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# FERMENTATION CHARACTERISTICS IN THE RUMEN OF DAIRY COWS FED WHOLE-CROP SPRING WHEAT SILAGE INOCULATED WITH HOMOLACTIC BACTERIA MIXTURE

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*ABSTRACT*

*Trials were conducted at the Institute of Animal Science of LVA to determine the fermentation changes in the rumen and the blood profile of Lithuanian Black-and-White dairy cows fed inoculated whole-crop spring wheat silage. Whole crop spring wheat cereals (DM content at harvest – 436 g $kg^{-1}$) was ensiled in round bales either untreated (C) or inoculated with a homolactic bacteria blend (Lactobacillus plantarum, Pediococcus acidilactici and Lactococcus lactis) at a rate 5 × $10^5$ colony forming units $g^{-1}$ of fresh herbage (I). The quality of both silages was good. However, the inoculated silage contained considerably more fermentation acids and its pH value was lower. Addition of lactic acid bacteria improved the fermentation profile by lowering butyric acid and dry matter losses and increasing lactic acid.*

*The silages were offered ad libitum with a standard concentrate suplementation at a flat-rate (280 g for 1 kg milk) for ten Lithuanian Black-and-White dairy cows divided in two analogous groups for a period of 92 days. When the ruminal fluid samples were analysed, the number of protozoa was by 15.5 % ($P<0.01$) higher in the inoculated silage compared with the control. Lactic acid bacteria blend treated silage resulted in increased pH value by 0.13 unit ($P<0.05$) and increased proportion of propionate of rumen volatile acids by 1.36 percentage units ($P<0.01$) compared with the untreated silage. The inoculated silage lowered rumen volatile acid concentration by 6.5% ($P<0.05$) and the ratio of acetate to propionate.*

*The silage treated with a microbial blend was beneficial to rumen protein synthesis, whereas the content of protein nitrogen and that of total nitrogen were, respectively, by 5.61 mg l00 $ml^{-1}$ ($P<0.01$) and by 3.7 mg l00 $ml^{-1}$ ($P<0.01$) higher compared with the untreated silage. The content of ammonia-N was lower in the rumen fluid of cows offered the inoculated silage. Blood metabolite content was unaffected by the treatment and the blood of animals in both groups corresponded to the physiological norm.*

***Key words:*** *silage, rumen content, infuzoria count, volatile fatty acids, nitrogen, blood*

## INTRODUCTION

Silage, which is a forage preserved through lactic acid fermentation, is a major component in the diets of dairy cattle. Inoculants, comprising mainly lactic acid bacteria (LAB), are used as silage additives to improve preservation efficiency. They are used because of their efficient utilization of the water-soluble carbohydrates of the crop, intensive production of lactic acid, and rapid reduction of pH [23]. As a result, the pH decreases and the forage is preserved [14]. Although successful fermentation of forages is affected by a variety of factors, it has been proposed that inoculation with at least $10^5$ lactic acid bacteria/g forage is needed to ensure consistent improvement in fermentation [3, 4].

The use of biological inoculants usually improves silage quality and increases feed intake and animal performance. In some cases, feeding with LAB-treated silage has been observed to affect animal performance; in 25 to 40% of the reviewed studies, feed intake, weight gain, feed efficiency, and/or milk production were improved, and the improvements ranged from 5 to 11% [12, 16]. The cause of the improvement in animal performance following feeding with inoculated silage is unclear, but the results of feeding experiments suggest a possible probiotic effect of the LAB used in inoculants. One hypothesis is that certain LAB strains interact with rumen microorganisms to enhance rumen functionality and animal performance. Such a hypothesis is consistent with Fuller's definition of a probiotic: "Live microbial feed supplement which beneficially affects the host animal by improving its intestinal microbial balance"[5]. To affect rumen microflora, LAB ingested by the animals along with the silage would have to survive under rumen conditions.

