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Study of various determining methods of wheat harvest losses by combine JD955

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Abstract

Wheat is a major food material for Iranian people and more than half of the world population. Therefore study, development and increase of production efficiency about this crop is very important. Reducing amount of losses in harvesting stage is one of the methods that increase wheat production efficiency. For this reason, information about the rate and the origin of losses is necessary. In order to determining the losses rate, various methods has been produced and used by many institutions. The aim of this study is the comparison of three custom measurement methods in our country and suggesting the method which is the most accurate and feasible. This study was conduction in Pars Abad in agricultural education center of Moghan. The performance of design and evaluating the results conducted based on strip plat design with three replication and in three moisture levels including 12-13, 14-15, 16-18 percent and with three method of losses measurement consists of FMO, ministry of agriculture, institute of dry land research. The results showed that there are significant differences between three measurement methods in every three moisture levels. FMO method was more accurate than two other methods and the ministry of agriculture method indicated high more accurate than dry land research institute method. Moisture of 14-15% in wheat harvest time has been recognized the most optimum range due to having minimum losses rate. The most amount of losses was seen in platform section.

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Introduction

Wheat has been recognized for nutritive, adaptation with various climate conditions, facility of cultivation as bread in every Iranian diet and its role in economics of country as a strategic crop and it has a special place in government development programs. One of the main problems in production of this important crop is its losses at harvesting time. The less harvest losses in field, the more products without input consumption and production cost. In fact, decreasing crop losses without effecting on environment causes production to increase (Deer, 1975). Various studies have been conducted on cereal losses measurement and there have been used many methods for losses determining which as following:

John Deer's suggested operations manual: John Deer's company uses combine general losses determination quick method using one or two crape myrtle frame 25×30 cm and a curve before drawing for evaluating depreciation rate in various parts of combine (John Deer, 1973). Behrouzi lar's suggestion method: In this method, a woody foam with a dimensions of 1 m^2 and 15 cm height has been used for platform and depreciation measurement before harvesting. There has been used from a plastic with 1 m^2 for combine back losses measurement. Behrorzi (1990) measured wheat harvest losses by using mentioned method in several province. They obtained mean losses in wheat harvest 2.3%, 4.5%, 7%, 7% and 7.8% in Esfahan, Fars, Hamedan, Mazandaran and khorasan respectively (Solhjoui, 2002). The recommendation of Fars agriculture research center, Zarghan: Fars research center uses from two frames with dimensions of 50×50 cm by 0.25 m^2 area for platform losses and depreciation measurement before harvesting and this center uses a frame with dimension of 120×50 cm for combine back losses measurement (Ministry of Agriculture, 1994). Three other common methods including FMO, Ministry of agriculture and Institute of dry land research have been given in materials and methods selection. The study of available sources indicate that there are various methods for wheat losses measurement in harvesting by combine that various factors which have special characteristics and different factors can

be affected on production losses rate till conducted to reducing production losses. In first step, in recognizing the origin and factors of losses, there must have been availability for enough data and information. In order to selection and use of these methods, it is necessary to study the benefit and limitation of them. Introduced methods have given in three main ways and the purpose of this research is comparing three main ways and grain losses measurement in common combine. The purpose of this study was to evaluate different methods to determine the loss of wheat was tested by combining the JD955.

Material and methods

In this research, three methods of crop losses has been compared including FMO, Ministry of agriculture and Dry land researches Institution in main strip and three humidity levels including 12-13,14-15,16-17 percent in sub-main strip with three replication in strip plot design. Mentioned range selected for humidity changes due to changes of crop humidity during harvesting time according to ripening rate and also due to changes of crop humidity during a day. Real amounts of grain humidity measured as followed 12.7%, 14.4% and 16.5%. The examination was done in completely uniform conditions as if the field was under control during tillage, leveling, cultivation and plantation and irrigation, as a result there was completely uniform crop in field. Also used combine not changed during measurement stages and has been used from John Deer 955. Combine setting were considered constant and similar at different humidity levels. By creating uniform condition, losses rate by harvesting in blocks were the same as a result in equal conditions the method which has much ability in reducing losses rate, it introduced as a best way.

FMO method

This method is derived from the book of combine harvesting from FMO series books of John Deer Company. John Deer company uses from 3 frames in 31.6×31.6 cm dimensions for losses measurement in order to investigate back and front part of device. For

measuring combine platform losses, after harvesting, the combine is derived back some meters and the frames are placed in harvest points and placed back the device for determining back losses of device. In figure 1, the region of losses measurement has illustrated in first method. Bold square indicated the place of frames (John Deer, 1975).

