DYNAMIC EFFECTS OF APPLIED HOMOFERMENTATIVE LACTOBACILLI ON WET GRASS SILAGE WITH REGARD TO FERMENTATION QUALITY AND MASS LOSSES

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Introduction

- Crops ensiled wet are prone to effluent losses and clostridial fermentation, both reducing the feed value of the silage (MUCK et al. 2003).
- In wet silage making it is a practical challenge to preserve the nutrients quantitatively and qualitatively over a longer period by inactivating microbial and feed-specific enzymes, i.e. to limit the decomposition processes to an unavoidable or desirable extent (STEINHÖFEL et al. 2023).

Conclusions

- The use of new homofermentative LAB was able to significantly improve the fermentation quality in wet grass silage, but did not completely prevent butyric acid fermentation.
- Application of new LAB caused a reduction of losses in grass silage by more than half, which have positive effects on operating success in practice.

Material and Methods

- Forage of first growth of permanent grassland, 95 % grasses, DM 238 g/kg.
- Particle length 5-10cm (harvest wagon).
- **Treatment of ensiled material**:
  - **V1** untreated control
  - **V2** mixture of new selected species of Lactobacillus (LAB) - *L. plantarum, Lc. lactis, L. paracasei and L. huelsenbergensis;* dose of 500 ml/t forage; target LAB-density 250,000 cfu/g forage
- For dynamics after 1, 4, 7, 14, 31 days: vaccum bags (VB) 295 × 365mm; 500 g FM in each VB in 3 replications.
- For silage opening after 87 rep. 192 days: wide necked barrels (WNB) 60 litre; 10 charges á 4 kg FM = 40 kg FM in 3 replications.
- Wet chemistry analysis by standardized methods of VDLUFA (2012).
  - DM-correction, because of VOC (WEISSBACH & KUHLA 1995)
- Balance method Total-in vs. Total-out (KÖHLER et al. (2019)
- Statistical analysis Tukey-HSD (P-Niveau 95%)

Tab. 1: Impact of treatment and storage duration on ingredients, losses and fermentation quality of slightly wilted grass silage

Parameter	Unit	Forage	Silage after 7 d		Silage after 30 d		Silage after 87 d		Silage after 192 d	
			V1	V2	V1	V2	V1	V2	V1	V2
dry matter	g/kg FM	238	235	238	223	231	216^{a}	229^{b}	213^{a}	232^{b}
ammonia	% of N	0	9.6^{b}	7.9^{a}	15.0^{b}	9.3^{a}	18.3^{b}	11.0^{a}	19.4^{b}	10.5^{a}
metabolic energy	MJ/kg DM	10.5	-	-	-	-	10.5^{a}	10.6^{b}	10.6^{a}	10.8^{b}
DM loss	%	0	0.9^{b}	0.1^{a}	7.3^{b}	3.3^{a}	11.7^{b}	4.9^{a}	13.1^{b}	3.7^{a}
Protein loss	%	0	8.8^{b}	6.9^{a}	17.4^{b}	9.5^{a}	25.7^{b}	11.7^{a}	24.5^{b}	10.3^{a}
ME loss	%	0	-	-	-	-	12.8^{b}	4.1^{a}	12.4^{b}	1.4^{a}
pH value			5.1^{b}	4.9^{a}	4.9^{b}	4.2^{a}	4.8^{b}	3.9^{a}	4.9^{b}	4.0^{a}
lactic acid	g/kg DM		100^{b}	96^{a}	54^{a}	92^{b}	38^{a}	171^{b}	28^{a}	137^{b}
acetic acid	g/kg DM		13.1^{b}	5.5^{a}	11.7^{b}	6.8^{a}	13.7^{b}	7.7^{a}	13.2^{b}	5.0^{a}
butyric acid	g/kg DM		2.5^{b}	0.3^{a}	18.9^{b}	0.9^{a}	47.8^{b}	17.9^{a}	53.5^{b}	17.9^{a}
ethanol	g/kg DM		9.6^{b}	6.4^{a}	17.0^{b}	7.1^{a}	23.1^{b}	10.4^{a}	28.1^{b}	14.1^{a}

