Comparative Evaluation of Traditional and Mechanical Maize Threshing Techniques in Major Maize Growing Districts of Karnataka

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Abstract

This study was conducted to comparatively evaluate traditional and mechanical maize threshing techniques in major maize growing districts of Karnataka namely Chitradurga, Davanagere, Tumkur, Hassan, and Chikkamagaluru. The investigation aimed to assess threshing efficiency, operational cost, labour utilization, post-harvest losses, and economic feasibility of different maize threshing methods. A multistage sampling technique was employed for selecting districts, taluks, villages, and respondents. Primary data were collected from maize-growing farmers through structured interviews, while secondary data were obtained from agricultural reports and district records. The major traditional threshing methods identified were bare hand shelling, hand beating, stick beating, and bullock trampling, whereas engine-operated threshers, tractor-operated shellers, and power-operated threshing machines represented mechanical methods. Results revealed that mechanical threshing methods significantly reduced labour requirement, threshing duration, and post-harvest losses compared to traditional methods. Mechanical methods also provided higher threshing efficiency and economic returns despite higher initial investment and maintenance costs. Among the districts studied, Davanagere and Tumkur showed greater adoption of mechanized threshing systems due to larger operational holdings and labour scarcity. Farmers in Hassan and Chikkamagaluru faced challenges related to terrain and machine accessibility. The study concluded that mechanization in maize threshing improves operational efficiency, minimizes post-harvest losses, and enhances farmer profitability. Promotion of custom hiring centres, subsidy support, and training programmes can enhance adoption of mechanical threshing technologies among small and marginal farmers in Karnataka.

Introduction

Maize is one of the most important cereal crops cultivated worldwide and plays a significant role in food security, livestock feed, and industrial applications(Hussain *et al.*, 2019). In India, maize occupies an important position among cereal crops because of its adaptability to different agro-climatic conditions and increasing demand from the poultry, starch, and food processing industries. Karnataka is one of the leading maize-producing states in India, contributing substantially to the national maize production. (D. Singh & Kaur, 2025; S. Singh *et al.*, 2024). Districts such as Chitradurga, Davanagere, Tumkur, Hassan, and Chikkamagaluru have emerged as major maize-growing regions because of favorable climatic conditions and increasing adoption of improved cultivation practices(Chemiat & Makone, 2015). Threshing is an important post-harvest operation in maize cultivation. It involves the separation of grains from the cob and directly influences grain quality, market value, storage stability, and overall profitability. Traditionally, farmers have relied on manual threshing methods, such as hand shelling, stick beating, and bullock trampling. Although these methods require low capital investment, they are labor-intensive, time-consuming, and often associated with high post-harvest losses(Amare, 2017; Mashood *et al.*, 2019). Manual threshing also increases physical drudgery and exposes grains to contamination and weather-related damage. Rapid agricultural mechanization has introduced several mechanical threshing technologies that improve operational efficiency and reduce labor dependency. Mechanical threshers, such as engine-operated shellers and tractor-powered threshing machines, have become increasingly popular in maize-growing areas because of labor shortages and rising wage rates(Al-Dola, 2023). These machines provide higher threshing capacity, lower grain damage, and reduced time consumption. However, the adoption of mechanized threshing systems is often constrained by high initial investment, maintenance costs, lack of technical skills, and poor accessibility in remote regions. Post-harvest losses continue to be a major challenge in maize production systems(Akbar Ali *et al.*, 2024). Losses occurring during threshing and handling reduce farmer income and affect grain quality. Efficient threshing methods can substantially reduce quantitative and qualitative losses and contribute to improved food security. Therefore, understanding the economic and operational performance of different threshing methods is essential for promoting sustainable agricultural mechanization. Several studies have compared traditional and mechanical threshing methods for different crops(M. Alam *et al.*, 1996). Most studies reported that mechanical threshing significantly increases threshing efficiency and reduces labor requirements and operational costs. However, region-specific information on maize threshing methods in Karnataka is limited. Variations in agro-climatic conditions, farm size, terrain, and labor availability influence the adoption and performance of threshing technologies across districts(Akbar Ali *et al.*, 2024).

