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Exploring constraints and policy interventions in cotton seed production and marketing: Evidence from Aurangabad and Jalna districts, Maharashtra

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Abstract

Cotton seed production is a critical segment of India's agricultural sector, particularly in Maharashtra's Aurangabad and Jalna districts, where favourable agro-climatic conditions and the involvement of major private seed companies have positioned the region as a leading hybrid seed hub. Unlike commercial cotton farming, seed production is a labour-intensive and capital-demanding process requiring skilled manpower and stringent quality protocols. This study investigates the key production and marketing constraints encountered by cotton seed producers in these districts.

A multi-stage sampling method was employed to select 75 seed-producing farmers associated with five major seed companies. Data were collected through structured interviews and analysed using the Garrett Ranking Technique to prioritize the identified constraints.

The results revealed that the high cost of inputs (Garrett Score: 52.13) was the most significant production challenge, followed by delayed seed supply, pest and disease incidence, and labour shortages during critical stages like pollination and emasculation. Other issues included unpredictable weather, seed purity norms, limited technical guidance, and the absence of crop insurance, reflecting both biophysical and institutional vulnerabilities.

On the marketing front, delayed payments (Garrett Score: 54.33), restricted buyer access, stringent quality rejections, and non-negotiable pricing structures imposed by dominant companies emerged as major hurdles. Additional concerns such as unfair grading, lack of transparency, and high transportation costs further weakened the producers' position, especially for small and marginal farmers.

The study highlights how the dominance of private firms has created a power imbalance, undermining farmer autonomy and profitability. It recommends targeted interventions including labour support schemes, decentralized seed distribution, crop insurance, improved extension services, and cooperative marketing platforms to address both structural and operational constraints, thereby enhancing the sustainability of cotton seed production in Maharashtra.

Keywords: Cotton seed production, production constraints, marketing constraints, Garrett ranking technique, farmer resilience, contract farming

Introduction

Cotton seed production occupies a pivotal position within the larger agricultural framework of India, particularly in states like Maharashtra, which is renowned not only for its extensive cotton cultivation but also for its robust hybrid seed production infrastructure. The districts of Aurangabad and Jalna, situated in the Marathwada region, have emerged as important centers of cotton seed activity due to their favourable agro-climatic conditions and the presence of numerous private seed companies that engage local farmers under contractual production arrangements (Singh & Pal, 2018) [11].

Unlike commercial cotton cultivation, seed production involves a series of specialized, labour-intensive practices, including the maintenance of genetic purity through controlled pollination and rouging. These tasks demand a high level of skill and precision, often performed manually, which in turn elevates the cost and complexity of operations. Farmers engaged in this segment are frequently confronted with a multitude of production-related challenges such as scarcity of skilled labour, pest outbreaks, adverse weather conditions, and irregularities in the supply of male and female parental seeds—an essential input in hybrid seed production (Sundaram *et al*., 2020; Kumar, 2019) [13, 5]. These constraints can severely undermine productivity, seed quality, and ultimately, farmers' income.

Beyond the field, marketing dynamics introduce an additional layer of difficulty. Most cotton seed producers operate within contract frameworks tied to private seed companies, wherein the terms of sale, pricing mechanisms, and quality assessments are predominantly dictated by the buyer. In many cases, farmers report issues such as delayed

lifting of produce, rejection of seeds on ambiguous quality grounds, and limited transparency in pricing and payment systems. The dependency on organizers or intermediaries further dilutes farmers' control over the marketing process and erodes their negotiating power (Rao & Dev, 2014) [8]. This creates a scenario where, despite their central role in ensuring the availability of quality seed for the cotton sector, seed-producing farmers remain economically vulnerable.

In light of these challenges, it becomes imperative to explore the nature and intensity of constraints that these farmers experience throughout the seed production and marketing process. A deeper understanding of their difficulties—rooted in both farm-level practices and institutional frameworks—can contribute significantly to policy discourse and the development of supportive interventions. By examining the lived realities of seed producers in Aurangabad and Jalna, this study seeks to offer grounded insights into the operational bottlenecks that hinder their efficiency and profitability, with a view toward informing both academic inquiry and practical policymaking.

