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Research Paper

Assessment of Farm Level Post-harvest Losses in Wheat in Haryana

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ABSTRACT

The post – harvest losses have been evaluated at various levels in wheat grain in Haryana. Growth rate analysis was performed using time-series data on area, production, and productivity of the selected wheat crop from 2008-09 to 2017-18. The survey data obtained from 60 farmers in two districts in 2019-20 was used to estimate post-harvest losses. In each village, 15 people were chosen as responders. The influence of socio-economic factors on post-harvest losses at the farm level was investigated using functional analysis, whilst post-harvest losses at various levels were quantified using tabular analysis. At the state level, the yearly growth rates of area, production, and productivity rose by 0.43, 0.73, and 0.30 percent, respectively. Wheat post-harvest damages where calculated to be 3.47, 3.41, and 3.44 kg/quintal in Hisar, Karnal, and overall respectively. In both the districts and the state as a whole, the damages were largest during wheat combine harvesting. The variables that have a significant influence on post-harvest damages at the farm level, as well as certain policy implication, have been identified. As far as losses in monitory term is concerns, ₹ 335.45 crores were calculated in combine harvesting which is highest of the total post-harvest losses followed by Threshing (210.52). Storage, on the other hand, saw the least losses, accounting for 19.66 per cent of total post-harvest losses. Post-harvest losses in the state as a whole were anticipated to be ₹ 735.82 crores.

HIGHLIGHTS

- In light of the study's findings, it is necessary to focus on the refining of harvesting methods such as combine and tractor-driven threshers in order to reduce post-harvest losses.

Keywords: Post harvest losses, Economic cost, CAGR, MSP, Procurement incidentals and Acquisition cost

A usage of a stylized wheat spike as a sign of FAO can convey the importance of wheat as a staple grain across the world. After rice, wheat is India's most popular cereal. In India, total food grain output was expected to be 281.40 million tonnes in 2018-2019, with wheat accounting for 99.10 million tonnes, or roughly 35 per cent. After China, India has surpassed China as the world's second-largest wheat producer, accounting for 13.80 percent of global wheat production. Wheat output rose dramatically as a result of continuous efforts by policy makers, agricultural scientists, extension workers, and receptive farmers to adopt modern production techniques. India's wheat output grew

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dramatically from 69.35 million tonnes in 2005-06 to 99.10 million tonnes in 2018–2019.

Haryana is one of India's top 10 producers of food grains. It has three agro-climatic zones that are ideal for cultivating a range of food grains throughout the year. The state's total agricultural area is 6.5 million hectares. The main grains cultivated in the state are rice, wheat, pearl millet, and maize. From 4.3 million hectares in 2005-06 to 4.5 million ha in 2018-19, the total area under food grain has risen. Food grain output increased from 13.1 million tonnes in 2005-06 to 18.1 million tonnes in 2018-19.

Before agricultural commodities generated on farm fields reach government procurement, they must go through a number of processes such as harvesting, threshing, cleaning/winnowing, drying, bagging, storage, shipping, and packaging, all of which result in significant crop losses.

Annual post-harvest losses of 20 Mt are a substantial waste that might be avoided in a country where 20 percent of the population is hungry. Food grain post-harvest damages in India are 7-10 percent of total production from farm to market, and 4-5 percent at market and distribution levels, according to a World Bank study from 1999. Such losses have been calculated to be 11-15 Mt of food grains each year for the entire system, including 3-4 Mt of wheat. With an average monthly food grain intake of around 15 kg, These losses would feed approximately 70-100 million people, or more than a third of India's impoverished, or the whole population of Bihar and Haryana for nearly a year.

The study of post-harvest losses in wheat grains at various stages of handling would aid in determining the scope and size of losses as well as the variables that cause them. As a result, effective methods to decrease these losses may be developed. Accurate and reliable evaluations of post-harvest losses at various stages are essential for the development of suitable solutions for minimizing post-harvest losses. Scientists, technicians, politicians, administrators, and industrialists all benefit from this knowledge. The research experiment's particular aims were to quantify post-harvest losses in wheat at various operations, examine the factors causing post-harvest losses, and estimate post-harvest losses for the entire state.