The cause of improved animal performance is unclear. A considerable number of animal experiments using a single silage inoculant strain, *L. plantarum* MTD1 were performed in Northern Ireland with grass silage [7, 8, 9]. The majority of these studies reported improved animal performance with silages inoculated with this strain, regardless of fermentation quality. When the inoculant was added to the silage immediately before feeding, there was no significant effect on dry matter (DM), nitrogen, neutral detergent fibre (NDF), or modified acid detergent fibre digestibility [9]. This might suggest that the benefits result from the silage fermentation rather than from effects of the LAB in the rumen itself. By contrast, in a recent study [11], dietary addition of a mixed culture of LAB increased DM intake, liveweight gain and DM digestibility in calves. Rumen pH was lower and lactic acid was higher following LAB feeding. Salawu et al. (2001) found that application of L. plantarum to pea–wheat silage increased the rate of nitrogen and NDF degradation in the rumen. Malik and Sharma (1998) inoculated rumen fluid (RF) with various microorganisms in the presence of wheat straw and concentrates, and showed that *L. acidophilus* improved DM and organic matter digestibility in vitro as compared with an untreated control.

The results of some of these studies suggest a possible probiotic effect of LAB used in inoculants for silage, the mechanism of which is yet unclear. One hypothesis is that specific LAB strains interact with rumen microorganisms to enhance rumen functionality and animal performance [22]. Another hypothesis is that LAB which are used as inoculants for silage inhibit detrimental microorganisms in the silage. In this regard, it

is well known that LAB produce a variety of antimicrobial substances such as bacteriocins [17, 21].

This experiment was conducted to study the effects of silage inoculant (blend of LAB- *Lactobacillus plantarum, Pediococcus acidilactici* and *Lactococcus lactis*) used for whole-crop spring wheat silage on the rumen fermentation of dairy cows.

## MATERIALS AND METHODS

Two silages were made from one field of whole-crop spring wheat at the medium to hard dough stage of grain. The whole-crop spring wheat dry matter (DM) was 435 g $kg^{-1}$ and it contained crude protein 98, water soluble carbohydrates (WSC) 63 and NDF 491 g $kg^{-1}$ DM, and was ensiled in big bales.

The whole-crop spring wheat was ensiled without any additive (control-C) and with the inoculant containing combination of the lactic acid bacteria – *Lactobacillus plantarum* AMY, *Pediococcus acidilactici* 33–06 and *Lactococcus lactis* SR3. The concentration of the bacteria in the blend was 2.5 x $10^{11}$ cfu/g. The target level of the inoculant addition was 5 x $10^5$ colony-forming units (cfu) $g^{-1}$ fresh forage.

In the physiological study ten dairy cows of the Lithuanian Black-and-White breed devided into two analogous groups were used. After three weeks of the pre-experimental period, in the experimental period (92 days) each group consisting of five cows was fed its respective silage *ad libitum* offered in two meals per day (Table 1). Compound feed to cows was fed individually according to the milk yield (280 g for 1 kg milk). The weight of the offered silage was determined once weekly on two consecutive days and refusals were weighed back and subtracted when calculating daily intake. The amount of compound feed was recorded at each meal. Milking of cows was performed twice daily in the stable.

The rumen fluid was collected from three cows of each group using the pharynx probe with a steel tip in 2 hours after a.m. feeding once in the pre-experimental period and three times in the experimental period. The rumen contents was analyzed for infusoria count per 1 ml fluid in the Fux-Rozenthal chamber, total VFA by distillation with Markgham's apparatus and VFA ratio was determined with the gas chromatograph Chrom-5, pH-value was determined with the pH 526-meter, total nitrogen, protein

