



## The Investigation of wheat losses harvesting in Lordegan County (Iran)

Asadullah Mirasi <sup>1\*</sup>, Ehsan Kamran<sup>2</sup>, Mohammad Amin Asoodar <sup>3</sup>, Mousarreza samadi<sup>4</sup>

<sup>1</sup>Department of farm machinery, Faculty of Biosystems Engineering, Islamic Azad University, Lordegan Branch, Shahrecord, Iran.

<sup>2</sup>Department of farm machinery, Faculty of Agriculture, Islamic Azad University, Ilam Branch, Ilam, Iran.

<sup>3</sup>Department of Agricultural Machinery Engineering, Khuzestan Ramin Agriculture and Natural Resources University, Ahwaz, Khuzestan, Iran.

<sup>4</sup>Ph.D. Candidate in post-harvest, Department of Agricultural Machinery Engineering, University of Tabriz, Iran.

\*Corresponding author: [asadmirasi@yahoo.com](mailto:asadmirasi@yahoo.com)

### ABSTRACT

Wheat is one of the important food staff in consumption pattern of each country. More than 50 % of human energy is supplied from bread in the developing country. Combine losses is less than 2-3% in developed countries, while in developing country is about 15-20% in different regions and circumstances of harvesting seasons and field conditions. In this research project that effect of combine type and wheat variety to grain losses and waists were investigated. Experimental design was split plot in a completely randomized block design with three replications. Wheat variety in two levels of Sardari and Omid as a main plot and combines type in two levels of John Deere (JD) 1055 and JD 955 as a sub plot. Field experiments were carried out in the farmers field with 5 ha area. The results showed that higher amount of losses were in the Omid variety and JD 955 with totally 5.97 % (306.3 kg ha<sup>-1</sup>) that 14.75 % of them attributed on the combine back, 41.6 % on Header, 5.4 % on Drum and 24.45 % on impurity and 13.8% on grain breakage. The lowest losses related to JD 1055 and Sardari variety with 3.12 % (160.05 kg ha<sup>-1</sup>) that 14.65 % of them attributed on the combine back, 35.7 % on Header, 4.5 % on Drum, 26.15 % on impurity and 19% on grain breakage.

**Keywords:** Omid, Sardari, Header, grain breakage, John Deere

### INTRODUCTION

Wheat is the most prominent nutrition material in our food consumption. In fact, more than 50 % of each Iranian nutrition material is provided by different kinds of breads. Fars province is the first producer of wheat in country, in addition to adjustable weather leader farmers, producer's effects; research finding and using the latest scientific results has a significant role in production. The under cultivation area of wheat in country in the year of 2005-2006 was estimated about 6.88 million hectare, and Khorasan province

with 9.4% of whole area wheat cultivation has the most area. Fars province and eastern Azarbayjan province with 8.5 and 6.4 % of whole wheat yield has the second and third place in country. However, in this year Fars province had second place in level but with 14.9 % of wheat production has had the first place while Khorasan and Golestan provinces with 8.2 and 6.4% has second and third place.

In Iran, most available combines in the agricultural mechanization branch is combine 955, of which the number is 10489 (Chegini, 2007). The country's increasing need for small and cheap combines with high performance is the most important major problems in cereals harvest that has been on Iran's fields (Anon, 2004; Chegini, 2006). On the other hand, the internal components frazzle of combine and supplying them is the major problem of this combine. Another common important point about using this combine in Iran is combine immigration from south to north and from east to west for harvesting crops. This issue, due to delay of harvesting, has been causing much loss (Behrozi et al., 1994; Chegini, 2006).

Rahimi & Khosravani (2003) survey from Fars province resulted average loss of wheat harvesting stage in Fars province was 4.81% of production. The maximum amount of loss related combine loss was 68% and after it the amount was for natural loss, sieve loss, drums loss then quality loss. Asghari Meydani (2003) investigated 2 types of combines (Class, John Deer) in two times of harvesting in time of 15 days on two kinds of dry land wheat. The results have indicated second time, means harvesting with delay comparing to first time has more loss while it increase about 9 kg h<sup>-1</sup> for each day.