MATERIALS AND METHODS

Both primary and secondary data were employed in the research investigation. With the aid of a pre-tested questionnaire schedule, primary data was obtained from respondent farms. The districts of Hisar and Karnal were chosen with care. Two blocks, Hisar and Agroha, were chosen from the Hisar district. Karnal and Indri blocks in the Karnal district, on the other hand, were chosen at random. One village was chosen at random from each block. A total of fifteen farmers from each village were questioned at random. A total of sixty farmers were polled as part of the study. We gathered data on wheat post-harvest losses, including harvesting and drying methods, drying locations, packing methods, storage systems, modes of transportation, and losses throughout post-harvest activities. Both time series and cross-sectional secondary data were used in this investigation. Time series data from the Directorate of Economics and Statistics Department of Haryana were obtained for the period 2008-09 to 2017-18 to investigate the growth rates in area, output, and productivity of wheat.

Analytical Techniques

A compound growth equation $Y = ab^t$ was calculated to compute the growth in area, production and productivity of a specific wheat crop. To calculate post- harvest damages, averages and percentages were utilized. Farmers provided information on post-harvest losses throughout the following operations: harvesting, threshing, cleaning/winnowing, drying, storage, transportation and packing.

Nag *et al.* (2000) in chickpea utilizes functional analysis to investigate the factors impacting post-harvest losses at the farm level. In this research, we used the following multiple linear regression function:

$$Y = a_0 + a_1x_1 + a_2x_2 + a_3x_3 + \ldots\ldots\ldots + a_{10}x_{10} + e \quad \ldots(1)$$

Where,

Y = Wheat post-harvest losses in quintals per hectare at the farm level.

X_1 = Age of the farmers in years

X_2 = Education of the farmers in years

X_3 = Total wheat output in quintals

X_4 = Storage dummy with a value of '0' if the storage facility was adequate and '1', if it was not.

X_5 = Weather dummy with a value of '0' if the weather was favorable during harvesting and a value of '1', otherwise.

X_6 = Transportation dummy with a value of '0' if the transportation facility was acceptable and a value of '1', if it was not.

X_7 = Threshing machine dummy with a value of '0' if availability of threshing machine during harvesting was adequate, '1', otherwise.

X_8 = Means of harvesting machine dummy which takes the value '0' if use of thresher during harvesting, '1', for combine harvester.

X_9 = Maturity of crops dummy which takes the value '0' if high maturity level during harvesting, '1', for maturity level.

X_{10} = Labour dummy which takes the value '0' if the labour availability during harvesting was adequate and value, '1', otherwise.

e = Random-error

RESULTS AND DISCUSSION

Compound annual growth rate area, production and productivity of wheat in Haryana

The growth study with regard to their area, production, and productivity was carried out to evaluate the temporal production pattern of wheat. During the year 2008-09 to 2017-18, the CAGR in wheat area, production, and productivity in Hisar, Karnal, and the state as a whole showed a favorable trend. In Hisar, the area, production, and productivity all grew at a moderate pace of 0.02, 0.40, and 0.38 percent, respectively. While it was increased at 0.22, 0.93, 0.71 and 0.43, 0.73, 0.30 in Karnal district and state as whole, respectively, in the Table 1.

Table 1: CAGR in area, production and productivity of wheat (2008-09 to 2017-18)

Sl. No.	Particulars	Hisar	Karnal	Haryana
1	Area	0.02	0.22	0.43
2	Production	0.40	0.93	0.73
3	Productivity	0.38	0.71	0.30

Farm level post-harvest losses of wheat in Haryana

Farm level post-harvest losses in wheat were estimated to be 3.25, 3.22 and 3.23 kilogram per quintal in Hisar, Karnal and over all bases respectively. Highest farm level post-harvest losses were observed during combine harvesting *i.e.* (1.45 kg/qtl) followed by threshing (0.91 kg/qtl), cleaning/ winnowing (0.55 kg/qtl), transportation (0.17 kg/qtl) and moisture losses during the marketing (0.16 kg/ qtl) at overall basis. Same trends were found in both the districts. Similar trends were found by Atibudhi H.N. (1997) and Basavaraja, *et al*. (2007) in their respective studies in the Table 2.

Table 2: Operation wise farm level post-harvest losses of wheat in Hisar and Karnal districts of Haryana (kg/q.)