Materials and Methods

Study Area and Sampling Design

The present study was conducted in Aurangabad and Jalna districts of Maharashtra, recognized for their significant contribution to hybrid cotton seed production. These districts host a concentration of private seed companies actively engaging local farmers in seed production through contract arrangements. A multi-stage sampling approach was adopted to select the study units, integrating both purposive and random sampling techniques to ensure representativeness and relevance (Kothari, 2004) [4].

First Stage: Selection of Districts (Purposively)

Aurangabad and Jalna districts were purposively selected based on their prominence in cotton seed production and the active presence of private seed companies engaged in seed multiplication programs.

Second Stage: Selection of Seed Companies (Purposively)

Five seed companies operating in the selected districts were chosen based on their continuous engagement in cotton seed production and the availability of active seed-producing farmers. The selected companies were:

1. Ankur Seeds Private Limited
2. Mahyco Private Limited
3. Nath Seeds
4. Nuziveedu Seeds Limited (NSL)
5. SeedWorks International Pvt. Ltd.

These companies were identified in consultation with local organizers and stakeholders due to their established footprint and relevance to the study objectives.

Third Stage: Selection of Cotton Seed Producing Farmers (Randomly)

From each of the five selected companies, 15 cotton seed-producing farmers were randomly selected, making a total sample of 75 farmers. This approach ensured randomness in farmer selection while retaining company-level representativeness.

Fourth Stage: Selection of Market/Marketing Functionaries (Purposively)

Marketing functionaries such as company organizers, field procurement agents, ginners/millers and intermediaries involved in seed collection and procurement were purposively selected. Their inclusion provided insights into the practical challenges of seed marketing and company-farmer interactions.

Data Collection Tools

Primary data were collected through a pre-tested structured interview schedule administered personally to the respondents. The schedule included components related to socio-economic conditions, seed production practices, marketing arrangements, and perceived constraints. Supplementary qualitative data were collected through key informant interviews to validate and enrich the primary responses (Patton, 2002) [7].

Analytical Techniques: Garrett Ranking Method

To prioritize the constraints faced by seed producers in production and marketing, the Garrett Ranking Method was employed. This technique is effective in quantifying subjective assessments and producing clear, ranked outputs (Garrett, 1969) [3]. It is widely used in agricultural research where qualitative perceptions need to be analysed systematically.

Steps Involved

1. Ranking by Farmers

Farmers were asked to rank identified constraints in order of severity based on their personal experiences.

2. Calculation of Percent Position

The percent position was calculated using the following formula:

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

Where,

R_{ij} = Rank given for the i^{th} constraint by the j^{th} respondent

N_j = Total number of constraints ranked by the j^{th} respondent

3. Garrett Score Conversion

These percent positions were then converted into scores using Garrett's table (Garrett, 1969) [3].

4. Calculation of Average Scores

The average Garrett score for each constraint was computed across all respondents.

5. Final Ranking

Constraints were ranked based on their average scores, with higher scores indicating higher severity.

Results and Discussion

1. Constraints in Cotton Production

The cotton producers in the study area reported a range of

constraints that adversely affected their production efficiency and overall profitability. These constraints, ranked using the Garrett Ranking Technique, are presented in Table 1.

Table 1: Constraints Faced by the Farmers in Cotton Seed Production

Sl. No.	Constraints	Garrett Score	Ranking
1	High input costs	52.13	I
2	Delayed supply of quality seeds	51.65	II
3	Frequent pest and disease outbreaks	51.20	III
4	Strict seed purity standards	50.69	IV
5	Changing weather patterns	49.48	V
6	Shortage of skilled labour	49.39	VI
7	High cost of labour	49.11	VII
8	Lack of technical support	49.00	VIII
9	Poor soil health	47.93	IX
10	No insurance coverage	47.41	X