This study was conducted to comparatively evaluate traditional and mechanical maize threshing techniques in selected districts of Karnataka. The study focused on operational efficiency, cost analysis, post-harvest losses, and constraints associated with threshing methods(M. M. Alam *et al.*, 2006). The findings of this investigation can help policymakers, agricultural engineers, and extension agencies promote suitable threshing technologies for different farming conditions. The objectives of the study were to identify major maize threshing methods practiced in selected districts, estimate the cost and efficiency of different threshing techniques, evaluate the financial feasibility of mechanical threshers, assess post-harvest losses, and identify constraints affecting the adoption of threshing technologies(Li *et al.*, 2023). The study also aimed to provide recommendations for improving mechanization and post-harvest management in maize production systems.

Materials and Methods

Study Area

This study was conducted in the major maize-producing regions of Karnataka, namely, Chitradurga, Davanagere, Tumkur, Hassan, and Chikkamagaluru districts. Karnataka is situated between 11.5° and 19.0° N latitude and between 74° and 78° E longitude, with a geographical area of 1,91,791 sq. km. The state receives an average annual rainfall of 1,189 mm and experiences mean temperatures ranging from 21.5°C to 31.7°C. The major crops cultivated in Karnataka include cereals, pulses, oilseeds, commercial crops, vegetables, fruits, and plantation crops.(Patil *et al*., 2019)

Chitradurga District

The Chitradurga district falls under the Central Dry Zone of Karnataka. The district is located between 13°42′ and 15°00′ N latitude and 76°01′ and 77°01′ E longitude. The geographical area of the district is approximately 8,440 km2. The average annual rainfall ranges between 550 and 650 mm, and the temperature ranges between 18 and 40°C. The major crops cultivated in the district include maize, jowar, ragi, groundnut, sunflower, cotton, red gram, and vegetables. Maize is an important commercial cereal crop that is grown extensively under rain-fed conditions.(Dwived, 2017)

Davanagere District

The Davanagere district falls under the Northern and Central Dry Zone of Karnataka. It is situated between 13°38′ and 14°42′ North latitude and 75°38′ and 76°25′ East longitude. The district has a geographical area of 5,924 sq. km with an average annual rainfall of 657 mm and a temperature ranging from 15 to 43°C. The major crops cultivated in the district include paddy, maize, jowar, ragi, bengal gram, red gram, groundnut, cotton, sunflower, sugarcane, and vegetables.(S.R *et al*., 2023)

Tumkur District

The Tumkur district belongs to the Southern Dry Zone of Karnataka and is situated between 12°45′ and 14°20′ N latitude and 76°20′ and 77°31′ E longitude. The district covers an area of approximately 10,598 km2 and receives an average annual rainfall of approximately 687 mm. The temperature ranges between 17 and 39°C. The major crops grown in the district include maize, ragi, groundnut, coconut, pulses, sunflower, and vegetables. Maize cultivation has increased significantly owing to the growing industrial demand and the poultry feed industry.(Thapa, 1996)

Hassan District

Hassan district falls under the Southern Transitional Zone of Karnataka. The district lies between 12°13′ and 13°33′ North latitude and 75°33′ and 76°38′ East longitude. Hassan district has a geographical area of approximately 6,814 sq. km with an average annual rainfall of 1,031 mm. The mean temperature ranges from 16°C to 35°C. Major crops cultivated include maize, paddy, coffee, sugarcane, ragi, pulses, and plantation crops. Maize cultivation occupies a major share under irrigated and rainfed conditions.(Jayalakshmi, 2023)

Chikkamagaluru District

Chickamagaluru district belongs to the Malnad and Hilly Zones of Karnataka and is situated between 12°54′ and 13°53′ North latitude and 75°04′ and 76°21′ East longitude. The district has a geographical area of approximately 7201 sq. km and receives high annual rainfall ranging from 1500 to 2500 mm. The temperature ranges from 14 to 32°C. Coffee is the dominant plantation crop, along with maize, paddy, pepper, arecanut, and pulses. Maize cultivation is mainly practiced in the semi-hilly and transitional regions of the district.(Thimmareddy *et al*., 2022)

Sampling Procedure

A multistage sampling technique was adopted to select the study area and respondents.(Kamalu *et al*., 2024)

1. Selection of Districts

Five districts–Chitradurga, Davanagere, Tumkur, Hassan, and Chikkamagaluru–were selected purposively based on the area and production of maize in Karnataka.

2. Selection of Taluks

One major maize-growing taluk was selected from each district based on the highest area under maize cultivation in recent years.

