

International Journal of Agriculture Extension and Social Development

Volume 8; Issue 12; December 2025; Page No. 492-499

Received: 17-11-2025
Accepted: 18-12-2025

Indexed Journal
Peer Reviewed Journal

Socio-economic and market dynamics of Ajara ghansal rice cultivation in Ajara taluka, Kolhapur district, Maharashtra

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DOI: <https://www.doi.org/10.33545/26180723.2025.v8.i12g.2797>

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Abstract

Ajara Ghansal is an indigenous aromatic rice landrace cultivated predominantly in Ajara Taluka of Kolhapur District, Maharashtra. Although the variety holds Geographical Indication (GI) status and is valued for its distinctive aroma, culinary quality, and cultural heritage, the area under its cultivation has declined significantly in recent years. This study draws on an extensive field survey conducted across all 90 villages of Ajara Taluka, involving systematic interactions with Agriculture Department officials, FPO representatives, village heads, Panchayat members, and active Ghansal cultivators. Data were collected through individual farmer interviews, group discussions, and village-level consultations to document traditional cultivation practices, socio-economic conditions, market constraints, and factors influencing varietal persistence.

The findings show that Ajara Ghansal is currently grown in only 35 villages, with 11 villages accounting for the majority of production. Major constraints include price fluctuations, unpredictable demand, adulteration with Kumut rice and artificial aroma additives, labour and production risks, and inadequate marketing and post-harvest infrastructure. Limited farmer awareness of the nutritional and medicinal attributes of Ghansal, along with the absence of value-added product development, further restricts its commercial potential. Despite the increasing dominance of hybrid rice varieties, Ghansal cultivation continues largely due to strong cultural ties, traditional knowledge systems, and the emotional commitment of long-standing cultivators.

The study underscores the need for comprehensive interventions—such as stringent GI enforcement, farmer-led marketing platforms, improved institutional support, and value-added commercialization—to safeguard varietal authenticity, enhance farmer income security, and ensure the long-term sustainability of this culturally significant landrace.

Keywords: Ajara Ghansal, aromatic rice, indigenous landrace, field survey, cultivation practices, socio-economic assessment, geographical indication, market constraints, adulteration, value addition, heritage crop, Western Ghats, Kolhapur District

Introduction

Rice (*Oryza sativa* L.) is a central component of India's agrarian and nutritional system and holds deep cultural, economic, and ecological significance. Beyond its role as a staple crop, India is home to an exceptionally rich diversity of traditional rice landraces, many of which possess unique aromatic, nutritional, or therapeutic properties. Aromatic rice has long been embedded in the subcontinent's cultural and medicinal heritage. Classical Ayurvedic texts—including the *Charaka Samhitā* and *Suśruta Samhitā*—document the use of fragrant and fine-grained rice varieties for their digestive, strengthening, and health-promoting attributes (Charaka Samhitā, Sutrasthana 27; Suśruta

Samhitā, Sutrasthana 46). These early references underline the long-standing recognition of aromatic rice as both a dietary and medicinal resource.

Indigenous aromatic landraces across India, such as Ajara Ghansal, Ambemohar, Gobindobhog, Jeerakasala, and Kaivara, are valued not only for their sensory qualities but also for their resilience, cultural relevance, and unique agro-ecological adaptations. However, many of these traditional varieties are increasingly threatened by the expansion of high-yielding hybrids, market homogenization, and the erosion of local cultivation knowledge.

Ajara Ghansal, an aromatic rice landrace native to Ajara Taluka in Kolhapur district, Maharashtra, exemplifies this

vulnerability. Despite receiving Geographical Indication (GI) status for its distinctive aroma, texture, and culinary quality, its cultivation area has steadily declined. Constraints such as market volatility, adulteration, labour shortages, and inadequate institutional support have contributed to this erosion. Yet the variety continues to persist due to cultural attachment, traditional agronomic knowledge, and the commitment of local farming communities.

Given the increasing risk of genetic and cultural erosion, scientific documentation of cultivation practices, production dynamics, and farmer perceptions is crucial for the conservation and revival of this heritage rice. Systematic field-based research also provides essential insights for developing targeted interventions—such as value-addition, GI enforcement, and farmer-led marketing—to strengthen the sustainability of Ajara Ghansal and other indigenous aromatic rice landraces.

