

Economic Analysis of Post-Harvest Losses of Chickpea in Prakasam District of Andhra Pradesh.

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ABSTRACT

The post-harvest losses have been estimated at different stages in chickpea in prakasam district of Andhra Pradesh using the survey data collected from 80 farmers, 20 wholesalers and 20 retailers during 2016-17. Tabular analysis has been used to estimate the post-harvest losses at different stages, and multiple linear regression has been used to assess the influence of socio-economic factors on postharvest losses at the farm level. The postharvest losses at the farm level have been estimated to be 7.26 kg / q. The losses have been highest during harvesting. Weather, transportation and timely labour availability were the factors that influenced the post-harvest losses significantly at the farm level. Major constraints in post harvest management of chickpea were identified and some policy implications have been highlighted.

Key Words: Chickpea, Farm level, Post harvest losses, Storage

Agricultural commodities produced on the farm have to undergo a series of operations such as harvesting, drying, threshing, bagging, transportation, storage, processing and exchange before they reach the consumer, and there are appreciable losses in crop output at all these stages. A recent estimate by the Ministry of Food and Civil Supplies, Government of India, puts the total preventable post-harvest losses of food grains at 10 per cent of the total production or about 20 MT, which is equivalent to the total food grains produced in Australia annually. In a country where 20 per cent of the population is undernourished, post-harvest losses of 20 MT annually is a substantial avoidable waste. According to a World Bank study (1999), post-harvest losses of food grains in India are 7-10 per cent of the total production from farm to market level and 4-5 per cent at market and distribution levels. For the system as a whole, such losses have been worked out to be 11-15 Mt of food grains annually. Chickpea losses in India were around 8.41 per cent. In all India study, post harvest losses occur relatively higher during harvesting/threshing and other farm operations (> 7%). Loss during storage is relatively lower (< 1.5%) with an average per capita consumption of about 15 kg of food grains per month, these losses would be enough to feed about 70-100 million people, i.e. about 1/3rd of India's poor or the entire population of the states of the Bihar and Haryana together for about one year. Thus, the post-harvest losses have impact at both the micro and macro levels of the economy.

Chickpea is the premier food legume crop in India, covering about 8.251 Mha with a production of 8.092 M tonnes and productivity of 8.89 q/ha. India is the largest chickpea producing country with a share of

70 per cent in world production. Chickpea occupies about 38 per cent of area under pulses and contributes about 50 per cent of the total pulse production in India. Chickpea is an important pulse crop of Andhra Pradesh and grown in 472 thousand hectares of land, producing 514 thousand tonnes with a productivity of 11.43q/ha. In Prakasam district of Andhra Pradesh, chickpea was grown in an area of 88815.84 hectares with a production of 87905.83 tonnes. (www.indiastat.com. 2016).

The study on post-harvest losses in chickpea at different stages of their handling would help to assess the extent of loss and identify the factors responsible for such loss. This in turn would help develop proper measures to reduce these losses. Evolving correct policies for minimizing post-harvest losses would depend on reliable and objective estimates of such losses at different stages. This information is important for scientists, technologists, policymakers, administrators and industrialists. The specific objectives of the present study were:

- i. to measure the extent of post-harvest losses in food grains at different stages.
- ii. to study the factors affecting post-harvest losses at different stages.
- iii. to identify the constraints in minimizing post harvest losses in chickpea.

MATERIAL AND METHODS

The primary data has been collected from the survey of sample cultivators, wholesalers and retailers through personal interview with the help of pre-tested and structured schedules. The data collection from the farmer and respondent included general information about the total holding, cultivation of chickpea, labour and input used for production, total production of crop,

methods of harvesting and drying, place of drying, storage system, mode of transportation, losses during post-harvest operations and sale price. A separate schedule was developed and used for eliciting information from market intermediaries who deal in chickpea. This included information on quantity purchased, mode of transport, storage, and purchase and quantity sold.