Major Constraints Identified

- **High Input Costs (Garrett Score: 52.13, Rank: I):** The most significant challenge identified by cotton seed producers is the escalating cost of essential inputs. High prices for fertilizers, pesticides, hybrid seeds, and other materials increase the overall cost of seed production, leading to reduced profitability for farmers.
- **Delayed Supply of Quality Seeds (Garrett Score: 51.65, Rank: II):** Timely availability of quality seeds is a critical factor for successful cotton seed production. Delays in seed supply hinder the timely planting of crops, which can affect both seed quality and the overall yield.
- **Frequent Pest and Disease Outbreaks (Garrett Score: 51.20, Rank: III):** Pest attacks and diseases continue to be significant challenges. Despite the adoption of Bt cotton, pest resistance and recurring outbreaks of harmful insects like pink bollworm and fungal diseases remain a major threat to the quality and quantity of seeds.
- **Strict Seed Purity Standards (Garrett Score: 50.69, Rank: IV):** Seed purity is a non-negotiable factor in seed production, but strict purity standards often add complexity to the process. These standards require precise management during pollination and harvesting, which increases the labour and time investment required for cotton seed production.
- **Changing Weather Patterns (Garrett Score: 49.48, Rank: V):** Unpredictable weather, such as irregular rainfall and temperature shifts, significantly impacts seed production. These fluctuations can interfere with the pollination process, negatively affecting both the quantity and the quality of seeds produced.
- **Shortage of Skilled Labour (Garrett Score: 49.39, Rank: VI):** Skilled labour is crucial for specific tasks like emasculation, pollination, and harvesting of cotton seeds. A shortage of skilled workers affects the efficiency of the production process and may lead to lower-quality seeds.
- **High Cost of Labour (Garrett Score: 49.11, Rank: VII):** Cotton seed production is labour-intensive, especially during critical phases like planting, weeding, and harvesting. The increasing cost of labour puts additional pressure on the farmers' cost structure, impacting profitability.
- **Lack of Technical Support (Garrett Score: 49.00, Rank: VIII):** Many farmers face a lack of adequate technical support, including guidance on seed treatment, pest management, and quality control practices. This gap in knowledge often leads to suboptimal production methods, which further decrease seed quality.
- **Poor Soil Health (Garrett Score: 47.93, Rank: IX):** Soil health issues, such as low fertility or improper soil management practices, significantly impact seed quality. Poor soil conditions can lead to poor germination rates and lower yields, thereby affecting seed production.
- **No Insurance Coverage (Garrett Score: 47.41, Rank: X):** The lack of insurance coverage for seed producers leaves them vulnerable to unforeseen events such as natural disasters, pest infestations, or market fluctuations. Without insurance, farmers bear the full financial risk associated with seed production failures.

2. Constraints in Cotton Marketing

Farmers also face numerous challenges when marketing their cotton seed. The issues, ranked using the Garrett Ranking Technique, are presented in Table 2.

Table 2: Constraints Faced by the Farmers in Cotton Seed Marketing

Sl. No.	Constraints	Garrett Score	Ranking
1	Late payments	54.33	I
2	Limited access to seed buyers	51.33	II
3	High seed rejection rates	51.28	III
4	Non-negotiable prices	49.87	IV
5	Unfair grading and weighing practices	49.43	V
6	Lack of transparency in quality standards	49.15	VI
7	Lack of seed certification	49.05	VII
8	High transportation costs	48.53	VIII
9	Limited information on seed demand	48.27	IX
10	Monopoly of seed companies	46.76	X

Key Marketing Issues

- **Late Payments (Garrett Score: 54.33, Rank: I):** The most critical issue for cotton seed marketers is delayed payments from buyers, which significantly affects farmers' cash flows. This problem, common in the seed industry, creates financial instability for farmers.
- **Limited Access to Seed Buyers (Garrett Score: 51.33, Rank: II):** Farmers report difficulty in accessing a variety of seed buyers, limiting their bargaining power and often forcing them to accept the terms set by fewer buyers or middlemen.
- **High Seed Rejection Rates (Garrett Score: 51.28, Rank: III):** Seed rejection, due to quality issues, affects farmers' incomes. High rejection rates, often based on strict purity standards, contribute to significant financial losses.
- **Non-Negotiable Prices (Garrett Score: 49.87, Rank: IV):** Seed prices are often set by companies or buyers, leaving farmers with little room for negotiation. This lack of price flexibility further reduces profitability,

especially for smallholder farmers.