Objectives

- To delineate the spatial distribution and extent of Ajara Ghansal cultivation across villages in Ajara Taluka.
- To document traditional agronomic practices and the cultural knowledge associated with Ajara Ghansal cultivation.
- To examine the socio-economic characteristics of cultivating households and identify production-level constraints affecting Ghansal rice.
- To evaluate market-related challenges, including pricing dynamics, adulteration, and limitations in marketing infrastructure.
- To assess farmer awareness and perceptions regarding GI status, authenticity concerns, and factors influencing varietal adoption or decline.
- To propose evidence-based interventions to strengthen sustainable cultivation and enhance the income security of Ajara Ghansal farmers.

Materials and Methods

Study Area

The research was conducted across Ajara Taluka, Kolhapur district, Maharashtra, covering all major rice-growing villages. The area is known for the cultivation of Ajara Ghansal, an indigenous aromatic rice landrace. The field survey included 95 villages, selected to represent the complete geographical spread of Ghansal cultivation.

Methodology

Stakeholder Consultation and Field Survey Initiation

The survey began with preliminary consultations to understand the prominence and cultivation dynamics of Ajara Ghansal. Initial discussions were held with:

- Local Agriculture Officers

- Leaders of Farmer Producer Organizations (FPOs)
- Representatives of the Ajara Ghansal Cluster and Ajara Agro Products Company

These interactions provided foundational insights on village-level prevalence and guided the design of the field survey.

Farmer Identification and Engagement

Within each village, farmers were purposively selected based on their experience with Ajara Ghansal cultivation. Efforts were made to engage:

- Village heads and Panchayat members
- Large- and medium-scale Ghansal cultivators
- Active seasonal and long-term farmers

Engagement formats included individual interviews, group discussions, and informal village meetings. On average, 60-70 farmers were interacted with per village.

Data Collection

Data collection focused on qualitative and perception-based information through semi-structured interviews and participatory rural appraisal (PRA). Key areas of inquiry included:

- Historical continuity of Ghansal cultivation
- Traditional agronomic practices
- Farmer perceptions of benefits and challenges
- Field-level constraints (labour, pests, climate, production risk)
- Market dynamics (price, demand, adulteration, competition with hybrid varieties)
- Adoption trends and reasons for declining cultivation

Verification of Prevalence and Core Villages

Cumulative field interactions identified **35 villages** where Ajara Ghansal is currently cultivated:

Dabheel, Gavase, Pernoli, Latagaon, Shelap, Masoli, Chafavade, Mendholi, Kitvade, Sulgaon, Yamekond, Polgaon, Chitale, Jeur, Khanapur, Dewarde, Ajara, Salgaon, Pethewadi, Uchangi, Kasar Kandgaon, Kine, Halewadi, Erandol, Shringarwadi, Hatiwade, Ite, Harapwade, Chandewadi, Watangi, Hajgoli (Kh & Bk), Sohale, Murude, Bhavewadi, and Shirsangi.

Among these, 11 villages form the high-production core belt, representing the cultural and genetic nucleus of Ajara Ghansal cultivation:

Dabheel, Gavase, Latagaon, Shelap, Pernoli, Kitvade, Chandewadi, Ajara, Kasar Kandgaon, Watangi and Hajgoli (Kh & Bk).

