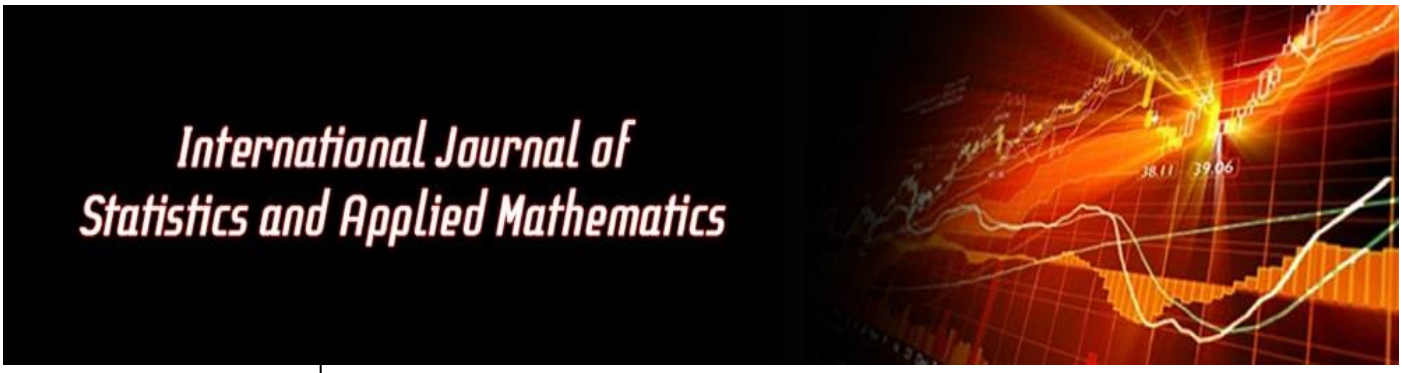

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Economic analysis of post-harvest losses in selected crops of Buldhana district

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Abstract
The present study has been carried out to estimate the extent of post-harvest losses at different stages of pigeon pea and gram. The post-harvest losses have been estimated using survey data collected from 90 farmers for each crop in Buldhana district for the year 2023-2024. The post-harvest losses at the farm level have been estimated to be 2.73 kg/qtl for pigeon pea and 2.63 kg/qtl for gram. The losses have been highest during harvesting for both crops: 0.75 kg/qtl (27.37%) for pigeon pea and 0.79 kg/qtl (29.97%) for gram, followed by storage: 0.62 kg/qtl (22.68%) for pigeon pea and 0.70 kg/qtl (26.71%) for gram. The quantity loss during threshing was 0.68 kg/qtl (25.13%) for pigeon pea and 0.60 kg/qtl (22.88%) for gram. The quantity loss during winnowing was 0.32 kg/qtl (11.60%) for pigeon pea and 0.28 kg/qtl (10.52%) for gram. The average loss during drying was found to be 0.36 kg/qtl (13.22%) for pigeon pea and 0.26 kg/qtl (9.90%) for gram. Regression analysis showed that age, education, productivity, and area under crop have a significant impact on post-harvest losses. Hence, efforts should be made for capacity building by providing training and technical advice on post-harvest handling, storage practices, drying, and proper use of insecticides to significantly reduce these losses.

Keywords: Post-harvest losses, factors affecting post-harvest, farm level, pigeon pea, gram, Buldhana

Introduction
Agricultural products go through a series of critical stages from harvest to their final destination with consumers. These stages include harvesting, threshing, winnowing, drying, bagging, transportation, storage, processing, marketing, and distribution. At each phase, there is potential for significant losses, which can adversely affect both the quantity and quality of crops before they reach the market. Addressing these challenges through innovative practices and technologies is crucial for maximising crop value and ensuring food security.

Measuring post-harvest losses is vital for assessing agricultural practices and enhancing food security. These losses, occurring between harvest and consumption, affect crop yield and quality. Quantifying losses at various stages helps identify their sources and implement effective interventions.

The extent of post-harvest losses can vary widely depending on the type of crop, the stage of the post-harvest process, and the environmental and economic conditions. For instance, losses can occur during harvesting, threshing, winnowing, drying, and storage. Each of these stages presents unique challenges and opportunities for loss reduction. To effectively address these losses, it is necessary to measure and analyze the extent of loss at each stage for different crops.

This research paper aims to analyze post-harvest losses in pigeon pea and gram within Buldhana district by investigating losses across various stages, including harvesting, threshing, winnowing, drying and storage. The study, which involves surveying 90 farmers for each crop, seeks to quantify these losses and explore how socio-economic factors such as age, education, and farm size influence post-harvest practices. By utilizing both tabular and functional analyses, the research identifies critical stages of loss and the factors contributing to these inefficiencies. The specific objectives of the present study were:

1. To measure the extent of post-harvest losses in selected crops at different stages.
2. To study the factors affecting post-harvest losses at farm level.