Sampling

A multi-stage sampling design was adopted for the selection of chickpea growing farmers. The Prakasam district of Andhra Pradesh with a chickpea area of 88815.84 ha (18.81 %), out of the total chickpea area of 472000 ha in the state. Hence, this district was selected for choosing chickpea growing cultivators in the preliminary stage of sampling. In the second stage, four mandals were chosen from the selected district and then four villages predominantly growing chickpea were chosen from each of the selected mandals. Finally, five chickpea growing farmers in each village were randomly interviewed. In all, 80 cultivators growing chickpea in prakasam district were selected at the rate of 20 farmers from each mandal. From the selected district, 20 wholesalers and 20 retailers dealing with chickpea were also interviewed for eliciting information on post-harvest losses.

Analytical Techniques

To quantify the post harvest losses and to identify constraints in minimising post harvest losses, general tabular analysis was used. Information about post-harvest losses was obtained from the farmers during following operations: (i) harvesting, (ii) threshing, (iii) cleaning/winnowing, and (iv) drying.

The information on following losses was collected from the farmers as well as market intermediaries: (i) storage, and (ii) transit. The total post harvest losses of prakasam district were estimated as a sum of all these losses.

The following procedure was specified in the present study:

$$Y_i = \frac{B_i}{b_i} \sum_{b=1}^{b_i} \frac{V_{ib}}{v_{ib}} \sum_{v=1}^{v_{ib}} \frac{F_{ibv}}{f_{ibv}} \sum_{f=1}^{f_{ibv}} Y_{ibvf}$$

Where,

Y_i = Estimate of quantity handled for a particular farm operation of the crop in i^{th} district.

B_i = Total number of mandals in i^{th} district.

b_i = Number of selected mandals in i^{th} district.

V_{ib} = Total number of villages in b^{th} selected mandal of i^{th} district.

v_{ib} = Number of selected villages in b^{th} selected mandal of i^{th} district of farm operation.

F_{ibv} = Total number of farmers growing a particular crop in v^{th} selected village of b^{th} selected mandal from i^{th} district.

f_{ibv} = Number of selected farmers growing a crop in v^{th} selected village of b^{th} selected mandal from i^{th} district.

Y_{ibvf} = quantity handled for a farm operation of a crop by the f^{th} selected farmer in v^{th} selected village of b^{th} selected mandal of i^{th} district.

$$\delta_i = \frac{B_i}{b_i} \sum_{b=1}^{b_i} \frac{V_{ib}}{v_{ib}} \sum_{v=1}^{v_{ib}} \frac{F_{ibv}}{f_{ibv}} \sum_{f=1}^{f_{ibv}} \delta_{ibvf}$$

Where,

δ_i = Estimate of quantity lost for a particular farm operation of the crop in i^{th} district.

B_i = Total number of mandals in i^{th} district.

b_i = Number of selected mandals in i^{th} district.

V_{ib} = Total number of villages in b^{th} selected mandal of i^{th} district.

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f_{ibv} = Number of selected farmers growing a crop in v^{th} selected village of b^{th} selected mandal from i^{th} district.

Y_{ibvf} = quantity of crop lost at a particular farm operation by the f^{th} selected farmer in v^{th} selected village of b^{th} selected mandal of i^{th} district.

$$V(L_i) = \left(\frac{\delta_i}{Y_i} \times 100 \right)^2 \left(\frac{V(\delta_i)}{(\delta_i)^2} + \frac{V(Y_i)}{(Y_i)^2} \right)$$

in which the estimate of variance of δ_i and Y_i were obtained using the following expressions:

$$V(\delta_i) = \frac{1}{b_i(b_i-1)} \sum_{b=1}^{b_i} (\delta_{ib} - \bar{x}_i)^2$$

Where,

$$\delta_{ib} = \frac{V_{ib}}{v_{ib}} \sum_{v=1}^{v_{ib}} \frac{F_{ibv}}{f_{ibv}} \sum_{f=1}^{f_{ibv}} \delta_{ibvf}$$

$$x_i = \frac{1}{b_i} \sum_{b=1}^{b_i} \delta_{ib}$$

$$V(Y_i) = \frac{1}{b_i(b_i-1)} \sum_{b=1}^{b_i} (Y_{ib} - \bar{y}_i)^2$$

Where,

$$Y_{ib} = \frac{V_{ib}}{v_{ib}} \sum_{v=1}^{v_{ib}} \frac{F_{ibv}}{f_{ibv}} \sum_{f=1}^{f_{ibv}} Y_{ibvf}$$

$$y_i = \frac{1}{b_i} \sum_{b=1}^{b_i} Y_{ib}$$

where \bar{x}_i and \bar{y}_i are the means of the variable for the i_{th} district and δ_{ib} and Y_{ib} are the estimates of quantity lost and quantity handled for b_{th} mandal in i_{th} district.

