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INFLUENCE OF QUALITY OF SILAGE FROM RYE AND TYPHON MIXTURE ON MILK PRODUCTIVITY OF COWS

The article analyzes organoleptic parameters, biochemical composition and energy nutrition of the silage stored in the ground burts with moisture of 75% and harvested from the mixture of winter rye and typhon with the use of biological preservative Viaferm. The productive effect of the researched forage for dairy cows feeding has been established.

It was determined that the use of bacterial and enzyme preparation Viaferm in the amount of 1 g per 1 ton of dried winter rye and typhon mixture did not produce the 1st grade silage. The total content of organic acids in the silage was 1.73%, the proportion of acetic acid was 51.32%, while that one of lactic acid was only 48.22% at the recommended level of 60% and more. The content of ammonia nitrogen as the indicator of protein hydrolysis exceeded the norm by 14.2%.

The comparison of indicators of the chemical composition of the dry matter of fresh cut and dried mass of rye with typhon and the silage obtained from it showed that the crude protein loss was 16.86%, the loss of non-base extraneous substances was 5.1% and that one of crude fat was 0.74% during the process of silage harvesting. The crude fiber and ash content in the silage was higher by 3.64 and 4.93%. The dry matter energy content of the silage was 9.13 mJ of the exchange energy, which was by 0.74 mJ lower than the green mass of rye with typhon.

Feeding the silage from winter rye and typhon mixture harvested with the preservative Viaferm did not provide a significant increase of milk productivity in the physical mass. However, the fat content in the milk of the experimental group was lower by 0.13%, which led to a decrease of productivity in the obtained mass. This decrease in the productivity of cows was due to the low quality of the silage, i.e. the presence of butyric acid and the high content of ash.

Keywords: *rye, typhon, silage, lactic acid, butyric acid, ammonia nitrogen, dry matter, crude protein, ash, milk yield*

Tab. 3. Ref. 7.

Setting the problem. Improving the quality and protein nutritional value of silage as the main voluminous feed in the rations of milking cows plays an important role in the intensification of the dairy industry. The use of silage in the summer period is also an important measure to provide uninterrupted animal feed, especially in the zones of Steppe and Southern Forest-steppe, where low precipitation and high temperatures do not allow to obtain high yields of perennial legumes. One of the ways to solve this problem is to use winter rye for the silage and green fodder. Winter moisture is sufficient for the growth of this crop and it is possible to obtain optimum yield even in the absence of precipitation in spring. In order to increase the protein nutrition of rye silage, co-crops of this cereal with wild turnip and typhon are used. Typhon is a hybrid of Chinese cabbage and turnip, a relatively new promising crop of the family of crucifers, which was introduced in the Netherlands at the end of the last century.

Analysis of recent researches and publications. Growing cabbage crops together with cereals in the main and intermediate crops allows to obtain high-protein green mass from April to December or to harvest early silage in the 3rd decade of April – 1st decade of December. The silage from winter rye and winter wild turnip grown in the conditions of Hoshchanskyi district, Rivne region had a higher energy and protein nutrient content of dry matter as compared to pure rye silage, which resulted in an increase by 7.92% of its productive effect on milk yield of cows with a decrease by 6.17% in feed costs [1].

According to L. Podobied [2] the effect of applying the green mass of winter rye and typhon mixture increases if autumn plantings of these crops are conducted spherically, i.e. by stripes. The mixture of winter rye and typhon had an excellent energy-protein ratio at a content of 0.20-0.25 feed units and 25-29 g of crude protein per 1 kg.

Our observations also indicate that growing a mixture of winter rye with typhon in such a scheme gives an opportunity to get a high yield of green mass of 279.1 cwt/ha with high quality indices in Ternopil region in the third decade of April, as well as to produce the high quality silage, which can be stored in aerobic conditions after the opening, without significant loss of nutrients when using the bacterial enzyme preparation Litosyl plus [3].

The effectiveness of bacterial fermentation in silaging the herbs is proved by scientific researches of V. Kucheriavyi and others [4], S. Ovsienko [5]. They have found that bacterial preservatives influence the course of fermentation, inhibit the development of butyric bacteria, improve the ratio of organic acids in the feed, in which the loss of nutrients decreases, while the quality and nutritional value of canned feed increase.