The recommendation method of institute dry land agricultural researches

In this method, has been used a frame 50×50 cm dimension with an area of 0.25 m² for measuring platform losses and the losses before harvesting. For measuring back losses of device, there has been used from canvas cloth of 3×3 m dimensions with area of 9 m². In order to determine platform losses used sides of combine and for losses of back combine has been placed canvas cloth in back device (Yavari and Shahpasand, 2000).

The suggestion method of agriculture ministry

In this way, a frame has been used with 65×38.5 cm dimensions with an area of 0.25 m² for investigation of losses rate before harvesting and platform and there has been used a woody frame 60×33.5 cm

dimensions by useful area of 0.2 m² with net floor to measuring losses of back of combine. In this method, frame points are only in back combine, thus net floor has been placed back device while driving combine that it given losses of back of combine and it has placed around wood frame for measuring losses of platform in metal frame that is bigger than woody frame. Then net floor has picked up and remain material with in metal frame indicates platform losses (Ministry of Agriculture, 1994).

Results and discussion

Losses before Harvesting

Mean comparison of losses before harvesting indicated that there was no meaningful difference between measurement methods, because the operation method in all methods were similar, the size of used frames were different which had no effect. In 16.5 percent moisture, this loss was the least amount (0.007) and there were a significant difference with two levels of moisture. Its reason can be stated high moisture of wheat panicle and stem that it causes to reduce panicle and stem breaking, as a result before harvesting; losses were less because of natural factors.

Table 1. Mean comparison of measurement method and moisture on losses of every section of combine.

Total Losses	Losses of Extractor and Cleaner	Losses of Thresher	Platform Losses	Measurement Method	Moisture%
3.22 c	0.11 a	0.28 d	2.07 ab	FMO	16.5
2.15 f	0.02 e	0.11 ef	1.04 de	Dry land researches	
2.15 f	0.05 d	0.19 cd	1.16 cd	Ministry of agriculture	
2.48 e	0.06 c	0.18 cde	0.72 f	FMO	14.4
2.45 e	0.01 f	0.11 ef	0.96 de	Dry land researches	
2.46 e	0.03 e	0.07 f	0.92 e	Ministry of agriculture	
4.54 a	0.09 b	0.78 a	2.14 a	FMO	12.7
2.92 d	0.03 e	0.13 def	1.25 c	Dry land researches	
3.63 b	0.09 b	0.22 bc	1.92 b	Ministry of agriculture	

Means which have different letters, had significant differences at 1% probability level.

Platform Losses

Mean Comparison of losses of platform indicated that there were three methods that have been investigated statistically placed in three separately groups. FMO method has meaningful increasing than two other methods and it placed in the first group alone, the method of agriculture ministry was second and in the

last group located the method of dry land researches institute. Thus, among three measurement method, FMO method has the highest precision and dry land institute method has the least precision in losses determining of platform. In FMO method, the width of platform has been used to determining platform losses and it accumulates more accurate rate of losses.

However, in other methods there have been used sides or central part for measuring losses of platform. Also, according to diagram 1 can be concluded that the FMO method is the best if 16.5 and 12.7 percent moisture of grain has been used, if 14.4 percent moisture can be considered, there was no meaningful difference between methods. According to the mean total of platform losses for three moisture contents, FMO method has been evaluated the most losses rate (fig 2).

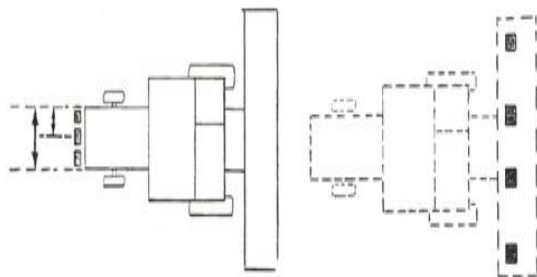


Fig. 1. The point of measuring platform, thresher and extractor losses.

Thresher Losses

Comparison of mean of thresher losses indicated that FMO method had more precision than two other methods in measuring losses of thresher and then Ministry of agriculture located and finally dry land Researches method placed. In this stage of measurement in FMO method, replacement of frame is that it covers final output of combine completely, while the other methods i.e. ministry of agriculture method can't cover completely the end of combine. In dry land Researches, closing a cloth into the end of combine causes overloading in the end of combine and it increases losses rate and there are problems such as grain and straw wind erosion, due to difficulty of correct keeping of cloth, as a result of fan wind.