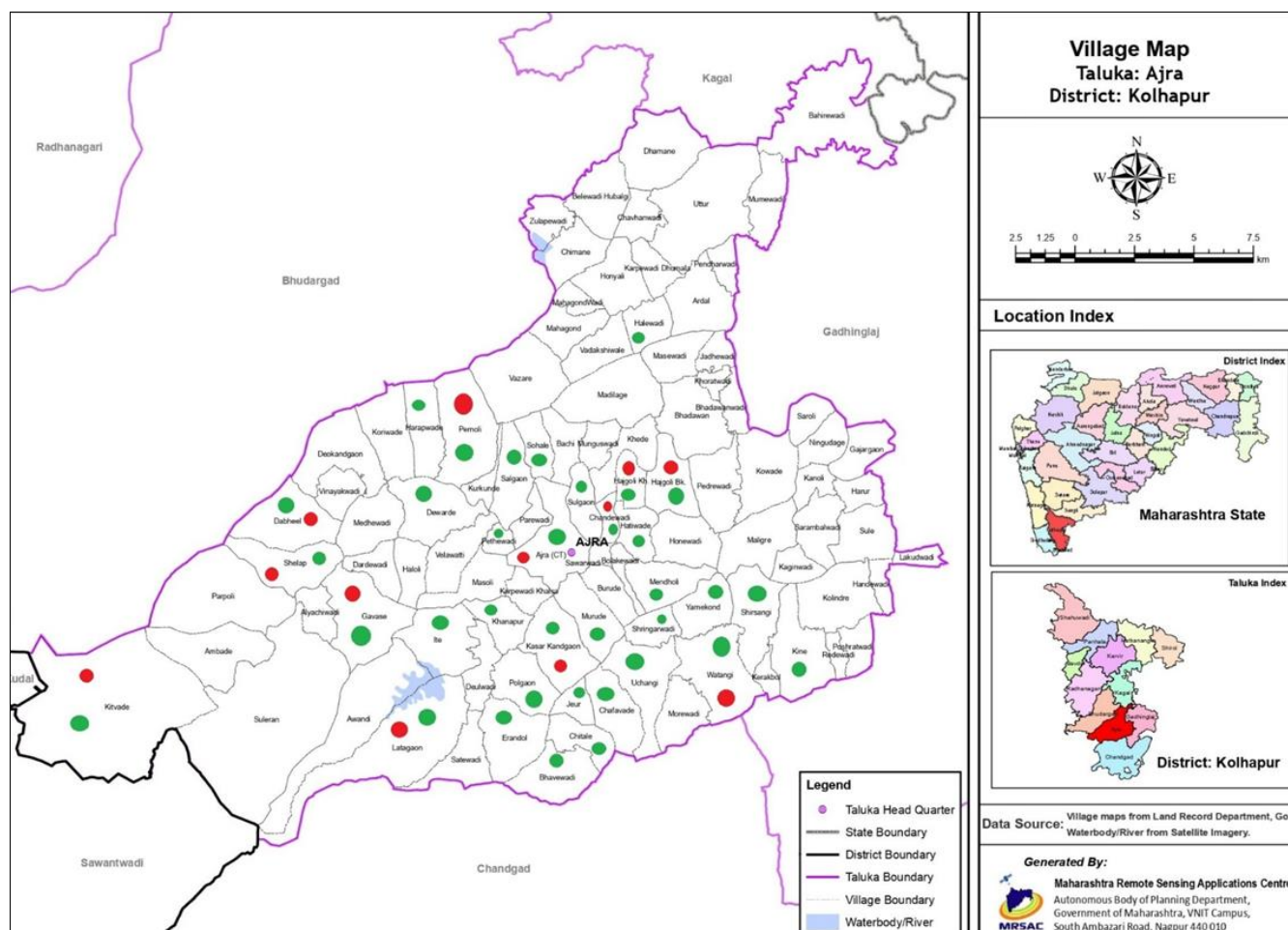


Fig 1: Modified map of Ajra Taluka (District: Kolhapur District, Maharashtra, India) showing villages with Ghansal-rice cultivation. Red dots indicate high-production core belt of ghansal-rice cultivation villages; Green dots indicate all ghansal-rice cultivation villages.

Data Analysis

Collected data were synthesized using descriptive and interpretive methods. Insights were categorized under agronomic practices, socio-economic viability, market challenges, and socio-cultural significance. Case examples and farmer narratives were included to enrich contextual understanding.

Ethical Considerations

All participants were informed about the study objectives, and their participation was voluntary. Farmers' insights were treated with confidentiality, and the research reflected their lived experiences and cultural heritage associated with Ajara Ghansal.

Agronomic and Cultural Practices of Ajara Ghansal Rice

Overview of the Production System

Ajara Ghansal rice is cultivated predominantly under a traditional, low-mechanization farming system, where agronomic decisions are guided by indigenous knowledge transmitted across generations. Farmers maintain seed purity and varietal integrity through on-farm selection and storage practices. The crop is largely rainfed, benefiting from the abundant monsoon and hill-runoff typical of the Ajara region in the Sahyadri landscape.

a) Land Preparation

Land preparation typically begins in June, immediately after the onset of the southwest monsoon. Key operations include:

- Manual field cleaning and ploughing, followed by puddling to create a suitable transplanting environment.
- Burning of weeds is practiced to suppress pest and pathogen inoculum.
- Application of farmyard manure (FYM) serves as the primary nutrient input, underscoring the system's organic and low-external-input character.

