Evaluation on post-harvest losses of paddy in Tiruvallur district – A study of Statistical approach

ABSTRACT

Aims: To study the factors contributing post-harvest losses in rice, because rice is a staple food crop consumed in worldwide. Selective post-harvest factors are considered will be made possible by a thorough understanding post-harvest losses. So, it will soon be possible to profile the post-harvest losses in paddy. In the current study, the post-harvest management of 30 farmers was considered using 10 quantitative characters.
Study design: Primary data has been collected through questionaries.
Place and Duration of Study: Kadambathur, Thirutani, Tiruvallur blocks of Tiruvallur district, Tamil Nadu, India. Between February 2023 to March 2023.
Methodology: The descriptive statistical analysis, correlation analysis was carried out for each of the 10 factors. Using Factor analysis, the proportion of each factor contribution to overall post-harvest losses was found. Path analysis has been used to study the direct and indirect effect between them.
Results: Correlation revealed the connection Threshing and drying and packing and storing(final output) were considerably quite favourable and significant. The Scree plot of the variables gives that the first two Principal components (PC), which have eigenvalues greater than one, collectively explained about 70 % of the total variation. By Biplot. Farmer_09, Farmer_20, Farmer_16, Farmer_20 present in upper quadrant show higher value of initial losses, Parboiling, milling. And winnowing. Parboiling has considerably show longer dispersion. By Path analysis, highest positive direct effect is observed in parboiling (0.6078908), followed by polishing (0.4977), initial losses (0.4039), winnowing (0.137) and highest negative direct effect is observed in milling (-04507)
Conclusion: From the above study it is conclude that initial losses (i.e losses during harvest), milling, parboiling and polishing are major contribution of post-harvest management. Hence When the crop is harvested on schedule and at the ideal moisture level (20 to 22%), it should be processed correctly, which includes cleaning, parboiling, and milling.

Keywords: Pearson coefficient; biplot; scree plot; path analysis.

1. INTRODUCTON

Rice as a staple food, primarily in Asia. In some nations the food consumed is made up of rice. It is typically eaten with cooked pulses, vegetables, fish, or meat after being boiled in boiling water. In three rice growing seasons, postharvest losses from harvest to drying were on average 10%. Mechanical threshing caused losses of 3.16% and conventional sun drying caused losses of 3.14%, respectively. When compared to shoulder and head carrying techniques, a power tiller-driven trolley demonstrated the least amount of carrying loss[1]. In India, rice is used to make a variety of cuisines that are flavoured with herbs, spices, and other ingredients. Other rice dishes include fermented dishes, puffed rice, and parched dishes. By Indian scenario, about 10% of the foodgrains produced in India are thought to be lost during processing and storage. According to reports, 9% of paddy is wasted during drying, milling, storage, transport, and handling because of antiquated, poor, and unreliable processes. At the producer level, the post-harvest losses for paddy were calculated to be 2.71 percent of total production. In Tamil Nadu, there are roughly 58.43 lakh hectares of gross cropped land, of which 33.09 lakh hectares, or 57%, are irrigated. The remaining 43% of the land is used for rainfed agriculture. About 2.8 tonnes per hectare are produced on average across the state. It is believed that 20-30% of the rice grain produced is lost throughout the post-production procedures, which include harvesting and milling.The term post-harvest losses in rice production means any decrease in the amount of edible rice grain owing to a decrease in availability, edibility, wholesomeness, or quality that precludes people from consuming the rice grains is referred to as post-harvest losses in the production of rice. Every stage of rice production, from harvesting to consumption, results in rice grain loss. Both on- and off-farm levels of rice cultivation experience post-harvest or post-production losses. Between the time of harvest and the point of human consumption. They consist of losses that occur on the farm, like those that occur when grain is threshed, winnowed, and dried, as well as losses that occur throughout the chain during shipping, storage, and processing. Rice grain's decreased moisture content and the removal of undesirable components like husk and bran during milling are not regarded as post-harvest losses as stated. Loss is a difficult concept to define. If losses are calculated using the crop's initial weight, it may result in an overestimation of losses. However, there are other losses that are harder to quantify. These losses include those related to time, human labour, agricultural inputs, and opportunity cost. Please incorporate statistical importance of path analysis in the above mentioned studies with suggestive references.