- **Unfair Grading and Weighing Practices (Garrett Score: 49.43, Rank: V):** Grading and weighing practices are perceived as unfair, with farmers frequently reporting discrepancies in the evaluation of their seed quality and quantity, leading to lower payments.
- **Lack of Transparency in Quality Standards (Garrett Score: 49.15, Rank: VI):** A lack of clarity in how seed quality is assessed and certified can be a source of conflict between farmers and seed companies, with farmers often unaware of the criteria or standards they must meet.
- **Lack of Seed Certification (Garrett Score: 49.05, Rank: VII):** Certification issues impact the credibility and marketability of cotton seeds. Farmers' seeds often lack proper certification, limiting their market access and buyer confidence.
- **High Transportation Costs (Garrett Score: 48.53, Rank: VIII):** With high transportation costs, especially for remote farmers, getting seeds to buyers or procurement centers becomes an additional economic burden, reducing margins.
- **Limited Information on Seed Demand (Garrett Score: 48.27, Rank: IX):** A lack of real-time information on seed demand limits the ability of farmers to time their production and marketing strategies effectively, potentially resulting in oversupply or missed market opportunities.
- **Monopoly of Seed Companies (Garrett Score: 46.76, Rank: X):** The dominance of large seed companies limits farmers' market choices, leading to a situation where they must accept less favourable terms or conditions dictated by the monopolistic market structure

Inferences

The analysis of both production and marketing constraints reveals a complex set of challenges faced by cotton seed producers. In the production phase, issues such as high input costs, delayed seed supply, and pest outbreaks are compounded by labour and climate-related difficulties. Meanwhile, marketing challenges stem from a lack of access to fair pricing mechanisms, delayed payments, and the dominance of intermediaries and large seed companies. These constraints collectively reduce profitability and discourage investment in cotton seed production.

Addressing these challenges will require focused interventions, such as improved access to timely credit and technical support, better seed quality control, and more transparent payment practices. Policy recommendations could include promoting cooperative marketing platforms, enhancing irrigation facilities, establishing price stabilization mechanisms, and improving rural infrastructure to reduce transportation costs.

Policy Implications

The study's findings underscore the need for targeted interventions by policymakers, seed companies, and extension services to mitigate the constraints faced by cotton farmers in both production and marketing. These interventions can improve productivity, profitability, and sustainability in the cotton sector.

1. Labour Support Policies

Labour-related constraints, particularly high costs and shortages during peak periods, require urgent attention. One policy recommendation is the introduction of labour subsidies or financial incentives for hiring seasonal workers during critical stages of cotton production. Additionally, training programs targeting rural youth can enhance the availability of skilled labour for cotton cultivation (Ninan, 2009) [6]. These policies can reduce labour costs and address the increasing difficulty in sourcing skilled labour during peak periods.

2. Timely Seed Supply

Seed-related challenges, particularly the delayed and inconsistent supply of quality cotton seeds, can hinder timely sowing and reduce yields. Policymakers must facilitate timely seed distribution to ensure that cotton producers have access to certified seeds at the right time. Public-private partnerships between seed companies and government agencies could streamline seed procurement and distribution channels, ensuring farmers receive the best quality seeds when needed (Suryawanshi *et al*., 2017) [14].

3. Strengthening Extension Services

A critical factor influencing cotton farmers' ability to overcome production challenges is access to extension services. Policymakers should increase investment in agricultural extension programs that provide farmers with timely, relevant, and location-specific advice on best practices, pest management, and improved cotton cultivation techniques. Expanding the outreach of extension services can help farmers make informed decisions, leading to better crop yields and reduced input costs (Adebayo & Oyekale, 2020) [1].

4. Transparent Marketing Contracts

The challenges in cotton marketing, such as delayed payments and limited price transparency, necessitate a shift towards contract farming models. Policymakers should promote clear, transparent agreements between cotton producers and buyers to ensure timely payments and eliminate price exploitation. By enforcing laws that protect farmers' interests in contractual agreements, governments can reduce the power imbalances between farmers and intermediaries (Bharati *et al*., 2020) [2]. Additionally, price stabilization mechanisms can help mitigate the negative impact of price fluctuations.