- Chitradurga taluk from Chitradurga district
- Davanagere taluk from Davanagere district
- Tumkur taluk from Tumkur district
- Hassan taluk from Hassan district
- Chikkamagaluru taluk from Chikkamagaluru district

3. Selection of Villages

Six villages from each selected taluk were identified based on the prevalence of both traditional and mechanical maize-threshing methods.

4. Selection of Respondents

Ten maize-growing farmers were selected randomly from each village, consisting of:

- Five farmers practicing traditional/manual threshing methods
- Five farmers using mechanical threshing methods

Thus, a total of 351 respondents were selected from all five districts, representing different threshing systems.

Nature and Sources of Data

This study was based on both primary and secondary data.

Primary Data

Primary data were collected from the sample farmers through personal interviews using a pre-tested structured interview schedule. Information collected included:

- Socio-economic characteristics
- Farm size and cropping pattern
- Threshing methods practiced
- Labour utilization
- Cost of threshing
- Post-harvest losses
- Operational efficiency
- Constraints faced during threshing operations

Secondary Data

Secondary information related to:

- Area and production of maize
- Productivity
- Rainfall
- Land utilization
- Cropping pattern
- District agricultural profile

was collected from published sources, such as

- Karnataka at a Glance
- Department of Agriculture reports
- District statistical records
- Agricultural university publications

Analytical Techniques

The collected data were analyzed using tabular and comparative methods.

1. Cost Analysis

The cost of threshing under different methods (manual and mechanical) was estimated on a per-hectare basis, considering the following:

- Labour charges
- Machine rental charges
- Fuel expenses
- Repair and maintenance cost
- Transportation cost

2. Financial Feasibility Analysis

The investment feasibility of mechanical threshers was evaluated using:

- Break-even analysis
- Payback period
- Benefit-Cost Ratio (BCR)
- **Net return analysis**

3. Post-Harvest Loss Estimation

Quantitative losses occurring during threshing using different methods were estimated and compared based on

- Grain breakage
- Unthreshed grains
- Spillage losses
- Grain quality deterioration

4. Constraint Analysis

Challenges faced by farmers using traditional and mechanical threshing methods were identified and ranked based on the frequency and severity reported by respondents.

Concepts Used in the Study

Traditional/Manual Threshing Methods
The following manual threshing techniques were considered:

- Bare hand shelling
- Hand beating method
- Stick beating method
- Bullock trampling method

Mechanical Threshing Methods

The following mechanical threshing techniques were evaluated:

- Engine-operated maize threshers
- Tractor-operated maize shellers
- Power-operated threshing machines
- Sheath removal maize threshers

The comparison among threshing methods was made based on:

- Threshing efficiency
- Cost of operation
- Labour requirement
- Time consumption
- Grain damage
- Post-harvest losses
- Economic feasibility

Results

Socio-Economic Characteristics of the Respondents

A socio-economic analysis of maize-growing farmers in Chitradurga, Davanagere, Tumkur, Hassan, and Chikkamagaluru districts revealed considerable variations in farm size, annual income, educational status, and mechanization level among respondents. Farmers practicing mechanical threshing methods generally possessed larger operational holdings and higher annual farm incomes than farmers adopting traditional or manual threshing methods. The majority of small and marginal farmers depended on manual threshing techniques because of limited financial resources and lack of access to agricultural machinery. Medium- and large-scale farmers were more inclined toward mechanical threshing because of labor scarcity, increased maize production, and the need for timely post-harvest operations. Farmers from the Davanagere and Tumkur districts showed a higher adoption of mechanized threshing systems owing to better access to custom hiring centers and agricultural machinery services. The educational status of farmers also influenced the adoption of threshing technologies. Educated farmers were more aware of the advantages of mechanized threshing, such as reduced labor requirements, improved efficiency, and lower post-harvest losses. Younger farmers showed greater interest in adopting modern agricultural technologies than older farmers, who continued to rely on conventional methods.

Farm Inventory and Cropping Pattern

The inventory analysis indicated that farmers using mechanical threshing methods possessed a comparatively better agricultural infrastructure, including tractors, threshers, irrigation facilities, storage structures, and transport vehicles. Mechanical threshing adopters also maintained larger cultivated areas under maize crops. The major crops cultivated in the study area included maize, paddy, jowar, ragi, groundnut, sunflower, pulses, and vegetables. Maize occupied a major share of the cultivated area in all selected districts owing to its increasing demand from the poultry feed, starch, and food processing industries. Cropping intensity was comparatively higher in the Hassan and Chikkamagaluru districts because of better rainfall and irrigation availability. In contrast, Chitradurga and Tumkur districts were largely dependent on rainfed agriculture.

