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# EUROPEAN MYCOTOXIN CONTAMINATION IN 2012: INCREASING CONCERN

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*SUMMARY*: *Mycotoxin contamination of crops represents a widespread problem in the animal feed industry. The major classes of mycotoxins are aflatoxins (Afla), deoxynivalenol (DON), fumonisins (FUM), zearalenone (ZEN) and ochratoxin A (OTA). The aim of this study is to obtain information on the occurrence of 5 major mycotoxins in various animal feeds and ingredients samples from different European regions. A total of 4,023 samples sourced worldwide (from January to December 2012), 1,654 sample from Europe were analysed for the most important mycotoxins in terms of agriculture and animal production – Afla, ZEN, DON, FUM and OTA. Samples were analysed by high performance liquid chromatography (HPLC) and Enzyme-Linked Immunosorbent Assay (ELISA). Only single commodities were analysed by ELISA. More complex matrixes which could interfere with the ELISA method such as Dried Destillers Grains with Solubles and finished feed were analysed by HPLC. For each toxin, results below the quantification limits were expressed as non-detectedAll five major mycotoxins were highly prevalent in European countries and only 21% of all sampled were tested negative for the presence of the analysed mycotoxins. In 40% of animal feed and ingredient samples, more than one different mycotoxin was found. Out of all 4,023 samples, Afla were present in 41%, ZEN in 50%, DON in 67%, FUM in 58% and OTA in 56%. Similar to previous years, DON and FUM present the most prevalent group of mycotoxins with average contamination of 496 and 409 ppb; however average detected contamination levels were lower this year in comparison to 2011 (DON: 673 ppb and FUM 539 ppb). Survey results presented above clearly demonstrate that mycotoxins are a topic of concern in animal feed. An effective mycotoxin risk management program is a key factor for reaching optimum performance in animal husbandry.*

***Key words***: *mycotoxin, analyses, contamination, Europe.*

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## INTRODUCTION

Mycotoxins and pesticide residues are among the top food and feed safety concerns related with an altering climate (Miraglia et al., 2009). Mycotoxins depend on climatic conditions as the ability of fungi to produce them is mainly influenced by temperature, relative humidity, insect attacks and the general stress conditions of plants. The complex topic of climate change involves not only temperature rise but also predicted variations in relative humidity, carbon dioxide levels, inter-relationships between different fungal genera, and different crops in different geographical locations (Bryden, 2012; Miller, 2008). Temperature and water availability are the two main factors which affect the lifecycle of all organisms. It is suggested that slightly elevated $CO_2$ concentrations and interactions with temperature and water availability may stimulate growth of some mycotoxigenic fungi, especially under water stress (Magan et al., 2011).

A factual example of erratic climate patterns and their impact on mycotoxin occurrence is the series of floods which occurred in Australia, mainly in the state of Queensland in December 2010, and less than one month later in the state of Victoria. As a result of that, and unlike what had been registered for the country in the previous years, wheat sourced in Australia in 2011 hit skyrocketing levels and presented the highest zearalenone and deoxynivalenol levels recorded worldwide (Rodrigues and Naehrer, 20112).

The 2012 draught in the US raised the mycotoxin awareness all over the world, but instead of in addition to the the US we faced the also true challenge in Europe: The aflatoxin scandal started in Serbia and was exported to Germany and the Netherlands. The origin of contaminated corn was mainly southeastern Europe, like Bulgaria, Greece, Romania, Ukraine, Hungary, Serbia and Italy. Up to 40 times higher concentrations of aflatoxin $B_1$, than the regulatory limit of 5 ppb in compound feed for dairy cattle was found in corn samples (e.g. 204 ppb aflatoxin $B_1$ in corn from Serbia). Fungal growth and the ability to produce mycotoxins like aflatoxins, are dependent on climatic conditions. Heat and drought stress are known to favour the growth of *Aspergillus flavus* and *Aspergillus parasiticus*, the fungi producing aflatoxins. Due to changing weather patterns, even well planned crops in usually aflatoxin free areas may become exposed to conditions favorable for contamination. After Serbia's harvest was already reduced by 45 % due to the severe drought in 2012, an increased awareness towards the predictable mycotoxin problem is essential for farmers. BIOMIN, a pioneer in mycotoxin risk management, has been conducting over the years a mycotoxin survey which allows feed and animal producers to assess the risks of using certain feedstuffs/feeds from different regions.

