Mycotoxin reduction in grain storage.

Process technologies for enhanced food and feed safety.
Optimised grain storage. For higher food safety.

Mycotoxin contamination of agricultural raw materials used in food and feed production is a major threat for human and animal health. The Food and Agriculture Organization of the United Nations (FAO) estimates that up to 25% of agricultural raw materials are contaminated with mycotoxins.

Mycotoxins as a risk factor
Mycotoxins are secondary metabolites of mould fungi and have a toxic effect on humans and animals, even at low concentrations. The most common mycotoxins found in grains are aflatoxin, deoxynivalenol (DON), zearalenone, fumonisins, and ergot alkaloids. As a result of changing climate patterns, mycotoxins are a growing concern in grains.

Mycotoxin reduction is crucial
Infected grain kernels must be removed as early in the process as possible. Many countries have legal limits on mycotoxin levels in food and feed. There are various laboratory analysis methods for determining mycotoxin levels; these require a representative sample for precise results. Grain cleaning is the most effective post-harvest measure to reduce elevated mycotoxin levels. This has been successfully proven in countless industrial case studies for all kinds of grains and mould fungi and their corresponding mycotoxins.

Bühler solutions improve food safety
Bühler provides solutions for effective mycotoxin reduction along the entire value chain of industrial grain processing. These include methods for obtaining representative samples, various cleaning solutions, and automation and process monitoring. The focus lies on the efficient removal of mould-infested grains and grain fractions on the basis of features such as size, density, and optical properties.

Cornerstones of successful post-harvest mycotoxin reduction:
- Obtaining representative samples for quality control
- Removal of coarse, fine, and low-density impurities
- Removal of grain with low bulk density
- Optical sorting of discoloured or defective grain kernels
- Surface cleaning
- Uniform drying
- Professional storage solutions
- Specialist consultation

Ergot has a high toxicity potential.
Aflatoxin-contaminated corn (maize): a health hazard for humans and animals.
Mycotoxin reduction from A to Z. For valuable food and feed products.

Low risk of mycotoxin contamination along the entire value chain
The risk of mycotoxin contamination of grain can be reduced by good agricultural practice, but never entirely eliminated. In order to effectively reduce mycotoxin levels, Bühler provides effective and efficient solutions for every step of grain processing—from grain reception points and storage to grain mills, as well as processing of food and feed products. Innovative solutions and technologies for automation and process monitoring ensure efficient processes and the highest level of food safety. Customers can rely on the food and feed safety expertise of experienced Bühler specialists.

Bühler solutions are critical elements of an integrated mycotoxin risk management along the entire value chain.
Reliable high-performance cleaning. Prepared for the future.

Reliable reduction of mycotoxin levels with high-performance cleaning using Bühler process technologies not only provides maximum safety for grain reception and storage facilities, but also forms the basis for high-quality products that can generate higher profit margins. The following are three main reasons for using Bühler technologies for the reduction of mycotoxin levels:

1. **Commercial success: Bühler technologies guarantee maximum crop and yield**
   - Safe elimination of the most severely affected fractions.
   - Reliable reduction of the mycotoxin content of affected lots so that they can be traded on the market for a higher price.
   - Safe final products due to cleaning directly after harvest, as carryover within the process is avoided.
   - Prevention of commercially detrimental food and feed scandals, as well as no loss of valuable food and feed.

2. **Independence: Bühler solutions provide consistent cleaning results—regardless of incoming product quality**
   - Increase of value of contaminated product lots and higher, profitable product quality owing to the safe reduction of mycotoxins below the legal maximum levels.
   - Cleaning performance without remaining “hotspots” in the product flow and free of variations in contamination levels, adding an additional safety aspect alongside representative sampling.

3. **Safety: Bühler cleaning technologies ensure safety on a daily basis—required for the long-term commercial success of our customers**
   - Maximum availability and reliability based on the field-validated Bühler technologies and comprehensive Bühler expertise along the entire value chain for food and feed.
   - Seamlessly integrated, efficient cleaning lines as a result of combined mechanical cleaning, aspiration, and optical sorting for comprehensive cleaning solutions.

