sectors contribute 26.92 per cent to the Gross State Value Added (GSVA) at current prices (Rajasthan Economic Survey, 2024–25). However, productivity is severely hampered by erratic rainfall, declining

water tables, and high soil salinity. The state's SC population (17.78%) faces a "double burden": the environmental rigors of the arid ecosystem and the socioeconomic limitations imposed by their marginalized status (Pareek & Sole, 2019). National data suggest that SC farmers in Rajasthan face higher indebtedness and lower access to public extension services than non-SC farmers (NSSO, 2019; Ibrahim, 2018).

Access to extension services and formal credit remains a critical bottleneck. Social exclusion often limits the flow of technical knowledge and market information to SC households, leading to a hierarchy of production (Medat et al., 2016), financial, and marketing constraints (Krishna, 2019). While general constraints in dryland agriculture are well documented (Patil et al., 2020; Kumar et al., 2020), there is a significant research gap in the systematic prioritization of these barriers for SC households in arid zones.

Accordingly, the present study employs the Analytical Hierarchy Process (AHP) to unveil and rank these constraints. AHP is a robust multi-criteria decision-making tool that transforms qualitative farmer judgments into quantitative priority weights while maintaining logical consistency (Saaty, 1980; Choudhary et al., 2023). By prioritizing constraints ranging from water scarcity and high input costs to weak market linkages this study aims to provide evidence-based insights for designing inclusive extension strategies and policy interventions tailored to the needs of marginalized farmers in Rajasthan's arid regions.

OBJECTIVE

To identify and prioritise the crop farming constraints faced by Scheduled Caste households in the arid region

METHODOLOGY

The study adopted a positivist philosophy and a deductive, quantitative approach to prioritise crop farming constraints using numerical weights objectively. A survey-based ex post facto design was employed because the research examined existing conditions without experimental manipulation. The study was conducted in Rajasthan's arid region, covering Bikaner and Hanumangarh districts, which were purposively selected for their Scheduled Caste (SC) population exceeding 25.00 per cent (Government of Rajasthan, Census of India, 2011). From each district, one block and three villages were selected, with 40 respondents per village, yielding a total of 240 SC dairy farmers. Data were collected during 2023–24 using a semi-structured interview schedule covering socio-economic and constraint dimensions. Interviews were conducted in local dialects to ensure comprehension, supplemented with field observations for contextual validation. To prioritize constraints, the Analytical Hierarchy Process (AHP) developed by Saaty

(1980) was used. AHP is a structured multi-criteria decision-making method that integrates qualitative judgments into quantitative rankings through pairwise comparisons and consistency checks.

Stepwise Process of AHP:

Step 1: A five $n \times n$ matrix for five components on the dairy production system to Scheduled Caste farmers, denoted as A, B, C, D and E, are created using the pairwise comparisons with the elements a_{ij} indicating the value of i^{th} criterion relative to j^{th} criterion, as shown in the following formula.

$$A = \begin{bmatrix} a_{11} & \cdots & a_{1n} \\ \vdots & \ddots & \vdots \\ a_{n1} & \cdots & a_{nn} \end{bmatrix}$$

a_{ij} = Pairwise comparison of the i^{th} row relative to the j^{th} column.

Step 2: Forming a judgmental scale

Table 1: Scoring pattern for pair-wise comparisons in AHP

Which one is more important	How much
Equally Important	1
Slightly important	2
Moderate important	3
Strongly important	4
Strongly important	5
Strongly plus important	6
Very strongly important	7
Very very strongly important	8
Extremely important	9

Step 3: Filling the value in the matrix

The following expressions: $a_{ij} = 1$, $a_{ji} = 1/a_{ij}$, where $a_{ij} > 0$ for all i, j , yield the values a_{ij} . Therefore, if element i was given a number in comparison to element j , then element j had the reciprocal value in comparison to i .

Step 4: Obtaining of normalized matrices.

$$B = \begin{bmatrix} \frac{a_{11}}{a'_1} & \cdots & \frac{a_{1n}}{a'_n} \\ \vdots & \ddots & \vdots \\ \frac{a_{n1}}{a'_1} & \cdots & \frac{a_{nn}}{a'_n} \end{bmatrix}$$

Here, $a'_1, a'_2, \dots, a'_n$; are sum of column 1, 2, ..., n respectively

Step 5: Calculation of criteria weights/priority vector/ scaling factor.