## MATERIALS AND METHODS

From January to December 2012, a total of 4,023 samples collected worldwide were analyzed for the presence of mycotoxins. In total, 14,468 analyses were carried out for the most important mycotoxins in terms of agriculture and animal production – aflatoxins (Afla), zearalenone (ZEN), deoxynivalenol (DON), fumonisins (FUM) and ochratoxin A (OTA). For the purpose of data analysis, non-detection levels were

based on the quantification limits of the test method for each mycotoxin. For more details regarding the analytical procedure, please contact the authors.

## RESULTS

Worldwide 25%, 46%, 64%, 56% and 31% of all the samples surveyed tested positive for contamination with Afla, ZEN, DON, FUM and OTA, respectively. Compared with data from the previous year 2011 (Table 1), an increase in the occurrence of fusariotoxins (ZEN, DON, FUM and ZEN) was observed together with a slight decrease in Afla.

Table 1. Regional content of mycotoxin in Europe in feedstuffs and feed
*Tabela 1. Sadržaj mikotoksina u hranivima i stočnoj hrani u Evropi po regionima*

| North Europe (Norway, Finland, Sweden, Demark)<br>*Severna Evropa (Norveška, Finska, Švedska, Danska)* | | | | | | |
|---|---|---|---|---|---|---|
| North Europe/ *Sev. Evropa* | Afla | ZEN | DON | FUM | OTA | T-2 |
| Number of tests/ *br.uzoraka* | 4 | 103 | 103 | 0 | 6 | 103 |
| Percent positive (%) / *procenat pozitivnih (%)* | 0 | 71 | 88 | - | 67 | 29 |
| Average of positive (µg/kg)/ *prosečna vrednost pozivitnih(µg/kg)* | - | 41 | 1564 | - | 1 | 106 |
| Maximum (µg/kg) / *maksimum (µg/kg)* | 0 | 861 | 21540 | 0 | 2 | 273 |
| Central Europe (Austria, Belgium, Czech Republic, Germany, France, Hungary, Romania, Slovakia, Slovenia and Poland)<br>*Centralna Evropa (Austrija, Belgija, Češka, Nemačka, Francuska,Mađarska, Rumunija,Slovačka, Slovenija, Poljska)* | | | | | | |
| Central Europe/ *Centralna Evropa* | Afla | ZEN | DON | FUM | OTA | T-2 |
| Number of tests/ *br.uzoraka* | 119 | 829 | 1158 | 111 | 135 | 232 |
| Percent positive (%) / *procenat pozitivnih (%)* | 19 | 50 | 68 | 23 | 23 | 16 |
| Average of positive (µg/kg)/ *prosečna vrednost pozivitnih(µg/kg)* | 7 | 41 | 744 | 113 | 10 | 31 |
| Maximum (µg/kg) / *maksimum (µg/kg)* | 36 | 675 | 12000 | 493 | 71 | 137 |
| South Europe (Italy, Greece, Portugal, Spain, Croatia, Bulgaria and Turkey)<br>*Južna Evropa (Italija, Grčka, Portugal, Španija, Hrvatska, Bugarska, Turska)* | | | | | | |
| South Europe/ *Južna Evropa* | Afla | ZEN | DON | FUM | OTA | T-2 |
| Number of tests/ *br.uzoraka* | 173 | 193 | 215 | 166 | 168 | 192 |
| Percent positive (%) / *procenat pozitivnih (%)* | 44 | 43 | 51 | 84 | 70 | 8 |
| Average of positive (µg/kg)/ *prosečna vrednost pozivitnih(µg/kg)* | 6 | 35 | 330 | 879 | 4 | 258 |
| Maximum (µg/kg) / *maksimum (µg/kg)* | 87 | 604 | 10455 | 13457 | 64 | 3051 |
| East Europe (Ukraine, Belarus, Lithuania, Estonia, Latvia and Russia)<br>*Istočna Evropa (Ukrajina, Belorusija, Litvanija, Estonija, Latvija, Rusija)* | | | | | | |
| East Europe/ *Istočna Evropa* | Afla | ZEN | DON | FUM | OTA | T-2 |
| Number of tests/ *br.uzoraka* | 73 | 74 | 104 | 81 | 91 | 94 |
| Percent positive (%) / *procenat pozitivnih (%)* | 71 | 42 | 67 | 54 | 79 | 56 |
| Average of positive (µg/kg)/ *prosečna vrednost pozivitnih(µg/kg)* | 5 | 32 | 285 | 485 | 6 | 70 |
| Maximum (µg/kg) / *maksimum (µg/kg)* | 10 | 340 | 960 | 1930 | 50 | 200 |