Methodology

Selection of study area and farmer

The present study was undertaken in the Buldhana district of the Vidarbha region. Out of the district's thirteen tehsils, Jalgaon (jamod) and Sangrampur were purposively selected. From each tehsil 03 villages were selected randomly and from each village 15 farmers were selected randomly. So, for this study total 90 farmers were selected.

Collection of data

The present investigation was based on the primary data. The selected farmers were personally interviewed and required data collected from them for the year 2023-2024 through a well prepared and pre designed questionnaire.

Analytical tools and techniques

Averages and percentages were used to compute the post-harvest losses at different stages. Information about post-harvest losses was obtained from the farmers during following operations: (i) harvesting, (ii) threshing, (iii) cleaning/ winnowing, and (iv) drying (v) storage. The total post-harvest losses were estimated as a sum of all these losses. Functional analysis was carried out to examine the factors affecting post-harvest losses at farm in pigeon pea and gram.

The following multiple linear regression function was specified in the present study:

$$Y=\beta_0+\beta_1X_1+\beta_2X_2+\beta_3X_3+\beta_4X_4+\beta_5X_5$$

Where:

Y = Post-harvest losses of pigeon pea/gram at farm level in quintals per ha

X_1 = Age of the respondents in years

X_2 = Education of the respondents in years

X_3 = productivity of pigeon pea/gram in quintals/ha

X_4 = Area under pigeon pea/gram (ha)

X_5 = Area under irrigation (ha)

Results and Discussion

Estimated Post-harvest losses in pigeon pea and gram

The survey data revealed that average size of farm holding was 2.9 ha. These sample farmers obtained an average yield of 16.75 qtl/ha of pigeon pea and 21.33 qtl/ha of gram. A majority of farmers (70.00%) belonged to middle age group of 35-50 years. The proportion of illiterate farmers in the sample was 4.45 per cent. The cropping intensity of farmers selected was found to be 148.57%.

Post-harvest losses at different stages

The estimated post-harvest losses per quintal of food grains produced or handled at different stages were presented in table no.1 as follows: 2.73 kg/qtl in pigeon pea and 2.63 kg/qtl in gram at the farm level. The greatest losses occurred due to faulty harvesting, amounting to 0.75 kg/qtl in pigeon pea and 0.79 kg/qtl in gram, primarily due to the shedding of grains. The extent of these losses depended on the crop stage and time of harvesting. During threshing, the losses were estimated at 0.68 kg/qtl for pigeon pea and 0.60 kg/qtl for gram, primarily consisting of broken grains. Losses were somewhat higher with machine threshing compared to manual methods, and the use of power threshers resulted in even greater losses. Despite this, most producers favoured power threshers due to their significant cost and time savings.

Table 1: Post-harvest losses at different stages in pigeon pea and gram:

Stages	Pigeon Pea		Gram	
	Loss(kg/qtl)	Loss (%)	Loss(kg/qtl)	Loss (%)
Harvesting	0.75	27.37	0.79	29.97
Threshing	0.68	25.13	0.60	22.88
Cleaning	0.32	11.60	0.28	10.52
Drying	0.36	13.22	0.26	9.90
Storage	0.62	22.68	0.70	26.71
Total	2.73	100.00	2.63	100.00

The average loss during drying was found to be 0.36 kg/qtl for pigeon pea and 0.26 kg/qtl for gram. These losses were primarily attributed to traditional drying methods used by farmers, which may be less efficient and result in prolonged exposure to conditions that can degrade the grains. During winnowing/cleaning, the losses were 0.32 kg/qtl for pigeon pea and 0.28 kg/qtl for gram. Winnowing losses were mainly due to traditional methods, which might not effectively separate grain from chaff and can lead to higher grain loss. Additionally, these methods can be less precise, resulting in increased grain loss during the process.

The losses during storage were found to be 0.62 kg/qtl for pigeon pea and 0.70 kg/qtl for gram. These storage losses were largely driven by several key factors. The absence of dedicated storage buildings often resulted in inadequate protection of the produce. Additionally, poorly constructed or maintained storage structures contributed to increased losses. The presence of rodents, insects, and damp conditions further exacerbated the problem, while improper drainage at storage sites allowed excess moisture to accumulate, promoting spoilage. Addressing these issues through improved infrastructure, effective pest control, and proper moisture management is essential for reducing storage losses.

