

THE INFLUENCE OF SILAGE ADDITIVES FOR QUALITATIVE PARAMETERS OF CLOVER-GRASS SILAGES

VLIV ADITIV NA VYBRANÉ KVALITATIVNÍ UKAZATELE JETELOTRAVNÍCH SILÁŽÍ

LÁD, F.*, ČERMÁK, B., JANČÍK, F., KADLEC, J.

Department of Genetics, Animal Breeding and Nutrition, Faculty of Agriculture, University of South Bohemia, Studentská 13, 370 05, České Budějovice, Czech Republic, Tel: +42387772599

*correspondence author, e-mail: lad@zf.jcu.cz

Manuscript received: May 1, 2005; Reviewed: July 10, 2005; Accepted for publication: August 13, 2006

ABSTRACT

We observed the influence of silage additives for choice qualitative parameters at 109 samples of clovergrass silages in working conditions. We evaluated total classification and categorization to quality classes according to fermentation process.

It has been found out positive effect of the silage additives for fermentation class and for total silage quality of silages. This positive effect has been more considerable at classification to the fermentation classes at clover-grass silages. The high content of crude fibre decreased fermentation results and total silage quality at test clover-grass silages. The greatest (deterioration) influence for classification to total quality class has crude fibre content. It is seen from correlation coefficient at clover-grass silages – $r = 0,75$ ($P < 0,05$). The weak dependence $r = 0,37$ ($P < 0,05$) was detected between fermentation class and acetic acid content. It was detected large dependence between fermentation class and butyric acid content $r = 0,73$ ($P < 0,05$).

KEY WORDS: clover-grass silages, qualitative parameters, silage additives

ABSTRAKT

U 109 vzorků jetelotravních siláží byl v provozních podmínkách sledován vliv silážních aditiv na kvalitativní ukazatele. Posuzováno bylo jednak celkové zařazení a zařazení do tříd jakosti podle fermentačního procesu. U silážovaných krmiv bylo potvrzeno, že aditiva mají pozitivní vliv na fermentační proces a tím i na celkovou kvalitu siláží. Tento pozitivní vliv byl ještě více patrný na zařazení do třídy fermentace. Vysoký obsah vlákniny u sledovaných silážovaných krmiv zhoršoval fermentační výsledky i celkovou jakost siláží. Z korelačních koeficientů hodnotící jetelotravní siláže je patrné, že největší (zhoršující) vliv na zařazení do celkové třídy jakosti má množství vlákniny $r = 0,75$ ($P < 0,05$). Mírná závislost $r = 0,37$ ($P < 0,05$) byla zjištěna mezi třídou fermentace a obsahem kyseliny octové. Mezi třídou fermentace a obsahem kyseliny máselné byla zjištěna velká závislost $r = 0,73$ ($P < 0,05$).

KLÍČOVÁ SLOVA: jetelotravní siláže, kvalitativní ukazatele, aditiva

INTRODUCTION

Ideal fermentation process reduces fermentation losses and preserves good aerobic stability during animal feeding. Right silage and suitable silage additives are the most important for silage quality. We know examples very bad silages but with good aerobic stability (high content of nonprotein nitrogen or high content of acetic acid or butyric acid) and very good prepared silages can be aerobic unstable (Woolford, 1998).

They are known two reasons why to use silage additives for better aerobic stability of silages. We must prevent to silage warming with following loss of dry matter. We must stop reducing of animal production in consequence of poor-quality silage (Bolsen et al., 1996). The effective silage additives remove one or both problems (Kung, et al., 1998). The silage additives improve fermentation process and reduce aerobic degradability (Honig, 1995). These additives stimulate quick acidification of silage matter with help of higher production of acid lactic and obstruct growth and increasing of bad microorganisms.

MATERIALS AND METHODS

We evaluated the influence of silage additives for quality parameters according to categorization to total classes and fermentation process in working conditions. We have evaluated 109 samples of clover-grass silages in co-operation with Agriculture district laboratory in České Budějovice.

The samples of silages have been evaluated by silage evaluation EKO-LAB Žamberk (Mikyska et Šeda, 2000). The samples have been classification to quality classes according to share of acids contents in silage, pH, dry matter and crude protein. The quality of silages has been evaluated according to sensory evaluation and fermentation process too.

