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# A Study on Challenges in Pineapple Production and Post-harvest Management in Uttara Kannada District

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## Abstract

Considering the pineapple industry needs, research over time period to overcome drawbacks such as marketing challenges, production and post production. The present study, consist of multiple research objectives, rigorously explores the intricacies of pineapple farming inUttara Kannada district, particularly in Sirsi and Siddapur taluks. A robust sample of 173 respondents across 15 villages, aimed to holistically assess the challenges faced by pineapple farmers throughout production and post-harvest stages. Key challenges, identified across various research topics, encompass adverse weather conditions, high production costs, and intricateissues in post-harvest management, including price fluctuations and transportation constraints. Further scrutinized farming practices, revealing nuanced correlations such as the negative relationship between cultivation area and inter cropping, and Good Agriculture Practice (GAP) factors are considered during regression analysis to know contribution of labour practice, irrigation, Hormones usage, post-harvest handling. The socio-economic landscape, the findings, derived from objectives reveal 10 different challenges ranked by respondents. The valuable insights offered for policymakers, agribusiness stakeholders, and farmers has been the top challenge. It is concluded by emphasizing the need for targeted strategies and interventions to enhance the sustainability and economic viability of pineapple farming in the region.

***Key words*:** Pineapple, Production, Post-harvesting, Management challenges, Farming practices, Socio-economic, Hormones, Inter cropping, Labors

Pineapple, a crucial fruit crop in India, ranks fifth globally, with a cultivation area of approximately 116 thousand hectares, producing 1984 thousand tonnes and boasting a productivity of 17.1 t/ha (National Horticulture Board, 2015-16). Notably, the northeastern states, particularly Tripura, play a significant role, standing as the fourth-largest pineapple producer in India. In Tripura, the cultivation area covers 8768 hectares, yielding 127 thousand tonnes, with a productivity of 14 t/ha (National Horticulture Board, 2015-16 & Directorate of Horticulture and Soil Conservation, Government of Tripura, 2015-16 and 2016-17). Tripura's iconic 'Queen' pineapple, declared the 'State Fruit' in 2018 with a Geographical Indication (GI) tag, is renowned globally for its exceptional quality. However, despite its economic influence, the pineapple industry in Tripura has faced challenges, leading to a decline in cultivation area from 12000 ha in 2014-15 to 8850 ha in 2016-17 (Mission for Integrated Development of Horticulture, MoA & FW, Govt. of India, 2018). The decline is attributed to the absence of processing infrastructure, reduced prices, and the high perishability of pineapples, causing significant losses for farmers [1]. According to reports, the fruit is sold at less than half of the market rate in June-July due to a market glut, resulting in substantial losses for growers [2-4]. The pineapple marketing sector, despite its potential to reduce unemployment, is complex and risky due to the fruit's perishable and bulky nature. Effective marketing systems are crucial to transfer the produce from production to consumption points within a specified time, but existing regulatory markets have struggled to eliminate trade malpractices [5-7]. The government's aim to regulate trade practices and enhance marketing efficiency is challenged by the complexities of the pineapple market. This study, conducted in the backdrop of the declining pineapple industry, aims to assess the perceived effectiveness of the marketing system by pineapple growers in Tripura, identifying its determinants. The study will provide valuable insights into improving the sustainability and profitability of pineapple farming in the region.

*Objectives of the study*

1 - To Identify the Key Challenges in Pineapple Production.
2 - To Identify the Challenges in Pineapple Post-Harvesting Management.
3 - To study the adoption of Good Agricultural Practices in Pineapple Farming.

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*Hypothesis*

Objective 3 - To study the adoption of Good Agricultural Practices in Pineapple Farming.

H1 - Adoption of inter cropping practice has negative impact on GAP satisfaction.

H0 - There is no relationship between inter cropping practice and GAP satisfaction.

H2 - Adoption of labor practice has positive impact on GAP satisfaction.

H0 - There is no relationship between labor practice and GAP satisfaction.

H3 - Adoption of hormones usage practice has negative impact on GAP satisfaction.

H0 - There is no relationship between hormones usage practice and GAP satisfaction.

H4 - Adoption of irrigation practice has positive impact on GAP satisfaction.

