



Effects of Licensed Storage on Wheat Quality in the Thrace Region

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Abstract In this study, the changes in some quality characteristics of wheat stored in 12 silos, belonging to a commercial licensed storage business in the Thrace region, during the storage period were examined. For this purpose, the quality characteristics of the stored wheat were monitored by analysing the hectolitre, moisture content, protein amount and foreign matter in samples taken at certain intervals from the product acceptance to the end of storage.

As a result of the study, it was determined that the hectolitre and moisture content had very small increases while the amount of protein and foreign matter had very small decreases after the 8-month storage period. In the light of the results obtained, it is clear that in the case of long-term storage, losses can be reduced and significant economic benefits can be achieved with the help of licensed storage. Therefore, licensed storage should be promoted in the storage of different agricultural products in our country

Keywords Storage, Licensed Storage, Wheat, Quality Losses

Introduction

As in the whole world, population growth and resulting nutritional needs in our country make it necessary to use the resources of the country in the most efficient way. This increasing need has made it necessary to increase agricultural production by acquiring more crops from the unit area. However, in addition to increasing production, it is very important for the country's economy to process and use the products properly. Very few agricultural crops are consumed immediately after they are harvested without being subjected to any treatment, while the majority are consumed after processing or storage for consumption. Whether processed or not processed, it is imperative that products should be stored until they are consumed or marketed. The purpose of storage is to maintain the freshness and properties of the product. Large quantitative and qualitative losses occur in storage made without suitable conditions according to the variety of the product [1-4].

Grain is an important agricultural product used both in human and animal nutrition. Grain, which has very high strategic importance in the world, is a group of plants that have been cultivated by people since the first ages. In terms of nutrition, the most important plant products such as wheat, corn, rice, barley, oat, rye, maize, etc. are included in the grain group [5]. The amounts of grain production in the world are given in Table 1 by years.

Table 1: Grain Production in the world (Milion Ton) [6-7]

Product	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Wheat	597	607	685	679	653	695	655	709	697	730	736	754
Maize	711	797	800	821	831	877	861	965	950	1000	959	1030
Barley	138	133	155	150	122	134	130	145	135	141	147	144
Oat	23	26	27	24	20	23	21	24	23	22	22	23
Rye	13	15	18	19	13	14	15	18	16	14	12	13

The preservation of product harvest quality and freshness in storage can only be achieved through a conscious and professional approach. Licensed storage is a commercial enterprise in which agricultural products are stored



and secured by this approach. Licensed storage is defined as "organizations providing services for the storage of agricultural products that are suitable for long-term storage, subject to domestic and foreign trade" [8].

Licensed storage is established in accordance with the Agricultural Products Licensed Storage Law numbered 5300 and dated 2005 and the regulations prepared by the Ministry of Customs and Commerce for different product groups (grain, legume and oilseed licensed warehouse regulation, cotton licensed warehouse regulation, hazelnut licensed warehouse regulation, etc.) [9].

Licensed storage has the following responsibilities:

1. Accepting the delivered products to their commercial enterprise, making them suitable for storage (cleaning, drying, etc.) if needed, determining the quality and quantity, insuring and storing them under suitable conditions,
2. Providing a product bill which can be bought and sold on the stock exchange and can be used to take a bank loan by pledging against the products they accept to their commercial enterprise and
3. Delivering the product to its owner without any delay.

Material and Methods

This study was carried out in licensed stores consisting of 12 steel silos belonging to a commercial company affiliated to the Turkish Grain Board (TMO) and the Union of Chambers and Commodity Exchanges of Turkey (TOBB) in the district of Lüleburgaz. The district of Lüleburgaz where the study was carried out is located in the province of Kırklareli and in the Maritsa basin. Lüleburgaz, which is 60 m above sea level, lies between 41° 24' north latitude and 27° 21' east longitude. Its summers are hot and dry, and its winters are cool and rainy as it has a continental climate. According to the multi-year climate data in the region, the average annual temperature is 11.3 °C, the coldest month is January with a temperature of 0.2 °C, and the hottest month is July with a temperature of 30.5 °C. The average annual precipitation is 602 mm [10].