Table 1. Estimated post-harvest losses at farm level in chickpea

Particulars	Quantity lost with respect to total production (qt)	Quantity lost per quintal (kg)	Loss with respect to total post harvest losses (per cent)	Economic loss per quintal (@ Rs. 6000/q)
Harvesting loss	551.45	3.56	49.49	213.00
Drying loss	292.50	1.89	26.02	113.40
Threshing loss	131.25	0.85	11.73	51.00
Storage loss	94.70	0.62	8.16	37.20
Marketing loss	52.95	0.34	4.60	20.40
Total post harvest losses	1122.85	7.26	100.00	435.60

Table 2. Post harvest losses at district level in Prakasam district of Andhra Pradesh

Particulars	Quantity lost (qt)	Loss with respect to total post harvest losses (per cent)	Economic loss (Rs in Crores)
Harvesting loss	351442.35	47.73	210.87
Drying loss	193235.68	26.24	115.94
Threshing loss	87918.20	11.94	52.75
Storage loss	61070.31	8.29	36.64
Marketing loss	42633.99	5.79	25.58
Total post harvest losses	736300.53	100.00	441.78

Table 3. Factors affecting post-harvest losses in chickpea at farm level

S. No	Explanatory variable	Regression coefficient
1	Intercept	3.727
2	Age (X ₁)	-0.0183
3	Cultivated area in ha (X ₂)	0.053
4	Education (X ₃)	0.012
5	Production in quintal per ha (X ₄)	0.005
6	Weather (X ₅)	-0.967**
7	Transportation (X ₆)	-0.63**
8	Threshing machine (X ₇)	-0.156
9	Storage (X ₈)	-0.06
10	Timely labour (X ₉)	-0.633**
	Coefficient of multiple	0.446

Table 4. Factors affecting post-harvest losses in chickpea at intermediary's level

S.No	Explanatory variable	Regression coefficient
1	Intercept	1.055*
2	Age (X ₁)	-0.024*
3	Education (X ₂)	0.004
4	Experience (X ₃)	0.02
5	Quantity handled (X ₄)	0.003*
6	Time of storage (X ₅)	0.004**
7	Transportation (X ₆)	-0.645**
8	Storage (X ₇)	0.198
	Coefficient of determination	0.914

Note : Figures in parenthesis are the probability values

* and ** denote that the coefficients are significant at 5 per cent and 1 per cent respectively.

Functional analysis was carried out to examine the factors affecting post-harvest losses at farm level in chickpea, as used by Nag *et al.* (2000).

The following multiple linear regression function was used for the present study:

$$Y = a_0 + a_1X_1 + a_2X_2 + a_3X_3 + \dots + a_{10}X_{10} + e$$

Where,

Y = Post-harvest losses of chickpea at farm level in quintals per ha

X₁ = Education of the respondents in years

X₂ = Total production of chickpea in quintals per ha

X₃ = Area under chickpea in (ha)

X₄ = Age of the respondent

X₅ = Weather dummy which takes the value '1' if the

Weather during harvesting was favourable and value '0' otherwise

X₆ = Transportation facility dummy which takes the value '1' if transport facility was adequate and value '0' otherwise

X₇ = Threshing machine availability dummy which takes the value '1' if availability of threshing machine and value '0' otherwise

X₈ = Storage facility dummy which takes the value '1' if Storage facility was adequate and value '0' otherwise.

X₉ = Timely labour availability dummy which takes the value '1' if labour available was adequate and value '0' otherwise.

e = Random-error

Factors affecting post-harvest losses at intermediary's level in chickpea,

Where,

$$Y = a_0 + a_1X_1 + a_2X_2 + a_3X_3 + \dots + a_7X_7 + e$$

Y = Post-harvest losses of chickpea at intermediaries level in quintals

X₁ = Education of the respondents in years

X₂ = Total quantity of chickpea retained in quintals

X₃ = Business experience in years

X₄ = Age of the respondent

X₅ = Time of storage in years.