Yavari and Poordad (2003) in a survey randomly investigated 61 combines (John Deer 955). According to finding in Kermanshah province there was an average 105.42 kg ha<sup>-1</sup> equal to 7.2% of loss resulted from harvesting. That was decreased to 29.06 kg ha<sup>-1</sup> equal to 3.31 % because of technical and agricultural points. Mansouri & Minaei (2003) investigated the effects of combine parameters on wheat loss in combine of John Deer. In this study the effects of combine ground speed, drum speed the distance between drum and concave and fan speed on loss amount were investigated. The results show with increasing ground speed cutting edge loss will increase dramatically.

Tavasoli and Minaei (2002) investigated effective factors on drum, separator and cleaner Performance and studied their effects on combine loss. The processing loss of combine (John Deer 955) manufactured by Iran-Arak Combine Company in 7 different levels of ground speed (from 1.3 to 3.5 km h<sup>-1</sup>) for wheat harvesting was measured. Sheradian and Gulan (1991) carried out a study about harvesting hours and date influence on wheat loss in Pakistan. The results has indicated, the least loss was for the hours of 8-12 am while until 10 days after appropriate time, the loss was a little but after it because of harvesting delay, there is an increase in loss. In addition, grain moisture content in linear was decreased with a harvesting delay and resulted in grain loss.

Mohd (1997) investigated wheat loss during combine harvesting. They measured parameters like ground speed, drum speed, sieves openness rate, fan adjustment and grain moisture content. The results of their investigation pointed out among 55 studied combines no one adjusted like the others. The average of measured loss in first year was 9% while it was 12.7 in second year. The mentioned suitable moisture content for harvesting was about 9-14 %.

Masdari et al (2008) reported that the combine type and Wheat Variety with probability 61.2% showed a correlation between the types of combine harvesting wheat on mortality were influential. Khosravani and Rahimi (2003) reported that wheat, wheat harvest losses in the city and combines the correlation between

they showed about 47% of total wheat losses, changes in the different fields of the elements combine, wheat and the city.

## Materials and Methods

In this study, the effect of combine type and wheat variety on wheat loss during harvesting was investigated. This field study was performed in Lordegan County to evaluate wheat harvesting losses utilizing combines JD 955 and JD 1055. The adjustments were performed according to the combine operator manual. The farm yield was 5.4 ton ha and grain moisture content was 11-13% during experiments. Test was performed in a field about 5 hectare and combine ground speed according to crop density about 2.5 to 3 km h<sup>-1</sup>. For statistical analysis, there were used from statistical design of split plot in the completely randomized block design in 3 replications and Duncan test.

Wheat type in 2 levels of Omid and Sardari were chosen as a main-plot and Combine types in 2 levels: JD 955 and JD 1055 while were chosen as sub-plots. In each treatment following factors were measured and investigated:

1. Header losses
2. Drum losses
3. Combine back losses (separators and cleaning)
4. Grain breakage losses
5. Impurity losses (straw and stubble) in the tank
6. Total losses
7. Grain moisture content

Grain moisture content according to percent was measured with sampling available wheat in combine storage and with using grain moisture content meter.

## Results and Discussion

### Header losses

Analyzing the variance of the effect different combine type and wheat variety on the losses in the combine Header is shown in Table 1. The effect of combine type and wheat variety and their interaction effect with probability level of 1% are significant. The JD 955 combine with an average of 2.21 % losses (112.45 kg ha<sup>-1</sup>) and JD 1055 combine with a mean of 1.61 % losses (82.59 kg ha<sup>-1</sup>) were highest and lowest amounts allocated to header losses respectively. Also, the results showed that the average losses on the header losses for Sardari variety was 1.15 % (58.82 kg ha<sup>-1</sup>) and the Omid variety was 1.75 % (89.58 kg ha<sup>-1</sup>), respectively. Average header losses were 39.89 % of total, and it shows that most of the losses related to combine header.

