

SF_Contaminant	Aflatoxin B1
What is it?	Aflatoxin is a natural toxin made by fungi such as <i>Aspergillus flavus</i> . Aflatoxin is differentiated into several types, such as aflatoxin B1, B2, G1, G2, M1. Aflatoxin B1 is the most common type and most harmful to humans and animals. Dairy cattle convert the aflatoxin B1 they ingest through their feed into aflatoxin M1, which partly ends up in the milk produced.
Source of contaminant	The fungus <i>Aspergillus</i> occurs worldwide and some species can contaminate food and feed with aflatoxin B1. The fungus grows best at higher temperatures and then also produces the toxin aflatoxin, this occurs in <i>Aspergillus flavus</i> between 15-37°C (GMP factsheet, 2016). The fungus is drought-resistant, yet drying to 12% moisture (88% DM) is sufficient to prevent fungus growth during storage.
What is the danger?	The risks of aflatoxin B1 to humans and animals are described in the EFSA risk assessment for food and feed (see under "Sources of information")
How is the growth of Aflatoxin B1 affected?	Wet and warm conditions during cultivation or storage <ul style="list-style-type: none"> - Crops under stress (e.g. due to drought or insect predation) are more susceptible to fungi - Crops grown in countries in southern Europe have a higher aflatoxin risk due to climate - Insufficient drying and/or condensation during transport or storage can lead to fungus and aflatoxin formation. <p>NB: Removal or inactivation of the producing fungus does not mean that the aflatoxin is gone!</p>
Legislation	The maximum level of aflatoxin is regulated in the EU for several foodstuffs, including: <ul style="list-style-type: none"> - dried fruit, e.g. figs and dates - oilseeds and nuts, e.g. peanuts and hazelnuts - cereals, e.g. maize and rice - spices, e.g. paprika, chili peppers and ginger - milk (M1) and infant formula <p>EU animal feed standard sets maximum levels based on intended use and on an 88% dry matter basis:</p> <ul style="list-style-type: none"> - Compound feed for dairy cattle and young cattle: 5 µg/kg - Feed materials: 20 µg/kg (=20 ppb= 0.020 mg/kg = 0.02 ppm) - Other compound feed: 10-20 µg/kg <p>In addition, there are above-legal standards (see under "Assurance at SecureFeed")</p>
Relevant products	Higher aflatoxin B1 values are expected in the following feed materials: <ol style="list-style-type: none"> 1. Maize grown in HIGH / MEDIUM risk countries (D-25) 2. Corn gluten products & corn screenings 3. Rice bran 4. Rice protein concentrate 5. Sunflower seed expeller organic, origin China <p>Aflatoxin B1 can also occur in other feed materials, see the SecureFeed risk classification. Participants can view reports of current exceedances any time of the day in the SF database under Notifications > Report Alerts.</p>
Attention	<ol style="list-style-type: none"> 1. Aflatoxin contamination is often unevenly distributed in a batch of commodities "Foci": there may be peaks of contamination in a lot because only part of the crop/harvest/load is affected by fungi. One sample from a lot is not enough to get a representative picture of the aflatoxin status, a sample for analysis should be composed of sub-samples from different places in the lot and be sufficiently large (see aflatoxin protocol). 2. Aflatoxin can concentrate when a crop is processed into a feed material because <ol style="list-style-type: none"> a. The fungus and therefore the aflatoxin is often on the outside of the grain. Rice bran contains more aflatoxin than rice (concentration factor ~10).