Stages	Hisar		Karnal		Overall	
	Loss (kg/q)	Per cent	Loss (kg/q)	Per cent	Loss (kg/q)	Per cent
Combine harvesting	1.38	42.46	1.52	47.20	1.45	44.89
Threshing	0.94	28.92	0.88	27.33	0.91	28.17
Cleaning/ Winnowing	0.54	16.61	0.56	17.39	0.55	17.03
Transportation	0.19	5.85	0.14	4.35	0.17	5.26
Losses due to moisture content	0.20	6.15	0.12	3.73	0.16	4.95
Total losses at farm level	3.25	100.00	3.22	100.00	3.23	100.00

Factors affecting post-harvest losses at farm level in wheat

The eight independent factors in the regression model explained almost 91, 74 and 76 percent of total post-harvest losses in wheat Hisar, Karnal and overall, respectively. The F- ratio was significant in Hisar, Karnal and overall, indicationg that the regression models were well-fitting. Except for the factors of farmer education, a positive relationship between the dependent variable and other independent variables was hypothesized in Hisar, Karnal and overall.

The regression coefficients for means of harvesting were observed highly significant and positive effect on post-harvest losses of wheat in Hisar, Karnal and overall respectively. In Hisar, Karnal, and

Table 3: Factors affecting post-harvest losses at farm level of wheat

Stages	Hisar		Karnal		Over all	
	All	Step-wise	All	Step-wise	All	Step-wise
Intercept	1.731** (<0.001)	1.756** (<0.001)	3.232** (0.004)	2.821** (<0.001)	1.830** (<0.001)	2.330** (<0.001)
Age of the farmers (X_1)	0.002 (0.725)	—	-0.001 (0.956)	—	0.008 (0.134)	—
Education of farmers (X_2)	-0.226* (0.023)	-0.263** (<0.001)	-0.402** (0.003)	-0.416** (<0.001)	-0.291** (<0.001)	-0.358** (<0.001)
Total wheat output in quintals (X_3)	0.000 (0.624)	—	-0.007 (0.063)	—	0.000 (0.884)	—
Weather dummy (X_5)	0.066 (0.637)	—	-0.154 (0.387)	—	0.094 (0.345)	—
Transportation dummy (X_6)	0.029 (0.821)	—	-0.203 (0.221)	—	-0.135 (0.201)	—
Threshing machine dummy (X_7)	-0.017 (0.889)	—	-0.127 (0.516)	—	0.067 (0.514)	—
Means of harvesting (X_8)	0.906** (<0.001)	0.943** (<0.001)	0.670** (<0.001)	0.669** (<0.001)	0.691** (<0.001)	0.670** (<0.001)
Condition of Crop (X_9)	0.197 (0.119)	—	-0.065 (0.685)	—	0.082 (0.398)	—
Labour dummy (X_{10})	-0.132 (0.300)	—	-0.186 (0.444)	—	-0.341 (0.158)	-0.310 (0.162)
R^2	0.91	0.90	0.74	0.66	0.76	0.71
F-Value	21.082**	82.792**	5.532**	17.068**	15.558**	47.654**
P-Value	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)

Note: *Figures in the parentheses are standard errors of coefficients, ** significance level P<0.01, and significance level P<0.05.*

overall, degree of education was shown to be very significant and adversely related with post-harvest losses of wheat Table 3. These findings are consistent with those of Begum *et al.* (2012).

Table 4: Operation wise post-harvest losses of wheat in Haryana

Farm Operations	Haryana	
	Losses 000 tonnes	Value in Crores
Combine harvesting	182.31	335.45
Threshing	114.41	210.52
Cleaning/Winnowing	69.15	127.24
Transportation	20.75	38.17
Losses due moisture contents	20.12	37.01
Total losses at state level	406.74	748.39

Total state level post-harvest losses in wheat were found to be 406.74 thousand tonnes. While maximum losses were found to be in combine harvesting *i.e.* (182.31 thousand tones) followed by threshing (114.41 thousand tonnes), cleaning/ winnowing (69.15 thousand tonnes), transportation (20.75thousand tonnes) and losses due to moisture content during the marketing (20.12 thousand tonnes). As far as losses in monitory term, it was estimated to be ₹ 335.45 crores during the harvesting from combine which is highest of the total post-harvest losses followed by threshing ₹ 210.52 crore, cleaning/winnowing ₹ 127.24 crore, transportation ₹ 38.17 crore and losses due to moisture content at the time of marketing ₹ 37.01 crore. Total post-harvest losses at the state level, on the other hand, were predicted to be 735.82 crores (Table 4). Gauraha, A.K. (1997) found similar results in his research.

