Long term preservation of high moisture grain and maize with a non-corrosive organic acid blend

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The potential action of organic acids under farm conditions in feed preservation and protecting feed from microbial and fungal destruction is already widely accepted in the agricultural business. The use of organic acids significantly reduces microbial contamination in treated grain, furthermore securing the nutritional value of the stored grain, grain crush and maize; resulting in a better quality of feedstuffs necessary for healthy animals, good animal performance and optimised economic production. Despite this, year on year the agricultural industry faces huge losses due to spoiled grain during storage. Unlimited mould growth causes nutrient losses; mycotoxin contamination can cause acute health problems in animal husbandry, including reduced animal performance and fertility problems. Successful preservative products need to guarantee the preservation and stabilisation of grain while offering easy, user-friendly handling to the customer. The use of buffered propionic acid combined with sodium benzoate as a preservative for wet corn storage, even without prior drying, is an interesting option for long term storage and secures the quality of the stored raw material.
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Introduction
High Feed quality!

- Nutrients
- High hygienic level
- Stability
- No losses in the storage
- Feed intake
- High performance
High-moisture grains susceptible to deterioration in storage if harvest moisture exceeds 14% ...

Microbial processes in grain

Aspergillus + Penicillium
The grain is „breathing“

- Carbohydrate Glucose is completely decomposed in the grain with the help of oxygen

**Will be developed:**
- carbon dioxide
- water
- heat energy

**Process depends on:**
- moisture
- temperature
- time

Optimum conditions for growth of microorganisms

Process of metabolism of the microorganisms (moulds, yeasts, bacteria)

leads to the spoilage of the grain!
Major factors affecting microbial growth

- Temperature
- Composition of the gas atmosphere
- Substrate properties
  - water activity ($a_w$), water content (moisture)
  - pH
  - nutrient supply
- Competition (microorganisms, insects …)

⇒ Interactions between those factors very likely!
Feed spoilage

How can we avoid it?
„Fresh” Grains

- High nutrient concentration, (e.g. starch)
- Best hygienic (sanitary) quality

How can we achieve it?
Prevent the spoilage of the crop

- Cooling
- Drying with heating system (hot air)
- Storage without oxygen (CO$_2$-preservation)
- Ensiling
- Preservation

**Target:** Stop of the undesirable expansion of:
- Bacteria
- Mould
- Yeasts
Chemical preservation

✓ Storage of feed upon exposure to air
✓ Application of chemical substances, mainly propionic acid
✓ Intensive research since the early 70`s, with increasing importance over the last 20 years
✓ Preservation by propionic acid tested and applied world-wide; technology works
✓ Disadvantages: corrosive to machinery, hazardous to people

⇒ Neutralization of the free acid (buffering) at the expense of activity
Safety precautions when using pure propionic acid
Product Development
Usage of a product, which is comparable with pure propionic acid in terms of application rate and application range (also usable at high moisture contents),

BUT

is non-corrosive and non-hazardous
Combination of propionic acid and sodium benzoate, the salt of benzoic acid (KofaGrain pH5 = OAB)

→ two antimycotic components (active against yeasts and moulds)

• partly neutralization of propionic acid (increase in pH, significant reduction in corrosivity)

• activation of the antimycotic potential of sodium benzoate by propionic acid that is still free in the mixture and not neutralized
Non-corrosive preservative:

Neutral salt-solution: propionic acid
sodium benzoate
buffered with special mixture of salts

Density: ca. 1.1 g / ml
pH-value: 4.8 – 5.0
Rated: Not dangerous! Non corrosive!

Pure propionic acid as a widely used grain preservative is a dangerous good!
Effect on mycoflora of high-moisture grain

wheat, 21.5 % moisture

Storage length (weeks)

Field fungi

Storage fungi

Infection rate (%)

Fresh

Untreated

Propionic acid

OAB

OKI 8/96 GK 2/95
Effect of OAB on microbial contamination of damp grain

![Graph showing microbial count at harvest, after application of OAB, and after 7 weeks of storage.](image)

- **Microbial count (per g grain)**
  - **at harvest**
  - **after application of OAB**
  - **after 7 weeks of storage**

- **Legend**:
  - Blue: bacteria
  - Red: yeasts
  - Green: moulds

- **Notes**:
  - Whole kernels, 20-22% moisture, 11-12 l/t
Effect of OAB on stability of high-moisture grain maize

(moisture 35 %, whole kernels)
Product Application
Control of moisture

Minimum 2 measurements per charge

The dosage should be always related to the highest moisture of a charge in the storage

Never make a rough guess!
✓ Any screw conveyors: at least 3 meters long

✓ The nozzles should be located in lower part of the screw at a minimum distance of 1.5 spirals
Preserved Corn

Moisture of corn: up to 45 %
Conclusion
Target achieved!

...for best Food Hygiene...

...and Animal Performance

High Quality Grain Preservation
Preservation is...

...an interesting alternative in producing high feed quality for healthy and high performing animals at farm level!

Thank you!