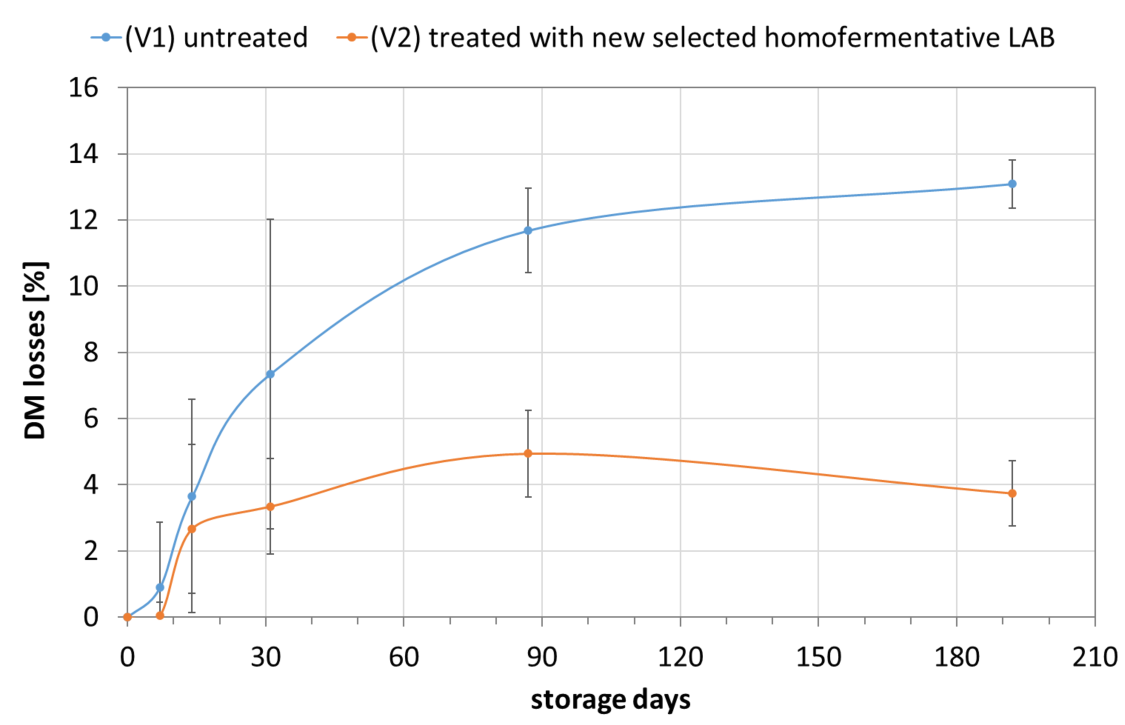

Fig. 1: Dynamics of DM losses in dependence of LAB-treatment and storage duration of slightly wilted grass silage

Effects of new selected LAB vs. control

- Increase of fermentation quality of grass silage: pH↓, LA↑, BA↓, AA↓, Eth↓
- Reduction of losses: DM (-9.4%), Protein (-14.2%), ME (-11%)

Fig. 2: Gas production of grass silage in vacuum bags after 31 days (3 replications)
first row: untreated control
(strong gas formation and bloated bags)
second row: LAB-treated silage
(almost no gas formation)

Example for an average Austrian farm

- Forage yield of first cut of permanent grassland:
  - **3.0 t DM/ha, 510 kg CP/ha; 31.8 Gigajoule (GJ) ME/ha**
- Average in Austria: 300 m³ ensiled material, density of 172 kg DM/m³
- This corresponds with **51.6 t ensiled DM** = DM yield of 17.6 ha

Tab. 2: Effects of LAB-treatment on farm scaled losses and compensation for an average Austrian farm (Protein loss = total N loss + NH_3-N loss; ME = mebabolic energy in Gigajoule)

Treatment	DM loss	DM output	Protein loss	CP output	ME loss	ME output
	%	kg	%	kg	%	GJ
V1	11.7	45,563	25.7	6,441	12.8	472
V2	4.9	49,072	11.7	7,655	4.1	520
Difference (V2 - V1)	6.8	3,509	14.0	1,214	8.7	47
Required Yield [ha] for compensation		**1.17**		**2.38**		**1.48**

compensation means the required yield of xy hectars to get the same yield resp. quality as without treatment

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