The nutritive values were analysed by Laboratory Methods for Feed Analyses in Appendix No. 9 – 13 Announcement of Ministry of Agriculture Czech Republic No. 124/2001 Digest. Crude proteins were analysed by Kjeldahl method at apparatus KJELTEC TECATOR and crude fibre was analysed by acidalkaline method at apparatus ANKOM. The silage acids were analysed by izotachoforetic analyser IONOSEP 2001.

They are calculated points for dry matter, crude fibre, crude protein and fermentation process according to analytic values. There is assign total class Ist – IVth to table and word comment – excellent, good, worse, bad (Mikyska et Šeda, 2000).

It was not dressed 46 samples of clover-grass silages (42,2 %) by silage additives and 67 samples (57,8 %) was dressed from total number of tested clover-grass silages.

The share of bacterial-ferment additives was 50,1 % and bacterial additives 49,9 % from total number of used additives.

We tested seven kinds of silage supplements in clover-grass silages – GOLDZYM (20,8 %), BACTOZYM (20,8 %), FEEDTECH F 3000 (13,9 %), MICROSIL (11,1 %), BONSIŁAGE PLUS (8,4 %), SILLA-BAC (6,9 %), SILL-ALL 4x4 (5,6 %) and KEM LAC DRY (2,8 %). Graph No. 1.A

RESULTS AND DISCUSSION

The categorization of the clover-grass silages to total classes: class excellent 27,5 % of samples, class good 30,3 %, class worse 23,9 % and class bad 18,3 %. The clover-grass silages with silage additives have been classification to class excellent – 30,2 % of samples and to class good – 34,9 %, class worse 23,8 % and class bad 11,1 %. The clover-grass silages without silage additives have been classification to class excellent – 23,9 % of samples, class good – 23,9 %, class worse – 23,9 % and class bad – 28,3 %. The values in table No. 3.

The categorization of the clover-grass silages to class according to fermentation process: 56,9% of samples in Ist class, 22,9 % in IInd class, 10,1 % in IIIrd class, 3,7 % in IVth and 6,4 % in Vth class of fermentation. The categorization of the clover-grass silages with fermentation additives to class according to fermentation process is better: 71,4 % of samples in Ist class and 19 % in IInd class, 3,2 % in IIIrd class, 3,2 % in IVth and 3,2 % in Vth class. The categorization of silages without fermentation additives to class according to fermentation process: 37 % of samples in Ist class, 28,3 % in IInd class, 19,6 % in IIIrd class, 4,3 % in IVth and 10,8 % in Vth class of fermentation. The fermentation additives have very positive influence for fermentation process. The values in table No. 4.

There are cited percentage shares of clovergrass silage samples in single total classes that unmatched to silage evaluation EKO-LAB Žamberk (Mikyska et Šeda, 2000) in nutrients dry matter, crude fibre and crude proteins in table No. 5. These nutrients are important for evaluation of silages. The clover-grass silages categorization to class excellent: 10 % of samples with high dry matter and 6,7 % with low dry matter, class good: 18,2 % of samples with high dry matter and 9,1 % with low dry matter, class worse 15,4 % of samples with high dry matter and 23,1 % with low dry matter and to class bad: 20 % of samples with high dry matter and 25 % with low dry matter. The share of all samples with high content of dry matter was 15,6 % and 14,7 % with low dry matter. The share of unmatched samples in content of crude proteins in class

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Table No.1: Composition of bacterial-enzymatic additives for preservation of roughages (clover-grass)

Name of additive	Species (strains) of microbes and their minimum quantity in additive (CFU/g)	Enzymes and their minimum activity in additive (nkat/g, nkat/ml)	Other components
Bactozym	<i>L. plantarum</i> (CCM 3769), <i>L. casei</i> (CCM 3775), <i>E. faecium</i> (CCM 6226), <i>P. pentosaceus</i> (CCM 3770)	cellulase and hemicellulase 31 000 glukosaoxidase 4 800	dry whey, sacharose, laktose
Goldzym	<i>L. plantarum</i> (CCM 3769), <i>L. casei</i> (CCM 3775), <i>E. faecium</i> (CCM 6226), <i>P. pentosaceus</i> (CCM 3770)	cellulase a hemicellulase glukózaoxidase 28 000	dry whey, sacharose
Kemlac Dry	<i>L. acidophilus</i> ATCC 4 356, <i>L. delbrueckii ssp. Bulgaricus</i> ATCC 11 842, <i>L. plantarum</i> ATCC 4 008	endo-1,2(4)- β glukanaase 16 700 endo-1,4- β glukanaase 16 700 amylase 16 700	laktose
Sill-All 4 x 4	<i>L. plantarum</i> , <i>E. faecium</i> , <i>P. acidilactici</i> , <i>L. salivarius</i>	cellulase, hemicellulase, amylase, pentozanase	dextrose