Both descriptions consistently highlight the dominance of traditional labour-intensive methods over mechanized land preparation.

b) Seed Selection and Nursery Management

Seed-related practices are highly traditional and purity-oriented:

- Farmers select superior panicles during harvest and store them separately for the next season.
- Seedbeds are established in the 1st-2nd week of June, coinciding with the first rains.
- Recommended seed rate ranges between 30-35 kg/ha.
- Seeds are often bio-inoculated with *Azotobacter*, reflecting an integration of organic and biofertilizer-

based practices.

c) Transplanting

Transplanting is conducted manually to protect seedling vigor:

- 20-25-day-old pre-germinated seedlings are transplanted into puddled fields.
- Planting density is maintained at approximately 20×15 cm.
- Prior to transplanting, FYM is added to enhance soil fertility and early crop establishment.

Manual transplanting is highlighted in both descriptions as crucial for maintaining varietal purity and reducing mechanical disturbance.

d) Water Management

The water regime of Ajara Ghansal is distinctively eco-geographical:

- The crop relies on monsoon rainfall supplemented by runoff from surrounding hills.
- Additional moisture comes from nearby streams, ponds, and the Hiranyakeshi River.
- The variety performs well in high water-retention soils, which support prolonged vegetative growth.

This rainfed yet moisture-secure system is key to developing the aroma and grain quality of Ghansal rice.

e) Crop Duration and Climatic Requirement

Ajara Ghansal exhibits a 150-160 days growth duration. Cool, humid conditions during grain ripening are considered essential for retention of its characteristic aroma.

f) Grain and Quality Characteristics

Farmers and consumers recognize Ajara Ghansal for its:

- Creamy white, short-bold grains (approx. 3.61×5.5 mm).
- Strong natural aroma and distinctive taste.
- Firm texture when touched or chewed.
- Well-separated yet cohesive cooked grains, contributing to high culinary acceptability.

Both sources emphasize that traditional cultivation and minimal polishing enhance sensory quality.

g) Harvesting and Post-Harvest Operations

Harvesting is performed manually during October-November:

- Sickles are used to reduce grain shattering and prevent contamination.
- Post-harvest operations involve cutting, stacking, threshing, cleaning, and hauling, executed with minimal mechanization.
- Grains are dried to approximately 13% moisture to ensure safe storage.

h) Traditional Storage Practices

A unique storage method preserves grain quality and seed viability:

- Seeds are stored in large earthen pots coated with clay and cow dung.

- Neem (*Azadirachta indica*) leaves are added as a natural insect repellent, reducing reliance on chemical pesticides.

Both datasets identify this as a distinguishing hallmark of Ajara Ghansal conservation.

i) Polishing

Most farmers prefer manual polishing, which helps retain bran-associated aromatic compounds and preserves the traditional sensory profile of Ghansal rice. Use of large mechanized polishers is rare.

j) Cultural and Heritage Value

The farming system reflects strong cultural embeddedness:

- Knowledge is transmitted intergenerationally through observation and practice.
- Traditional practices contribute directly to maintaining the aroma, grain texture, identity, and heritage value of Ajara Ghansal.

Geographical Area of Production

The cultivation of Ajara Ghansal rice is geographically confined to Ajara Taluka in Kolhapur District, Maharashtra, situated in the foothills of the Western Ghats. The region lies between $16^{\circ}12' N$ to $16^{\circ}43' N$ latitude and $74^{\circ}02' E$ to $74^{\circ}14' E$ longitude, at an elevation ranging from 574 to 660 m above mean sea level. Ajara is located approximately 84 km from Kolhapur, 121 km from Panaji, 320 km from Pune, and 469 km from Mumbai.

The agro-ecological landscape of Ajara is characterized by undulating hilly terrain, dense semi-evergreen forests, and high monsoon rainfall, which collectively create a cool, humid microclimate. These conditions provide an optimal ecological niche for the cultivation of the traditional aromatic landrace *Ajara Ghansal*, supporting its unique grain quality, aroma expression, and varietal distinctiveness.

