

Mycotoxins

Mycotoxins, toxic chemical compounds produced by moulds, can contaminate commodities either in the field or during storage and are invisible, odourless and tasteless. The only proven way to determine whether grain, cereals, feed or food are contaminated, is by analytical testing. According to the Food and Agriculture Organization, food losses due to mycotoxin contamination are estimated at 25% on a global scale and pose a real threat to food security, especially in Africa where the magnitude of losses is difficult to estimate because of a lack of information.

Mycotoxin production is foremost a food safety issue, although the occurrence of moulds can also lead to damage ranging from rancidity, odour, flavour changes, loss of nutrients and germ layer destruction resulting in a reduction in quality. Most mycotoxins are toxic in very low concentrations so this requires sensitive and reliable methods for their detection.

Effective management to prevent food losses or adverse health effects as a result of long-term exposure to contaminated food is only possible when adequate reliable testing data is available. Well-timed interventions in the food and feed value chain can then be based on these testing results.

The accredited multi-mycotoxin assessments included in the annual wheat crop quality survey for the past eight seasons, provide the most comprehensive overview of the multi-mycotoxin risk in commercial wheat produced and delivered to commercial grain storage companies in South Africa. Approximately 10 - 20% of the wheat crop samples were selected every season to proportionally represent all the production regions.

The absence of Aflatoxin B₁, B₂, G₁, G₂, Fumonisin B₁, B₂, B₃, Ochratoxin A, Zearalenone, T2-toxin and HT-2 toxin in the wheat samples over the past seven seasons were confirmed in the 2017/2018 season. The Deoxynivalenol residue levels measured, were all well below national and international maximum residue levels.

Constant monitoring and continued research on the prevention and mitigation of mycotoxin contamination are necessary. Application of good agricultural practices and storage conditions as well as effective mycotoxin risk management programs are essential elements in preventing the negative effects of mycotoxins.

National Mycotoxin Regulations

According to the Foodstuffs, Cosmetics and Disinfectants Act (Act 54 of 1972) and regulations published under Government Notice No. R. 1145, dated 8 October 2004, all foodstuffs, ready for human consumption, may not contain more than 10 µg/kg of aflatoxin, of which aflatoxin B₁ may not exceed 5 µg/kg.

Amendments to Government Notice No. R. 1145, dated 8 October 2004, published under Government Notice No. 987 of 05 September 2016, specify that:

- Cereal grains (wheat, maize and barley) intended for further processing, may not contain more than 2 000 µg/kg of Deoxynivalenol.
- Flour, meal, semolina and flakes derived from wheat, maize or barley, ready for human consumption, may not contain more than 1 000 µg/kg of Deoxynivalenol.

Further processing means any other treatment or processing method that has been proven to reduce levels of fungus produced toxins in foodstuffs intended for human consumption.

International Mycotoxin Regulations

The Maximum, advisory and guidance levels for mycotoxins on cereals from the European Union, USA, China and Codex are provided below for comparison purposes.

The European Union specifies the following maximum levels for mycotoxins on cereals and specifically wheat:

Aflatoxins

- All cereals and all products derived from cereals, including processed cereal products, with the exception of maize, rice, processed cereal-based foods for infants and young children and dietary foods for special medical purposes intended specifically for infants, B₁ ≤ 2.0 µg/kg.
- All cereals and all products derived from cereals, including processed cereal products, with the exception

of maize, rice, processed cereal-based foods for infants and young children and dietary foods for special medical purposes intended specifically for infants, $B_1 + B_2 + G_1 + G_2 \leq 40 \mu\text{g/kg}$.

Ochratoxin A

- Unprocessed cereals, $\leq 5.0 \mu\text{g/kg}$.
- All products derived from unprocessed cereals, including processed cereal products and cereals intended for direct human consumption with certain exceptions (see full regulation), $\leq 3.0 \mu\text{g/kg}$.

Deoxynivalenol

- Unprocessed cereals other than durum wheat, oats and maize, $\leq 1\ 250 \mu\text{g/kg}$.
- Cereals intended for direct human consumption, cereal flour, bran and germ as end product marketed for direct human consumption, with the certain exceptions (see full regulation) $\leq 750 \mu\text{g/kg}$.
- Bread (including small bakery wares), pastries, biscuits, cereal snacks and breakfast cereals, $\leq 500 \mu\text{g/kg}$.

Zearalenone

- Unprocessed cereals other than maize $\leq 100 \mu\text{g/kg}$.
- Cereals intended for direct human consumption, cereal flour, bran and germ as end product marketed for direct human consumption and the germ with certain exceptions (see full regulation) $\leq 75 \mu\text{g/kg}$.
- Bread (including small bakery wares), pastries, biscuits, cereal snacks and breakfast cereals, excluding maize-snacks and maize-based breakfast cereals, $\leq 50 \mu\text{g/kg}$.⁽¹⁾

T-2 and HT-2 toxin

- Unprocessed cereal – wheat, rye and other cereal, indicative level $100 \mu\text{g/kg}$.
- Cereal grains for direct human consumption – cereals other than oats and maize, indicative level $50 \mu\text{g/kg}$.
- Cereal products for human consumption – cereal milling products other than oat and maize, indicative level $50 \mu\text{g/kg}$.
- Cereal products for human consumption – breakfast cereals including formed cereal flakes, indicative level $75 \mu\text{g/kg}$.
- Cereal products for human consumption – bread (including small bakery wares), pastries, biscuits, cereal snacks, pasta, indicative level $25 \mu\text{g/kg}$.
- Cereal products for human consumption – cereal-based foods for infants and young children, indicative level $15 \mu\text{g/kg}$.⁽²⁾

In the USA, the Food and Drug Administration (FDA) actions levels for Aflatoxin for all commodities intended for human consumption is $20 \mu\text{g/kg}$ (excluding Aflatoxin M1 in milk where the maximum level is $0.5 \mu\text{g/kg}$). Advisory maximum levels for DON in finished wheat products intended for human consumption is $1\ 000 \mu\text{g/kg}$.⁽³⁾

In China the maximum level for Aflatoxin B1 in wheat is $5.0 \mu\text{g/kg}$. The maximum level for DON in cereals and their products including wheat and wheat meal is $1\ 000 \mu\text{g/kg}$. Ochratoxin A in cereals and processed products of milled grains may not exceed $5.0 \mu\text{g/kg}$ and Zearalenone in wheat flour may not exceed $60 \mu\text{g/kg}$.⁽⁴⁾

According to Codex, Ochratoxin A in raw wheat may not exceed $5 \mu\text{g/kg}$ and the proposed maximum level for DON is 2 mg/kg in raw wheat and 1 mg/kg in flour, semolina, meal and flakes derived from wheat.⁽⁵⁾

References:

1. COMMISSION REGULATION (EC) No 1881/226 of 19 December 2006 setting maximum levels for certain contaminants in foodstuffs.
2. COMMISSION RECOMMENDATION of 27 March 2013 on the presence of T-2 and HT-2 toxin in cereals and cereal products.
3. FDA Mycotoxin Regulatory Guidance, A Guide for Grain Elevators, Feed Manufacturers, Grain Processors and Exporters, August 2011.
4. National Food Safety Standard, Maximum Levels of Mycotoxins in Foods, GB 2761-2017.
5. CODEX General Standard for contaminants and toxins in food and feed, CODEX STAN 193-1995, Revised in 1997, 2006, 2008, 2009, Amended 2009.