### Drum losses

Analyzing the variance of the effect different combines' type and wheat variety on the losses in the combine drum is shown in Table 2. The effects of combines' type and wheat variety with probability level of 1% are significant. The highest amount of losses were in JD 955 with 0.27% (13.72 kg ha<sup>-1</sup>) and the lowest losses were in JD 1055 with 0.16% (8.01 kg ha<sup>-1</sup>), respectively. The average losses for drum unit of JD 1055 were 37 % lower than JD 955. The results showed that the average of drum losses were 0.13 % for Sardari variety (9.65 kg ha<sup>-1</sup>) and 0.19 % for Omid variety (5.58 kg ha<sup>-1</sup>) that were the highest and the lowest losses.

### **Combine back losses (separators and cleaning)**

Analyzing the variance of the effect combines type and wheat varieties on the losses in the combine back is shown in Table 3. The effect of combines' type with probability level of 1 % is significant. The JD 955 Combine back unit had the highest losses rate with 0.65 % (32.75 kg ha<sup>-1</sup>) and the lowest losses related to JD 1055 with 0.54 % (27.75 kg ha<sup>-1</sup>). So, JD 1055 Combine back unit were on average 18 % lower than JD 955. The highest losses of Combine back unit related to Sardari variety with 0.57 % (29.24 kg ha<sup>-1</sup>) and the lowest losses amount related to Omid variety with 0.45 % (23.08 kg ha<sup>-1</sup>). So, Omid variety losses were 44.18 % lower than Sardari variety.

### **Grain breakage losses**

Analyzing the variance of the effect combines type and wheat varieties on the losses in the combine Broken grain is shown in Table 4. The effects of combines' type and wheat varieties' with probability level of 1 % are significant JD 1055 with an average of 0.81 % (41.35 kg ha<sup>-1</sup>) and 955 JD with an average of 1.15 % (58.61 kg ha<sup>-1</sup>) had the highest and the lowest percent of grain breakage to the tank. Omid variety had the highest amount of grain breakage with 0.92 % (47.21 kg ha<sup>-1</sup>), and the lowest grain breakage related Sardari variety with 0.63 % (32.31 kg ha<sup>-1</sup>).

### **Impurity losses (straw and stubble) in the tank**

Analyzing the variance of the effect combines type and wheat variety on the losses in the combine impurity is shown in Table 5. The effects of combine type and wheat varieties with probability level of 5 % are significant. JD 955 with an average of 1.37 % (70.28 kg ha<sup>-1</sup>) and JD 1055 with an average of 1.14 % (58.47 kg ha<sup>-1</sup>) were the highest and the lowest levels of impurities in the tank, which were statistically divided into two groups and there was significant difference between 955 and 1055 JD. By changing the varieties the rates impurities in the grain tank increased so that the lowest rates impurities in the tank with 0.71 % (36.42 kg ha<sup>-1</sup>) in Sardari variety and the highest average with 0.97 % (49.76 kg ha<sup>-1</sup>) in Omid variety, that the varieties are statistically different in the two groups.

### **Total losses**

Analyzing the variance of the effect combines type and wheat varieties on the losses in the combine is shown in Table 6. The effect of combines' type and wheat varieties and their interaction effect with probability level of 1 and 5 % are significant. Combine effect average comparing in Figure 1 shows that by changing JD 955 to JD 1055 total losses were reduced and there were between significant difference combine levels. So, the lowest total losses with 4.6 % (235.98 kg ha<sup>-1</sup>) in JD 1055 and that 11.7 % of this amount related to combine back losses, 35 % of the header losses, 3.47 % for drum losses, 24 grain breakage and 24.8 impurity losses . The highest amount of total losses related to JD 955 with 5.31 % (272.4 kg ha<sup>-1</sup>), which 12.24 % of this amount related to combine back losses, 41.6 % of the header losses, 5.8 % for drum losses, 15.25 % grain breakage losses and 25% impurity losses.

