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Biological conservants impact on the silage quality and aerobic stability

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There were showed the technological trial results of the corn silage conservation with using the new generation microbial additives. There were characterized the main advantages of biological inoculants and their influence on the silage quality, nutrients preservation, energy value, and the forage aerobic stability.

The place reaction and the hydrogen-ion concentration (pH) are the most important regulators of the microbiological and the biochemical procedures. We can observe this index in our control samples in 60 and 120 days after the silage making. The index was 4.1-4.0 and 4.0-3.8 relatively.

The silage making with inoculants gives us the quick sugar bacterial fermentation. It helps to make the sufficient volume of the milk acid and the acetic acid.

It was found out that the control silage sample had the least value of the milk acid comparing to the determined organic acids (62.31%). In the mean time we had 63.59% with the 'Litosyl plus' and 67.81% with the 11C33 inoculant. In addition to that there were 37.67% of the acetic acid in the control sample (without inoculants). There were 29.16 and 32.19% of the acetic acid in the trial samples consequently. Silage without inoculants had the butyric acid in the equivalent of 0.02% in comparison with the trial samples where we did not find it.

This was established that during the storage period the 'Litosyl Plus' conservant using at a dose of 4 g and the inoculant 11C33 using - 1 g per 1 tone of silage mass provided the dry matter losses reduction at the level of 3.63 and 0.33% vs 4.98% in the control group.

Keywords: Silage; conservant; inoculant; feeding industry; microbial yeast; crude protein; enzymes

Introduction

The Ukrainian population needs supplying with the high quality and environment-oriented feeds are closely associated to the development and efficiency of the agricultural industry. The livestock industry plays the important role in seeking to resolve such matter as for the main supplier of the most valuable food products.

The basis of production of livestock products with the high genetic potential of animals are the feed base and its structure and the feed level and the feed quality are considered as well. The creation of the fully-fledged scientifically based forage base involves the intensive use of lands, new high-yielding breeds and hybrids of the fodder crops. The main point is that we should use the economically profitable harvesting technologies, storage, conservation and rational use of feed (Zinchenko et al., 2005, Caetano et al., 2011).

The rationed feeding importance helps to increase the feeds and rations nutritional value. Due to the fact that the cattle feeding practice most often use the forages with inoculants, the choice of harvesting technology and this is the main factor of their nutritional value preservation.

In ancient times ensilage was probably undertaken mostly with grain intended for human consumption, as it afforded a means of storage in times of plenty for years when pestilence and bad weather led to poor harvests; it was also a method of concealing food from marauding tribes. The only apparent connection between the ancient and modern methods of preserving crops by ensilage is in the use of silo to store them. Moreover, in all probability the stored grains had not undergone fermentation and was not, therefore, necessarily silage in the strict sense of the word.

The forage conservation without careful selection of the high-yielding modern hybrids of fodder crops and if we do it without taking into consideration of the vegetable stage, and the harvesting technology then this leads to the significant losses in the storage and feeding process (Reich et al., 2010, Jalc et al., 2009, Wilkinson et al., 2013).

Silage is assuming ever-increasing importance in the feeding of livestock owing to the escalation cost of feed concentrates through-out in the world. Livestock, like human beings, require energy, proteins, minerals, and vitamins from their food. While fresh fodders on the whole provide these items, conserved forages, on the other hand may be deficient in one or more of them. The aim of conservation process is to preserve as many of the original nutrients as possible, particularly the energy

and protein components, since technically it is a relatively easy task to compensate for the deficiencies in minerals and vitamins (Andrae et al., 2001, Podgornij et al., 2010, Hrupov et al., 2005).
The perspective fodder conservation technology direction of the feed is put the inoculants using. Two factors that impact fermentation are silage porosity and density. Porosity influences air's ability to move through the silage mass and penetrate deeply. Forage that is drier, coarsely chopped or not packed densely enough is more porous. Density refers to how much feed an operator can pack into a cubic foot of silo, bag or bunker. Fine chopping or shredding and extra heavy equipment help increase density. Producers should limit porosity and ensure adequate density (Adesogan et al., 2007, Faligowska et al., 2014, Sucu et al., 2006).
Fermentation failures occur in areas when too much oxygen is available and the process of lowering the pH slows or stops. This happens because the aerobic (oxygen-loving) bacteria can grow unchecked and dominate the lactic acid bacteria. Higher porosity areas, often near the outer rim of structures, will show mold or spoilage.
If water enters the silage and dilutes the acids, layers or areas of spoiled feed may appear. This happens if rain falls on forages during filling, when feed is over packed (cell walls rupture and excess plant moisture accumulates into a layer) or when holes in the covering allow water to leak in.
When fermented feed is re-exposed to oxygen during facing and feed out, dormant yeasts become active and feed on the lactic acid, raising silage pH and allowing the "decomposition microorganisms" including molds to begin breaking down the feed (akin to composting). Heat probes allow us to measure the heating that occurs during this decomposition (Pobednov et al., 2013, Johnson et al., 2003).
The feeds conservation with the silage inoculants using is the progressive element of the silage making technology (Wrobel et al., 2004).
However, this is so vital to pay attention to the most productive silage corn hybrids and new technology created silage inoculants. This needs to be estimated in order to understand their influence on the livestock health and its productivity.
The goal of research was to determine the biochemical parameters of corn silage quality and its aerobic stability when we use the new inoculants generation.