Table No. 2: Composition of bacterial additives for preservation of roughages (clover-grass)

Name of additive	Species (strains) of microbes and their minimum quantity in additive (CFU/g)	Other components
Bonsilage	<i>L. rhamnosus</i> (NCIMB 30121), <i>E. faecium</i> (NCIMB 30122)	R: 1 x 10 ¹¹ G: 2 x 10 ⁸
Bonsilage plus	<i>L. rhamnosus</i> (NCIMB 30121), <i>L. plantarum</i> (DSM 12836), <i>L. brevis</i> (DSM 12835), <i>L. buchneri</i> (DSM 12856), <i>P. acidilactici</i> (<i>P. pentosaceus</i>) (DSM 12834)	R: 1x 10 ¹¹ G: 2 x 10 ⁸
Feedtech F3000	<i>L. plantarum</i> Milab, <i>P. acidilactici</i> , <i>E. faecium</i> , <i>Lactococcus lactis</i>	5 x 10 ⁵
Microsil	<i>L. plantarum</i> (CCM 3769), <i>L. casei</i> (CCM 3775), <i>E. faecium</i> (CCM 6226), <i>P. pentosaceus</i> (CCM 3770)	1 x 10 ¹⁰
Sila-Bac	<i>L. plantarum</i> (DSM 4784, DSM 4785, DSM 4786, DSM 4787), <i>E. faecium</i> (DSM 4788, DSM 4789)	R: 1,35 x 10 ¹¹ G: 2 x 10 ⁸
		dry whey, sacharose, laktose R: maltodextrin, sodium aluminium silicate, sodium thiosulfate, color E133 G: calcium carbonate

L = *Lactobacillus*, *E* = *Enterococcus*, *P* = *Pediococcus*, CFU = colony forming unit, R = soluble, G = granulated

excellent 90 %, in class good 39,4 %, in class worse 30,8 % and in class bad 55 %. The share of all samples with unmatched content of crude proteins was 54,1 %. The share of samples with high content of crude fibre in class excellent 36,7 %, in class good 81,8 %, in class worse 96,2 % and in class bad 100 %. The share of all samples with high content of crude fibre was 76,1 %.

The greatest (deterioration) influence for classification to total quality class has crude fibre content. It is seen from correlation coefficient at clover-grass silages $r = 0,75$ ($P < 0,05$). The weak dependence $r = 0,37$ ($P < 0,05$) was detected between fermentation class and acetic acid content. It was detected large dependence between fermentation class and butyric acid content $r = 0,73$ ($P < 0,05$).

The using of silage additives improves qualitative parameters of silages (LOUČKA et al., 1999; LÁD et al., 2004). WEDDELL, (2001) writes results of silages from working conditions in years 1998, 1999 and 2001. Statistical significant differences were not detected. They exist explicit suggestions the using of silage additives improves quality of fermentation process. WILKINS et al., (1999) estimate the share of silage additives for