In order to estimate post-harvest losses, the losses occurring during harvest, threshing, winnowing, transportations, handling and storage, assessment quantitative aspects of storage and suggestions of the relating to reduce the post-harvest losses of paddy crop. An adoption is made to identify the factors that contribute post-harvest losses

2. MATERIALS AND METHODS

Primary data has been collected from 30 farmers through interview schedule, at 3 stages i.e., farm level, intermediate or wholesaler and rice mill in Tiruvallur district. It includes three blocks i.e., Kadambathur, Thiruvalangadu and Tiruvallur. The interview schedule includes the socio-economic factors, cost of cultivation and quantity losses at each stage and also gathered where these farmers lack on post-harvest management.

For the analysis, quantity losses at each stage is taken viz., losses during initial, threshing, drying, winnowing, packing and loading, storage, grading, parboiling, milling, polishing, packing and storage. To each factor descriptive statistical analysis, correlation, analysis was performed. For analysis Factor analysis has been carried out. To analyse the direct and indirect effect path analysis has been carried out. The RStudio, version 4.3.0, was used to carry out these analyses.

3. RESULT AND DISCUSSION

3.1. **Descriptive statistics** (mention specifically what types of descriptive statistical analysis, little bit detail about pathway analysis)

The different factors among the farmers were revealed by the descriptive statistics for eleven quantitative features given above table, which opens the door for improvement through descriptive statistics. The coefficient of variation (CV) for milling (130.27%), polishing (118.36%), initial losses (98.26%) were all rather high, indicating vulnerability to environmental fluctuation impacting their expression to some extent.

3.2. Correlation

11 factors were considered for post-harvest losses of 30 farmers, and their correlation coefficients are shown in above Table with significant values. Threshing and drying and packing and storing(final output) were considerably and while threshing and winnowing were significantly and adversely connected. These results demonstrate that these characteristics have a connection with one another and with grain yield. Because of this, selection for any of these post-harvest loss-causing factors will eventually lead to an increase in all of the other factors. The results of this study were in agreement with those of[2] and[3].