Factors affecting post-harvest losses at farm level

To study the factors affecting post-harvest losses at the farm level, multiple linear regression function of the form $Y=\beta0+\beta1x1+\beta2x2+\beta3x3+\beta4x4+\beta5x5$ was run by taking post-harvest losses as the dependent variable (Y) and age (X1), education (X2), productivity (X3), area under crop (X4), area under irrigation (X5), as the independent variables. For estimating regression coefficients, the regression model was fitted to cross sectional data obtained from 90 farmers for the agricultural year 2023-2024.The results of multiple linear regression estimates indicating relationship of the selected variables with the post- harvest losses on the selected farms in Buldhana district for the year 2023-2024 are presented in the table 2.

The regression model demonstrated that the variations in five independent variables explained approximately 53 percent of the total post-harvest losses in pigeon pea and 61 percent in the case of gram. This indicates that the selected variables had a substantial impact on the extent of post-harvest losses for both crops. The regression coefficients for all variables, with the exception of age and education, were positive, consistent with the initial hypotheses of the model. This suggests that most of the independent variables positively contributed to the increase in post-harvest losses. However, a negative relationship was observed between age and education and the dependent variable, indicating that as farmers became older and more educated, the total post-harvest losses tended to decrease.

Table 2: Factors affecting post-harvest losses in pigeon pea and gram at farm level:

S. N.	Explanatory variables	Pigeon pea	Gram
1	Intercept	0.6456 (0.2587)	0.5692 (0.2645)
2	Age of farmer	-0.0118** (0.0040)	-0.0110* (0.0043)
3	Education of farmer	-0.0256* (0.0121)	-0.0291* (0.0126)
4	productivity of the crop	0.0162* (0.0065)	0.0081** (0.0022)
5	Area under crop	0.2237** (0.0686)	0.3228** (0.127)
6	Area under irrigation	0.0265 (0.0450)	0.0351 (0.0913)
7	R^2	0.53	0.61

Note: Figures within the parentheses are standard errors of coefficients
** Level of significance $p<0.01$
* Level of significance $p<0.05$

The findings also revealed that crop productivity and the area under cultivation had a positive and significant influence on post-harvest losses. This suggests that higher productivity and larger areas under cultivation were associated with greater losses, possibly due to the increased volume of produce being harder to manage and store efficiently. Conversely, the negative and significant association between post-harvest losses and the age and education of farmers highlights the importance of experience and knowledge in reducing these losses. Older and more educated farmers may have better access to resources, improved techniques, and awareness of proper post-harvest management practices, leading to more efficient handling of crops and reduced losses. These results emphasize the need to focus on improving the management skills of younger and less-educated farmers to mitigate post-harvest losses.

Conclusion

Estimating post-harvest losses and identifying the problems faced by farmers are crucial for pinpointing the underlying causes and developing effective strategies to mitigate these losses. Understanding these factors helps in implementing targeted measures to address issues and improve overall efficiency in the agricultural supply chain. The study has estimated post-harvest losses in two major food grains, *viz*. pigeon pea and gram. It has been found that the majority of total post-harvest losses occur during harvesting followed by storage. The post-harvest losses at the farm level have been estimated to be 2.73 kg/qtl for pigeon pea and 2.63 kg/qtl for gram. The functional analysis has revealed that post-harvest losses were positively and significantly affecting by productivity of crop and area under crop. The post-harvest losses were negatively and significantly associated with age and education of the farmers. Training and educating farmers on post-harvest practices can substantially reduce food grain losses.

Implication and policy implementations

The economic analysis of post-harvest losses in pigeon pea and gram in Buldhana District reveals important implications for the agricultural sector. It underscores how significant losses during post-harvest handling can adversely affect farmers' financial stability, reducing their income and overall profitability. These losses highlight inefficiencies in the post-harvest process, leading to diminished crop quality and lower productivity. Moreover, the reduced availability of these key crops due to post-harvest losses can contribute to food insecurity. Addressing these challenges is essential for improving the efficiency of agricultural practices, enhancing farmer income, and ensuring a more reliable food supply in the district.

To effectively address post-harvest losses in pigeon pea and gram in Buldhana District, several key policy measures should be adopted. Begin by focusing on improving harvesting techniques through targeted training programs for farmers to ensure optimal practices and reduce losses at this initial stage. Invest in the development of modern storage facilities and enhance transportation infrastructure to minimize losses during handling and movement. Encourage the adoption of advanced technologies for drying and cleaning to prevent spoilage. Additionally, promote research into crop varieties that are more resilient to post-harvest challenges and support the implementation of innovative processing methods. Finally, provide financial support and incentives for farmers to upgrade their technology and infrastructure. These policies collectively aim to enhance the efficiency of post-harvest operations, boost farmer profitability, and strengthen food security in the region.

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