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INFLUENCE OF ADDITIVE AIV-2000 AND PRE-WILTED BIG BALE ON SILAGE QUALITY, ANIMAL PERFORMANCE AND RUMEN METABOLISM

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Abstract

Silage treatment with *AIV-2000* or making of silage big bales resulted in a higher level of lactic acid and organic matter digestibilities and reduced concentrations of butyric acid and ammonia-N. Feeding *AIV-2000* treated and big bale silages increased weight gains of young fattening bulls by, respectively, 5.44 and 6.77% in comparison with the ordinary made silage. *AIV-2000* treated and big bale silages affected microflora activity in the rumen. Infusoria count was higher by 13.5 and 30.34% ($P < 0.05$), VFA concentration increased by 0.39 and 8.45%, the pH value decreased by 0.05 and 0.1 unit, the content of total nitrogen was by 14.67 and 18.73 mg/100 ml, protein nitrogen by 14.12 and 16.63 mg/100 ml and non-protein nitrogen by 0.53 and 1.39 mg/100 ml higher, respectively for *AIV-2000* and big bale groups in comparison with the control group.

Keywords: silage, treatment, fermentation quality, chemical additives, rumen, metabolism.

Introduction

It has been determined that grass, its silage and hay may account, respectively, for 60% of required energy and 67% of required protein for lactating cows and, respectively, for 79 and 85% of required energy and protein for fattening bulls. Certainly, in this case silage should be of high quality and made from not overgrown grass and from good swards

(Kempisty 1997, Wilkinson & Bolsen 1996).

It is planned that in the future in Europe silage will be competitive to grain feeding and even grazing (Wilkins et al. 1999, McDonald & Henderson 1991). The level of silage feeding can be increased through improvement of silage quality, reduction of nutrient, especially, protein losses in forages and by lowering the costs of silage production, i.e. it is necessary to look for new silage production technologies, including modernization of ensilage machinery and application of various additives (Frank & Waltham 1996, Uno & Sarand 1999).

The aim of this study was investigate the fermentation quality, feeding value, growth and rumen metabolism for fattening bulls fed silages treated with the chemical additive *AIV-2000* or untreated and made in big bales.

Material and Methods

In 1998-99, a trial (125 days) was conducted at the Lithuanian Institute of Animal Science with 18 Lithuanian Black-and-White bulls allotted to three analogous groups by age (15-16 mo.), weight (361.3-361.8 kg) and daily weight gain (890-930 g). The bulls were maintained loose in individual pens and watered automatically. The diets were balanced according to the feeding standards. Bulls in Group 1 (control) were fed silage *ad libitum* fermented ordinarily in the trench (OS), in Group 2 (experimental) – silage treated with the chemical additive *AIV-2000* (product of Finland Company "Kemira Chemical": 52.3% of formic acid, 26.1% of ammonia tetraformiate, 5.4% of propionic acid, 1.1% of ethyl-benzoate) 7 l/t) in the trench (AIV) and in Group 3 (experimental) – untreated silage made in big bales (BB). The whole silage was made from wilted clover-timothy first cut grass. In addition, animals in all groups were given compound feed (barley meal, 93%, and protein-vitamin-mineral-pre-mix, 7%). Microbiological and biochemical analysis of the rumen

contents and biochemical analysis of blood have been carried out. Weight gains were determined by individual weighing of bulls once a month. Chemical composition of feeds and metabolism products has been determined at the Analytical Laboratory of the LIAS by routine methods.

Results and Discussion

The fermentation quality, organic matter digestibility and energy values of silages were high. The mean pH, organic acids, ammonia-N, organic matter digestibility and chemical composition of silages are shown in Table 1.

Silage treatment with *AIV-2000* or making of silage in big bales resulted in a higher level of lactic acid and organic matter digestibilities and reduced concentrations of butyric acid and ammonia-N.