	<p>b. The aflatoxin remains in the by-product that is fed to animals. Maize DDGS from ethanol production contains more aflatoxin B1 than the input maize (concentration factor ~3-3.5).</p>
<p>Assurance at SecureFeed</p>	<ul style="list-style-type: none"> - Monitoring and restrictions maize and maize by-products in the SF aflatoxin protocol - Positive release for certain products in specific product conditions - For MEDIUM risk products such as sunflower seed expeller and palm kernel expeller, aflatoxin risk assurance is assessed by an FSDS. - Supplier audits of suppliers of processed risk products - Refusal of cargoes affected by insects or fungi (refused cargo system) - Collective collection of results regarding new harvest grains (F-24) - Verification assurance by analysis on purchased high-risk products (SF Monitoring Plan, D-15) - Verification assurance steps by analysis produced dairy feed by SF participants (D-28, I-08-03c) - Above-legal action and rejection limits for dairy cattle feed (D-01)
<p>Transfer to food of animal origin</p>	<p><u>Milk</u> Why does SecureFeed set above-legal maximum level for aflatoxin B1 in feed intended for dairy cattle? The SecureFeed maximum level for aflatoxin B1 in compound feed is set, based on the regulated aflatoxin M1 level in milk. The SecureFeed maximum level ensures that the maximum level of aflatoxin M1 in milk is not exceeded, even if the cow excretes a high fraction of aflatoxin M1 to the milk (worst case transfer). The SF maximum level for compound feed for dairy cattle is 2.5 µg aflatoxin B1/kg.</p> <ul style="list-style-type: none"> - Ration: 10 kg compound feed/day per cow - Milk yield: 30 kg milk/day per cow - Intake Aflatoxin B1: 2.5 µg/kg compound feed *10 kg compound feed/day = 25 µg/day - Transfer intake B1 -> M1 in milk produced: max 6% (1 to 6%) - Transfer to milk: 6% of 25 µg/kg = 1.5 µg/day - Concentration of Aflatoxin M1 in milk 1.5/30 = 0.05 µg/litre <p>Note that the above is a worst-case approach, the expected transfer is estimated lower in https://www.feedfoodtransfer.nl/en/transfer-model-aflatoxin-b1-dairy-cow.</p> <p><u>Poultry</u> SecureFeed has not set an additional SecureFeed above-legal limit for poultry, as transmission to meat or eggs is lower than to milk:</p> <ul style="list-style-type: none"> - Meat: If an older broiler eats a week's feed containing 80x the legal standard (1600 µg /kg), max 0.0005 µg /kg enters the muscles. The animal eliminates this contamination after several days of feed without aflatoxin (Hussein et al, 2010). - Egg: If a laying hen eats contaminated feed containing 165x the legal standard for 4 weeks, a plateau value of 0.5 ug/kg aflatoxin B1 (Wolzak, 1985). The animal lays eggs without detectable aflatoxin again after one week of feed free of aflatoxin.
<p>How is it measured?</p>	<p>Aflatoxin is not visible in a batch, but can be measured with measurement methods at the lab.</p> <p>GMP+ requires participants to use a GMP+-registered laboratory for aflatoxin B1. These laboratories should meet the performance criteria in TS 1.2. Here, for example, the detection limit for most analyses should be at least 1 µg /kg (=1 ppb = 0.001 mg/kg= 0.001 ppm) on <u>88% dry matter</u>.</p> <p>Note: semi-quantitative analytical methods such as thin-layer chromatography (TLC), ELISA etc. should not be used in the context of SecureFeed aflatoxin.</p>
<p>Information sources</p>	<p>EFSA (2020) Scientific opinion Aflatoxins in food https://doi.org/10.2903/j.efsa.2020.6040 EFSA (2004) Opinion of the Scientific Panel on contaminants in the food chain [CONTAM] related to Aflatoxin B1 as undesirable substance in animal feed https://doi.org/10.2903/j.efsa.2004.39 GMP factsheet (2016) Factsheet Aflatoxin B1 Version: 20-12-2016 Hussain et al (2010) Residues of aflatoxin B1 in broiler meat: Effect of age and dietary aflatoxin B1 levels, Food and Chemical Toxicology, Vol: 48, Issue: 12, 3304-3307 Wolzak (1985) Abstract of Aflatoxin deposition and clearance in the eggs of laying hens Food and Chemical Toxicology, Vol: 23, Issue: 12, 1057-106</p>

Disclaimer	SecureFeed fact sheets are intended to provide concise information on a particular contaminant. For more and in-depth information, please refer to the sources mentioned. SecureFeed provides this fact sheet as a service and accepts no liability for (consequences of) any errors or omissions. Should you have any suggestions or additions, please share them at monitoring@securefeed.eu .
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