The lowest total losses related to Sardari variety with an average of 3.48 % (178.52 kg ha<sup>-1</sup>) that 33% for header losses, 16.38 % for combine back losses and 3.73 % for drum losses, 26.43 grain breakage losses and 20.46% impurity losses. From figure 2 it can be seen that total losses were highest with an average of 3.99 % (204.71 kg ha<sup>-1</sup>) was observed in the figure is the Omid of this amount, 43.8 % of the head losses, 11.28 % of the combine back losses, 4.76 % the drum losses, 15.86 grain breakage losses and 24.3% impurity losses. From figure 2 it can be seen that, interaction effects of wheat varieties and combines types shows that the highest losses related to JD 955 and Omid variety with 5.97 % (306.3 kg ha<sup>-1</sup>) and

the lowest losses related to JD 1055 and Sardari variety with 3.12 % (160.05 kg ha<sup>-1</sup>). Also, there is a significant difference between all surfaces of John Deere combines and by total losses increase.

## Conclusion

The highest total losses were happened on combine JD 955 with 5.31 % and the lowest one was on JD 1055 with 4.6 %.

The highest total losses was happened on JD 955 and Omid variety with 5.97 % and the lowest one was on JD 1055 and Sardari variety with 3.12 %.

The highest total losses were occurred on Omid Wheat variety with 3.99 % and the lowest one was on Sardari variety with 3.48 %. With attention to above mentioned, wheat product is one of the strategic products and food staple in Iran and play an important role in food security in Iran but statistic results showed that this product has a many losses in harvest stage of process from cultivation to consumption. So it seems wheat losses management is the best solution to reduce these losses and to provide food security in Iran. Wheat losses management includes of some components such as; education, policy making, establishing infrastructures and effective marketing system that explained in above paragraph. In order to achievement a self-sufficient and food security we must pay attention to component of wheat losses management.

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Table (1): Analyzing of variance for Combines type and Wheat varieties on header losses

Changes resources	Degree of freedom	Mean square	F probability
Replication	2	0.51	2.04ns
Wheat (W)	1	4.18	16.72**
Error 1	4	0.25	-
Combine (C)	1	2.93	19.53**
W*C	1	1.15	7.66**
Error 2	4	0.15	-
CV	11.19		

\*\* , \* , ns not statistically significant at 1% and 5% respectively, and the difference shows.

Table (2): Analyzing of variance for Combine type and Wheat varieties on Drum losses

Changes resources	Degree of freedom	Mean square	F probability
Replication	2	0.12	8.01 ns
Wheat (W)	1	0.25	16.67**
Error 1	4	0.015	-
Combine (C)	1	0.47	27.64**
W*C	1	0.09	5.29 ns
Error 2	4	0.017	-
CV	21.88		

\*\* , \* , ns not statistically significant at 1% and 5% respectively, and the difference shows.

Table (3): Analyzing of variance for Combine type and Wheat varieties on combine back losses

Changes resources	Degree of freedom	Mean square	F probability
Replication	2	0.069	3.01 ns
Wheat (W)	1	0.13	5.65 ns
Error 1	4	0.023	-
Combine (C)	1	0.17	12.14**
W*C	1	0.042	3.02 ns
Error 2	4	0.014	-
CV	15.96		

\*\* , \* , ns not statistically significant at 1% and 5% respectively, and the difference shows.

Table (4): Analyzing of variance for Combine type and Wheat variety on broken grain losses

Changes resources	Degree of freedom	Mean square	F probability
Replication	2	0.205	9.76 ns
Wheat (W)	1	1.035	49.27**
Error 1	4	0.021	-
Combine (C)	1	1.35	31.39**
W*C	1	0.24	5.58 ns
Error 2	4	0.043	-
CV	18.75		

\*\* , \* , ns not statistically significant at 1% and 5% respectively, and the difference shows.