H0 - There is no relationship between irrigation practice and GAP satisfaction.

H5 - Post harvest handling practice has negative impact on GAP satisfaction.

H0 - There is no relationship between post-harvest handling practice and GAP satisfaction.

## MATERIALS AND METHODS

The research employed a systematic sample selection, focusing on 15 villages in Uttara Kannada district to ensure representation and diversity in pineapple farming. Utilizing a cross-sectional design and simple random sampling across 15 villages in Sirsi and Siddapur taluks, the study included 173 respondents for statistical significance. Data collection involved structured interviews and surveys with a comprehensive questionnaire, covering demographic details, farming practices, challenges, income, and technology adoption, using a simple random technique. Quantitative data analysis included regression and correlation analyses, along with descriptive statistics, utilizing tools like Garret ranking and percentage analysis. Despite robust methodology, limitations include a specific focus on 15 villages, potentially limiting the broader agricultural diversity in Uttara Kannada district. The study's context-specific findings should be cautiously applied beyond the sampled villages.

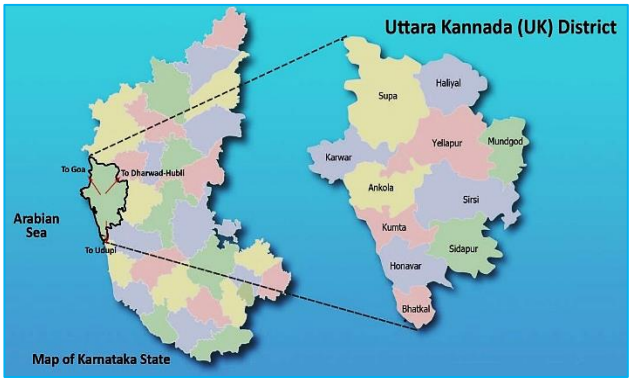



Fig 1 Uttara Kannada district map

*i) Garret ranking*

Garrett's ranking technique was used to rank the preference indicated by the respondents on different factors. As per this method, respondents have been asked to assign the rank for all factors and the outcomes of such ranking have been converted into score value with the help of the following formula:

$$\text{Percent position} = 100\,(Rij - 0.5) / Nj$$

Where;

Rij = Rank given for the $i^{th}$ variable by $j^{th}$ respondents

Nj = Number of variables ranked by $j^{th}$ respondents with the help of Garrett's Table, the percent position estimated is converted into scores. Then, for each factor, the scores of each individual are added and then total value of scores and mean values of score is calculated. The factors having highest mean value is considered to be the most important factor.

*ii) Logit model of regression analysis*

In any situation where an individual makes a decision between the responses of "yes" and "no" and the choice to say "yes" is affected by a set of explanatory variables, the regression model for the $i^{th}$ individual may be written as:

$$yi = \beta\, 1 + \beta\, 2\, x_{i2} + \ldots\ldots\ldots\ldots\ldots\ldots + \beta k\, Xik + ui$$

or

$$y_i = xi\, \beta + u_i$$

Where;

GAP satisfaction (Y) = Li-kart scale 1 to 5 satisfaction, (1 is less and 5 is highly satisfied)

$X_1$ = 1 if the pineapple grower adopts inter cropping

0 for not adopting

$X_2$ = 1 if the pineapple grower adopts Hired labors 0 for not adopting

$X_3$ = 1 if the pineapple grower adopts usage of hormone 0 for not adopting

$X_4$ = 1 if the pineapple grower adopts Irrigation 0 for not adopting

$X_5$ = if the pineapple grower adopts post handling practice 0 for not adopting

## RESULTS AND DISCUSSION

*Demographic characteristics of pineapple farmers*

*i. Age distribution*

The diverse age representation among 173 respondents in the pineapple farming research study reveals that 67.05% fall within the 26-50 years age range, indicating the significance of insights from this demographic group. Individuals over 50 years constitute 28.32%, and those below 25 years are at 4.62% [8-9]. This demographic breakdown is crucial for contextualizing findings within the pineapple farming community.

*ii. Educational qualifications*

In terms of education, the study reflects varied levels among the participants. The majority (30.06%) have completed Matriculation, while 27.17% hold PUC/Diploma/ITI qualifications. Notably, there are no illiterate participants, emphasizing a baseline level of education within the surveyed population.