The aim of the research was to determine the qualitative indicators and the productive effect of the silage from winter rye and typhon mixture harvested with the use of bacterial-enzyme preparation Viaferm when replacing the corn silage in rations of milking cows.

Materials and methods of research. The green mass of winter rye with typhon was grown in the conditions of LLC Kramagrosvit of Sloviansk district, Donetsk region. Fodder crops were planted by stripes with a HorschPronto seed drill. The stripe width of each component was 12 m. The crops were matured on May 5, 2018. The yield of the mixture was 124 cwt/ha with a moisture content of 81.9%. The mowing of herbs was carried out in the phase of entering the tube – «flag leaf» in rye and during the flowering typhon. During this period rye has a high sugar content, which provides acceleration of fermentation processes and avoids the development of undesirable microflora in canning. The mass was mowed across the crops, dried in rolls to 75% of moisture, harvested, chopped with the adding of preservative Viaferm at a dose of 1 g/ton of raw material, laid in a ground burt and sealed.

Viaferm is a bacterial concentrate of 2.0×10^{11} CFU/g of lactic acid bacteria *Lactobacillus plantarum* (NCIMB 30083, 1k 20736), *Enterococcus Faecium* (DCM 22502, 1k 20602), *Lactobacillus plantarum* (NCIM 30084, 1k 20737), *Pediococcus pentosazeus* (DCM 23688, 1k 101; DSM 23689, 1k 1011) and maltodextrins. In order to prepare the working solution, 1000 g of dry preservative was dissolved in 20 liters of water. 20 ml of a working solution were added per 1 ton of silage.

After a month and a half the burt was opened, samples were taken out for the determination of organoleptic, biochemical and chemical composition of the silage.

The energy nutrition of the silage was determined by the calculation method, using the data of the chemical analysis and the regression equation [6]:

$$EE = 0,0151 \cdot CP + 0,01378 \cdot CF + 0,00328 \cdot CF + 0,01265 \cdot NAES$$

where: EE – exchange energy;

CP – crude protein, g;

CF – crude fat, g;

CF – crude fiber, g;

NAES – non-acid extractive substances, g.

The productive effect of the harvested silage was determined by conducting a scientific experiment on the cows of Simmental breed by the method of group-periods [7]. When determining the productive effect, the difference in feeding cows was that 50% of the corn silage was replaced with the silage from winter rye and typhon mixture in the diet of the experimental group.

Research results. The results of the conducted chemical analysis indicate a high fodder value of the green mass of winter rye and typhon mixture (Table 1). The moisture of the green mass was 81.9%, the crude protein content – 2.93%, the crude fiber content – 4.30%, the crude fat content – 0.56%, NAES – 9.31%. The total energy nutrition of 1 kg of grass was 0.18 feed energy units.

However, the following technological operations, namely moving, rolling and weight selection, lead to the loss of nutrients and the contamination with the soil, which negatively affects the nutritional value of the mass. This is evidenced by an indicator of ash content, which is almost twice as high as the green mass. The reason for this is the over-dried upper layer of soil (i.e. deep soil moisture) and the low cut (7.1 ± 3.2 cm), which leads to the rise of dust, even with well-adjusted working parts of the forage harvesting machinery.

The content of lactic acid in the silage from winter rye and typhon mixture was only 48.26%, while the proportion of acetic acid was 51.32% and that one of butyric acid – 0.42%. The energy losses as a result of the formation of gaseous hydrogen occur during the fermentation of sugars and lactic acid to butyric acid. The total content of organic acids is low – 1.73%, which is explained by the partial neutralization of ammonia with organic acids.

Table 1

Chemical composition, energy nutrition of green dried mass of winter rye and typhon mixture and biochemical indicators of the silage from it

Indicator	Winter rye and typhon mixture		
	green mass	dried mass	silage
Dry matter, %	18.1	26.64	26.01
Nutrients content per 1 kg of dry matter, %:			
crude protein	16.2	14.23	13.47
crude fat	3.05	2.64	2.31
crude fiber	24.25	25.65	27.89
crude ash	5.06	6.74	9.99
crude NAES	51.44	50.74	46.34
Exchange energy, mJ/dry matter	9.87	9.43	9.13
pH	–	–	4.37
Ratio of organic acids:			
lactic			48.26
acetic			51.32
butyric			0.42

According to the ammonia nitrogen content and the total acidity, the harvested silage is not stable when stored in the aerobic conditions. The content of ammonia nitrogen was 14.2%, which indicates the processes of proteolysis and the growth of butyric acid bacteria that leads to a deterioration in the quality of silage, nutrient losses, especially protein. It is obvious that the applied preservative Viaferm at a dose of 1 g/ton did not create conditions for a rapid decrease in the pH of the silage mass to stop the development of negative microflora.