Steel silos of the company are located in the southwest of the district, near Lüleburgaz railway station and 2 km from the district center. The total capacity of the silos is 20.000 tons (2,500 tons in 4 silos, 1250 tons in 8 silos). The section plan of the 1250 ton silos is presented in Figure 1.

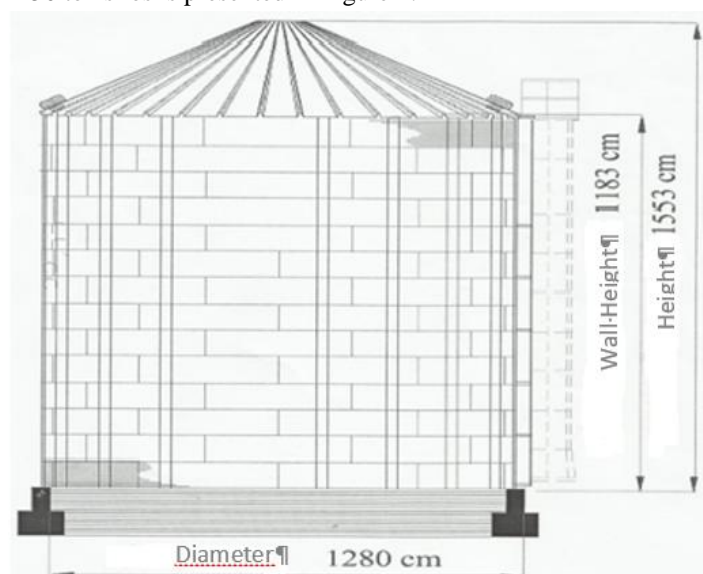


Figure 1: Section plan of the silo

The stores where the study was carried out and the wheat samples taken from these stores every 15 days between September 2012 and April 2013 on a regular basis constituted the study material. In the samples taken from the silos, the product hectolitre, moisture content, protein amount and foreign matter amount as quality characteristics were monitored during storage. The wheat from the regional farmers is stored in all the silos of the company. In the stored wheat, moisture content is 12%, and foreign matter content is below 2%. The hectolitre analysis of the wheat samples taken during the study was determined according to Anonymous [11], the moisture content was determined according to Nas et al. [12] and Anonymous [13], and the amount of protein and foreign matters were determined according to Özkaya and Özkaya[14].



Results and Discussion

Monthly ventilation amounts during storage in the examined silos are given in Figure 2. The harvest temperature was lowered by ventilation for 242 hours in order to cool the products in the first month when the products were placed in the warehouse. In the following months, ventilation was made depending on the decreases in outside temperatures and the temperature variations in the silos. The lowest ventilation was made in December with 35 hours to eliminate the smallest temperature differences. In spring, the amount of ventilation increased due to the bulk temperature differences in parallel to the increase in the outside temperatures.