X₆ = Transportation facility dummy which takes the value '1' if transport facility was adequate and value '0' otherwise

X₇ = Storage facility dummy which takes the value '1' if storage facility was adequate and value '0' otherwise.

RESULTS AND DISCUSSION

Most of the farmers in the selected area were medium farmers having average size of holding 7.14

ha. Average size of the family was three per household. There were more farmers (67.5%) in the age group 41 to 60 years in the study area. Most of the farmers (48.75) in selected sample had secondary education.

Estimation of Post-harvest Losses

Farm Level Losses

The post-harvest losses per quintal of chickpea produced or handled at different stages were estimated and presented in Table 1. These were estimated to be 7.26 kg/q in chickpea at farm level. These losses were maximum due to late harvesting (3.56 kg/q) in chickpea. The losses due to drying operation in grains were estimated to be 1.89 kg/q. These were mainly due to use of traditional methods of drying by the farmers, unfavorable weather, losses due to animals, rodents and birds. The grain losses during the threshing activity were estimated to be 0.85 kg/q in chickpea. The threshing losses were mainly in the form of broken grains, which were slightly higher, when the produce was threshed by machine as compared to manual threshing. However a majority of the producers preferred threshers due to their cost and time advantage.

The grain losses as a result of transportation and storage were estimated to be 0.62 kg/q. A majority of the producers used tractors to transport the produce to storage units. The losses were noticed during loading and unloading of produce during transportation.

Grain losses during transportation and marketing were estimated to be 0.34 kg/q in chickpea. Basavaraja *et al* (2007) has revealed the total post-harvest losses at farm level in food grains as 3.82 per cent of the total output.

On an average price of chickpea was taken as 6000 per quintal. Due to post harvest losses estimated economic loss was found to be Rs.435.6/q. Maximum loss was due to harvesting loss (Rs.213/q), followed by drying loss (Rs.113.4/q). Economic loss due to threshing, storage and marketing losses were Rs. 51/q, Rs.37.2/q and 20.4/q respectively.

Estimation of total Post-harvest losses in Prakasam district of Andhra Pradesh.

Total estimated quantity of commodity handled for farm operation in prakasam district was 1,00,16,106.98 quintals. Total estimated quantity of commodity lost in prakasam district was 7,36,300.53 quintals. The loss percentage obtained in prakasam district was 7.35%.

From the table 2 it is observed that losses were found maximum in harvesting (351442.35 q) i.e. 47.73 per cent of total post harvest losses followed by drying loss (193235.68 q) i.e. 26.24 per cent of total post harvest losses. Followed by threshing, storage and

marketing losses which were found to be 11.94, 8.29, 5.79 per cent of total post harvest losses respectively.

On an average price of chickpea was taken as 6000 per quintal. Due to post harvest losses estimated economic loss in prakasam district is found to be 441.78 Crores. Maximum loss was due to harvesting loss (210.87 Crores), followed by drying loss (115.94 Crores). Economic loss due to Threshing, storage and marketing losses were 52.75, 36.64 and 25.58 Crores respectively.

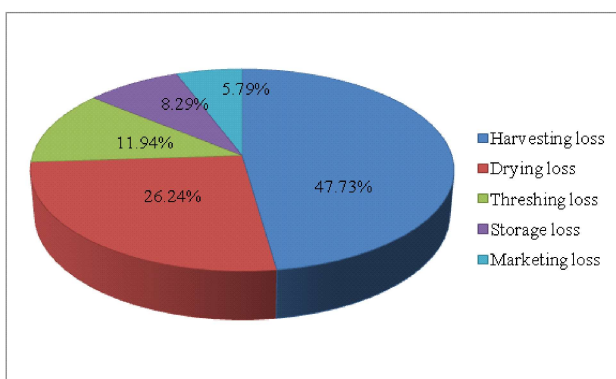


Figure 1. Post harvest losses at farm level in Prakasam district

Intermediaries' level

The total post-harvest losses at intermediary's level were 0.97 kg/q in chickpea. The storage losses in chickpea at intermediary's level were 0.32 kg/q. The other component of post-harvest losses at this stage was transit losses of 0.65 kg/q. The transit losses were more because of the use of unsuitable transport containers, negligent driving and rough roads.