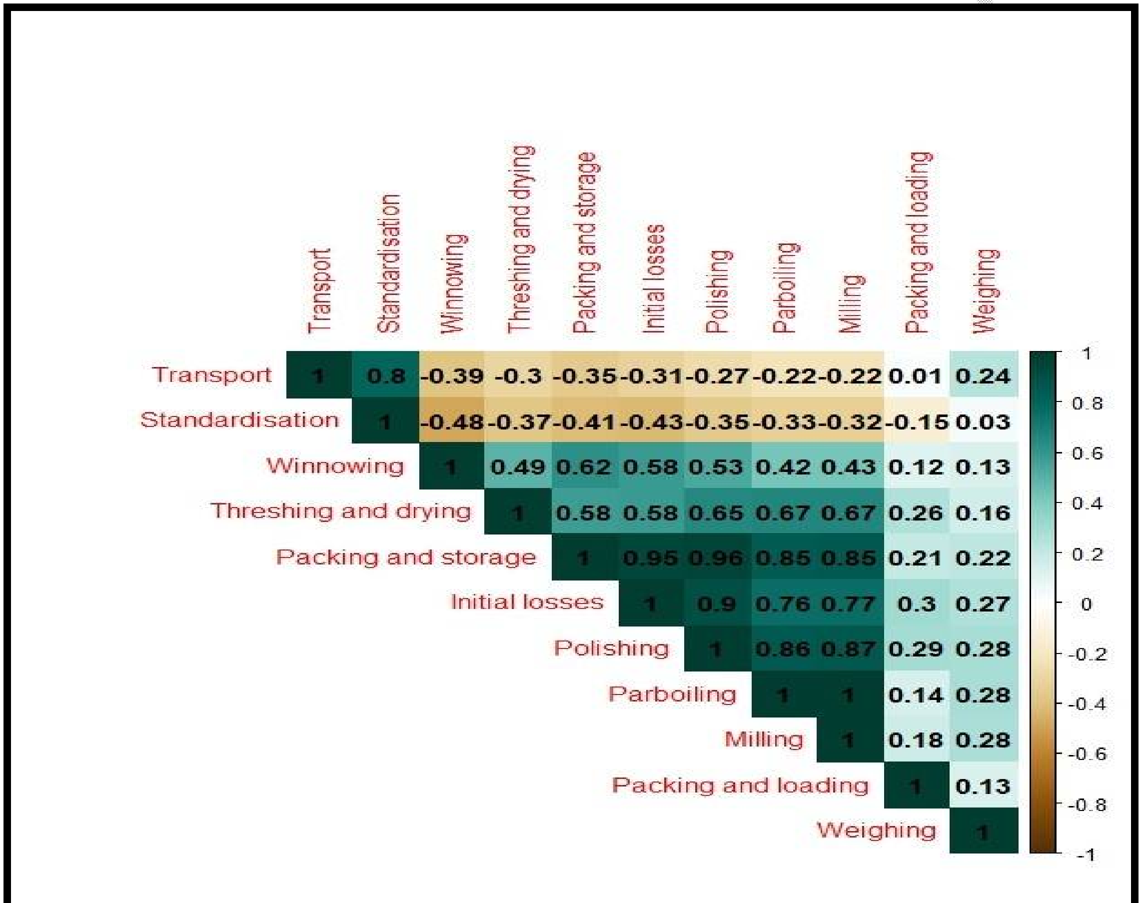

Fig. 1. Correlation between post-harvest management factors

3.3. Path analysis

Path analysis is a methodology holds strength because it enables researchers to investigate both direct and indirect effects while using a variety of independent and dependent variables. When an independent variable has an impact on a dependent variable, this is called a direct effect. When a dependent variable is impacted by an independent variable through a mediating variable, this is known as an indirect effect[4]. From the table, highest positive direct effect is observed in parboiling (0.6078908), followed by polishing (0.4977), initial losses (0.4039), winnowing (0.137) and highest negative direct effect is observed in milling (-04507), followed by threshing (-0.1366). Highest positive indirect effect is observed in milling and parboiling (0.60), highest negative indirect effect is observed in milling and initial losses (-0.34). residual effect was 0.04, which indicates that environmental effect was less effect on post-harvest losses.

Table 1. Descriptive statistics of factors in post-harvest Management

	Initial losses	Threshing and drying	Winnowing	Packing and loading	Transport	Standardisation	Weighing	Parboiling	Milling	Polishing	Packing and storage
minimum	60	15	50	10	0	0	25	33	540	115	1151
maximum	2200	800	1300	200	50	70	180	1506	25103	3905	54701
range	2140	785	1250	190	50	70	155	1473	24563	3790	53550
mean	530.3333	310.4	371.5	54.6333	17.4667	18.9667	88.4333	277.5567	4594.333	852.8333	11635.5333
SD	521.1343	221.0827	297.4088	49.5424	14.2726	16.8246	39.2496	365.6507	5985.038	1009.416	14224.5539
CV	98.2654	71.2251	80.0562	90.6816	81.7131	88.7063	44.3832	131.7391	130.27	118.3603	122.251

Table 2. Direct (Diagonal) and indirect effect path coefficients inpost harvest management

	Initial losses	Threshing and drying	Winnowing	Packing and loading	Transport	Standardisation	Weighing	Parboiling	Milling	Polishing
Initial losses	0.4039186	-0.080639	0.0810766	-0.0093792	0.045921	-0.0427801	-0.01103	0.461997	-0.34706	0.447971
Threshing and drying	0.238312	-0.1366763	0.0700832	-0.0077044	0.047312	-0.0407903	-0.00827	0.401208	-0.30199	0.328512
Winnowing	0.238312	-0.0697049	0.137418	-0.0030148	0.055662	-0.0477545	-0.00669	0.255314	-0.19832	0.268782
Packing and loading	0.1130972	-0.0314355	0.0123676	-0.0334973	-0.01392	-0.0039795	-0.00394	0.079026	-0.07212	0.134391
Transport	-0.1332931	0.0464699	-0.0549672	-0.0033497	-0.13915	0.0875499	-0.00236	-0.13374	0.117189	-0.14435
Standardisation	-0.173685	0.0560373	-0.0659606	0.0013399	-0.12246	0.0994885	0.003544	-0.18237	0.153247	-0.17919
Weighing	0.1130972	-0.028702	0.0233611	-0.0033497	-0.00835	-0.008954	-0.03938	0.164131	-0.1262	0.144346
Parboiling	0.3069781	-0.0902064	0.0577156	-0.0043547	0.030614	-0.0298466	-0.01063	0.607891	-0.44622	0.428061
Milling	0.3110173	-0.0915731	0.0604639	-0.0053596	0.03618	-0.0338261	-0.01103	0.601812	-0.45073	0.433038
Polishing	0.3635267	-0.0902064	0.0742057	-0.0090443	0.040355	-0.0358159	-0.01142	0.522786	-0.39213	0.497745