Table (5): Analyzing of variance for Combine type and Wheat variety on impurity losses

Changes resources	Degree of freedom	Mean square	F probability
Replication	2	0.114	3.94 ns
Wheat (W)	1	0.53	18.27*
Error 1	4	0.029	-
Combine (C)	1	0.34	18.88*
W*C	1	0.039	2.16 ns
Error 2	4	0.018	-
CV	17.63		

\*\* , \* , ns not statistically significant at 1% and 5% respectively, and the difference shows.

Table (6): Analyzing of variance for Combine type and Wheat variety on total losses

Changes resources	Degree of freedom	Mean square	F probability
Replication	2	3.65	10.73 ns
Wheat (W)	1	14.16	41.64**
Error 1	4	0.34	-
Combine (C)	1	10.12	53.26**
W*C	1	3.26	17.15**
Error 2	4	0.19	-
CV	12.45		

\*\* , \* , ns not statistically significant at 1% and 5% respectively, and the difference shows.

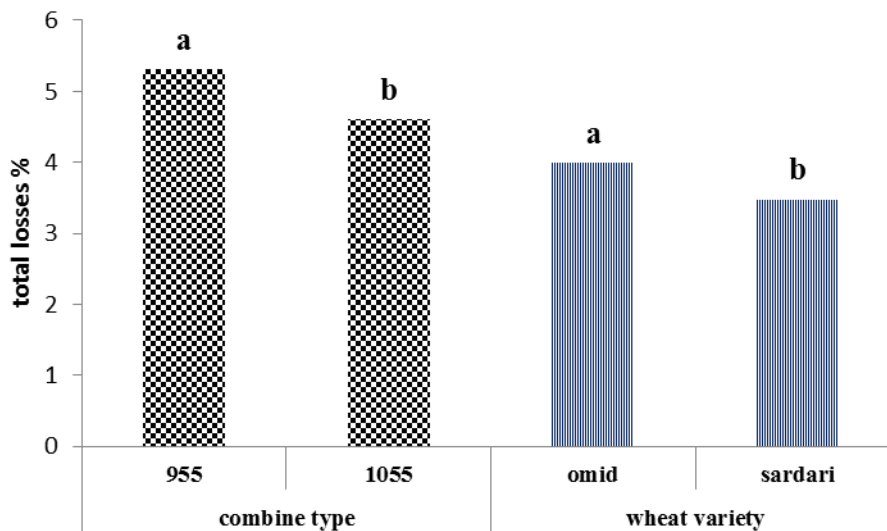


Figure 1: The effect of combines' type and wheat varieties in total losses



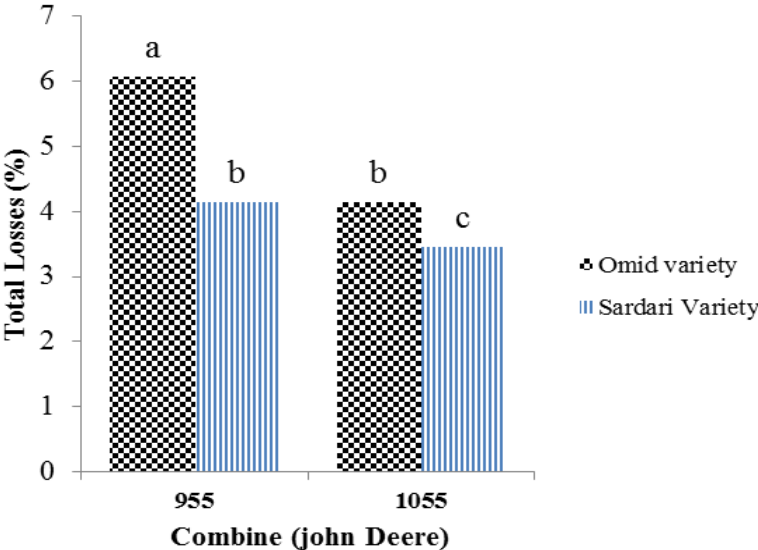


Figure 2: Interaction effect of wheat varieties and combines type on total losses