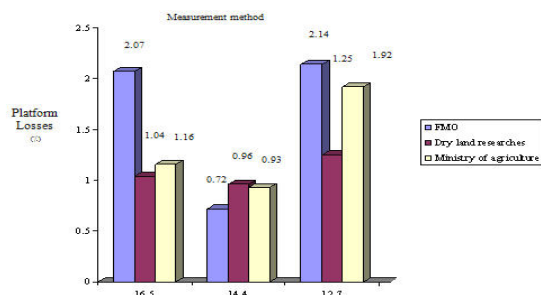
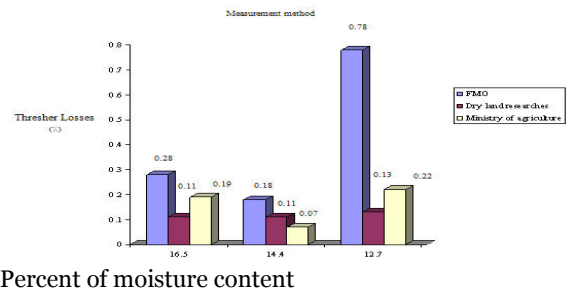


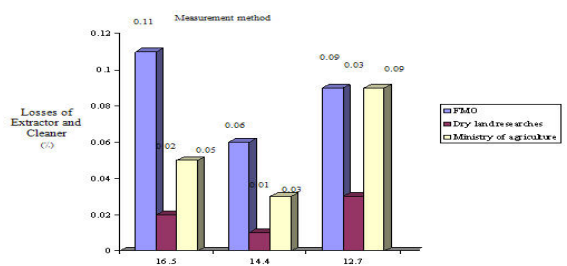
Fig. 2. Platform losses in moisture levels and methods of measurement separately. Percent of moisture content.

In 1% probability level, FMO method in 14.4 % moisture had meaningful increasing than the ministry of agriculture method, but it hadn't significant different than dry land researches method. In 12.7% moisture, there was a meaningful increasing than two methods. In 16.5% moisture, FMO method has a meaningful increasing than dry land researches and it is similar to the method of Agriculture Ministry (fig 3).



Percent of moisture content

Fig. 3. Thresher losses rate in moisture content and methods of measurement separately.



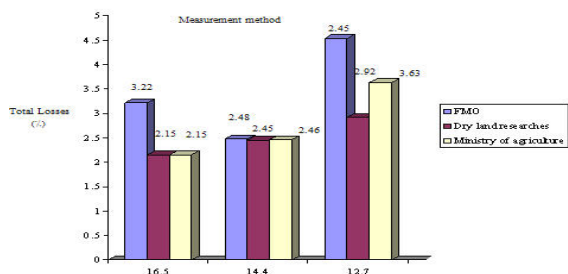
Percent of moisture content

Fig. 4. Losses rate of extractor and cleaner sections in moisture content and methods of measurement separately.

Extractor and Cleaner Losses

Mean comparison of losses in extractor and cleaner sections indicated that three methods located statically in three distinctive groups. FMO method losses were greater than two other methods and it is in the first Duncan's category alone. Ministry of agriculture and dry land research institute methods are classified respectively. FMO method had the highest precision rate and dry land research institute method had the least precision of losses determining in extractor and cleaner sections, its reason was the location of frame replacement. In FMO method, the frame covers completely the end of combine. Figure 3 indicates that in humidity of 14.4 and 16.5 percent,

FMO method is the best and then methods of agriculture ministry and dry land research institution are classified respectively. In 12.7% moisture, the methods of FMO and agriculture ministry are located in similar group and showed a meaningful increasing than dry land researches institution method.



Percent of moisture content

Fig. 5. Total Losses in moisture content and methods of measurement separately.

The Total Losses

Mean comparison of total losses indicated that every three methods located in three distinctive category statistically. FMO method had meaningful increasing than other methods and located alone in first grope of Duncan's classification means FMO method was more accurate than two other methods in measuring of total losses and then agriculture ministry and dry land research institution methods are located respectively (fig 5).

Conclusion

We can understand from figure 1 and table 1 that FMO method was the best method in 16.5 and 12.7 moisture contents. In 14.4 % moisture content, there weren't significant differences between methods. As a whole, the best estimation as total losses is FMO method with 12.7 % moisture. Also it recognized that

14.4% moisture content is the best harvesting time with the least losses. As a result, the most accurate method of losses determination as follows: FMO method, Agriculture Ministry method and institute of dry land researches method. It seems that integrated and combinations of mentioned three methods have more beneficial.

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