Soil Profile and Landform

- Ajara Taluka lies within the western hills of Kolhapur District, where soils are largely derived from the weathering of Deccan trap basalt, overlaid in many areas by lateritic soils (locally termed “Tambadi mati”) — predominantly in hilly tracts, ridges and hilltops.
- These lateritic soils are typically red to reddish-brown, shallow to medium in depth, well-drained, and often acidic (pH 4.5-6.5).
- In more undulating or valley regions, soils may show a gradation towards brown or dark-brown soils derived from trap basalts. In some lower/transition zones, shallow black soils may also be encountered.
- The soil texture typically includes substantial proportions of sand, silt and clay — allowing for moderate to good drainage yet retaining enough moisture — which supports paddy cultivation in terraces or valley bottoms.
- This heterogeneity of soils (lateritic hills, trap-derived brown soils, deeper soils in valley bottoms) provides a mosaic of micro-environments, enabling cultivation of Ghansal rice under varied terrain, while offering soil fertility and appropriate moisture balance for rainfed paddy.

Climate and Agro-Climatic Zone

- Kolhapur District — including its western talukas such as Ajara — lies within the Western Ghats / Sahyadri foothills and is part of the “Western Ghats / Western Maharashtra Hill Region,” characterised by heavy monsoon rainfall and a humid tropical monsoon climate.
- The district average annual rainfall lies in the order of ~1,900-2,000 mm (for the wetter western talukas), although ranges vary depending on altitude and local topography.
- The rainfall is strongly seasonal: monsoon period spans from June to October, supplying the bulk of annual precipitation.
- Temperature regime is tropical to subtropical, with summer extremes, but due to elevation and western-Ghats influence, climatic variation is moderated. Mean temperatures, humidity and post-monsoon cool periods create a favorable microclimate for paddy rice.
- This combination of lateritic/volcanic-derived soils, high rainfall, and a humid but relatively temperate climate during growth and cool, dry conditions at maturity creates a terroir-like environment. Such environmental conditions may influence not only yield and agronomic success but also quality traits — for example, aroma development, grain filling, and physico-chemical attributes in Ghansal rice.

Implications for Ajara Ghansal Rice Cultivation

Given the soil-climate context, Ajara Ghansal rice benefits from:

- Adequate but well-drained soils (lateritic and trap-derived) that support root development, drainage and prevent waterlogging despite heavy monsoon rainfall.
- Seasonal rainfall regime aligning with paddy's water demand cycle, enabling a largely rainfed cultivation system — reducing dependence on irrigation infrastructure.
- Climatic moderation from coastal/Western Ghats influence, with humidity during vegetative growth and cooler, drier conditions at grain maturity — potentially supporting aroma and grain quality traits (e.g. reduced chalkiness, good grain texture).
- Soil fertility and mineral composition (when organic matter and manure are used) enabling traditional nutrient management to support crop growth without heavy external fertilizer dependence.

Uniqueness, Historical Origin, and Heritage Significance

Historical records indicate that aromatic rice has held a prominent place in the Indian subcontinent for millennia. Early Sanskrit medical treatises such as the *Charaka Samhitā* (c. 700 BCE) and the *Suśruta Samhitā* (c. 400 BCE) describe the dietary, therapeutic, and cultural relevance of scented rice varieties, highlighting their association with elite households, temple institutions, and regional royal families. These texts establish that India has a long tradition of cultivating region-specific aromatic rice, each adapted to distinct ecological niches.

Within this broader historical context, Ajara Ghansal represents a locally evolved aromatic landrace cultivated in

Ajara Taluka for more than a century. Oral traditions, local archival material, and testimonies from farming communities consistently affirm that Ghansal rice has been maintained through generational seed preservation, largely outside formal seed systems. The biography of *Late Shrimant Narayanrao Govindrao Ghorpade*, Chief of Ichalkaranji (1870-1943), documents his support for expanding Ghansal cultivation in Ajara during the early 20th century, providing one of the earliest written confirmations of its localized production. Traditional agrarian systems such as *Kinishet* and *Patharshet* continue to guide land allocation and community-based knowledge transfer, further reinforcing the long-standing cultural identity and conserved origin of this variety. Collectively, these historical references and community practices substantiate that Ajara Ghansal is a heritage rice with deep temporal continuity and strong geographic anchorage.

Aroma Chemistry of Ajara Ghansal Rice

The distinctive quality attribute of Ajara Ghansal rice is its strong and naturally occurring aroma, which is governed by its unique volatile compound profile. Consistent with analytical reports, the aroma arises from a complex mixture of alcohols, aldehydes, esters, and other low-molecular-weight volatiles. Among these constituents, 2-Acetyl-1-Pyrroline (2-AP) is recognized as the principal aromatic compound responsible for the characteristic popcorn- or pandan-like fragrance in aromatic rice varieties.