Major Maize Threshing Methods Identified

The study identified several traditional/manual and mechanical threshing methods practiced by farmers in the selected districts.

Traditional/Manual Threshing Methods

The traditional threshing methods identified are as follows:

- Bare hand shelling
- Hand beating method
- Stick beating method
- Bullock trampling method

These methods are mainly practiced by small and marginal farmers because of their low capital investment requirements. However, these methods are highly labor-intensive and time-consuming.

Mechanical Threshing Methods

The major mechanical threshing techniques identified were as follows:

- Engine-operated maize threshers
- Tractor-operated maize shellers
- Power-operated threshing machines
- Sheath removal maize threshers

Mechanical threshers were more prevalent in the Davanagere and Tumkur districts, where large-scale maize cultivation and labor shortages encouraged mechanization.

Cost of Maize Threshing

This study revealed significant variations in the cost of maize threshing using different methods. Traditional threshing methods require higher labor input and more time to complete threshing operations. Labor charges constitute the major component of the operational cost of manual threshing systems. Among traditional methods, hand beating and stick beating recorded higher operational costs because of the intensive labor requirements and prolonged threshing duration. Bullock trampling also entailed additional expenses related to animal maintenance and handling. Mechanical threshing methods substantially reduced the labor requirements and threshing duration. Although mechanical methods involve fuel charges, machine rental, repair, and maintenance expenses, the overall operational cost per unit output was comparatively lower than that of traditional methods.
Engine-operated maize threshers and tractor-operated shellers demonstrated better cost efficiency because of their higher threshing capacity and rapid grain separation. Farmers using mechanical threshers completed threshing operations quickly, thereby reducing labor costs and minimizing weather-related losses.

Table 1. Comparison of Traditional and Mechanical Maize Threshing Methods in Selected Districts of Karnataka

Parameters	Traditional/Manual Methods	Mechanical Methods
Major Methods Used	Hand shelling, stick beating, bullock trampling	Engine-operated threshers,

		tractor shellers
Labour Requirement	Very High	Low
Time Requirement	More time consuming	Rapid threshing operation
Threshing Efficiency	Moderate to Low	High
Grain Damage	Higher	Lower
Post-Harvest Losses	High	Low
Operational Cost	High due to labour wages	Lower per unit output
Grain Quality	Poor to Moderate	Better quality grains
Farmer Drudgery	Severe	Minimal
Suitability	Small-scale farmers	Medium and large farmers

Threshing Efficiency

Threshing efficiency varied considerably among different threshing methods. Mechanical threshers achieved a significantly higher threshing efficiency than traditional or manual methods. Engine-operated threshers and power-operated threshing machines recorded the maximum grain recovery and minimum unthreshed grains. These machines ensure rapid and uniform threshing with improved grain quality. Traditional threshing methods, such as hand beating and bullock trampling, showed lower threshing efficiency because of incomplete grain separation and higher grain scattering losses. Stick beating methods caused uneven threshing and grain breakage. Sheath removal maize threshers exhibited superior cleaning efficiency and reduced grain contamination compared to other threshing systems.

Labour Utilization and Time Requirement

Traditional threshing methods require significant amounts of manual labor and considerable operational time. Labor scarcity during peak harvesting seasons has emerged as a serious challenge for farmers practicing manual threshing techniques. Hand shelling and stick beating methods demanded continuous physical effort and caused severe drudgery among workers. Farmers reported difficulties in arranging sufficient labor during harvesting seasons because agricultural laborers migrated to urban areas. Mechanical threshers significantly reduce labor requirements and threshing duration. Engine-operated threshers complete threshing operations within a shorter period, allowing for timely storage and marketing of maize grains. Farmers using mechanical methods reported substantial savings in labor costs and operational time.

Post-Harvest Losses

Post-harvest losses differed significantly according to the threshing method.

Traditional Methods

Traditional threshing methods recorded higher post-harvest losses due to the following reasons:

- Grain breakage
- Spillage losses
- Incomplete threshing
- Grain contamination
- Exposure to weather conditions

Grain damage and loss of market quality were observed using hand beating and stick beating methods. Bullock trampling resulted in contamination of grains with soil, dust, and animal waste, thereby reducing grain quality and storage life.