*iii. Land scale*

Analyzing the scale of pineapple farming operations among respondents, the majority (43.93%) are small-scale farmers, followed by 29.48% large-scale farmers, and 26.59% medium- scale farmers. This breakdown underscores the prominence of small-scale farmers in the study, emphasizing the need to consider their unique challenges.

*iv. Experience level*

Insights into respondents' experience levels in pineapple farming reveal a diverse landscape. A significant portion (41.62%) has 6-10 years of experience, while 34.10% are relatively new entrants with less than 5 years of experience. The

data captures nuances essential for understanding perspectives and challenges within the community.

*v. Income distribution*

The income distribution among pineapple farmers showcases that 53.18% earn "above 3 lakh," 39.31% fall in the "2 lakh - 3 lakh" category, and 7.51% earn between "1-2 lakh." This breakdown offers valuable insights into the financial landscape, allowing for tailored strategies based on diverse economic circumstances within the community.

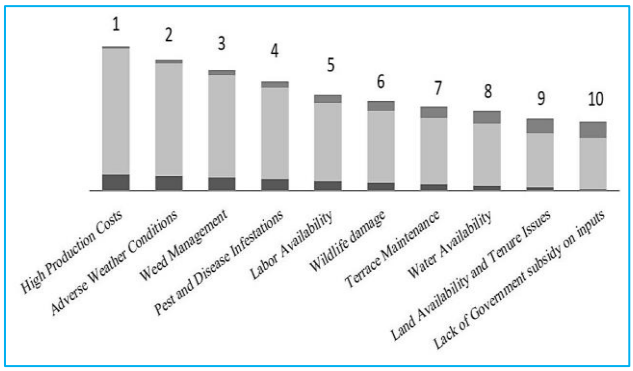
Table 1 Demographic characteristics of pineapple farmers

| S. No. | Particulars | No. of respondents | Percentage (%) |
|---|---|---|---|
| | Age | | |
| 1. | <25 | 08 | 04.62 |
| | 26-50 | 116 | 67.05 |
| | >50 | 49 | 28.32 |
| | Total | 173 | 100.00 |
| | Qualification | | |
| 2. | Primary | 47 | 27.17 |
| | Secondary | 17 | 09.83 |
| | Matriculation | 52 | 30.06 |
| | PUC / Diploma/ ITI | 47ss | 27.17 |
| | Degree | 09 | 05.20 |
| | Post Graduation | 01 | 00.58 |
| | Total | 173 | 100.00 |
| | Land | | |
| 3. | Small scale farmers | 76 | 43.93 |
| | Medium scale farmers | 46 | 26.59 |
| | Large scale farmers | 51 | 29.48 |
| | Total | 173 | 100.00 |
| | Experience | | |
| 4. | <5 years | 59 | 34.10 |
| | 6-10 years | 72 | 41.62 |
| | 11-15 years | 17 | 9.83 |
| | >15 years | 25 | 14.45 |
| | Total | 173 | 100 |
| | Income | | |
| 5. | 1-2 lakh | 13 | 07.51 |
| | 2 lakh - 3 lakhs | 68 | 39.31 |
| | above 3 lakhs | 92 | 53.18 |
| | Total | 173 | 100 |

Table 2 Ranking of production challenges faced by pineapple farmers

| S. No | Challenges | Ranks |
|---|---|---|
| 1. | Adverse weather conditions | II |
| 2. | High production costs | I |
| 3. | Weed management | III |
| 4. | Availability of quality inputs | IX |
| 5. | Pest and disease infestations | IV |
| 6. | Labor availability | V |
| 7. | Terrace maintenance | VII |
| 8. | Wildlife damage | VI |
| 9. | Water availability | VIII |
| 10. | Lack of government subsidy on inputs | X |