According to the *Agronomic and Morphological Characteristics Report* (Agriculture Research Station, Radhanagari, 2015) ^[1], Ajara Ghansal rice contains an average 2-AP concentration of 0.237 mg/kg, which is comparatively higher than levels reported in several Basmati accessions. Similar to Basmati, where the superior fragrance is attributed to elevated 2-AP accumulation, the high 2-AP content in Ajara Ghansal contributes significantly to its sensory identity, market preference, and economic value.

Environmental Determinants of Aroma Expression

The enhanced aroma profile of Ajara Ghansal rice is strongly associated with the geographical and ecological conditions of its cultivation zone in Ajara taluka. Aromatic rice-growing villages are predominantly located along foothill ecosystems and lateritic belts, characterized by:

- lower ambient temperatures during maturation,
- fertile lateritic soils, and
- cool, dry micro-climatic conditions.

These agro-ecological factors favour the biosynthesis and retention of 2-AP, resulting in a stable and pronounced aroma. The distinct terroir of Ajara thus plays a decisive role in shaping the chemical and sensory uniqueness of Ghansal rice.

Grain Texture and Physico-Chemical Properties

Ajara Ghansal rice is also valued for its desirable cooking quality traits. The cooked grains are tender, firm, and non-sticky. The variety exhibits 0% chalkiness, an important quality parameter, as chalky grains diminish cooking quality and consumer acceptability. Complete absence of chalkiness in Ghansal is attributed to favourable low-temperature and

dry climatic conditions during grain filling.

The physico-chemical characteristics reported by the Agriculture Research Station Radhanagari (2015) ^[1] are summarized below:

Parameter	Description
Grain classification	Short bold
Chalkiness (%)	0.00
Volume expansion	3.56
Kernel length after cooking (mm)	3.08
Elongation ratio	1.42
2-AP content (mg/kg)	0.237

These traits collectively support the premium culinary quality and regional importance of Ajara Ghansal rice.

Socio-Economic Determinants Influencing Continued Cultivation of Ajara Ghansal Rice

The persistence of Ajara Ghansal cultivation among farmers in Ajara Taluka is shaped by a combination of cultural, sensory, and social drivers. As a traditional and heritage rice variety, Ajara Ghansal holds considerable cultural significance, with its cultivation perceived as an act of preserving regional identity and agrarian heritage. This cultural embeddedness fosters emotional attachment and motivates farmers to maintain its production despite agronomic or economic uncertainties.

Sensory quality remains a major determinant of farmer preference. Ajara Ghansal is widely valued for its distinct aroma, soft texture, and superior taste—attributes that strongly influence household consumption patterns and local market demand. These organoleptic advantages create a niche market and sustain farmer interest even when competing with high-yielding or hybrid varieties.

Social prestige also plays a role in varietal retention. Cultivating this heritage rice is often regarded as a marker of traditional knowledge, skill, and stewardship of local biodiversity. Such social recognition reinforces farmer commitment and contributes to the continued presence of Ghansal in the agricultural landscape.

Constraints Limiting Wider Adoption of Ajara Ghansal

Although Ajara Ghansal commands a higher market price, its broader adoption is constrained by several production and market-related challenges. Price instability is a primary barrier—unlike commercial hybrid rice varieties with more predictable prices, Ghansal exhibits high market volatility, exposing farmers to financial uncertainty. Coupled with inconsistent or unpredictable demand, this volatility generates hesitation regarding expansion of cultivated area. The long duration of the crop is another critical constraint. Ajara Ghansal requires an extended growing period, which limits the timely sowing of rabi crops and increases opportunity costs for farmers who manage multi-seasonal cropping systems. The labour-intensive nature of traditional cultivation, including transplanting, weeding, and manual harvesting, further increases production costs relative to mechanized alternatives.

Despite receiving Geographical Indication (GI) status, the anticipated farm-level price benefits have not materialized uniformly. Market intermediaries often capture a significant share of the premium, leaving producers with marginal gains. The lack of formal marketing channels, absence of

producer cooperatives, and limited direct-to-consumer linkages further weaken farmers' ability to realize premium prices. These constraints collectively limit the expansion of Ghansal cultivation beyond traditional farming families.

