A novel bacterial silage additive effective against clostridial fermentation

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Introduction Silage quality is determined by factors including the content of butyric acid and ammonium-N. These parameters have to be restricted especially in lightly wilted silages due to a higher risk of clostridia contamination. In this study a novel silage additive was tested in grass silages of low dry matter content. The objective of this experiment was to explore the effect of the silage additive on quality parameters in comparison to an untreated control.

Materials and methods Ensiling: In three trials grass (each first cut of permanent grassland of different farms) was ensiled in 6.5 l laboratory silos and analysed after 90 d of storage at 20°C. In each trial a control without additive was compared with silages treated with the new biological silage additive (three homofermentative lactic acid bacteria: *Lactobacillus paracasei*, *Pediococcus acidilactici* and *Lactococcus lactis* treatment). The inoculant was applied at a dosage of $2.5x10^5$ cfu/g grass.
Analyses: An aqueous silage extract (50 g silage extracted with 250 g distilled water) was prepared and the following chemical analyses were performed. Sugars and organic acids were analysed by HPLC (Agilent 1100, Column: Transgenomic ICSep ICE-ION 300). Ammonia-N was determined by distillation (Gerhardt). Clostridia spores were determined on silage samples by MPN–method on a microtiter plate scale on RCM-bouillon with D-cycloserine and neutral red (Jonsson, 1990; Kaufmann & Weaver, 1959).

Results The dry matter range of grass ensiled was between 19 and 26%. The lowest pH value reached in the untreated controls was 4.8, whereas the inoculated silages reached significantly lower pH values (3.8 and 4.1). Due to the high production of lactic acid (mean value 12.7 g/100 g DM) an improved conservation effect was achieved in the treated samples. This is demonstrated by low concentrations of butyric acid and ammonia-N and by lower counts of clostridia spores. The strong lactic acid fermentation minimised weight losses by inhibiting activity of spoilage organisms (Control 3.1 g/100 g DM; Treatment 1.2 g/100 g DM).

Table 1 Silage parameters of trials with grass silages after 90 days of storage

Laboratory silage d 90	Trial 1		Trial 2		Trial 3		Mean values		Standard error		Signifi-cance
Groups	C	T	C	T	C	T	C	T	C	T	
DM (g/100 g FM)	25.0	26.1	20.1	20.8	22.8	19.0	22.6	22.0	2.4	3.7	-
pH – value	4.8	3.8	5.2	3.8	5.2	4.1	5.0	3.9	0.2	0.1	**
Ammonia-N (g/100 g TKN)	11.6	7.4	26.4	7.7	14.9	8.9	17.6	8.0	7.8	0.8	-
Weigth losses (g/100 g FM)	2.9	1.6	3.1	0.6	3.2	1.3	3.1	1.2	0.2	0.5	**
Lactic acid (g/100 g DM)	3.3	12.2	0.4	15.8	0.7	10.1	1.5	12.7	1.6	2.9	**
Butyric acid (g/100 g DM)	2.0	0.3	7.0	0.3	4.3	0.5	4.4	0.3	2.5	0.1	*
Cl spores (log (cfu/g FM))	6.2	4.9	6.3	3.9	6.8	4.9	6.5	4.7	0.3	0.6	**

C = Control; T = Treated; TKN = Total Kjeldahl nitrogen; FM = fresh matter; DM = dry matter; * $P<0.05$, ** $P<0.01$

Conclusions In summary it was observed that the additive improved silage quality. The main effects were the increased production of lactic acid (highly significant) connected with a highly significant reduction of pH value. Additionally the activity of clostridia was reduced as indicated by lower butyric acid formation and lower counts of clostridia spores.

References

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