During the feeding trial, each animal in all groups was given 2.26 kg of compound feeds. The values of metabolizable energy of *AIV-2000* treated and big bale silages were respectively by 0.38 and 1.09 MJ/kg DM higher than those for the untreated (control) silage. Therefore, bulls in experimental Groups 2 and 3 received daily by 0.89 and 5.26 MJ of metabolizable energy more, though the silage intakes were by 0.22 and 0.31 kg DM lower.

In the course of the trial, the growth rate of animals in all groups was high. The average daily gain amounted to 1.004-1.072 kg. During the trial, the total weight gain of bulls in Group 1 (OS) was 125.5 kg, in Group 2 (AIV) 132.33 kg and in Group 3 (BB) 134.0 kg or, respectively, by 5.44 and 6.77% ($P < 0.05$) higher than that of the bulls in the control group.

During the trial, metabolism in the rumen contents has been analysed (Fig 1). Infusoria count in both experimental groups was higher in the course of the whole trial in comparison with the control group. At the end of the trial, infusoria count in both experimental groups was by 13.5 and 30.34% ($P < 0.05$) higher than that in the control group.

At the end of the trial, VFA concentration was higher in all groups in comparison with the pre-experimental period: in the control group by 0.8 mmol/100 ml, in Group 2 (AIV) by 0.31 mmol/100 ml and in Group 3 (BB) by 1.42 mmol/100 ml. At the end of the trial, VFA concentration in experimental Groups 2 and 3 was respectively by 0.04 mmol/100 ml (0.39%) and 0.85 mmol/100 ml (8.45%) higher compared with the control group.

VFA variations affected the pH values of the rumen contents. At the end of the trial, pH values in experimental Groups 2 and 3 were by 0.05 and 0.1 units lower compared with the control group.

Changes in the rumen VFA patterns were similar for all groups, i.e. the content of acetic acid became higher, while that of propionic and butyric acids lower in comparison with the pre-experimental period.

At the end of the trial, the total content of nitrogen in the rumen of bulls was lower by 16.46 mg/100 ml (OS), 18.75 mg/100 ml (AIV) and 3.99 mg/100 ml (BB) in comparison with the pre-experimental period. The level of protein nitrogen was lower in all groups in comparison with the pre-experimental period, however, in experimental Groups 2 and 3 it was by 14.12 and 16.63 mg/100 ml higher than that for the control group. The content of non-protein nitrogen in the rumen contents was reduced during the trial in all groups. At the end of the trial, the content of non-protein nitrogen in experimental Groups 2 and 3 was by 0.53 and 1.39 mg/100 ml higher than that for the control group. Similar tendencies were observed regarding the changes in the content of ammonia nitrogen. The content of ammonia nitrogen in Groups 2 and 3 was by 0.18 and 0.68 mg/100 ml higher compared with the control group.

It is concluded that the silage treatment with *AIV-2000* or making of silage in big bales resulted in a higher level of lactic acid and organic matter digestibilities, reduced concentrations of butyric acid and ammonia-N.

AIV-2000 treated and big bale silages affected microflora activity in the rumen,

increased organic matter digestibility and energy value respectively by 0.22 and 0.31 kg DM and daily weight gain by 5.44 and 6.77% in comparison with the ordinary made silage.

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Table 1 - The chemical composition, fermentation quality of silages and performance of fattening bulls

Treatment	OS	AIV	BB
Chemical composition, %:			
Dry matter	35.2	36.4	36.2
Organic matter	93.46	93.30	93.71
Crude protein	15.38	15.64	15.35
Crude fibre	26.43	26.73	25.82
Fermentation quality:			
PH	4.91	4.51	4.74
Ammonia N (%N)	7.05	5.47	5.28
Lactic acid (g/kg DM)	32.94	42.93	37.84
Acetic acid (g/kg DM)	27.16	25.60	24.05
Butyric acid (g/kg DM)	0.50	0.00	0.00
OM digestibility (%)	68.2	71.8	70.6
ME MJ/kg DM	8.52	8.90	9.61
Animal performance:			
Forage (DM kg/day)	7.53	7.31	7.22
Concentrate (DM kg/day)	1.91	1.91	1.91
Average daily gain (kg)	1.004	1.059	1.072