Table 1. **Experimental design**

| Group | No. of animals | Feeding pattern |
|---|---|---|
| Control (C) | 5 | Untreated whole-crop summer wheat silage (DM content -429 g $kg^{-1}$, ME – 9.44 MJ $kg^{-1}$ DM, crude protein - 93 g $kg^{-1}$DM; pH-4.16; lactic acid – 23.6 g $kg^{-1}$DM, acetic acid- 8 g $kg^{-1}$DM, butyric acid – 1.7 g $kg^{-1}$DM; ammonia N - 35 g $kg^{-1}$N). Compound feed (72% barley meal, 10% wheat, 15% soybean meal, 3 % vitamin-mineral concentrate). |
| Experimental (I) | 5 | Inoculated whole-crop summer wheat silage (DM content -398 g $kg^{-1}$, ME – 9.61 MJ $kg^{-1}$ DM, crude protein - 101 g $kg^{-1}$DM; pH-4.07; lactic acid – 37.2 g $kg^{-1}$DM, acetic acid- 7 g $kg^{-1}$DM, butyric acid – 0.7 g $kg^{-1}$DM; ammonia N - 34 g $kg^{-1}$N). Compound feed (72% barley meal, 10% wheat, 15% soybean meal, 3 % vitamin-mineral concentrate). |

nitrogen – according to the method of Kjelahl with apparatus Kjeltec System 1002, ammonia – by the method of Convey and Bright. Blood samples were taken from three cows from each group at the end of the pre-experimental period and at the end of the experimental period. Samples were taken through the indwelling catheters placed in the jungular vein starting 2 hours after morning feeding. Blood samples were analyzed for calcium, phosphorus, total protein, glucose in LVA, Kaunas.

The data were analysed by one-way ANOVA, and a mean comparison by Fisher'PLSD [20].

## RESULTS AND DISCUSSION

The average intake of the untreated silage was 11.3 kg DM $cow^{-1}$ $day^{-1}$and inoculation resulted in a higher (by 0.6 kg DM d-$cow^{-1}$ $day^{-1}$) intake compared with the untreated silage. Hristov (2002) reported, that the inoculant-treated silage increased silage DM intake by 7% during weeks 4–12 of lactation. However, Saarisalo et al., (2004) found no differences between the inoculated and untreated silages. Energy corrected milk yield was higher by 0.9 kg $cow^{-1}$ $day^{-1}$ with the inoculated silage when compared with the untreated silage (17.7 *vs* 16.8 kg $cow^{-1}$ $day^{-1}$).

The rumen fermentation parameters of the cows are shown in Table 2. In the experimental period, the infusoria count in the rumen fluid of cows fed the inoculated silages was on average by15.5 % ($P<0.05$) higher than that in the C group and higher by 7.9 % compared with the pre-experimental period. In the experimental period, in the control group the infuzoria count was by 7.41% less than that in pre-experimental period.

Substantial difference in silage pH affected rumen pH for the cows fed the inoculated silage which increased the rumen pH value by 0.13 unit ($P<0.05$). VFA concentration in the course of the whole experimental period was lower in comparison with the untreated silage by 6.5% ($P<0.05$). The studies [24] indicated that freeze-dried

Table 2. **Microbiological and biochemical indicators**

| Item | Group | At the end of pre-experimental period | Experimental period | | | Average in experimental period |
|---|---|---|---|---|---|---|
| | | | start | middle | end | |
| pH | C | 6.53 | 6.57 | 6.54 | 6.56 | 6.55 |
| | I | 6.52 | 6.67 | 6.71 | 6.68 | 6.68* |
| | $LSD_{0.05}$ | 1.101 | 0.362 | 0.519 | 0.201 | 0.105 |
| | $S_{\bar{x}}$ | 2.773 | 0.899 | 1.287 | 0.498 | 0.486 |
| Infusoria count. thous. $ml^{-1}$ | C | 496.3 | 435.6 | 475.1 | 467.8 | 459.5 |
| | I | 491.6 | 476.7 | 563.3 | 551.4 | 530.5** |
| | $LSD_{0.05}$ | 59.807 | 143.366 | 162.215 | 152.911 | 44.513 |
| | $S_{\bar{x}}$ | 1.99 | 5.165 | 5.135 | 4.931 | 2.758 |
| Total VFA. mmol $100ml^{-1}$ | C | 10.31 | 10.08 | 10.97 | 10.82 | 10.62 |
| | I | 10.13 | 9.71 | 9.27** | 10.81 | 9.93* |
| | $LSD_{0.05}$ | 1.053 | 0.633 | 1.09 | 0.875 | 0.647 |
| | $S_{\bar{x}}$ | 1.694 | 1.051 | 1.77 | 1.327 | 1.929 |

** and ** denotes significant at level 0.05 and 0.01 respectively.*

cultures of LAB used in silage inoculants survived in rumen fluid; the pH of strained rumen fluid treated with LAB cultures was generally higher than that of uninoculated control rumen fluid throughout the 72-to 96-h incubation period.

