

# The effect of alcohol on the preservation of the nutritional value of the haylage when it is packed in agrostretch film

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**Abstract.** The article discusses the issue of the formation of alcohol vapor in haylage packaged in agrostretch film. The haylage includes ryegrass and alfalfa, which makes it possible to provide the entire livestock complex with a high-quality feed mixture. It was established that at the time of harvesting and packaging of haylage, the percentage of alcohol settled at 2.6%. The observation period for changes in the percentage of alcohol inside a soft container made of agrostretch film was 11 days. As a result of research, it was found that the percentage of alcohol decreases sharply and already on the tenth day becomes zero. At the same time, the percentage of carbon dioxide in the packaged haylage increases, which prevents the development of pathogenic microflora and the formation of fungi.

## 1 Introduction

Providing farms with highly nutritious feed today is one of the promising tasks facing large and medium-sized farms. Ensuring a reliable and sustainable food supply was announced by the Government of the Russian Federation in 2015. Today, farms prefer to use inexpensive methods of preparing plant feed. The main feeds used on farms include hay and silage. Harvesting hay and silage is not difficult and does not require special equipment or special storage conditions. Hay and silage can be classified as winter feed, and both methods of feed preparation are distinguished by their nutritional value and low preservation. An alternative to hay and silage is haylage.

Haylage is also a winter food, which includes annual and perennial plants. At the same time, the haylage ensures maximum preservation of the nutritional elements of the feed, such as protein, sugar, carotene and other elements included in its composition. Haylage is produced by wilting green grass in the field to a humidity of 45-55%, followed by packaging in an oxygen-free environment; it is best to use a carbon dioxide environment [1].

Considering the foreign practice of preparing winter feed, it can be noted that the emphasis on haylage in Eastern Europe, America, and Central Africa was made 30 years ago.

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At the same time, the share of haylage in the total volume of fodder procurement in foreign countries reaches 50%. The dynamic development of this feed procurement technology came to Russia a little more than 10 years ago. In this case, the total share of haylage in the total volume of feed does not exceed 20% [2]. A special feature of haylage compared to silage and hay is its low acidity, ranging from 5.4 to 6.8, which allows the product to provide a balance of taste and dietary properties. At the same time, the proportion of dry matter in haylage is significantly higher than in silage. The balance of nutritional value and digestibility contributes to good indicators of product consumption. Feeding animals with haylage alone and completely replacing silage and hay with it does not lead to a decrease in the productivity of animal fattening.

The pre-dried green mass of haylage is collected and packaged in agrostretch film. Wilting helps to increase the osmotic pressure in the cells of the green mass, which contributes to the suppression of putrefactive microflora, prevents the development of pathogenic microflora, while in agrostretch packaging there is an active release of carbon dioxide in the process of chemical reactions caused by the fermentation of silage. One of the main positive factors of drying can also be the formation of lactic acid bacteria, which have a positive effect on the intestinal microflora, which in turn leads to increased immunity. The formation of lactic acid bacteria depends on the humidity of the silage; at a humidity of about 55%, the number of lactic acid bacteria is about 40%, compared to other microorganisms [3]. With strict adherence to the technology of haylage harvesting using alfalfa and ryegrass, the proportion of fiber and metabolic energy in dry matter increases. Haylage prepared according to a recipe that includes alfalfa and ryegrass allows the consumption of concentrates used for low-quality feed in the composition of hay and silage. The use of haylage in feeding young animals can be used as an independent feed, but strict technology for harvesting haylage must be observed. If the technology is not followed, the total loss of the nutritional value of haylage during harvesting, packaging, and storage reaches 25% [4].

## 2 Materials and methods

In the conditions of the Avangard LLC enterprise in the Ryazan district of the Ryazan region, studies were carried out on changes in the composition of the gas environment when packaging haylage in agrostretch film. The main problem of an agricultural enterprise is to control changes in the gas environment during the entire fermentation process of haylage after packaging in agrostretch film. Agrostretch film allows you to ensure the tightness of the haylage. Research has established that the fermentation process of haylage after packaging lasts for ten days [5], while in the packaged haylage the oxygen content is formed within a day, the oxygen content significantly decreases and the carbon dioxide content increases. It should be noted that the haylage packaged in agrostretch film consists of ryegrass and alfalfa. Ryegrass is a perennial plant for feeding various types of animals, and it can be consumed both on pasture and as haylage prepared in advance. Storage of ryegrass as part of haylage should not exceed 4 years [6]. The nutritional value of ryegrass consists of the content of 0.15 feed units and 15 grams of protein per 1 kg of dried ryegrass. Alfalfa is a feed unit that provides household farms with stable green food, and it can be collected up to 3 times per season. Harvesting alfalfa 4 or more times per season is not recommended, due to the fact that the grass begins to coarsen. Harvesting of alfalfa should be carried out before the plant blooms; in some cases, harvesting can be carried out in the initial period of flowering. The use of alfalfa in feeding domestic animals promotes their active growth, especially when feeding young animals. Alfalfa is also actively used to feed dairy cows. Alfalfa haylage, as a rule, has a specific, balanced composition, which includes crude protein from 4.5% to 6%, fat up to 1%, fiber from 5.5% to 8.5%, while digestibility varies from 60% up to 70% [7]. Alfalfa is used both in the composition of haylage and for the preparation of grass meal.