Materials and methods

The scientific trial was done on the «Chernigiv Industrial Milk Company». During the experimental going we made 3 silage corn silos. The first one was done without inoculants using (control), the second one was done with Litosyl Plus conservant using and the third one was done with the DuPont Pioneer 11C33 inoculant using. The assessment of the feed quality was carried out by the BLGG AgroXpertus feed quality laboratory.

Results and discussion

The laboratory results are showed in Table 1.

Table 1. Silage biochemical values.

Holding period	The sum of acids, %	The ratio of acids, %		
		Lactic acid	Acetic acid	Butyric acid
Corn silage without conservants				
60 days	2.52	64.45	35.53	0.02
210 days	2.84	62.31	37.67	0.02
Corn silage with the bio conservants “Litosyl Plus”				
60 days	2.46	66.24	33.76	0
210 days	2.31	63.59	36.41	0
Corn silage with the inoculants of DuPont Pioneer (inoculant 11C33)				
60 days	2.34	68.37	31.63	0
210 days	2.72	67.81	32.19	0

The organoleptic evaluation showed that all prepared feeds had the dark and green color. The feeds structure was conserved properly and it had the sour taste and it had the same smell. Delayed lactic acid fermentation at the beginning of the silage making and the slow acidification lead to the development of the undesired bacteria. This moment helps to increase the nutrient losses and we have the feed deterioration. By the way, the milk acid is the great nutritional substrate for the vital rumen microorganisms. The energy value among the main fermentation acids has the peak value and this point is not differ comparing to the sugar value. At the same time the acetic acid absorbs the significant percentage of gross feed energy and this percentage reduces its energy nutritional value.
There were 62.31% of the lactic acid in the control group of our determined organic acids. The “Litosyl Plus” had 63.59% and the 11C33 inoculant - 67.81%. However, we had the acetic acid at the level of 37.67% in the control group (without inoculants). The trial group had 36.41 and 32.19% accordingly. We found the butyric acid in the silage what was without inoculants and this was 0.02%. We dare to conclude that we did not have the butyric acid in the trial groups.

The most important regulators of the microbiological and biochemical processes are the environment reaction and the concentration of the hydrogen ions (Figure 1). This index figures out between 4.2-3.7. And we do not have the differ significance here.

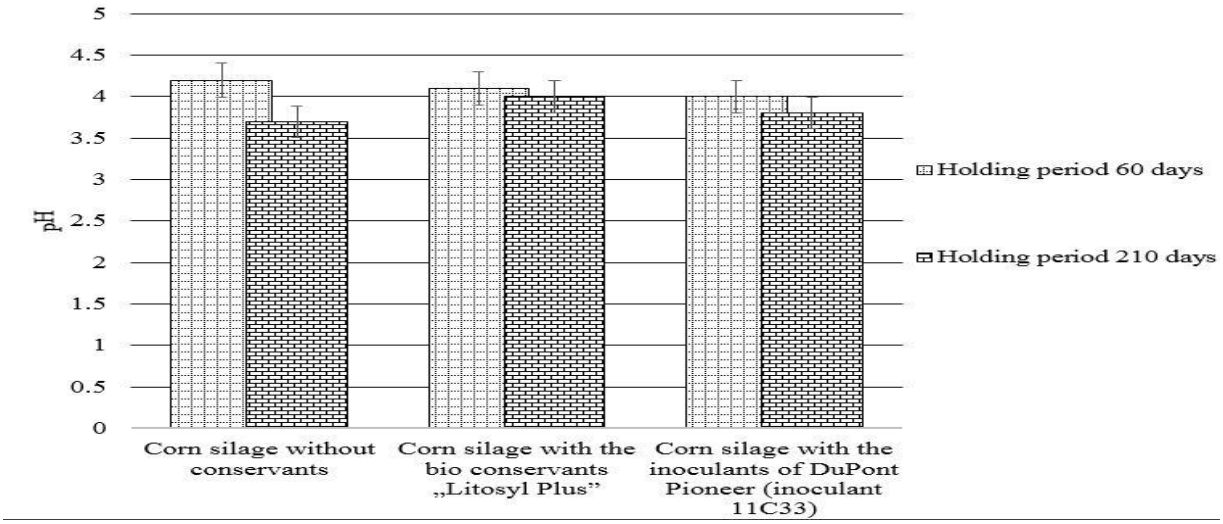

Figure 1. Silages pH index.