The proportion of acetic acid and butyric acid was not affected by the diet. However, in the experimental period, the proportion of propionate was by 1.36 % ($P<0.01$) higher with the inoculant, compared to the control. (Table 3). Lactic acid of the silage was probably transformed into propionate in the rumen [6]. The ratio of acetate: butyrate, acetarte: propionate and (acetate + butyrate): propionate in rumen cows fed the inoculated silage were lower by 0.1; 0.21 and 0.24, respectively, compared with the control cows.

Table 3. **Molar proportions of VFA**

| Item | Group | At the end of pre-experimental period | Experimental period | | | Average in experimental period |
|---|---|---|---|---|---|---|
| | | | start | middle | end | |
| Acetate | C | 64.45 | 63.56 | 61.36 | 58.99 | 61.31 |
| | I | 64.61 | 60.58 | 60.39 | 60.01 | 60.32 |
| | $LSD_{0.05}$ | 2.04 | 23.434 | 2.673 | 10.157 | 4.189 |
| | $S_{\bar{x}}$ | 0.52 | 6.205 | 0.722 | 2.805 | 2.112 |
| Propionate | C | 20.68 | 21.63 | 22.38 | 22.06 | 22.02 |
| | I | 21.19 | 23.39 | 23.51 | 23.26 | 23.38** |
| | $LSD_{0.05}$ | 2.103 | 2.786 | 1.718 | 3.161 | 0.74 |
| | $S_{\bar{x}}$ | 1.651 | 2.034 | 1.231 | 2.293 | 1.00 |
| Butyrate | C | 13.81 | 13.81 | 14.90 | 14.85 | 14.52 |
| | I | 13.73 | 14.27 | 14.88 | 14.80 | 14.65 |
| | $LSD_{0.05}$ | 1.795 | 4.168 | 2.193 | 1.018 | 0.769 |
| | $S_{\bar{x}}$ | 2.143 | 4.878 | 2.42 | 1.129 | 1.617 |
| Acetate: Butyrate | C | 4.67 | 4.60 | 4.14 | 3.97[a] | 4.24 |
| | I | 4.71 | 4.25 | 4.06 | 4.06 | 4.12 |
| | $LSD_{0.05}$ | 0.751 | 0.922 | 0.645 | 0.969 | 0.271 |
| | $S_{\bar{x}}$ | 2.633 | 3.452 | 2.587 | 3.965 | 1.991 |
| Acetate: Propionate | C | 3.17 | 2.95 | 2.74 | 2.69 | 2.79 |
| | I | 3.04** | 2.59 | 2.57 | 2.58[a] | 2.58 |
| | $LSD_{0.05}$ | 0.014 | 1.158 | 0.244 | 0.643 | 0.225 |
| | $S_{\bar{x}}$ | 0.076 | 6.873 | 1.508 | 4.009 | 2.573 |
| (Acetate + Butyrate) : Propionate | C | 3.85 | 3.57 | 3.41 | 3.36 | 3.45 |
| | I | 3.70* | 3.20 | 3.20* | 3.22[a] | 3.21 |
| | $LSD_{0.05}$ | 0.076 | 1.399 | 1.194 | 0.684 | 0.255 |
| | $S_{\bar{x}}$ | 0.331 | 6.783 | 0.964 | 3.415 | 2.351 |
| Propionate: Butyrate | C | 1.47 | 1.57 | 1.50 | 1.48 | 1.52 |
| | I | 1.54 | 1.64 | 1.57 | 1.57 | 1.60 |
| | $LSD_{0.05}$ | 0.203 | 0.648 | 0.10 | 0.211 | 0.107 |
| | $S_{\bar{x}}$ | 2.215 | 6.639 | 1.071 | 2.274 | 2.102 |
| Isobutyrate | C | 0.94 | 1.04 | 1.09 | 1.08 | |
| | I | 1.00 | 1.09 | 1.08 | 1.05 | |
| | $LSD_{0.05}$ | 0.152 | 1.112 | 0.512 | 0.131 | |
| | $S_{\bar{x}}$ | 2.572 | 17.153 | 7.763 | 2.028 | |
| Isovaleriate | C | 1.34 | 1.52 | 1.73 | 1.35 | |
| | I | 1.36 | 1.52 | 1.48 | 1.28 | |
| | $LSD_{0.05}$ | 0.58 | 0.704 | 0.572 | 0.671 | |