Mechanical Methods

Mechanical threshers considerably reduce post-harvest losses by improving threshing efficiency and grain recovery. Engine-operated and sheath-removal threshers minimize grain breakage and spillage losses. The improved cleaning efficiency of mechanical threshers enhances grain quality and reduces storage problems. Farmers who have adopted mechanized threshing systems have reported better market prices for clean and undamaged maize grains.

Financial Feasibility of Mechanical Threshers

A financial analysis indicated that investments in mechanical threshers were economically feasible and profitable, especially in districts with large-scale maize cultivation.

The benefit-cost ratio (BCR) was higher for mechanical threshing systems because

- Reduced labour cost
- Lower post-harvest losses
- Increased operational efficiency
- Higher threshing capacity

A break-even analysis revealed that mechanical threshers became profitable when utilized over larger cultivated areas or through custom hiring services. Farmers and rural entrepreneurs providing threshing services to neighboring farmers generated additional income through machinery utilization.

The payback period for engine-operated maize threshers was comparatively short because of the higher operational demand during harvesting seasons.

Constraints in Traditional Threshing Methods

The major constraints associated with traditional/manual threshing methods were as follows:

- Scarcity of agricultural labour
- Increasing labour wages
- High drudgery
- Time-consuming operations
- Higher post-harvest losses
- Delayed threshing during adverse weather conditions

Farmers reported that manual threshing methods became increasingly difficult to sustain because of rising labor shortages and increasing cultivation costs.

Constraints in Mechanical Threshing Methods

The important constraints faced in mechanical threshing methods include the following:

- High initial investment cost
- Fuel and maintenance expenses
- Limited machine accessibility in remote villages
- Lack of skilled operators
- Repair and spare parts availability problems

Farmers in the Hassan and Chikkamagaluru districts experienced additional operational difficulties owing to hilly terrain and fragmented landholdings, which restricted the movement and operation of large threshing machines.

Small and marginal farmers were financially constrained from purchasing threshing machinery and depended mainly on rental services or custom hiring centers.

Table 2. Major Constraints Faced by Farmers under Traditional and Mechanical Threshing Methods

Traditional Threshing Constraints	Mechanical Threshing Constraints
Labour scarcity during peak season	High initial investment cost
Increasing labour wages	Fuel and maintenance expenses
High physical drudgery	Lack of skilled operators
Time-consuming operations	Limited machine availability
Higher post-harvest losses	Repair and spare part problems
Delayed threshing during rainfall	Difficulty in operating on hilly terrain
Grain contamination and breakage	Financial constraints for small farmers
Lower threshing	Dependence on

efficiency	custom hiring services

Overall Findings

This study clearly demonstrated that mechanical maize threshing methods were superior to traditional/manual threshing systems in terms of

- Operational efficiency
- Labour saving
- Time reduction
- Reduced post-harvest losses
- Improved grain quality
- Economic profitability

The mechanization of maize threshing significantly enhanced the efficiency of post-harvest operations and improved farmer income. This study emphasizes the importance of promoting affordable mechanization, custom hiring centers, subsidy support, and technical training programs to increase the adoption of improved threshing technologies among maize-growing farmers in Karnataka.

Discussion

The present study clearly demonstrated the comparative advantages of mechanical maize threshing methods over traditional/manual threshing systems in the major maize-growing districts of Karnataka. The findings revealed that mechanized threshing significantly improved operational efficiency, reduced labor dependency, minimized post-harvest losses, and enhanced economic returns for maize-growing farmers.

Traditional threshing methods, such as bare-hand shelling, hand beating, stick beating, and bullock trampling, are highly labor-intensive and time-consuming. These methods require substantial human effort and prolonged working hours, especially during peak harvesting seasons. Labor scarcity and increasing wage rates have become major constraints affecting the sustainability of traditional threshing systems. Similar observations have been reported in earlier studies, where manual threshing methods were associated with higher operational costs and greater physical drudgery. Mechanical threshing methods, including engine-operated threshers, tractor-operated shellers, and power-operated threshing machines, substantially reduce labor requirements and threshing duration. The higher threshing efficiency observed in mechanical systems can be attributed to rapid grain separation, improved cleaning mechanisms, and uniform threshing operations. Farmers adopting mechanized threshing systems can complete threshing operations quickly, thereby reducing exposure of harvested produce to adverse weather conditions, such as rainfall and moisture damage.

