



Use of an inoculant in mixed crop corn silage

Ying Wen¹, Jürgen Hummel¹, Ewald Kramer², and Martin Hünerberg¹

¹Department of Animal Sciences, University of Goettingen, Goettingen, Germany; ²ISF GmbH, Pinneberg, Germany

Introduction

- Co-cultivation of corn with flowering plants (e.g., legumes or sunflowers), that are attractive to insects, is an approach to improve the environmental impact of corn silage production
- In 2024, more than 98,000 ha ($\pm$ 242,000 ac) mixed crop corn were grown in Germany (DMK, 2024)
- Aerobic stability of corn silage is reduced, when ensiled together with common beans (Benkner, 2020)
- Frequently, heterofermentative silage inoculants are used to improve fermentation characteristics and aerobic stability
- However, for mixed crop corn silages, there is a lack of data concerning overall silage quality and the use of inoculants

Objectives

- Compare the composition, fermentation quality, and aerobic stability of mixed crop corn silage to that of pure corn silage
- Evaluate the response of mixed crop corn silage to a heterofermentative silage inoculant

Materials and Methods

- Corn was planted alone (**C**) or together with common beans (**CCB**; *Phaseolus vulgaris*), field beans (**CFB**; *Vicia faba*) or sunflowers (**CSF**; *Helianthus annuus*; Figure 1)

Materials and Methods (cont.)

- The stands were harvested in late dough stage of the corn
- One half of the material remained untreated (**Ccon**, **CCBcon**, **CFBcon**, **CSFcon**)
- The other half was inoculated with a mix of *L. buchneri* and *L. diolivorans* (Lactosan GmbH & Co. KG, Kapfenberg, Austria) at 2.5×10^5 CFU/g FM (**Cinoc**, **CCBinoc**, **CFBinoc**, **CSFinoc**)
- The forages were packed into PVC mini silos (Fig. 2)



Figure 1. Mixed crop corn



Figure 2. Mini silo

- Measured parameters were: chemical composition, pH, fermentation products, counts of LAB, yeasts, mold, and clostridia, and aerobic stability (over 14 d)
- Data were analyzed using PROC MIXED in SAS (version 9.4; fixed effects: substrate, inoculation, and substrate $\times$ inoculation; random effect: mini silo)

Results

Table Crude protein (CP) content and fermentation characteristics of corn silage and mixed crop corn silages after 105 d of ensiling (n=3)

Item	Treatment								SEM ³	P-value ¹		
	Ccon	Cinoc	CCBcon	CCBinoc	CFBcon	CFBinoc	CSFcon	CSFinoc		Sub (S)	Inoc (I)	S $\times$ I
CP, % DM	7.04 ^d	7.10 ^d	9.70 ^a	9.74 ^a	7.43 ^{cd}	7.69 ^{bcd}	8.10 ^{bc}	8.58 ^b	0.199	<0.001	0.160	0.665
pH d105	4.01 ^{cd}	3.99 ^d	4.00 ^d	4.01 ^{cd}	4.05 ^c	4.02 ^{cd}	4.33 ^b	4.44 ^a	0.009	<0.001	0.020	<0.001
AUC, ² °C	113 ^{ab}	52.1 ^c	110 ^{ab}	106 ^b	131 ^a	129 ^a	10.8 ^d	10.2 ^d	5.29	<0.001	<0.001	<0.001
Lactate, % DM	4.77 ^c	4.69 ^c	7.10 ^b	6.87 ^b	4.85 ^c	5.10 ^c	12.71 ^a	12.58 ^a	0.348	<0.001	0.782	0.793
Acetate, % DM	1.46 ^e	1.97 ^{cde}	2.55 ^{abc}	2.29 ^{bcd}	1.47 ^e	1.53 ^{de}	3.03 ^{ab}	3.24 ^a	0.159	<0.001	0.271	0.146
Ethanol, % DM	0.73 ^a	0.65 ^{ab}	0.33 ^e	0.36 ^e	0.51 ^d	0.63 ^{bc}	0.53 ^{cd}	0.69 ^{ab}	0.021	<0.001	0.003	<0.001
NH ₃ -N, % DM	0.050 ^e	0.051 ^e	0.096 ^c	0.093 ^c	0.050 ^e	0.080 ^d	0.107 ^b	0.119 ^a	0.0006	<0.001	<0.001	<0.001

^{a-f} Within a row, means without a common superscript letter differ, $P < 0.05$; ¹ P-values type 3 fixed effects (Sub=substrate, Inoc=inoculation, S $\times$ I=interaction substrates $\times$ inoculation; ² AUC=area under the curve. The AUC was calculated as the sum of the absolute change in silage temperature, relative to ambient temperature (silage temperature minus ambient temperature) over the entire length of aerobic exposure (14 d)

Conclusion

- Mixed cropping of corn with common beans, field beans or sunflowers resulted only in moderate increases in CP
- Inoculation significantly prolonged aerobic stability of pure corn silage (+48h and smaller AUC) but was less effective in mixed silages
- Silage inoculants have to be chosen substrate specific and mixed crop corn silages differ from pure corn silages in terms of chemical composition, fermentation characteristics, and aerobic stability

References

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Contact: martin.huenerberg@uni-goettingen.de