Threats to Authenticity, Sustainability, and Market Integrity

Ajara Ghansal faces several threats that jeopardize both varietal purity and economic sustainability. A major concern is adulteration with other rice varieties such as Kumut, which is mixed intentionally to increase quantity and reduce costs. Such adulteration undermines consumer trust, erodes market confidence, and threatens the identity of Ghansal as a distinct heritage variety.

The use of artificial aromatic additives in non-Ghansal rice poses a further challenge. Mimicking the natural fragrance reduces market differentiation and weakens the premium associated with authentic Ghansal, adversely affecting farmers who maintain purity.

A lack of awareness among farmers regarding the nutritional and health-related attributes of Ghansal results in missed value-addition and marketing opportunities. Limited understanding prevents producers from leveraging these qualities for niche health-conscious markets.

Additionally, the absence of the GI logo on most retail Ghansal packaging restricts consumer recognition of authenticity. Without traceability or certification mechanisms, GI benefits remain largely theoretical, offering limited protection to farmers. The absence of regular auditing, enforcement, or quality verification further enables adulteration and mislabeling within local markets.

Collectively, these threats highlight the need for strengthened regulatory oversight, farmer training, improved traceability, and market organization to safeguard the authenticity and long-term viability of Ajara Ghansal rice.

Case Evidence from Key Sites

Pernoli

Field surveys in Pernoli revealed a substantial increase in the market price of Ajara Ghansal rice, from ₹18/kg to ₹250/kg, following GI certification. Despite this market expansion, farmers continue to receive limited economic benefits due to intermediary dominance and a complex value chain. Pernoli serves as a representative site for analyzing both market transformation and the challenges in translating GI status into direct producer gains.

The particularly acknowledge to Mr. Ranjit Kalekar for his pivotal role in facilitating the fieldwork. His guidance, coordination with local farmers, and deep knowledge of village-level cultivation practices were critical to successful data collection. Mr. Harshed Bajirao Desai and Mr. Dattaray Tatoba Patil also provided significant support by organizing household surveys and assisting with farmer interactions, which strengthened the comprehensiveness of the primary data.

Dabheel

Dabheel exhibited the highest soil organic matter content among surveyed sites, contributing to superior processing recovery rates of 70-75%. Farmers reported that fragmented landholdings restrict mechanization, increasing labour intensity and production costs. The village's location in the

foothills of the Sahyadri mountains and favourable soil conditions make it a key area for Ajara Ghansal cultivation.

Khorate's Store

Khorate's Store, a prominent retail outlet along the Ajara-Goa corridor, serves as a key point for observing consumer demand for GI-tagged Ajara Ghansal rice. Strategic product placement has increased the visibility of this heritage variety; however, value addition remains largely concentrated within the commercial supply chain, providing limited direct financial benefit to the farmers.

Ajara Common Facility Centre (CFC)

The Ajara CFC, established under the Farmer Producer Organization (FPO) initiative with an investment of approximately ₹8 crore, is intended to enhance processing, branding, and marketing of Ajara Ghansal rice. At present, the facility operates below its capacity due to irregular and insufficient raw paddy supply from farmers. This limitation restricts the CFC's ability to improve producer incomes and to fully realize operational efficiency.

Discussion

The present study highlights a notable paradox in the cultivation of Ajara Ghansal rice: despite high market demand and a significant price premium, the area under cultivation is declining. This trend underscores the complex interplay of socio-cultural, economic, and market factors that shape farmer decision-making.

Conventional frameworks, such as the diffusion of innovation theory, inadequately capture the adoption dynamics in this context. While higher market prices would generally incentivize broader cultivation, farmers' perceptions of risk—including price volatility, uncertain demand, and intensive labour requirements—often outweigh the potential economic gains. Consequently, market signals alone are insufficient to drive the expansion of Ghansal rice cultivation.

The continued persistence of Ajara Ghansal is therefore primarily sustained by cultural and emotional commitment rather than by economic incentives. Farmers' dedication reflects the heritage value of the variety, its integration into local identity, and the social prestige associated with its cultivation.

The study further identifies a pronounced market asymmetry, whereby the premium price is largely captured by intermediaries rather than by primary producers. This structural imbalance limits the economic benefits accruing to farmers and reinforces their reluctance to expand cultivation, despite the intrinsic and market value of the crop.