Here, i, ii,, m; are the criteria weights

$$\sum \left(\frac{a_{11}}{a'_{11}}, \frac{a_{12}}{a'_{12}}, \dots, \frac{a_{1n}}{a'_{1n}} \right) / n = i$$

$$\sum \left(\frac{a_{21}}{a'_{21}}, \frac{a_{22}}{a'_{22}}, \dots, \frac{a_{2n}}{a'_{2n}} \right) / n = ii$$

$$\sum \left(\frac{a_{n1}}{a'_{n1}}, \frac{a_{n2}}{a'_{n2}}, \dots, \frac{a_{nn}}{a'_{nn}} \right) / n = m$$

Step 6: Calculating the consistency ratio to check whether the calculated value was correct or not.

Calculation of the $\lambda_{\max}$. $\lambda_{\max}$ is the largest eigenvalue of the matrix A.

$$\text{Consistency Index} = \frac{(\lambda_{\max} - n)}{n - 1}$$

The prioritization results are considered consistent when the consistency ratio (CR) is less than 0.1. The CR is calculated as the ratio of the consistency index (CI) to the random index (RI) (CR = CI/RI), where RI values, provided by Saaty (1980), depend on the number of elements being compared.

Table 2: Value of random consistency index

N	1	2	3	4	5	6	7	8
RI	0.00	0.00	0.58	0.90	1.12	1.24	1.32	1.41

(Adopted from Saaty and Forman, 1992; actual calculation made by Saaty, 1997)

Step 7: The criteria weight for each component matrix was written in the highest to lowest form.

RESULTS AND DISCUSSIONS

Production constraints

The findings indicate that rainfall variability and high installation cost of irrigation systems are the most critical production constraints (global weightage = 0.35; component weightage = 0.59), highlighting the strong dependence on erratic monsoon patterns and limited irrigation access. Delayed sowing, soil moisture stress, and frequent yield losses, along with high capital investment, restrict irrigation adoption among smallholders. Rainfall variability and rising input costs remain dominant constraints in semi-arid agriculture, as they are major sources of production risk in rainfed systems (Morton, 2007; IPCC, 2022; Makuvu et al., 2017). The high cost of quality seeds (Bhatt et al., (2011); Kumbhani et al., (2023) and limited access to drought-resistant varieties (0.21) ranked 2nd, highlighting gaps in the dissemination of climate-resilient technologies. Farmers in arid regions rely on traditional, low-yield varieties owing to affordability and access barriers, thereby limiting their adaptive capacity (Pingali, 2012). The high cost, poor quality,

and limited availability of fertilizers and agrochemicals (0.13) reflect inefficiencies in input supply chains, reducing input-use efficiency and increasing production risk, especially under moisture stress (Rapsomanikis, 2015). Labor shortages and high wages during peak seasons (0.063) ranked last and stemmed from rural outmigration, leading to delays in key operations, such as sowing and harvesting, and consequently, yield losses in arid regions (Fan et al., 2013).

Marketing and management constraints

Marketing and management constraints significantly influence crop production systems among Scheduled Caste farmers, affecting liquidity, risk exposure, and livelihood security. The most critical issue was the delay in payments from government mandis (0.576), which disrupts cash flow, limiting reinvestment, credit repayment, and household expenditure, and increasing dependence on informal credit (Ramesh et al., 2021; Gohain & Singh, 2018). Complex marketing processes and market volatility (0.199) ranked 2nd, further reducing price realization due to inefficiencies such as price fluctuations and intermediary dominance (Chand, 2016). Distance to markets and high transportation costs (0.159), along with inadequate storage and logistics (storage and warehousing) (0.056) ranked 3rd and 4th, respectively, which reflect weak market linkages, often leading to distress sales BIRTHAL et al., (2015). Overall, these constraints reinforce low returns and high vulnerability, highlighting the need for timely payments, improved market systems, and better rural infrastructure (Barrett, 2008); Pingali et al., (2019).

Financial and informational constraints.