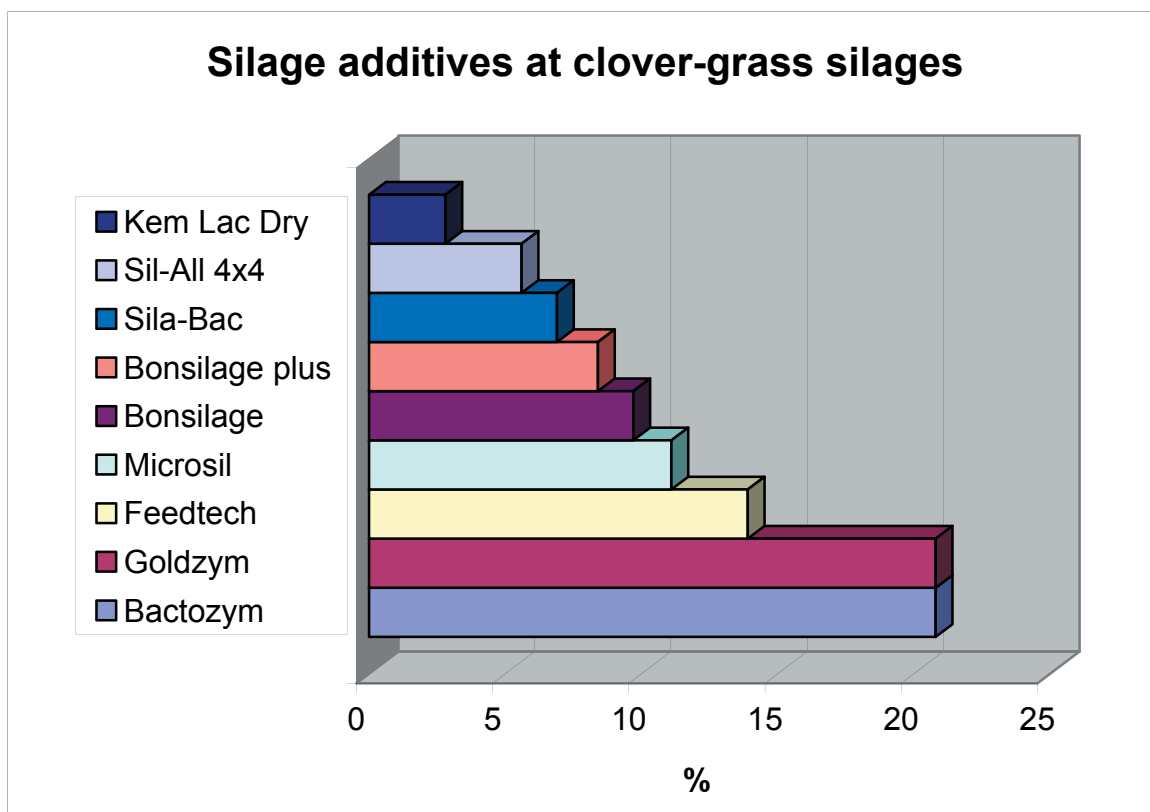
increase of ensilage profitability since 5 % at ensilages with high content of dry mater to 9 % at silages with low content of dry mater. DOLEŽAL, (2001) writes the ensilage quality is influenced by available silage additives but must be observed all technological requirements.

We have found out high contents of crude fibre and crude proteins at clover-grass silages. Optimum values: dry matter 280 - 450 g/kg, crude fibre to 250 g/kg of dry matter and crude protein to 150 g/kg of dry matter. The 76,5 % of clover-grass silages from experiment did not reach of optimal content of fibre.

silage additives are given to feedstuffs. The silage additives have positive effect for lactic acid fermentation, for aerobic stability and for feed value of ensilages. The silage additives do not compensate mistakes in ensilage technology but they used for preparation of high quality silages (LOUČKA et al., 1998, Doležal et al., (2001).

CONCLUSIONS

We observed the positive influence of silage additives for the fermentation process and quality of ensilages. This positive effect has been more considerable at classification



Graph No. 1

Table No. 3: The percentage categorization of clover-grass silages to total class

Total class	Total	With silage additives	Without silage additives
I	27,5	30,2	23,9
II	30,3	34,9	23,9
III	23,9	23,8	23,9
IV	18,3	11,1	28,3

Table No. 4: The percentage categorization of clover-grass silages to fermentation class

Fermentation class	Total	With silage additives	Without silage additives
I	56,9	71,4	37
II	22,9	19	28,3
III	10,1	3,2	19,6
IV	3,7	3,2	4,3
V	6,4	3,2	10,8

Table No. 5: The percentage share of clovergrass silage samples unmatched to silage evaluation, EKO-LAB Žamberk (Mikyska et Šeda, 2000)

Total class	Parameters			
	Dry matter (g/kg)		Crude fibre (g/kg DM)	Crude proteins (g/kg DM)
	to 280	Above 450	Above 250	above 150
I	6,7	10	36,7	90
II	9,1	18,2	81,8	39,4
III	23,1	15,4	96,2	30,8
IV	25	20	100	55
Total	14,7	15,6	76,1	54,1

to the fermentation class.

The high content of crude fibre decreased of fermentation results and total quality of examined fodder silages. They have been evaluated correlation coefficients at clover-grass silages. The greatest (deterioration) influence for classification to total quality class has crude fibre content. It is seen from correlation coefficient at clover-grass silages – $r = 0,75$ ($P < 0,05$). Optimal content of crude fibre in clover-grass silages matches to the value 250 g/kg DM. The 76,5 % of clover-grass silages from experiment did not reach of optimal content of fibre. The high content of crude fibre is big problem in practice. This insufficiency is caused by later harvest of fodder. The silage additives have positive influence for fermentative process and for total quality of silages too.

ACKNOWLEDGEMENTS

Supported by grant MSM 6007665806

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