The (Table 2), indicates the ranking of challenges in pineapple production, as per participant perceptions, unveils crucial insights into the varied concerns within the sector. "High Production Costs" taking the top spot (Rank I) signifies the overarching economic burden perceived by participants. "Adverse Weather Conditions" closely follows as the second most critical challenge (Rank II), emphasizing the susceptibility of pineapple cultivation to climatic uncertainties. "Weed Management" secures the third rank (Rank III), underlining the pivotal role of effective weed control for crop health and productivity. Challenges such as "Pest and Disease Infestations" (Rank IV), "Labor Availability" (Rank V), and "Wildlife Damage" (Rank VI) represent pressing issues in the middle tier, each with its unique implications for cultivation. "Terrace Maintenance" (Rank VII), "Water Availability" (Rank VIII), and "Availability of quality inputs" (Rank IX) also feature prominently, reflecting the diverse array of concerns in pineapple farming. "Lack of Government Subsidy on Inputs" is ranked the least challenging (Rank X), highlighting a perception that, in the current context, other challenges outweigh the impact of subsidy availability [10-13]. This comprehensive ranking offers stakeholders a strategic road map to address the spectrum of challenges in pineapple production effectively.



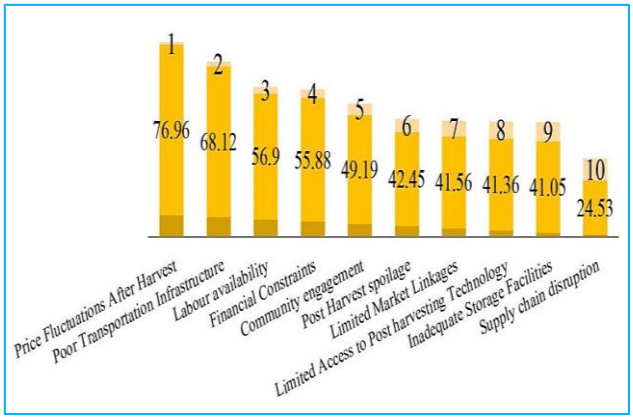

Graph 1 Ranking of production challenges faced by pineapple farmers

Table 3 Ranking of post-production challenges faced by pineapple farmers

| S. No | List of challenges in pineapple post-production | Ranks |
|---|---|---|
| 1. | Price fluctuations after harvest | I |
| 2. | Poor transportation infrastructure | II |
| 3. | Post harvest spoilage | VI |
| 4. | Financial constraints | IV |
| 5. | Labour availability | III |
| 6. | Community engagement | V |
| 7. | Limited market linkages | VII |
| 8. | Limited access to post harvesting technology | VIII |
| 9. | Inadequate storage facilities | IX |
| 10. | Supply chain disruption | X |

The ranking of challenges in pineapple post-production (Table 3), derived from participant perceptions, offers valuable insights into the nuanced concerns following the harvest stage. "Price Fluctuations After Harvest" secures the top rank (Rank I), emphasizing the significance of market dynamics in impacting post-harvest economics. "Poor Transportation Infrastructure" closely follows as the second most critical challenge (Rank II), highlighting the importance of efficient transportation for timely and cost-effective delivery. "Labour Availability" secures the third rank (Rank III), underscoring the pivotal role of labor in post-harvest processes. Challenges such as "Financial Constraints" (Rank IV) and "Community Engagement" (Rank V) represent pressing issues in the middle tier, each contributing to the complex landscape of post-harvest challenges. "Post Harvest Spoilage" (Rank VI), "Limited Market Linkages" (Rank VII), and "Limited Access to Post-harvesting Technology" (Rank VIII) also feature prominently, reflecting diverse concerns in post-production processes. "Inadequate Storage Facilities" (Rank IX) underscores the need

for proper storage infrastructure, while "Supply Chain Disruption" is ranked the least challenging (Rank X). This comprehensive ranking provides stakeholders with a strategic understanding of the varied challenges in pineapple post-production, facilitating targeted interventions to enhance efficiency and sustainability [14-19].