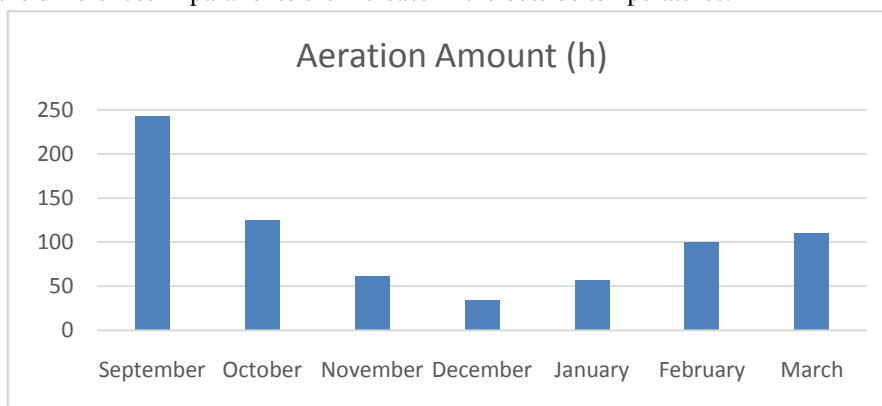


Figure 2: Aeration amount in the silos during storage

The changes in the hectolitre of the wheat samples taken every 15 days from the examined silos is given in Figure 3. As can be seen in Figure 3, it is observed that all silos have a value between 81.5-83 kg/hL. The change in the hectolitre value of the products at the beginning of storage and at the end of storage is below 0.1 kg/hL. This situation can be said to result from the fact that proper storage conditions were provided during storage.

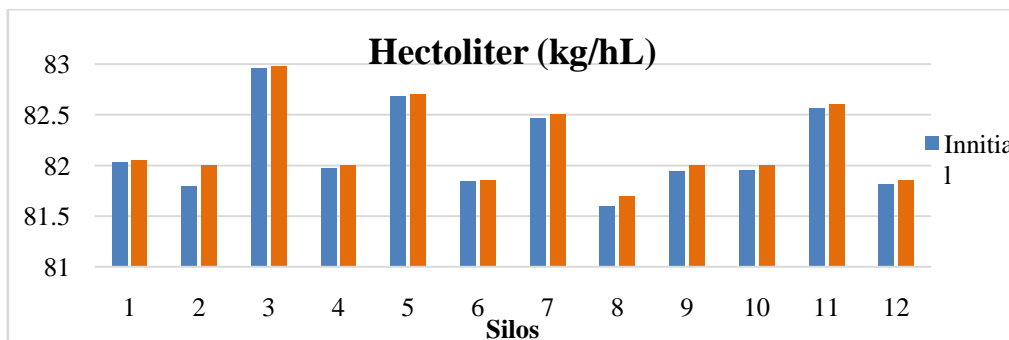


Figure 3: The change in the hectolitre of the wheat samples during storage

The change in the moisture content of the wheat during storage is shown in Figure 4. The product moisture content varied between 11.6 and 11.8%, and a very small increase between 0.02% and 0.06% was observed between the beginning and the end of storage. These values are the indication of the monitoring of the product moisture and the efficient use of ventilation in silos.

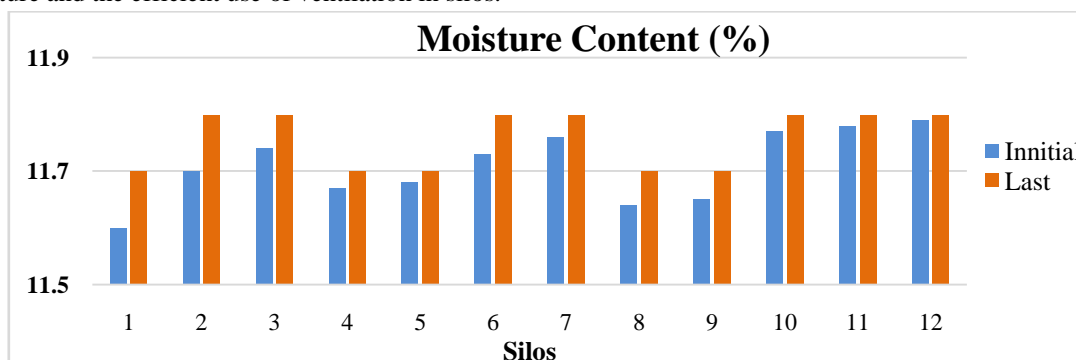


Figure 4: The change in the moisture content of the wheat during storage

When the change in the amount of protein, another quality parameter of wheat, during storage is examined (Figure 5), it can be observed that the protein ratios remained constant at around 13%. Approximately a 0.1% decrease in protein ratios was observed in around half of the 12 silos monitored, but this decrease is quite satisfactory for the 8-month storage period. It is evident from this that losses can be minimized by ensuring proper storage conditions during storage.