The findings indicate key financial and institutional constraints affecting farmers in dry regions of India, with direct implications for livelihood security. The lack of awareness regarding crop insurance schemes and developmental programmes (0.076) ranked 1st as it limits access to risk mitigation and institutional support (BIRTHAL et al., 2015; Kumar et al., 2020; Patel et al., 2015). Limited access to credit and financing (0.285) and lack of collateral security (0.132) further reflect persistent financial exclusion, compelling reliance on informal credit sources (Chand et al., 2017; NABARD, 2019). Additionally, lack of information on advanced farming practices (0.076) constrains technology adoption due to weak extension outreach (Mittal & Mehar, 2016). These constraints are further intensified by limited asset ownership, social marginalization, and weaker institutional linkages, which restrict their access to formal credit and information channels Balana & Oyeyemi, (2022). Overall, these interlinked constraints reinforce low investment and high vulnerability, highlighting the need for improved awareness, inclusive credit systems, and stronger extension services to enhance farmers' resilience.

Table 3: Constraints faced by Scheduled Caste households in crop-related activities

(n=240)

Dairy Components	Components weight	λ max	Consistency Ratio	CI	Constraints	Strategy weightage within components	Strategy Rank within components	Global weights	Global rank
Production constraints	0.60	4.37	0.06	0.09	P1: High cost of quality seed	0.21	2	0.13	3
					P2: Unavailability and high cost of fertilizers, pesticides & herbicides	0.13	3	0.08	4
					P3: Labour shortage during peak season and lack of availability of skilled labourers	0.06	4	0.04	9
					P4: Rainfall variability and high installation cost of irrigation systems	0.60	1	0.36	1
Marketing & management constraints	0.26	4.36	0.08	0.12	MM1: Complex marketing process, market volatility	0.20	2	0.05	6
					MM2: Distance from market and high transportation cost	0.16	3	0.04	7
					MM3: Infrastructure and logistics (Storage and warehousing)	0.06	4	0.02	11
					MM4: Delay in payments from the government mandis	0.58	1	0.15	2
Financial and informational constraints	0.14	4.35	0.009	0.12	FI1: Lack of collateral Security	0.13	3	0.02	10
					FI2: Limited Access to Credit and Financial Facilities	0.28	2	0.04	8
					FI3: Lack of awareness regarding crop insurance scheme and developmental programs	0.51	1	0.07	5
					FI4: Lack of information regarding advanced farming practices and technologies	0.08	4	0.01	12

Overall constraints

The findings reveal that Scheduled Caste farmers perceive multiple constraints in crop farming, with production-related challenges emerging as the most significant (Markana et al., 2015). This is primarily driven by the high cost of seeds which places a disproportionate financial burden on smallholders, limiting their ability to invest in quality inputs and thereby constraining productivity. Similar results have been reported by Sharma *et al.* (2020) and Prajapati *et al.* (2016), Raj *et al.* (2025), Madhuprasad *et al.*

(2024), Mahammad *et al.* (2022), Mahammad *et al.* (2021). Marketing constraints were identified as the next major concern, particularly delays in payments from government mandis, which disrupt farm cash flow (Sonawane & Jyoti, 2017) and hinder the ability to meet immediate expenses such as labour wages, input purchases, and household needs (Mishra et al., 2020). Financial and informational constraints ranked third, indicating that limited access to credit and inadequate information further restrict farmers' capacity to effectively engage in crop production.

Table 4: Dimension-wise analysis of priority weightage/ scaling factor

Dimensions	Priority Weightage	λ max	CI	CR	Ranks
Production Constraints	0.60	4.13	0.017	0.019	1
Marketing and management Constraints	0.26				2
Financial and informational Constraints	0.14				3