The loss of crude protein during the silaging of winter rye and typhon mixture was 16.86% compared with the green mass and 5.34% compared with the dried one. The content of crude fat and NAES in dry matter of silage was lower by 0.74 or 5.1% compared with the green mass, while the content of crude fiber increased by 3.64%. The energy value of the harvested silage was by 0.74 mJ EE lower compared with the green mass, while it was by 0.3 mJ EE lower than the initial mass and amounted to 9.13 mJ EE in dry matter.

The ration of feeding the experimental cows was balanced by the main nutrients and almost did not differ from each other. The concentration of exchange energy in 1 kg of dry matter was 10.34 and 10.33 mJ, the content of crude protein in the experimental group was only by 0.7% higher compared with the control, the ratio of calcium to phosphorus was 1.59 and 1.62, respectively.

During the experimental period (32 days), according to diets (Table 2), the control group consumed 88467.2 mJ EE and 1381.25 kg of crude protein. The experimental group consumed 85510.15 mJ EE and 1406.03 kg of crude protein.

Table 2

Ration of feeding the experimental cows

Indicators	Groups of cows	
	1 ration	2 ration (silage rye+typhon)
Barley straw, kg	2	2
Alfalfa hay, kg	1	1
Alfalfa haylage, kg	10	10
Corn silage, kg	22	11
Silage rye+typhon, kg	-	11
Mixed feed, kg	11.5	11.5
Molasses, kg	1.5	1.5
Concentration in dry matter:		
Exchange energy, mJ	10.34	10.33
Crude protein, %	16.1	16.8
Crude fiber,%	18.06	18.06
Sugar,%	5.89	5.90
Starch, %	13.81	13.96
Crude fat, %	3.84	3.81
Ratio Ca:P	1.59	1.61

Milk productivity is the main criterion for the full value of feeding cows, the qualitative and quantitative characteristics of the diet as well. The studies have shown that the replacement of corn silage with the silage from winter rye and typhon did not have a significant impact on the milk productivity of cows (Table 3).

Table 3

Productivity of cows when feeding the silage diet from winter rye and typhon mixture

Indicator	Groups of cows		
	1 main diet	2 main diet (silage rye+typhon)	
Gross yield of natural milk during 32 days of the accounting period, kg	7203.22±296.03	7248.73±274.01	
Average daily yield of natural milk, kg	22.51±0.35	22.65±0.27	
Average milk fat content, %	3.53 ±0.09	3.40±0.07	
Gross yield of milk of base fat content, kg	7478.41±237.13	7248.73±254.01	
Average daily yield of milk of base fat content, kg	23.37±0.33	22.65±0.27	
Protein, %	3.14±0.02	3.11±0.01	
Consistence	28.49±0.04	28.48±0.03	
Costs of feed per 1 kg of milk, mJ EE	of natural fat content	12.28	11.79
	of base fat content	11.80	11.79

The obtained data testify that the feeding of the silage diet from rye and typhon mixture almost did not affect the increase of milk productivity of cows in the physical mass. When comparing the productivity in the obtained mass, that is with the milk fat content of 3.4%, there was even a decrease in the productivity by 3.08% compared to the corn silage, but the difference was unlikely. The decrease of milk productivity of

cows when feeding the silage diet from rye and typhon mixture is due, first of all, to the quality of the silage, which has had butyric acid and an increased ash content.

Conclusions. Silaging the winter rye with typhon in burts with the use of Viaferm preservative at a dose of 1 g per 1 ton of raw material did not ensure the high quality silage, as evidenced by the presence of butyric acid and the increased level of ammonia nitrogen.

Feeding the silage from rye and typhon to dairy cows has led to an unlikely decrease in milk fat content and weight. The loss of feed per 1 centner of milk has not changed.

Prospects for further research are to study the effect of the cut height of rye with typhon, the type of storage and the doses of preservative on the quality and productive effect of silage.

