



SILAGE TROUBLESHOOTING – PART V: Classifying the hygienic status of silage

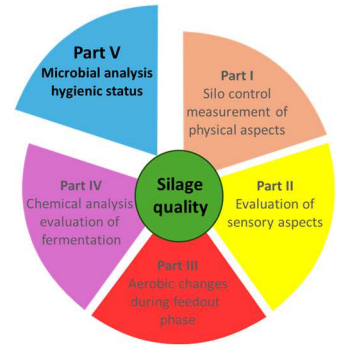
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Introduction

- Aim:** Development of orientation values for the microbiological quality of silages
- History:** since 1990s, the Feed Microbiology Working Group of the Association of German Agricultural Inspection and Research Institutes (VDLUFA) has been developing **orientation values (OV)** for the microbiological quality assessment of a large number of feed types. In the years 2004-2008, 5 laboratories analysed 386 grass silages, which were used to derive orientation values. In the case of maize silage 449 samples from the years 1999-2008 were analysed by 10 laboratories from Germany, Austria and Switzerland.
- Focus:** 19 typical aerobic indicator organisms - representing product-typical/ field-based or spoilage-indicating aerobic mesophilic bacteria, moulds, and yeasts were grouped into 7 **microbial groups (MG)**. Sulfite-reducing clostridia contents were also considered.
- Evaluation:** technical and statistical evaluation, OV are determined and published on the VDLUFA homepage.

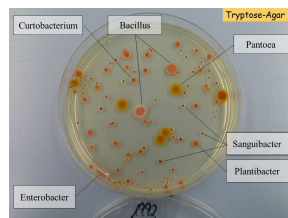
Materials and Methods

- VDLUFA method III 28.1.2** SOP to enumerate bacteria, yeasts, moulds, and Dematiaceae (Tryptose agar, aerobic, 30 °C for 4d; RoseBengal agar, and DG18 agar, aerobic, 25 °C for 5d)
- VDLUFA method III 28.3.2** Enumeration of sulfite-reducing clostridia (TSC agar, 37 °C, anaerobic, 1-2d)
- New qPCR method** for the detection of clostridia in silage
- Evaluation:** technical and statistical evaluation, orientation values are published on the VDLUFA homepage.

Microbial groups (MG):

MG 1: product-specific/ field-grown native bacteria:

Yellow pigmented bacteria, *Pseudomonas*/ *Enterobacteriaceae*, coryneform bacteria, etc.



MG 2: spoilage indicating bacteria:

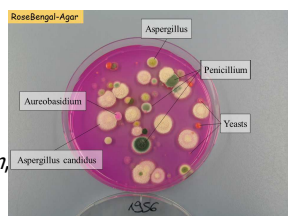
Bacillus, *Micrococcus*, *Staphylococcus*

MG 3: spoilage indicating bacteria:

Streptomyces

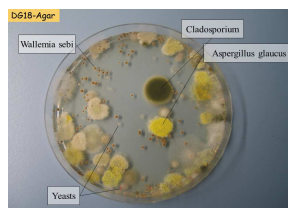
MG 4: product-specific/field-grown native molds and *Dematiaceae*:

Acremonium, *Aureobasidium*, *Verticillium*, *Fusarium*, *Trichothecium*, *Ustilago*, etc.



MG 5: spoilage indicating molds:

Aspergillus, *Penicillium*, *Scopulariopsis*, *Wallemia*, *Paecilomyces*, etc.



MG 6: spoilage indicating molds:

Mucorales

MG 7: Yeasts

Clostridia: cultural method (sulfite-reducing clostridia)
molecular method qPCR (all clostridia)

Conclusions

Quality levels from 1-4.

Ranking:

- 1 Normal microbial values (values of all 7 MGs are undercut)
- 2 Slightly increased values (at least 1 OV is exceeded)
- 3 Clearly increased values (at least 1 OV is exceeded 5 times)
- 4 Excessively raised values (at least 1 OV is exceeded 10 times)

Evaluation

Orientation Values (OV) for silages



Orientation values for MGs of mesophilic aerobic bacteria, yeasts, moulds, Dematiaceae and reference values for sulfite-reducing

MG	x 10 ⁶ CFU/g			x 10 ³ CFU/g				CFU/g
	1	2	3	4	5	6	7	
Maize silages ^{1),2)}	0.4	0.2	0.03	5	5	5	1000	Clostridia
Grass silages ^{1),2),3)}	0.2	0.2	0.01	5	5	5	200	200
								500

CFU: colony forming units

1) applies to silages after some weeks of anaerobic storage and not to freshly ensiled feeds (VDLUFA 28.1.4, 4.2.3)

2) Microbial groups 1 and 4: microorganisms originate from the field and are thus native to the plant material before ensiling; they die under optimal ensiling conditions.

3) Ensiling products, mainly consisting of Gramineae species.

<https://www.vdlufa.de/wp-content/uploads/2024/12/Orientation-values-2024.pdf>

Reference values are important benchmarks:

- to control compliance with legal requirements
- to clarify the suitability of feeding for livestock
- to determine the cause of problems in an animal population

Animal health should not be directly linked due to the involvement of many other factors. This would require further investigation of the microorganisms to determine whether pathogens are present in individual cases.

Quality level 1: unspoiled feed
no feeding restriction

Quality level 2: unspoiled feed, under surveillance
no feeding restriction

Quality level 3: possible limitation in feeding
⇒ not for susceptible animals (young, high performing animals, horses)
⇒ reduce proportion, e.g. by blending
⇒ controlling

Quality level 4: feeding restricted
⇒ do not feed without risk analysis
⇒ further investigation needed

Specific Analysis

- Mycotoxins: if orientation values of MG 4 or/and MG 5 are exceeded
- Clostridia: if fermentation quality is poor (e.g. very low dry matter, soiling, pH-value not adequate, smell/analysis of high concentrations of butyric acid)

Evaluation and control of feed processing chain and improvement

➔ **Posters Silage Troubleshooting Part I-IV**