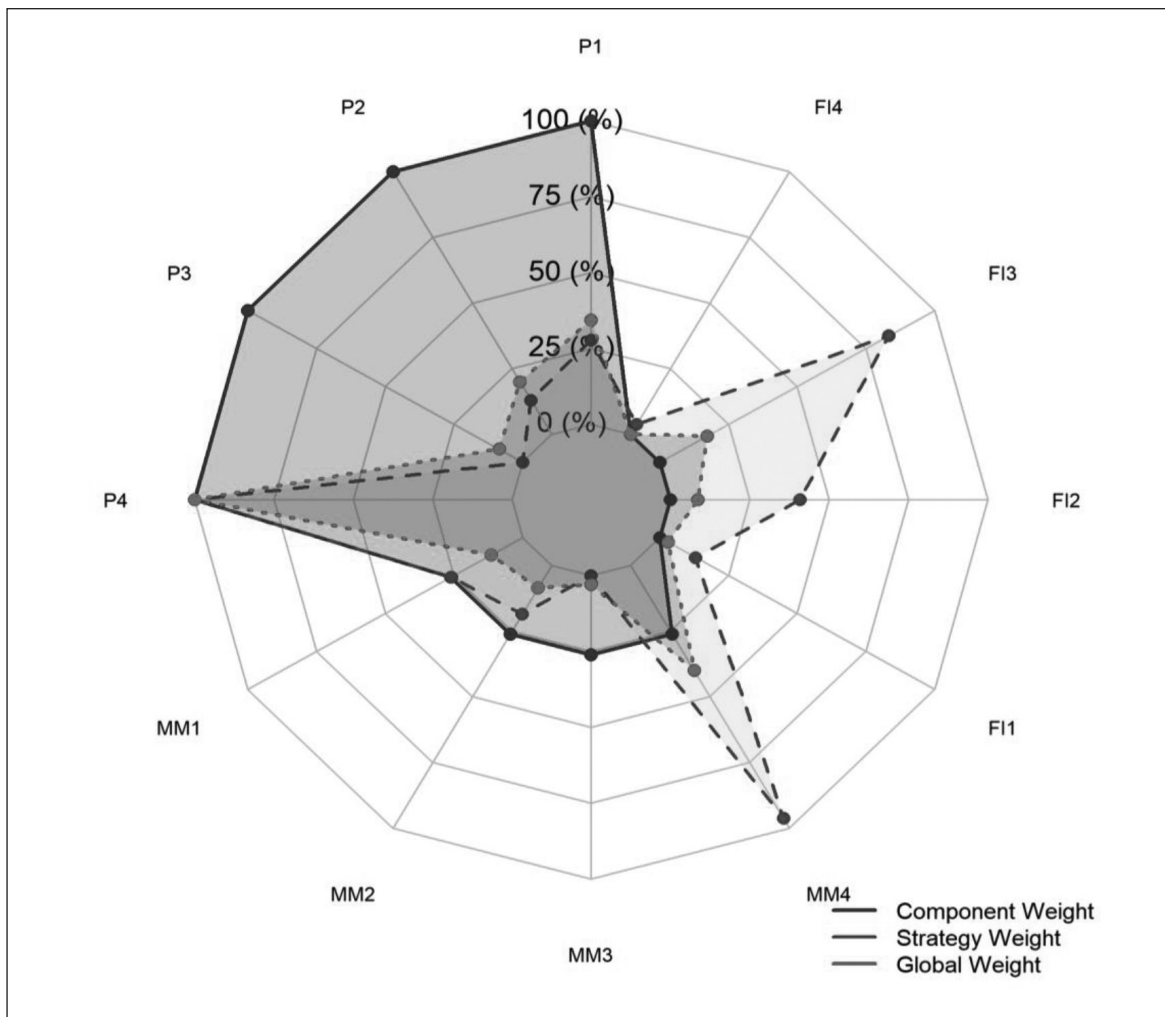


Fig. 1 : Priority weightage of crop components within component, component weightage and global weightage

CONCLUSION

The study clearly demonstrates that Scheduled Caste farmers in the arid regions of Rajasthan face a multidimensional constraint system, with production challenges, particularly rainfall variability and high input costs being the most dominant. These are closely followed by marketing inefficiencies, especially delayed payments, and persistent financial and informational gaps that limit access to credit, technology, and institutional support. The prioritization through AHP underscores the need for a holistic and targeted policy approach, emphasizing the promotion of climate-resilient and affordable inputs, the strengthening of transparent and timely market systems, the expansion of accessible and collateral-free credit facilities, and the revitalization of extension services for effective knowledge dissemination. Such integrated interventions are essential to reduce vulnerability, improve adaptive capacity, and ensure sustainable livelihood security among marginalised farming communities.

RECOMMENDATION

The findings suggest that Scheduled Caste farmers need better support, including affordable, climate-resilient inputs, timely mandi payments, easy access to credit, and practical extension guidance. Greater awareness about government schemes, along with improved rural market and storage facilities, can help farmers reduce risks and strengthen their livelihood security.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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