The study also revealed a significant reduction in post-harvest losses under mechanical threshing methods. Traditional methods caused higher grain breakage, spillage losses, contamination, and incomplete grain separation. Bullock trampling, in particular, reduced grain quality owing to contamination with soil and animal waste. In contrast, mechanical threshers improved grain recovery and reduced physical damage to kernels. Enhanced grain quality obtained through mechanized threshing contributes to better storage stability and a higher market value for produce. An economic analysis confirmed that investments in mechanical threshers were financially feasible and profitable. Higher benefit-cost ratio values and shorter payback periods indicated better economic performance of mechanized systems. Reduced labor expenses and improved operational efficiency contributed significantly to increased profitability. The profitability of threshing machinery further increased when utilized through custom hiring services, allowing small and marginal farmers to access mechanized technologies without purchasing machinery individually.

The adoption of threshing technologies varied among districts because of differences in agro-climatic conditions, farm size, terrain, and infrastructure availability. The Davanagere and Tumkur districts exhibited higher mechanization levels because of extensive maize cultivation and better availability of agricultural machinery services. In contrast, farmers in Hassan and Chikkamagaluru districts faced operational difficulties owing to hilly terrain, fragmented landholdings, and limited machine accessibility. These findings indicate the importance of developing location-specific and compact threshing technologies suitable for different geographical conditions. Although mechanized threshing systems offer substantial advantages, several constraints continue to limit their widespread adoption. High initial investment, fuel expenses, repair and maintenance costs, and lack of skilled operators are major concerns for farmers. Small and marginal farmers are particularly constrained by inadequate financial resources and dependence on rental services. Strengthening custom hiring centers, providing subsidy support, and improving access to institutional credit can enhance the adoption of mechanized threshing technologies among resource-poor farmers.

This study highlights the growing importance of agricultural mechanization in improving post-harvest management and reducing production losses in maize cultivation. The promotion of affordable threshing technologies, farmer training programs, and technical extension services can significantly improve operational efficiency and farmer income. Overall, the mechanization of maize threshing has the potential to enhance agricultural productivity, reduce labor burdens, and support sustainable agricultural development in Karnataka.

Conclusion

The present study comparatively evaluated traditional and mechanical maize threshing techniques in major maize-growing districts of Karnataka, namely Chitradurga, Davanagere, Tumkur, Hassan, and Chikkamagaluru. The investigation clearly demonstrated that mechanized threshing systems are more efficient, economical, and suitable for modern maize production systems than traditional or manual threshing methods. Traditional threshing techniques, such as bare-hand shelling, hand beating, stick beating, and bullock trampling, are labor-intensive, time-consuming, and are associated with higher post-harvest losses. These methods cause considerable grain breakage, spillage losses, contamination, and physical drudgery among farmers and laborers. Increasing labor scarcity and rising wage rates further reduce the economic viability of manual threshing systems. Mechanical threshing methods, including engine-operated maize threshers, tractor-operated shellers, power-operated threshing machines, and sheath removal threshers, significantly improved threshing efficiency and reduced operational time. Mechanized systems minimize labor requirements, reduce post-harvest losses, improve grain quality, and enhance marketable yields. Farmers adopting mechanical threshers obtained higher economic returns owing to reduced labor expenses and improved operational efficiency. A financial feasibility analysis indicated that investments in mechanical threshers were profitable, particularly in regions with extensive maize cultivation. The benefit-cost ratio and break-even analysis confirmed the economic sustainability of mechanized threshing systems. Custom hiring services also played an important role in improving the accessibility of threshing machinery among small and marginal farmers.

The study further revealed that the adoption of mechanized threshing varied across districts depending on farm size, terrain conditions, and accessibility to agricultural machinery. Farmers in the Davanagere and Tumkur districts showed greater mechanization owing to larger operational holdings and better machinery availability, whereas hilly terrain and fragmented landholdings limited mechanization in Hassan and Chikkamagaluru districts. Despite the advantages of mechanized threshing, constraints such as high initial investment, fuel and maintenance costs, lack of technical knowledge, and limited access to machinery in remote villages continue to affect adoption levels. Therefore, government support through subsidies, affordable credit facilities, farmer training programs, and the establishment of custom hiring centers is essential for promoting agricultural mechanization.

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