The feed samples were taken in 60 and 210 days. This was done after the silage making (Table 2). According to the nutrients content we can see that silage with the "Litosyl Plus" and the silage with 11C33 inoculant of the DuPont Pioneer Company were better than that silage without inoculants. This was established that nutrients losses with the „Litosyl Plus" conservant, DuPont Pioneer 11C33 inoculant (trial groups) and silage without inoculants (control group) after 7 months' period were different. Thus, the dry matter indexes were 29.2, 29.4 and 28.6% (Figure 2). Three groups of silages had the different protein levels and there were 2.23, 2.27 and 1.83%. crude fiber - 6.41, 6.18 and 6.84%. FNE - 18.63, 18.97 and 18.05%. crude fiber - 1.11, 1.12 and 1.12% accordingly.

Table 2. Silage chemical composition, %.

Preserving period	**Content of the dry matter in the feed**				
	Crude protein	**Crude fat**	**Crude fiber**	**Free-nitrogen extract**	**Crude ash**
Corn silage without conservants					
60 days	2.19	0.83	7.23	18.21	1.23
210 days	1.83	0.77	6.84	18.05	1.12
Corn silage with the bio conservants „Litosyl Plus"					
60 days	2.27	0.88	6.76	19.12	1.18
210 days	2.23	0.82	6.41	18.63	1.11
Corn silage with the inoculants of DuPont Pioneer (inoculant 11C33)					
60 days	2.38	0.94	6.79	19.01	1.18
210 days	2.27	0.86	6.18	18.97	1.12

Chemical composition analysis showed that the dry matter content in the second trial group was 96.7%, the third group - 97.1% and the control group - 96.3%. We can see that silage with 11C33 inoculant has the lowest losses of the dry matter.

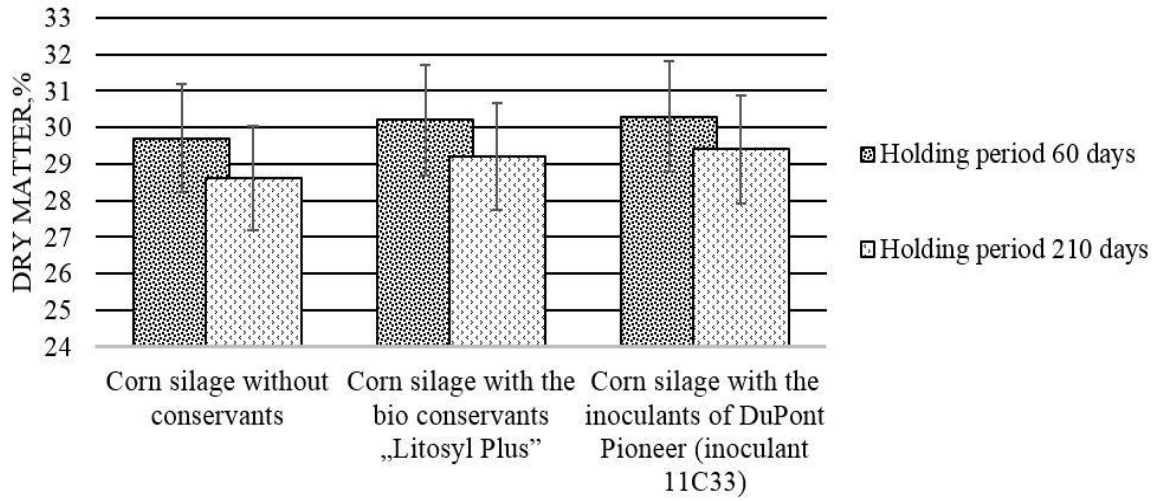

Figure 2. Mass fraction of dry matter in silage.

The inoculants usage during the silage making helps us to keep the better protein level in the second case (3.6% more) and in the third case it was 8.7% more. We say it when we compare the trial sample with the control sample. The trial sample has the better results than the control sample.

Under the inoculants influence we had the reduction of the fiber in the dry matter by 5.17%. The second variant had the reduction by 8.98% and the control group had it by 5.39% in comparison with the silage after 2 months of storage. The most significant decrease of the crude fiber indicates the effect of the fiber technology inoculant 11C33.

Conclusion

Consequently, the use of the "Litosyl Plus" conservant at the dose of 4 g and the using of the 11C33 - 1 g per 1t during the storage period of the silage mass provides the dry matter losses decreasing at the level of 3.3 and 2.9% versus 3.7% in the control group. The prospect of the further research is the study of the inoculants impact on the livestock productivity.

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