*Table 3 (continue)*

| | | | | | |
|---|---|---|---|---|---|
| Valeriate | $S_{\bar{x}}$ | 7.071 | 7.632 | 5.864 | 8.401 |
| | C | 1.42 | 1.55 | 2.30 | 1.83 |
| | I | 1.59 | 1.82 | 2.00 | 1.72 |
| | $LSD_{0.05}$ | 0.32 | 0.357 | 0.662 | 0.245 |
| Capriate | $S_{\bar{x}}$ | 3.487 | 3.477 | 5.057 | 2.269 |
| | C | 1.00 | 1.06 | 1.10 | 1.02 |
| | I | 1.04 | 1.03 | 1.09 | 1.06 |
| | $LSD_{0.05}$ | 0.086 | 0.42 | 0.547 | 0.186 |
| | $S_{\bar{x}}$ | 1.386 | 6.621 | 8.226 | 2.951 |

** and ** denotes significant at level 0.05 and 0.01 respectively.*
*[a] denotes significant at level 0.05, in comparison with pre-experimental period.*

The content of total nitrogen at the start, middle and end of the experiment was higher with the inoculant than without it 68.23 *vs* 66.20 mg 100 $ml^{-1}$, 66.77 *vs* 60.47 mg 100 $ml^{-1}$; P<0.05) and 64.73 *vs* 61.97 mg 100 $ml^{-1}$ respectively, while the opposite was observed for ammonia nitrogen – 11.08 *vs* 13.19 mg 100 $ml^{-1}$, 11.54 *vs* 13.58 mg 100 $ml^{-1}$ and 13.29 *vs* 13.76 mg 100 $ml^{-1}$ respectively. In the experimental period in the rumen fluid of cows fed the inoculated silage, the content of total nitrogen and the content of protein nitrogen was on average higher by 3.70 mg 100 $ml^{-1}$ (P<0.01) and by 5.61 mg 100 $ml^{-1}$ (P<0.01) and the content of ammonia nitrogen was lower by 1.54 mg 100 $ml^{-1}$ (P<0.05) compared with the control cows (Table 4).Most of the studies comparing the effects of silage fermentation on rumen fermentation pattern suggest that the type of silage has a considerable influence on the ruminal fermentation pattern of typical dairy cows [10,15]. In addition, the differences in fermentation characteristics of silage can affect feed intake and consequently the total nutrient supply [15].