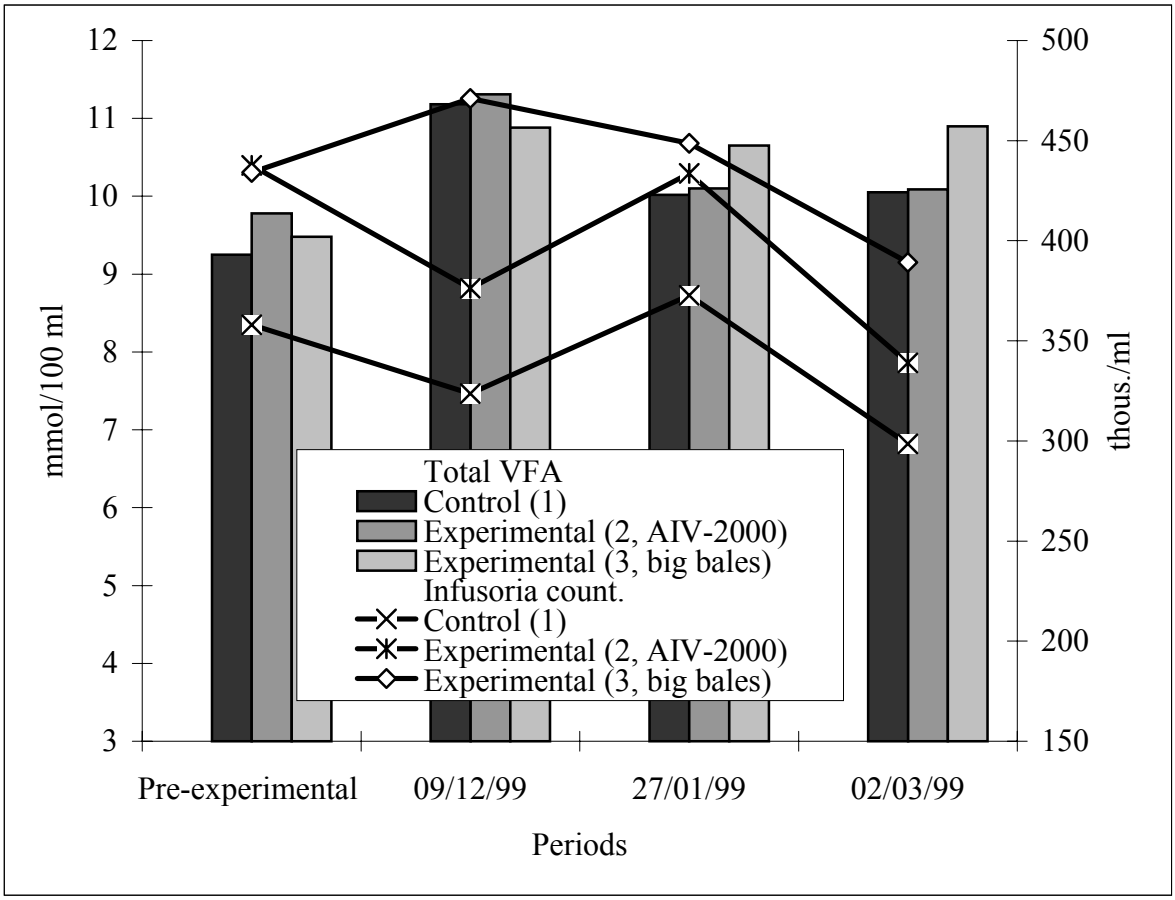

Figure 1 - Microbiological and biochemical characteristics of the rumen