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АННОТАЦІЯ
ВПЛИВ ЯКОСТІ СИЛОСУ З СУМІШКИ ЖИТА З ТИФОНОМ НА МОЛОЧНУ
ПРОДУКТИВНІСТЬ КОРІВ

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У статті досліджено органолептичні показники, біохімічний склад та енергетичну поживність силосу, заготовленого в наземних буртах із прив'язаної до вологості 75% сумішки озимого жита з тифоном із застосуванням біологічного консерванту Віаферм, та встановлено продуктивну дію досліджуваного корму в годівлі дійних корів.

Встановлено, що використання бактеріально-ферментного препарату Віаферм в кількості 1 г на 1 тонну прив'язаної сумішки озимого жита з тифоном не забезпечило

отримання силосу 1 класу. При загальному вмісті органічних кислот в силосі на рівні 1,73%, частка оцтової кислоти складала 51,32%, тоді як молочної – 48,22% при рекомендованому рівні 60% і вище. Вміст аміачного азоту, як індикатор гідролізу протеїну, був вищим норми і складав 14,2%.

Порівняння показників хімічного складу сухої речовини свіжоскошеної, прив'яленої маси жита з тифоном та силосу, отриманого із неї показала, що в процесі заготівлі силосу втрати сирого протеїну склали 16,86%, безазотистих екстрактивних речовин – 5,1%, сирого жиру – 0,74%. Вміст же сирової клітковини і золи у силосі був вищим на 3,64 та 4,93%. Енергетична поживність сухої речовини силосу складала 9,13 МДж обмінної енергії, що нижче рівня зеленої маси жита з тифоном на 0,74 МДж.

Згодкування силосу із сумішки озимого жита з тифоном, заготовленого з консервантом Віаферм не забезпечило суттєвого підвищення молочної продуктивності у фізичній масі. Однак вміст жиру в молоці дослідної групи, був нижчим на 0,13%, що призвело до зниження продуктивності в заліковій масі. Зниження продуктивності корів відбулось через невисоку якість силосу- наявність масляної кислоти та підвищений вміст золи.

Ключові слова: жито, тифон, силос, молочна кислота, масляна кислота, аміачний азот, корови, суха речовина, надій молока

Табл. 3. Літ. 7.

АННОТАЦИЯ ВЛИЯНИЕ КАЧЕСТВА СИЛОСА СМЕСИ РЖИ И ТИФОНА НА ПРОДУКТИВНОСТЬ КОРОВ

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В статье исследованы органолептические показатели, биохимический состав и энергетическая питательность силоса, заготовленного в наземных буртах с проявленной смеси озимой ржи с тифоном с применением биологического консерванта *Виаферм*, и установлено продуктивное действие исследуемого корма в кормлении дойных коров.

Установлено, что использование бактериально-ферментного препарата *Виаферм* в количестве 1 г на 1 тонну проявленной смеси озимой ржи с Тифоном не обеспечило получение силоса 1 класса. При общем содержании органических кислот в силосе на уровне 1,73%, доля уксусной кислоты составляла 51,32%, тогда как молочной – 48,22% при рекомендуемом уровне 60% и выше. Содержание аммиачного азота, как индикатора гидролиза протеина, был выше нормы и составлял 14,2%.

Сравнение показателей химического состава сухого вещества свежескошенной, проявленной смеси ржи с тифоном и силоса, полученного из нее показало, что в процессе заготовки силоса потери сырого протеина составили 16,86%, безазотистых экстрактивных веществ – 5,1%, сырого жира – 0,74%. Содержание же сырой клетчатки и зола в силосе было выше на 3,64 и 4,93%. Энергетическая питательность сухого вещества силоса составила 9,13 МДж обменной энергии, что по сравнению с зеленой массой ржи с тифоном ниже на 0,74 МДж.

Скармливание силоса из смеси озимой ржи с тифоном, заготовленного с консервантом *Виаферм* не обеспечило существенного повышения молочної продуктивності

в физической массе. Однако содержание жира в молоке опытной группы, было ниже на 0,13%, что привело к снижению молочной продуктивности в зачетной массе. Снижение продуктивности коров произошло из-за невысокого качества силоса – наличие масляной кислоты и повышенного содержания золы.

Ключевые слова: рожь, тифон, силос, молочная кислота, масляная кислота, аммиачный азот, коровы, сухое вещество, надой молока

Табл. 3. Лит. 7.

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