Reduced mycotoxin levels with Bühler solutions along the entire value chain for food and feed.
Bühler provides high-performance, reliable, and efficient cleaning solutions for all types of mycotoxins—the optimal basis for consistent cleaning results, optimal product quality, and greater margins.

**Aflatoxins** are produced by Aspergillus species and predominantly affect corn (maize) under the impact of high heat during the flowering and earing stage. Furthermore, high atmospheric humidity and feeding damage caused by thrips and/or earwigs during the earing stage exacerbate the fungal colonization. Aflatoxin B1 is the most harmful mycotoxin for both animals and humans.

**The Bühler solution:**
- Mechanical cleaning/grading
- Aspiration
- Optional gravity separation
- Optical sorting

**DON (deoxynivalenol),** also known as vomitoxin, is produced by Fusarium species and predominantly affects wheat, particularly under cold, wet, and cloudy weather conditions during flowering and subsequently in the earing phase.

**The Bühler solution:**
- Mechanical cleaning/grading
- Aspiration
- Optical sorting
- Mechanical surface cleaning

**Ergot alkaloids,** produced by Claviceps purpurea, predominantly occur in rye and are highly toxic. They can appear during flowering when the weather is predominantly damp and it is hard for pollen to reach the grain in order to fertilise it.

**The Bühler solution:**
- Mechanical cleaning/grading
- Aspiration
- Optical sorting
Efficient technologies.
For safe cleaning and grading.

The objective of grain cleaning is to reliably remove contaminants and impurities. Using high-performance technologies, the grain is graded on the basis of differences in shape, size, specific gravity, and optical properties. Cleaning markedly reduces the levels of substances hazardous to health, such as mycotoxins and ergot alkaloids.

**GrainPlus compact screening machine**
GrainPlus has been designed for efficient mechanical pre-cleaning of grain. It uses screens to remove coarse and fine impurities and grades the grain by kernel size. Low-density particles contained in the grain, which often have substantially higher mycotoxin levels, can be selectively removed by means of inlet and outlet aspiration.

**MTCD concentrator**
The MTCD concentrator has been developed for the classification of grains by specific gravity as high-density, mixed, and low-density product. For mycotoxins, the machine separates out light kernels that, as in the case of aflatoxins in corn (maize), have already lost kernel density as a result of a fungal infection in the endosperm.

**SORTEX optical sorter**
SORTEX sorters set new standards in the field of optical sorting. This efficient and reliable process technology enables detection of even very slight colour deviations and hard-to-differentiate defects. Ergot sclerotia and mould-infested grains posing a high risk of mycotoxin contamination are selectively identified on the basis of their optical properties and then removed from the product flow by means of precision compressed-air ejection.
Maximum economic efficiency.
For higher sales and quick amortisation.

Countless field applications prove that using Bühler technologies to reduce mycotoxin contamination is worthwhile in order to improve product quality and achieve higher margins. Here are two concrete examples that demonstrate the added value and sales potential that can be achieved—with solutions that soon pay for themselves.

Customer A

- Reception point and grain trader
- 25,000 metric tons of material annually
- 30% scrap rate (average)
- One cleaning line
- Corn (maize) received at biomass quality level
- Sells corn (maize) to feed industry
- Value added by cleaning: EUR 30 per metric ton

Added value per year: > EUR 500,000

Customer B

- Reception point, farmers’ cooperative
- 80,000 metric tons of material annually
- 10% scrap rate (average)
- Two cleaning lines
- Serves as a reception point for farmers (owners of the grain)
- Costs to farmers: EUR 15 per metric ton

Annual sales: > EUR 1,000,000

Fortunat Schmid
Head of Quality Management and Infrastructures
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“For grain lots infected with ergot, SORTEX is an efficient system that can successfully remove defective kernels in one process step. We are also increasingly using this technology to eliminate chalky white, pink, and shriveled kernels from grain lots infected with mycotoxins. The foremost objective for both variants, besides reliably complying with the maximum levels, is to reject as little good, non-infected product as possible.”