In the conditions of the agricultural enterprise Avangard LLC, an experimental study was carried out on the packaging and storage of alfalfa and ryegrass haylage. Previous studies have shown that during the storage of haylage inside a sealed container made of agrostretch film, chemical processes occur during which the oxygen content in the container during the day decreases to approximately 1% and the carbon dioxide content increases to 11-13%, which contributes to the preservation of the main quality product indicators, such as crude protein, fats, fiber and others [8].

The time from mowing to collecting haylage does not exceed 4-6 hours; the haylage itself comes in rolls (Figure 1). At the same time, during the packaging of haylage (Figure 2), from the first hours of packed haylage, fermentation processes begin in it, during which ethyl alcohol is formed. The presence of alcohol vapor shows the progress of biochemical processes in the product; at the beginning of fermentation, the content of alcohol vapor is highest, then gradually decreases. Based on the presence of alcohol vapor, it is possible to assess the safety of the main components of silage during storage, while fats and proteins are primarily subject to decomposition processes, while during fermentation the development of pathogenic microflora, molds and rot is limited.

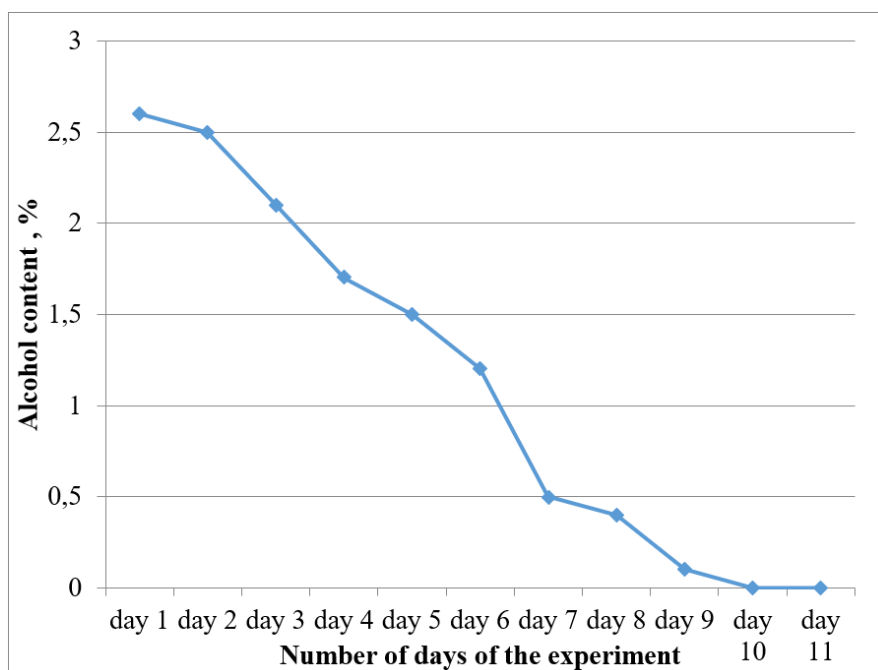


**Fig. 1** Roll of silage.



**Fig. 2.** Silage packaging process.

The alcohol concentration in the gas environment of haylage packed in agrostretch film was monitored every day for 10 days, including the day of packaging. The change in alcohol content can be seen in the graph shown in Figure 3. To monitor the readings of the amount of alcohol inside a sealed container with haylage, a “Signal - 4” gas analyzer was used, which was connected to the MAG-6 P device, designed for sampling a gaseous environment from a sealed container using injector needles. An experiment to control the percentage of alcohol in the environment of haylage packed in agrostretch film was carried out over 11 days. At the same time, theoretical studies have shown that on days 9-10 the alcohol content tends to zero.



**Fig. 3.** Changing the percentage of alcohol inside a soft silage container.

### 3 Results and discussion

Analyzing the graph in Figure 3, the experiment was carried out on 10 rolls packed in agrostretch film, the change in alcohol content on the first day of packaged haylage tends to zero by the tenth day. At the same time, the readings of the device recorded the percentage of alcohol on the first day at around 2.6%, while the readings varied from 2.7% to 2.5%, the average value was chosen to construct the graph, samples were taken similarly on other days, so when collecting from 10 packaged rolls, determining the arithmetic mean value. The value of the device readings on day 10 in all ten packaged rolls was around 0%; sampling on day 11 was carried out to finally understand that there was no alcohol left inside the packaged roll of haylage.

### 4 Conclusion

The use of sealed packaging in the form of agrostretch foam for storing haylage promotes the formation of gas sulfur with a high content of carbon dioxide inside the sealed container. At the same time, alcohol vapors have a negative impact on the safety of the main components

of haylage. The graph shows that the concentration of alcohol vapor decreases significantly on the tenth day and becomes equal to zero, while the readings on the first day of control were 2.6%, by the fifth day the percentage of alcohol decreased almost by half. Consequently, after the tenth day, the fermentation processes are completed and the haylage is prepared.

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