

Mycotoxins

Mycotoxins, toxic chemical compounds produced by moulds, can contaminate commodities either in the field or during storage and are invisible, odourless and tasteless. 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.

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.

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. The only proven way to determine whether grain, cereals, feed or food are contaminated, is by analytical testing. Most mycotoxins are toxic at very low concentrations, sensitive and reliable methods for their detection are therefore required.

The accredited multi-mycotoxin assessments included in the annual wheat crop quality survey for the past nine 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 eight seasons were confirmed in the 2018/2019 season. The Deoxynivalenol residue levels measured, were all well below national and international maximum allowable 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 in 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 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, including maize and rice, intended for direct human consumption, B₁ ≤ 2 µg/kg.
- All cereals, including maize and rice, intended for direct human consumption, Total ≤ 4 µg/kg.

Ochratoxin A

- Unprocessed cereals, $\leq 5 \mu\text{g}/\text{kg}$.
- All products derived from unprocessed cereals (including processed cereal products and cereals intended for direct human consumption), $\leq 3 \mu\text{g}/\text{kg}$.
- Wheat gluten not sold directly to the consumer, $\leq 8 \mu\text{g}/\text{kg}$.

Deoxynivalenol

- Unprocessed cereals (excluding durum wheat, oats and maize), $\leq 1\,250 \mu\text{g}/\text{kg}$.
- Cereal flour, maize flour, grits and maize meal, $\leq 750 \mu\text{g}/\text{kg}$.
- Bread, biscuits, pastries, cereal snacks and breakfast cereals, $\leq 500 \mu\text{g}/\text{kg}$.

Zearalenone

- Unprocessed cereals other than maize, $\leq 100 \mu\text{g}/\text{kg}$.
- Cereals intended for direct human consumption, cereal flour, bran as end product marketed for direct human consumption, $\leq 75 \mu\text{g}/\text{kg}$.
- Bread, pastries, biscuits, cereal snacks and breakfast cereals, $\leq 50 \mu\text{g}/\text{kg}$.

T-2 and HT-2 toxin

- Unprocessed cereals – wheat, rye and other cereal, guidance level $100 \mu\text{g}/\text{kg}$.
- Cereal grains for direct human consumption – cereals other than oats and maize, guidance level $50 \mu\text{g}/\text{kg}$.
- Cereal products for human consumption – cereal milling products other than oat and maize, guidance level $50 \mu\text{g}/\text{kg}$.
- Cereal products for human consumption – breakfast cereals including formed cereal flakes, guidance level $75 \mu\text{g}/\text{kg}$.
- Cereal products for human consumption – bread (including small bakery wares), pastries, biscuits, cereal snacks, pasta, guidance level $25 \mu\text{g}/\text{kg}$.
- Cereal products for human consumption – cereal-based foods for infants and young children, guidance level $15 \mu\text{g}/\text{kg}$.⁽¹⁾

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

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

According to Codex, Ochratoxin A in raw wheat may not exceed $5 \mu\text{g}/\text{kg}$. The maximum DON level for cereal grains (wheat, maize and barley) destined for further processing is $2\,000 \mu\text{g}/\text{kg}$ and the maximum level for DON in flour, meal, semolina and flakes derived from wheat, maize or barley is $1\,000 \mu\text{g}/\text{kg}$.⁽²⁾

References:

1. <https://www.romerlabs.com/knowledge-center/knowledge-library/articles/news/worldwide-mycotoxin-regulations/>
2. CODEX General Standard for contaminants and toxins in food and feed, CODEX STAN 193-1995, Revised in 1997, 2006, 2008, 2009 and Amended in 2010, 2012, 2013, 2014, 2015, 2016, 2017, 2018