Graph 2 Ranking of Post-production challenges faced by farmers

*Adoption of good agricultural practices (GAP)*

The tabulated (Table 4) information captures the diverse farming practices adopted by respondents in key agricultural domains. For pest and disease management, a significant majority (96.35%) opt for conventional pesticide use, with a smaller percentage (3.47%) employing integrated pest management. In the realm of irrigation, the majority favor sprinkler systems (72.09%), followed by drip irrigation (2.91%), while 25% do not specify their irrigation method. Regarding labor practices, a notable majority (90.75%) hire seasonal workers, a smaller percentage (4.04%) use machinery for task automation, and 5.20% employ a combination of both approaches. In post-harvest handling, a substantial majority (93.06%) emphasizes proper sorting and grading, with a minority (6.94%) employing cooling and preservation techniques. For storage practices, the predominant choice is open-air storage (80.92%), followed by storage in a cool and dry place (19.08%), and no respondents reported utilizing a refrigerated facility [20-25]. This comprehensive overview provides valuable insights into the varied approaches employed by farmers, showcasing the diverse landscape of agricultural practices within the population.

Table 4 Specific good practices adopted in pineapple farming by farmers

| S. No. | Particulars | Number of respondents | | |
|---|---|---|---|---|
| 1 | Pest and disease control | Integrated pest management<br>6 (3.47%) | Conventional pesticide use<br>167 (96.35%) | None of them<br>- |
| 2 | Irrigation | Drip irrigation<br>5 (2.91%) | Sprinkler<br>124 (72.09%) | None of them<br>43 (25%) |
| 3 | Labour | Use of machinery<br>7 (4.04%) | Hire seasonal workers<br>157 (90.75%) | Both<br>9 (5.20%) |
| 4 | Post harvest handling | Proper grading<br>161 (93.06%) | Efficient packaging<br>- | Cooling and preservation techniques<br>12 (6.94%) |
| 5 | Storage | Cool and dry place in field<br>33 (19.08%) | In open air<br>140 (80.92%) | In a refrigerated facility<br>- |

Table 5 Inter crops adopted by respondents (N=125)

| Crop | No. of respondents | Percentage |
|---|---|---|
| Areca nut | 28 | 22.40 |
| Papaya | 39 | 31.20 |
| Ginger | 43 | 34.40 |
| Vegetables | 11 | 08.80 |
| Legumes | 04 | 03.20 |
| Total | 125 | 100 |

The sorted data in (Table 5) reveals distinct patterns in crop preferences and inter cropping practices among respondents. Notably, ginger and papaya emerge as the predominant crops, with 34.40% and 31.20% representation, respectively. Areca nut constitutes 22.40% of the crops, indicating a notable but comparatively smaller presence. Vegetables and legumes make up 8.80% and 3.20%, respectively. The data further indicates that 72.25% (125) of respondents engaged in inter cropping, and upon closer analysis, it suggests a noteworthy trend. Those who are inter cropping, particularly with areca nut, are showing an inclination to transition away from pineapple farming. This nuanced insight underscores the dynamic nature of crop choices and farming practices within the surveyed population, emphasizing the potential impact of inter cropping decisions on the continuation of pineapple cultivation [26].

The regression analysis results in above (Table 6) revels that the factors influencing Good Agricultural Practices (GAP) satisfaction among pineapple farmers in Uttara Kannada. The R Square value of 0.82 indicates best fit for regression, that approximately 82% of the variability in GAP satisfaction can be explained by the included variables. Analyzing the coefficients the intercept of 2.92 is statistically significant ($p < 0.001$). It's crucial to focus on the individual factor coefficients and their respective p-values to assess their significance. The coefficient for Inter Cropping is 0.14 with a p-value 0.13, suggesting that the adoption of inter cropping practices does less (13%) significantly impact GAP satisfaction, thereby rejected alternative hypothesis (H1). The coefficient for Labor is 0.89 with a p-value of 0.006, providing evidence to accept the alternative hypothesis (H2). This implies that the adoption of labor. practices positively influence GAP satisfaction among pineapple farmers. The Hormones variable has a coefficient of -0.74 and a significant p-value of 0.001, supporting the acceptance of the alternative hypothesis (H3). The negative coefficient indicates that the adoption of hormone practices negatively impacts GAP satisfaction. For Irrigation, the coefficient is 0.16 with a p-value of 0.08. While the p-value is above the conventional significance level of 0.05, therefore rejecting the alternative hypothesis (H4). Post-Handling has a coefficient of 0.74 with a significant p-value of 0.007, supporting the acceptance of the alternative hypothesis (H5). This suggests that the adoption of post-harvest handling practices negatively influences GAP satisfaction. the analysis provides insights into the specific agricultural practices that influence GAP satisfaction among pineapple farmers, offering valuable implications for optimizing agricultural strategies and interventions in the region [27-30].