3.4. Factor Analysis

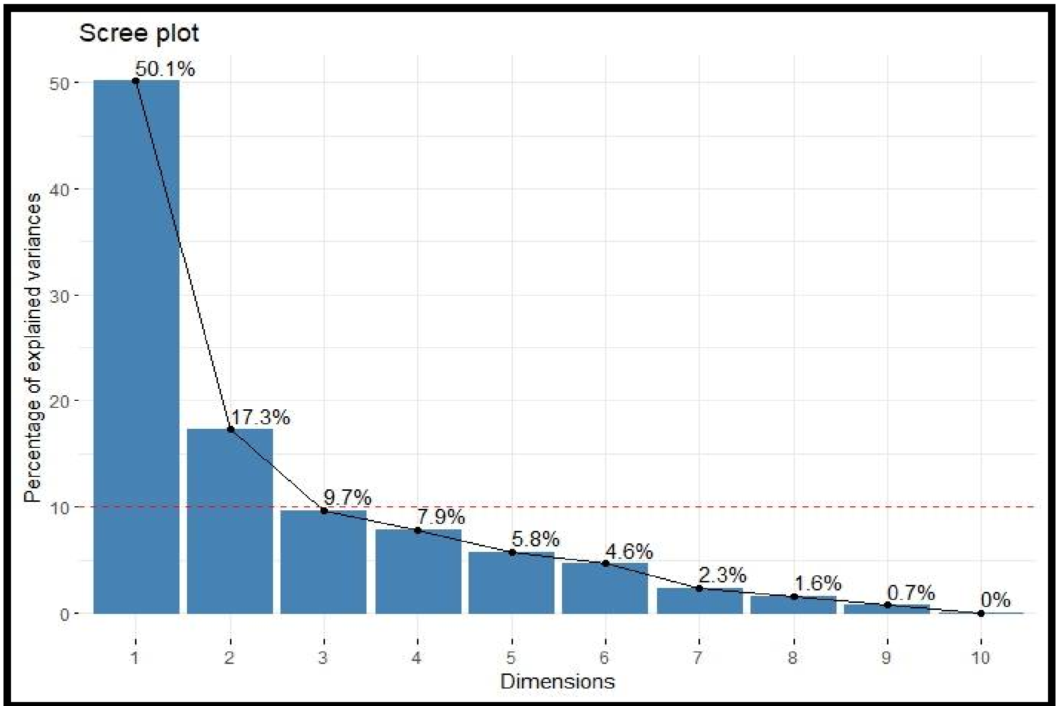

Fig. 2. Scree plot on ten post-harvest management factors

Table 3. Standardized loadings (pattern matrix) based upon correlation matrix of 10 factors in post-harvest management

Factors	ML1	ML3	ML2	Max variance explained	Max variance explained	com
Initial losses	0.46	0.82	-0.17	0.908	0.0923	1.7
Threshing and drying	0.6	0.27	-0.2	0.468	0.5323	1.6
Winnowing	0.19	0.56	-0.3	0.447	0.5525	1.8
Packing and loading	0.08	0.23	0.05	0.061	0.9387	1.3
Transport	0.12	0.12	0.98	0.995	0.005	1.1
Standardisation	0.22	0.18	0.77	0.671	0.3291	1.3
Weighing	0.25	0.18	0.3	0.182	0.8177	2.6
Parboiling	0.91	0.4	0.07	0.996	0.0042	1.4
Milling	0.91	0.41	0.07	0.996	0.0042	1.4
Polishing	0.61	0.74	0.11	0.929	0.0714	2

ML-maximum likelihood

To examine the relationships between the explanatory variables, factor analysis was performed. The eigenvalue of each component had to be equal to or greater than one as the condition for the number of factors to be extracted. After that, the varimax algorithm rotated the extracted factors. The most correlated factor was chosen to represent each of the claims [5]. Since ML accounted for ML1 is accounted for 28 of variance this is equivalence of Threshing, Parboiling, Milling, ML2 is accounted for 25%which is equivalence of Transport, Standaization, Weighing, Polishing and ML3 is accounted for 17% is equivalence of winnowing and packing. The maximum variance explained by initial losses, packing and loading parboiling, milling and polishing.The farmers with quantitative variable that could be explained by the biplot. As a result, a farmers may easily estimate the gap in post-harvest management condensed into the two main factor analysis and assessed simultaneously. Jain also employed biplot analysis to estimate the dispersion in farmers; in this case, a high level of dispersion was seen since the genotypes stayed dispersed across the four quadrants according to [3]. The post-harvest management factor's arrow direction and location could be used to predict how well a farmers performed for any post-harvest management. Farmer_09, Farmer_20, Farmer_16, Farmer_20 present in upper quadrant show higher value of initial losses, Parboiling, milling. And winnowing. Parboiling has considerably show longer dispersion. Packing and loading shows lesser dispersion. The results illustrate that factor analysis can be useful in assessing factor contributing post-harvest management and able to highlight important features that accounted for the greatest variability[6].