5. Investment in Infrastructure

Cotton farmers face significant challenges in marketing due to poor infrastructure, particularly in transportation and storage. The government must prioritize the construction of modern storage facilities and improve rural transportation networks. This would reduce post-harvest losses, lower transportation costs, and increase farmers' ability to store cotton until they can access better market prices (Sharma, 2018) [10]. By investing in infrastructure, farmers would also benefit from improved market access, reducing dependence on intermediaries.

6. Climate Resilience Support

With the increasing unpredictability of weather patterns, cotton farmers need climate-resilient solutions. Governments should promote the use of climate-resilient

cotton varieties that are less vulnerable to extreme weather events, such as droughts and erratic rainfall. Furthermore, irrigation infrastructure should be strengthened to reduce farmers' reliance on unpredictable monsoons. Subsidies for water-efficient technologies and rainwater harvesting systems could further enhance resilience to climate change (Singh *et al*., 2020) [12].

7. Promotion of Collective Marketing Mechanisms

The lack of market power among smallholder farmers exacerbates marketing difficulties. Encouraging the formation of Farmer Producer Organizations (FPOs) can significantly enhance farmers' bargaining power. These organizations can help farmers collectively market their produce, negotiate better prices, and reduce transaction costs. Support for the establishment of FPOs, along with training on cooperative marketing strategies, can lead to more favourable terms for farmers (Rao, 2017) [9].

In conclusion, a multi-faceted approach involving labour support, timely seed distribution, enhanced extension services, transparent marketing agreements, infrastructure development, climate resilience, and collective marketing initiatives can address the key constraints faced by cotton producers. Policymakers should prioritize these interventions to foster a more sustainable and profitable cotton industry.

Conclusion

This study has thoroughly explored the multifaceted challenges faced by cotton seed producers in the Aurangabad and Jalna districts of Maharashtra, focusing on both the production and marketing aspects of cotton seed farming. The findings underscore that while these farmers play a crucial role in sustaining India's cotton industry, they encounter a series of constraints that significantly hinder their productivity and profitability.

The production constraints, including high input costs, delayed seed supply, frequent pest outbreaks, and the labour-intensive nature of seed production, represent substantial barriers that need urgent attention. High input costs, particularly for fertilizers, pesticides, and hybrid seeds, emerge as the most critical challenge. The delay in the supply of quality seeds and the prevalence of pest outbreaks further exacerbate the difficulties faced by farmers. Moreover, labour shortages, both in terms of skilled labour for specialized tasks and the increasing cost of labour, significantly impact the production process.

In parallel, the marketing challenges faced by these farmers are equally pronounced. Issues such as delayed payments, limited access to seed buyers, high seed rejection rates, and the lack of price transparency reflect the imbalances and inefficiencies in the marketing system. These constraints not only undermine the farmers' financial stability but also erode their bargaining power in the market. The monopoly of large seed companies and the lack of transparent contracts further compound the farmers' difficulties, reducing their control over pricing and market access.

The policy implications emerging from this study suggest several targeted interventions. These include enhancing labour support policies to address the skilled labour shortage, facilitating timely seed supply through public-private partnerships, and strengthening agricultural extension services to provide farmers with timely, relevant advice on best practices and pest management. Furthermore, promoting transparent and fair marketing contracts, investing in rural infrastructure, and supporting the establishment of Farmer Producer Organizations (FPOs) are vital steps to mitigate the challenges faced in the marketing phase.

Additionally, given the increasing unpredictability of weather patterns, fostering climate resilience through the adoption of climate-resistant cotton varieties and strengthening irrigation infrastructure will be crucial in ensuring sustainable cotton production. Policy efforts should also prioritize investments in infrastructure, such as storage facilities and transportation networks, which would reduce post-harvest losses and enhance market access for farmers.

Ultimately, a comprehensive and multi-pronged approach, addressing both production and marketing constraints, is necessary to empower cotton seed producers. By focusing on labour support, timely seed distribution, enhanced technical support, transparent marketing, infrastructure development, and climate resilience, policymakers can create a more sustainable and profitable environment for cotton seed producers. These interventions will not only improve the economic viability of cotton seed production but also contribute to the overall growth and sustainability of the cotton industry in Maharashtra and beyond.

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