"Lack of financial resource" is reported by 10.4% of respondents, suggesting a minority but still noteworthy recognition of financial constraints as a barrier. "Resistance to change traditional practices" is cited by 23.1%, indicating a moderate level of reluctance among participants to adopt new agricultural methodologies. These findings provide valuable insights into the specific challenges perceived by participants, offering a basis for targeted strategies to address technological, expertise, financial, and traditional practice-related concerns within the pineapple farming community [31].

Table 6 Logit model regression analysis over GAP satisfaction in pineapple farming

| Regression statistics | |
|---|---|
| Multiple R | 0.346 |
| R Square | 0.820 |
| Adjusted R square | 0.835 |
| Standard error | 0.547 |
| Observations | 173 |

| ANOVA | df | SS | MS | F | Significance F |
|---|---|---|---|---|---|
| Regression | 5.00 | 6.808 | 1.362 | 4.547 | 0.001 |
| Residual | 167.00 | 50.002 | 0.299 | | |
| Total | 172.00 | 56.809 | | | |

| | Standard | | t Stat | P-value | Lower | Upper | Lower | Upper |
|---|---|---|---|---|---|---|---|---|
| | Coefficients | Error | | | 95% | 95% | 95.0% | 95.0% |
| Intercept | 2.917 | 0.329 | 8.860 | 0.000 | 2.267 | 3.567 | 2.267 | 3.567 |
| Inter cropping | 0.137 | 0.090 | 1.527 | 0.129 | -0.040 | 0.314 | -0.040 | 0.314 |
| Hired labors | 0.890 | 0.322 | 2.763 | 0.006 | 0.254 | 1.527 | 0.254 | 1.527 |
| Hormones usage | -0.741 | 0.229 | -3.237 | 0.001 | -1.192 | -0.289 | -1.192 | -0.289 |
| Irrigation | 0.163 | 0.092 | 1.767 | 0.079 | -0.344 | 0.019 | -0.344 | 0.019 |
| Post-handling | 0.745 | 0.271 | 2.753 | 0.007 | 0.211 | 1.279 | 0.211 | 1.279 |

Table 7 Challenges faced in technology adoption

| S. No. | Particulars | No. of respondents | Percentage (%) |
|---|---|---|---|
| 1 | Lack of financial resource | 18 | 10.4% |
| 2 | Limited availability of technology in region | 138 | 79.8% |
| 3 | Lack of technical support or expertise | 129 | 74.6% |
| 4 | Resistance to change traditional practices | 40 | 23.1% |

## CONCLUSION

The findings of this research shed light on key aspects of pineapple farming in Uttara Kannada, emphasizing the vital role of small-scale farmers and their unique challenges. The dominance of moderately experienced farmers and a substantial proportion with higher incomes underscores the economic significance of pineapple cultivation in the region. Challenges, notably high production costs, adverse weather conditions, and weed management, underscore the economic burden perceived by participants. Price fluctuations, transportation issues, labor availability, and financial constraints emerge as top challenges, highlighting the complex landscape of pineapple farming. Concerns about resistance to changing traditional practices emphasize the need to promote technological advancements. Encouragingly, notable adoption rates in inter cropping practices and common intercrops like areca nut, papaya, and ginger suggest a dynamic agricultural landscape. However, the inclination of some farmers to transition away from pineapple farming, especially those inter cropping with areca nut, warrants attention. Limited usage of hormones, coupled with a lack of knowledge in post-harvest handling technology, signifies areas for improvement. Suggestions to the government include economic support, subsidies, and infrastructure development to alleviate economic challenges and enhance overall viability. Bridging the technological gap through training programs is crucial. Farmers are encouraged to adopt climate-resilient farming practices and engage in community platforms for collective problem-solving and shared learning. Addressing economic challenges, promoting technology adoption, and fostering community engagement are essential for ensuring the sustainability and growth of pineapple farming in Uttara Kannada. The recommendations aim to create a supportive ecosystem that empowers farmers and enhances the resilience of pineapple cultivation in the face of diverse challenges.

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