Use of chemical additive to improve feed quality and hygienic value of wheat and barley straw

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Introduction

- Straw is an essential forage, bedding and enrichment material
- The quality of straw mainly determined by the harvest conditions, such as dry, sunny weather
- But: Straw can contain excessive levels of mycotoxins or markable levels of microorganisms which can negatively affect feed hygiene as well as animal performance
- **Could a chemical additive increase straw and hygienic values when harvested and stored in good condition?**

Material and Methods

- Commercial farm northwest Germany 2018
- Barley (*Hordeum vulgare*) and wheat (*Triticum aestivum*) straw, 90-100 kg bales
- Optimal harvest conditions (warm, sunny, dry)
- Bale treatment at baling:
  - Untreated control (four bales)
  - Treatment: mixture of potassium sorbate, sodium benzoate and sodium propionate (RaicoSil Straw) applied at 250 g/t fresh matter in 1.25 l water dissolved
- Measurements:
  - Mould counts; deoxynivalenol (DON) and zearalenone (ZEA), both with ELISA method
  - Dry matter, sensory quality, water activity

Conclusion

- Good harvest and storage conditions as well as sensory properties are not always linked with good hygienic value
- Straw can be a source of moulds and mycotoxins
- A chemical additive can reduce moulds and DON and increase hygienic value

Results and Discussion

- No sensory quality issues could be detected
- In the field (Table 1 & 2):
  - Wheat straw had a high initial mould count whereas barley straw had a low
  - Wheat had detectable DON levels, barley had no mycotoxins
- Just treated straw reached threshold of < 2 x 10^5 colony forming units mould/g straw
- Some of the mycotoxin values are already over the threshold for piglets and pigs
- Chemical and salty capacity of the treatment might explain the lower water activity and more pronounced drop in mould count

Table 1: Characteristics of barley straw at field and different storage time

Barley Storage time	Field	Day 1		Day 30		Day 100	
		Control	Treated	Control	Treated	Control	Treated
Dry matter g/kg	88.1	89.6	89.6	87.2	87.5	83.9	84.9
Water activity	-	0.22	0.19	0.47	0.45	0.66	0.62
Mould CFU/g	1.5 x 10^5	7.0 x 10^5	9.5 x 10^5	3.0 x 10^5	1.4 x 10^5	2.0 x 10^5	1.2 x 10^5
DON mg/kg	< 0.2.*	< 0.2*	< 0.2*	0.2	< 0.2*	< 0.3*	< 0.3*
ZEA mg/kg	< 0.01*	< 0.01*	< 0.01*	< 0.01*	< 0.01*	< 0.01*	< 0.01*

CFU colony forming units, DON deoxynivalenol, ZEA zearalenone, * below detection level

- Storage (Table 1 & 2):
  - Dry matter content decreased, and water activity increased in all bales but to a lesser extent in treatment
  - Barley increased mould counts in the first day, but with time all bales decreased counts; more pronounced in treatment
  - One untreated barley sample had detectable DON levels; treated wheat had constantly low DON levels; mycotoxin levels had a peak on day 30 in wheat, especially pronounced in untreated wheat straw

Table 2: Characteristics of wheat straw at field and different storage time

Wheat Storage time	Field	Day 1		Day 30		Day 100	
		Control	Treated	Control	Treated	Control	Treated
Dry matter g/kg	91.4	89.7	89.6	88.0	88.3	84.0	86.1
Water activity	-	0.38	0.39	0.58	0.57	0.72	0.65
Mould CFU/g	1.7 x 10^6	7.5 x 10^5	1.1 x 10^6	6.5 x 10^5	3.4 x 10^5	2.4 x 10^5	1.7 x 10^5
DON mg/kg	0.4	1.0	0.5	1.4	0.7	0.8	0.3
ZEA mg/kg	< 0.01*	< 0.01*	< 0.01*	0.14	0.15	< 0.01*	<0.01*

CFU colony forming units, DON deoxynivalenol, ZEA zearalenone, * below detection level