Table 4. **Nitrogen level in the rumen, mg 100 $ml^{-1}$**

| Item | Group | At the end of pre-experimental period | Experimental period | | | Average in experimental period |
|---|---|---|---|---|---|---|
| | | | start | middle | end | |
| Total nitrogen. mg 100 $ml^{-1}$ | C | 67.76 | 66.20 | 60.47 | 61.97 | 62.88 |
| | I | 67.59 | 68.23 | 66.77* | 64.73 | 66.58** |
| | $LSD_{0.05}$ | 3.681 | 3.495 | 3.998 | 7.387 | 2.072 |
| | $S_{\bar{x}}$ | 0.894 | 0.854 | 1.033 | 1.916 | 0.982 |
| Protein nitrogen. mg 100 $ml^{-1}$ | C | 53.61 | 51.52 | 44.74 | 46.01 | 47.43 |
| | I | 53.64 | 55.78** | 53.8* | 49.53 | 53.04** |
| | $LSD_{0.05}$ | 2.385 | 1.615 | 6.482 | 11.087 | 2.831 |
| | $S_{\bar{x}}$ | 0.731 | 0.495 | 2.162 | 3.814 | 1.728 |
| Ammonia nitrogen. mg 100 $ml^{-1}$ | C | 12.47 | 13.19 | 13.58 | 13.76 | 13.51 |
| | I | 12.72 | 11.08 | 11.54 | 13.29 | 11.97* |
| | $LSD_{0.05}$ | 5.534 | 2.499 | 4.262 | 1.653 | 1.141 |
| | $S_{\bar{x}}$ | 7.218 | 3.384 | 5.588 | 1.972 | 2.728 |

** and ** denotes significant at level 0.05 and 0.01 respectively.*

The analysis of blood samples indicated that the animals in both groups were healthy (Table 5).

Table 5. **Blood profile**

| Item | Group | End of pre-experimental period | End of experimental period |
|---|---|---|---|
| Total protein g $l^{-1}$ | C | 81.36 | 82.1 |
| | I | 81.31 | 81.87 |
| | $LSD_{0.05}$ | 4.331 | 4.583 |
| | $S_{\bar{x}}$ | 0.875 | 0.919 |
| Phosphorus mmol $l^{-1}$ | C | 1.60 | 1.72 |
| | I | 1.64 | 1.75 |
| | $LSD_{0.05}$ | 0.41 | 0.274 |
| | $S_{\bar{x}}$ | 4.155 | 2.592 |
| Calcium mmol $l^{-1}$ | C | 2.55 | 2.55 |
| | I | 2.68 | 2.74 |
| | $LSD_{0.05}$ | 0.734 | 0.39 |
| | $S_{\bar{x}}$ | 4.608 | 2.429 |
| Glucose mmol $l^{-1}$ | C | 2.10 | 2.43 |
| | I | 2.05 | 2.42 |
| | $LSD_{0.05}$ | 0.251 | 0.38 |
| | $S_{\bar{x}}$ | 1.992 | 2.577 |

## CONCLUSIONS

1. The treatment with a homolactic bacteria blend (*Lactobacillus plantarum, Pediococcus acidilactici* and *Lactococcus lactis*) improved the fermentation quality of the whole-crop spring wheat silage compared with the untreated one.

2. Rumen fermentation was affected by the type of silage. The inoculated silage with the increased amount of lactic acid increased the proportion of propionate in the rumen.

3. The inoculated silage significantly increased the content of total nitrogen and the content of protein nitrogen and significantly decreased the content of ammonia nitrogen.

4. The results obtained in the experiment indicate that the changes in the rumen fermentation of the cows fed the inoculated silage positively affected milk yield.

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# MELŽIAMŲ KARVIŲ, ŠERTŲ VASARINIŲ KVIEČIŲ VEGETACINĖS MASĖS SILOSU SU PIENO RŪGŠTIES BAKTERIJŲ PRIEDU, DIDŽIOJO PRIESKRANDŽIO FERMENTACIJOS RODIKLIAI

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Santrauka

LVA Gyvulininkystės institute atliktas bandymas su 10-čia Lietuvos juodmargių veislės melžiamų karvių, siekiant nustatyti vasarinių kviečių vegetacinės masės siloso, pagaminto su pieno rūgštį produkuojančių bakterijų mišiniu, įtaką jų didžiojo prieskrandžio fermentacijos rodikliams. Vasarinių kviečių vegetacinė masė, turinti 436 g $kg^{-1}$ SM ir grūdams esant vaškinėje brandoje, buvo silosuojama ritiniuose. Silosas buvo pagaminta be jokių priedų (C) arba su bakterijų mišinio (*Lactobacillus plantarum, Pediococcus acidilactici* ir *Lactococcus lactis*) priedu, įterpiant $5 \times 10^5$ ksv $g^{-1}$ žalios masės (I). Dešimt melžiamų karvių, suskirstytų į dvi analogines grupes, 92 dienas iki soties buvo šertos silosu, pagamintu su bakterijų mišinio priedu (grupė I) arba įprastai užraugtu silosu (grupė C). Papildomai karvėms buvo sušeriama po 280 g 1 kg pieno kombinuotųjų pašarų.