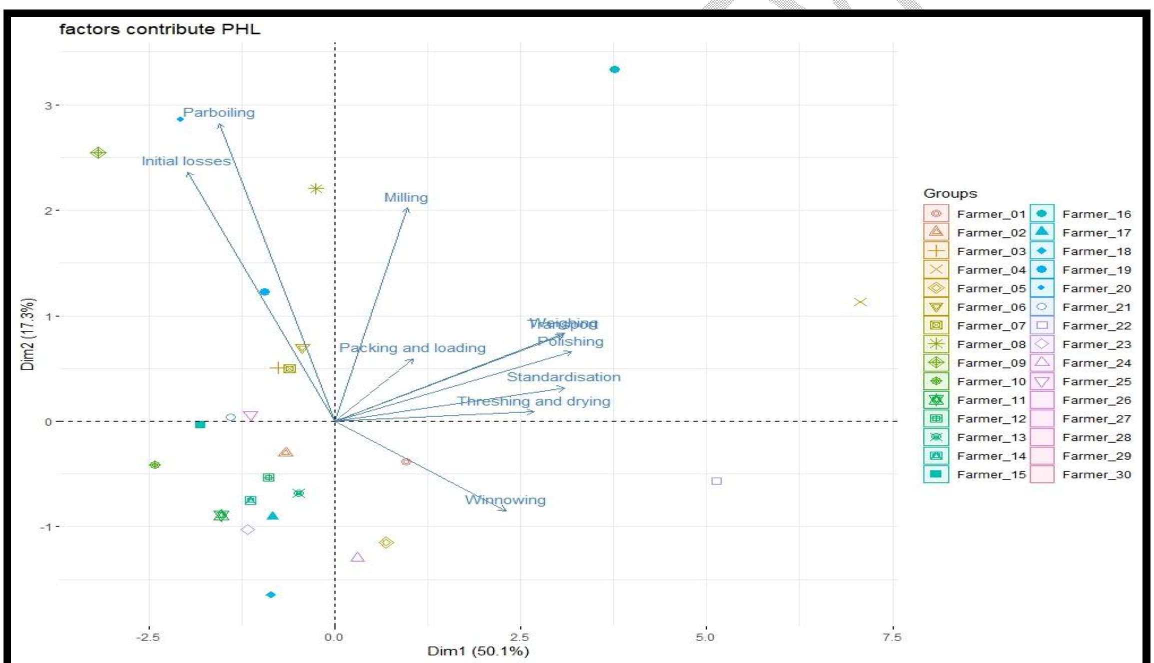

Fig. 3. Biplot of various farmers based on ten quantitative post-harvest management factors

4. Conclusion

This study provides evidence that quantitative factors that contribute post-harvest losses from harvest to final output. Studies of correlation clearly demonstrated that variables such as threshing & drying and packing and storing(final output) were considerably and, while threshing and winnowing were significantly and adversely connected. Factor analysis suggested that Scree plot of the variables in the current study, reveals that the first two Eigenvectors, which have eigenvalues greater than one, collectively explained about 69.37% of the total variation among the 10 quantitative characters in 30 farmers. Since PC1 accounted for 50.09 percent of the variances, its eigenvalue is 5.009 This is the equivalent of four different variables, namely initial losses, milling, polishing, and parboiling. Biplot suggested that Farmer_09, Farmer_20, Farmer_16, Farmer_20 present in upper quadrant show higher value of initial losses, Parboiling, milling and winnowing. Parboiling has considerably show longer dispersion. Packing and loading shows lesser dispersion. Path analysis suggested that direct effect highly seen in parboiling, polishing. negative direct effect is observed in milling, followed by threshing. Highest positive indirect effect is observed in milling and parboiling, highest negative indirect effect is observed in milling and initial losses. From the above study it is conclude that initial losses (i.e losses during harvest), milling, parboiling and polishing are major contribution of post-harvest management. Hence When the crop is harvested on schedule and at the ideal moisture level (20 to 22%), it should be processed correctly, which includes cleaning, parboiling, and milling. Additionally, losses in threshing and winnowing can be reduced by using more effective mechanical techniques. Losses at the field and market level can be reduced by proper handling (loading and unloading) of paddy and using efficient transportation methods.

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