Factors Affecting Post-harvest Losses at Farm Level

To study the influence of different socio-economic features of farmers on post-harvest losses at the farm level, a multiple linear regression analysis was carried out. The estimated regression coefficients are presented in Table 3. The variations in 9 independent variables included in the regression model explained nearly 44.6 per cent variations in the total post-harvest losses in chickpea. The intercept was 3.727 for farmers indicating that when all the variables were zero the expected mean value of Y_i was 3.727. At farm level, weather, transportation and timely labour were negatively significant at 1 per cent level of significance. If there was unfavourable weather, less transport facility and unavailability of timely labour post harvest losses increases which was indicated by negative sign of respective coefficient variable. Age, threshing machine and storage were negative but non-significant. Cultivated area in ha, education and production in quintal per ha were positive but non-significant.

Factors Affecting Post-harvest Losses at intermediary's Level

To study the influence of different socio-economic features of intermediaries on post-harvest losses, a multiple linear regression analysis was carried out. The estimated regression coefficients are presented in Table 4. The variations in 7 independent variables included in the regression model explained nearly 91.4 per cent variations in the total post-harvest losses in chickpea. The intercept of intermediaries was 1.055 indicating the mean value of Y_i was 1.055 when all variables were zero. At intermediary's level, age, quantity handled were negatively significant at 5 per cent level of significance. One unit increase in age resulted in 0.024 units decrease in post harvest losses. One unit increase in quantity handled resulted in 0.003 units increase in post harvest losses. Time of storage was positively significant at 1 per cent level of significance. One unit increase in time of storage resulted in 0.004 units increase in post harvest losses. Transportation was negatively significant at 1 per cent level of significance. Less transportation facility resulted in increase in post harvest losses. Education, experience and storage were positive but non-significant.

Constraints in minimizing post harvest losses

Late harvesting, unavailability of labour, threshing machine out of order, timely unavailability of machines, unavailability of proper sunlight at the time of drying and unavailability of right floor for drying are the major constraints faced by farmers in minimizing post harvest losses. Lack of own conveyance and defective packing at the time of transfer of material are the major constraints faced by the intermediaries in minimizing post harvest losses.

CONCLUSION

The study has estimated post-harvest losses in chickpea. It has been found that post-harvest losses were more at the farm level than post harvest losses at the intermediary level. The post-harvest losses at farm level have been observed as 7.26 kg/q in chickpea. This leads to an economic loss of Rs.435.6/q. Total estimated quantity of post harvest losses in prakasam district was 7,36,300.53 quintals. The loss percentage obtained in prakasam district was 7.35%. Economic loss of post harvest losses in prakasam district estimated to be 441.78 Crores. In prakasam district losses were found to be maximum in harvesting (351442.35 q) i.e. 47.73 per cent of total post harvest losses and economic loss found to be 210.87 Crores. In study area harvesting losses were maximum (3.56 kg/q) because of shattering of the grain i.e. due to delay in the harvesting. Economic loss found to be Rs. 213/q. The functional analysis has revealed that weather, transportation and timely labour

influence the post-harvest losses significantly at farm level while age, quantity handled, time of storage and transportation influence the post-harvest losses significantly at intermediary level. Educating and training the farmers on post-harvest operations would greatly help in reducing the post-harvest losses in food grains. Proper planning and management of short, medium and long duration varieties may result in minimum harvesting losses. It is suggested to harvest the chickpea at proper time of maturity. Due to unavailability of labour at the time of harvesting, mechanical harvesting is recommended. The post harvest losses (broken grains) occurred when farmer used threshing machine. Thus, it is recommended that specialized machine be evolved and popularized among the chickpea producers. Good quality jute bags and other equipments should be provided to the farmers at subsidized prices by PACS to minimize post harvest losses during transportation and storage stages. Government should construct the storage facilities and drying facilities in every village cluster.

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