Karvių, šertų silosu su bakterijų priedu, didžiajame prieskrandyje infuzorijų buvo 15,5 % daugiau ($P<0.01$) negu šertų silosu be priedų. Inokuliuotas silosas didžiojo prieskrandžio turinio pH padidino 0,13 vieneto ($P<0,05$), 6,5 % sumažino bendrą lakių riebalų rūgščių kiekį ir 1,36 procentiniais vienetais padidino ($P<0,01$) propiono rūgšties kiekį. Silosas su bakterijų priedu turėjo teigiamą įtaką baltymų sintezei didžiajame prieskrandyje, nes baltyminio azoto ir bendro azoto buvo rasta atitinkamai 5,61 ir 3,7 mg 100 $ml^{-1}$ daugiau, lyginant su karvėmis, šertomis silosu be priedo. Amoniakinio azoto mažiau buvo didžiajame priskrandyje karvių, šertų silosu su bakterijų priedu. Kraujo tyrimai parodė, kad abiejų grupių karvės buvo sveikos.

***Raktažodžiai:*** silosas, didžiojo prieskrandžio turinys, infuzorijos, lakios riebalų rūgštys, azotas, kraujas

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# ПОКАЗАТЕЛИ ФЕРМЕНТАЦИИ В РУБЦЕ МОЛОЧНЫХ КОРОВ ПРИ СКАРМЛИВАНИИ ИМ СИЛОСА, ПРИГОТОВЛЕННОГО ИЗ ВЕГЕТАТИВНОЙ МАССЫ ПШЕНИЦЫ С ДОБАВКОЙ МОЛОЧНОКИСЛЫХ БАКТЕРИЙ

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Резюме

Опыты были проведены в Институте животноводства Литовской ветеринарной академии с 10-тью молочных коров литовской черно-пестрой породы с целью изучить влияние силоса, приготовленного из вегетативной массы пшеницы с добавкой молочнокислых бактерий, на ферментацию рубца. Вегетативная масса яровой пшеницы, содержащей 436 г $кг^{-1}$ СВ, при восковой спелости зерна, была засилосована в рулонах. Силос был приготовлен без добавок (С) или с добавкой бактериальной смеси (*Lactobacillus plantarum, Pediococcus acidilactici* и *Lactococcus lactis)* в количестве $5 \times 10^5$ $г^{-1}$ зеленой массы (I). Десять дойных коров, разделенных на две группы, 92 дня получали досыта силос, приготовленный с добавкой бактериальной смеси (группа I) или силос без добавок (группа С). Коровы дополнительно получали комбикорм из расчета 280 г на 1 кг молока. В рубце коров, получавших силос с добавкой бактериальной смеси, количество инфузорий было на 15,5 % больше ($P<0.01$), чем в рубце коров, поедавших обычный силос. Инокулированный силос увеличил показатель pH на 0,13 единицы ($P<0.05$), уменьшил содержание летучих жирных кислот на 6,5 % и увеличил количество пропионовой кислоты на 1,36 процентных единиц. Силос с добавкой бактериальной смеси благоприятно влиял на синтез белка в рубце, так как белкового азота и общего азота было соответственно на 5,61 и 3,71 мг 100 $мл^{-1}$ больше по сравнению с коровами, получавшими контрольный силос. В рубце коров, поедавших силос с добавкой бактериальной смеси, было меньше аммиачного азота. Показатели крови обеих групп коров соответствовали физиологическим нормам.

**Ключевые слова:** силос, содержание рубца, инфузории, летучие жирные кислоты, аммиак, кровь

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