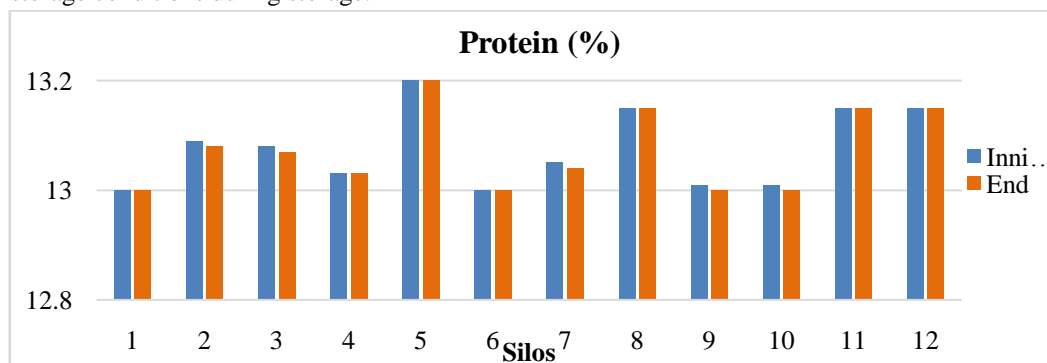


Figure 5: The change in the amount of protein of the wheat during storage

Figure 6 shows that the amount of foreign matters in wheat varied between 1.6-1.75% between the beginning and the end of storage. A small decrease in the amount of foreign matters is an indication that the silos were not affected by external conditions and the ventilation and the cleaning work during storage were successful.

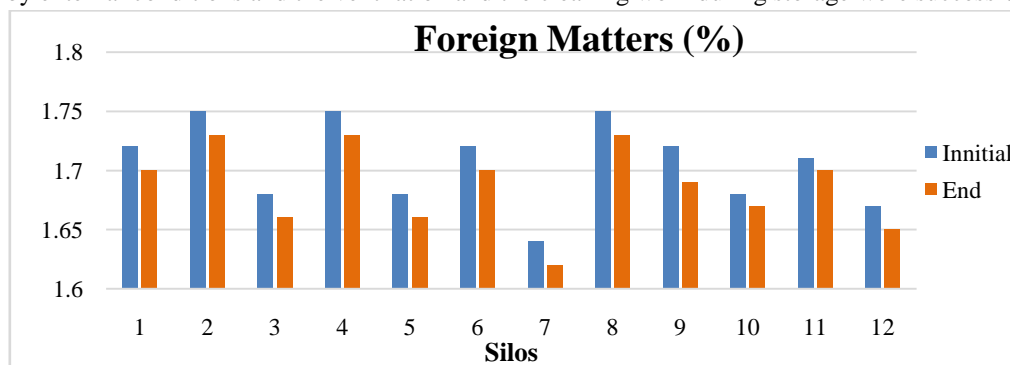


Figure 6: The change in the foreign materials of the wheat during storage

Conclusion and Suggestions

In this study, the effects of the storage of wheat, which has a significant production share in the Thrace region, in the licensed stores, which is a new concept, are examined.

As a result of the study, it was observed that the high outside temperatures at the beginning of storage affected the quality of wheat in the examined silos and the activities of harmful microorganisms increased. In these periods, ventilation systems were automatically operated depending on the bulk temperatures, and the bulk temperature was reduced. The decrease in the outside temperatures from October and November affected the storage positively. In this period, the storage conditions were improved by operating the ventilation system intermittently according to the bulk temperature differences determined with the help of automation. From January onwards, the outside temperatures started to increase, and the amount of ventilation was increased to prevent the temperature difference inside the silos.