These findings suggest that the sustainable survival and promotion of Ajara Ghansal rice require interventions beyond conventional price mechanisms. Policies and strategies that mitigate production risks, enhance market transparency, and strengthen farmer agency are critical to harmonizing cultural preservation with economic sustainability.

Recommendations for Enhancing Ajara Ghansal Cultivation and Market Sustainability

Based on socio-economic and market analyses, several

strategic interventions are proposed to safeguard the authenticity, improve profitability, and promote wider adoption of Ajara Ghansal rice:

Varietal Authenticity and Verification

Implementation of village-wise GI QR code verification can ensure varietal purity and prevent adulteration. This system allows both consumers and regulatory authorities to authenticate rice at the point of sale, thereby strengthening trust in the product and protecting farmers cultivating genuine Ghansal rice.

Price Stabilization and Market Security

Introduction of Minimum Support Price (MSP)-like mechanisms or contract farming arrangements can mitigate price volatility and market risk. Such measures provide predictable income streams, incentivize continued cultivation, and reduce economic uncertainty associated with heritage rice production.

Mechanization and Labour Efficiency

Provision of mini-machinery and custom hiring centers can reduce the labour-intensive nature of traditional cultivation practices. Appropriate mechanization enables farmers to optimize resource use, lower production costs, and enhance operational efficiency without compromising the traditional quality traits of the rice.

Value Addition and Product Diversification

Training programs focusing on value-added processing—such as ready-to-cook products, rice flour, and specialty food items—can expand market demand in urban and niche segments. Value addition not only increases profitability but also strengthens market linkages, ensuring that farmers benefit from premium pricing.

Collective Action and Institutional Support

Formation of Farmer Producer Companies (FPCs) can enhance collective bargaining power, reduce dependency on intermediaries, and facilitate coordinated marketing, procurement, and processing. FPCs can serve as institutional mechanisms for quality control, branding, and strategic market engagement.

Direct-to-Consumer Marketing and E-Commerce

Development of e-commerce platforms and direct-to-consumer marketing channels can bypass middlemen, allowing farmers to capture a larger share of the market premium while promoting the heritage value of Ajara Ghansal rice.

Awareness and Promotion

Awareness campaigns highlighting the nutritional, health, and cultural benefits of Ajara Ghansal rice can foster informed consumption, promote local adoption, and reinforce its heritage value. Educating consumers and households strengthens demand and supports sustainable cultivation practices.

Conclusion

Ajara Ghansal rice represents more than a mere agricultural commodity; it embodies the cultural identity and

agricultural heritage of the communities in Ajara Taluka. The long-term sustainability of this landrace depends on the development of robust value chain linkages, effective enforcement of Geographical Indication (GI) protections, and the establishment of farmer-led marketing and governance mechanisms.

Without targeted institutional support and appropriate economic incentives, cultivation of Ajara Ghansal is likely to remain restricted to a shrinking cohort of traditional farmers, primarily motivated by cultural and heritage considerations rather than market viability. Ensuring the preservation and broader adoption of this heritage rice variety requires an integrated strategy that aligns cultural conservation with economic sustainability, enabling farmers to realize equitable benefits while maintaining varietal authenticity.

Acknowledgement

Heartfelt thanks are due to Prof. Parmod Kumar, Acting Director, Professor & Head, ADRTC, Institute for Social and Economic Change (ISEC), Bengaluru, for his valuable guidance, encouragement, and constant support throughout the study.

The author also gratefully acknowledges the support and direction of Dr. Vilas Jadhav, Assistant Professor, ADRTC, ISEC, whose insights and constructive suggestions greatly contributed to the successful completion of the fieldwork and preparation of this research paper.

The author sincerely expresses gratitude to the Indian Council of Social Science Research (ICSSR), New Delhi.

Special appreciation is extended to Mr. Ranjith Kalekar, journalist, Sakal Newspaper, Ajara, whose influence and guidance were instrumental in initiating and facilitating the entire field journey. His support greatly helped in accessing the farmers and understanding the local context.

Deep gratitude is conveyed to the farmers of Ajara Taluk, Kolhapur District, Maharashtra, for their cooperation and willingness to share their experiences, which form the foundation of this study.

Finally, sincere thanks are extended to the ADRTC-ISEC research team for their assistance during field visits, data collection, and analysis.

Conflict of Interest

We declare no known conflict of interests that could have appeared to influence the work reported in this paper.

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