The cost of distributing food grains to each state is borne entirely by the central government. Table 5 shows the three main components of FCI's economic cost: procurement cost, procurement price, and distribution cost. Procurement costs are the initial expenses incurred when purchasing food grains at marketplaces, yards, or centers (incidentals). Statutory fees, lobour charges, sums paid to state agencies for establishment, storage, and interest on stocks are only a few examples. The Food corporation of India (FCI) buys food grains from farmers at a fixed price and distributes them to beneficiaries at the central issue price (CIP). The distribution costs include freight, handling, storage, interest and transit charges and establishment cost.

Table 5: Economic cost and minimum support price (MSP) of wheat during the year 2001-02 to 2020-21.(₹/q)

Year	Procurement incidentals	Acquisition Cost	Distribution Cost	Economic Cost	MSP
2001-02	135	726	127	853	620
2002-03	138	738	146	884	620
2003-04	138	749	170	919	630
2004-05	183	796	223	1019	640
2005-06	171	807	235	1042	650
2006-07	180	909	269	1178	850
2007-08	164	1068	244	1312	1000
2008-09	180	1136	245	1381	1080
2009-10	207	1125	200	1325	1100
2010-11	212	1276	218	1494	1170
2011-12	236	1355	240	1595	1285
2012-13	263	1483	270	1753	1350
2013-14	286	1558	351	1908	1400
2014-15	347	1664	387	2051	1450
2015-16	367	1773	354	2127	1525
2016-17	367	1835	362	2197	1625
2017-18	304	1892	406	2298	1735
2018-19	281	1957	403	2360	1840
2019-20	354	2115	565	2680	1925
2020-21*	371	2221	463	2684	-
CAGR	5.86	6.63	6.33	6.56	7.19
LGR	5.45	6.12	5.96	6.10	6.50

** Economic cost of wheat (Budgeted estimated 2020-21*

Source: *Computed using data given the Annual Repots of FCI, Agricultural Statistics at a Glance.*

Table 5 shows the estimated economic cost and minimum support price (MSP) for wheat from 2001-02 to 2020-21 in nominal prices. At nominal prices, the economic cost of wheat has grown considerably from ₹ 853 per quintal in 2001-02 to ₹ 2684 per quintal in 2020-21. On the other hand, per quintal minimum support price (MSP) for wheat was ₹ 620 during the year 2001-02 has increased ₹ 1925 in 2019-20. The annual rate of growth in economic cost is nearly 6.56 per cent for wheat from 2001-02 to 2019-20. It's worth noting that even if the Food Corporation of India (FCI) sells grains at market prices, it still needs a large subsidy to stay in business because its costs are twice as high as the wholesale price. Gauraha, A.K. (1997), Gangwar *et al.* (2014), and Jha *et al.* (2015) all found similar findings in their research.

CONCLUSION

According to the findings of the study, farm-level post-harvest losses in wheat were estimated to be 3.25, 3.22, and 3.23 kilogram per quintal in Hisar, Karnal, and overall, respectively. The functional analysis indicated that the method of harvesting had a substantial impact on post –harvest losses at field level. On the other hand, with a compound annual growth rate of 6.56 percent, the economic cost of wheat has grown considerably from 853 per quintal in 2001-02 to 2684 per quintal in 2020-21. As a result, the Food Corporation of India (FCI) requires a significant subsidy to sustain operations, as its costs are twice as high as the wholesale price.

In light of the study's findings, it is necessary to focus on the refining of harvesting methods such as combine and tractor-driven threshers in order to reduce post-harvest losses. According to the research, the government should buy wheat twice a year: once during the peak harvesting season at the minimum support price (MSP) and again during the lean season at an incentive price of ₹ 250-500 per quintal above and above the MSP. This would not only help all farmers (small, marginal, and big),

but it would also reduce the cost of wheat storage, resulting in lower post-harvest losses and higher farmer earnings.

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