According to the quality analysis of the wheat samples taken from the 12 silos at the end of storage, average hectolitre was determined as 82 kg/hl, moisture content was determined as 11.5%, protein content was determined as 13%, and foreign matter content was determined as 1.7%. Regarding the change in quality parameters during storage, hectolitre and moisture content increased by 0.06% and 0.42% respectively, while protein and foreign matter decreased by 0.005% and 1.13% respectively, on average.

The results of the analysis showed that suitable storage conditions were created for wheat during the storage period and the quality characteristics were maintained. In this respect, it can be said that the relevant company complied with the legislation of safe storage and licensed storage. Because of the low cost of storing



agricultural products in our country, the use of open and traditional closed stores causes significant economic losses. For the prevention of economic losses, and the protection and guarantee of the product and the producer, it is imperative that the modern licensed storage should be spread as soon as possible in the country. Instead of small and medium-sized stores, modern and automatic-controlled licensed stores that have high storage capacity and preserve the product quality characteristics should be used.

The high first investment cost of licensed storage ranks first among the doubts about investments in this field. Therefore, it is critical for non-profit organizations and institutions to pioneer the field of licensed storage.

In order for technically licensed storage to be implemented in a healthy manner, the establishment and professionalization of commodity stock exchanges for the agricultural products to be stored in each region also play a critical role [15]. Establishment of relevant commodity stock exchanges should take place with the common steps to be taken by commodity exchanges in the region, producers' organizations and other stakeholders in this field.

References

- [1]. Brooker, D.B., Arkema, F.B., Hall, C.W. (1992). *Drying and Storage of Grains and Oil seeds*. An AVI Book, Published by Van Nostrand Reinhold, ISBN 0-442-20515-5, New York.
- [2]. Jones, D., Shelton, P. (1994). *Management to Maintain Stored Grain Quality*. Nebraska StateUnv. Cooperative Extension Service, Institute of Agriculture and Natural Researces, G 94-1199-A, USA.
- [3]. Sisman, C.B., and Delibas, L. (2005). Storing Sunflower Seeds and Quality Losses during Storage. *HeliaInt. Scientific Journal*, 28(42): 115-132.
- [4]. Kendirli, B. (2007). Planning Protection and Storage Buildings in Farm Constructions. Ankara Univ. Agricultural Fac. Ankara.
- [5]. Sisman, C.B., Ergin, S. (2011). The Effects of Different Storage Buildings on Storage Conditions and Wheat Quality. *Journal of Applied Sciences* 11(14): 2613-2619.
- [6]. Anonimous (2014). *Grain Production in the World*. Publication of Turkish Grain Board. Nisan 2014.
- [7]. Anonimous (2017) <http://www.millermagazine.com/dunya-bugday-pazari/.html>
- [8]. Ünal, M.R. (2011). *Research Report of Licensed Storage for Agricultural Products*. Fırat Development Agency, Malatya
- [9]. Anonimous (2013) Licensed Storage Law, Number 5300 12.04.2013 Official Newspaper No:28616, Ankara
- [10]. Anonimous (2010). *Meteorological Bulletin*, Turkish State Meteorological Service Publication, Ankara.
- [11]. Anonimous (2009) TS 2974, *Quality standards of Wheat*. Institute of Turkish Standards, 1, 18 p. Ankara.
- [12]. Nas, S., Gökalp, H.Y., Ünsal, M. (1998). *Vegetal Oil Technology*. Pamukkale Üniv. Engineering Fac. Book Pub. Num: 005, 329p, Denizli.
- [13]. Anonimous (2008). *The Critical Moisture Contents of the Grains. Purchase and Storage Prosedures for Turkish Grain Board*. Publication of Turkish Grain Board. Vol. I. Ankara.
- [14]. Özkaya, H., Özkaya, B. (2005). *Analyses Method of Grain and Grain Products*. Food Tech. Pub. No 31. pp. 157.
- [15]. Mızrak, G. (2007). Licensed Storage in Exchange System of Farm Product Specialization. *Konya Commodity Exchange Journal*.