More than 1,600 samples were sourced in different European regions (Table 1). Due to the information gathered from previous years, samples originating from Northern Europe were mainly analysed for ZEN and DON. As expected, these were the major contaminants of commodities and feeds sourced from this region. Especially in terms of DON contamination levels were found to be fairly high. In Central Europe, DON remained the most commonly occurring mycotoxin followed by ZEN. In Southern Europe, similar to previous years, FUM was the most prevalent mycotoxin, followed by OTA.

## CONCLUSIONS

In view of the results shown for the more than 1,600 samples from Europe analyzed in the year 2012, it is clear that the majority of commodities and feed used in animal nutrition is contaminated with at least one mycotoxin. More frequently than not, more than one mycotoxin will be present in the same ingredient or feed. Prevention of the negative effects of these hazardous substances in animal health and performance is crucial.

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## KONTAMINACIJA MIKOTOKSINIMA U EVROPI U 2012: SVE VEĆI RAZLOG ZA ZABRINUTOST

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### Izvod

Kontaminacija useva mikotoksinima je rasprostranjen problem u industriji hrane za životinje. Glavne vrste mikotoksina su aflatoksini (AFLA), deoksinivalenol (DON), fumonizin (FUM), zearalenon (ZEN) i ohratoksin A (OTA). Cilj ove studije je da se dobiju informacije o prisutnosti 5 najznačajnijih mikotoksina u uzorcima hrane za životinje i komponentama iz različitih evropskih regiona. Ukupno 4023 uzoraka iz sveta (od januara do decembra 2012.) analizirani su na sledeće

mikotoksine - AFLA, ZEN, DON, FUM, i OTA. Uzorci su analizirani tečnom hromatografijom (HPLC) i *enzime-linked immunosorbent* testom (ELISA). Pojedina hraniva analizirani su samo sa ELISA testom. Složenije matrice koje mogu ometati ELISA metodu, kao što su DDGS i gotova hrana su analizirani tečnom hromatografijom. Kod svih toksina, rezultati koji su se nalazili ispod granice kvantifikacije su izraženi kao ne detektovani. Svih pet mikotoksina bili su veoma rasprostranjeni u evropskim zemljama, a samo 21% testiranih uzorka su bili negativni na prisustvo toksina. U 40% stočne hrane i hraniva, utvrđeno je više od jednog mikotoksina. Od analiziranih 4023 uzoraka, Afla su prisutni u 41%, ZEN u 50%, DON u 67%, FUM u 58% i OTA u 56%. Kao i prethodnih godina, DON i FUM predstavljaju najčešću grupu mikotoksina sa prosekom kontaminacije od 496 i 409 ppb. Prosečna kontaminiranost uzoraka je bila niža ove godine u odnosu na 2011. (DON 673 ppb i FUM 539 ppb). Rezultati istraživanja jasno pokazuju da su mikotoksini tema za brigu u industriji hrane za životinje. Efikasan program za upravljanje rizikom od mikotoksina je ključni faktor za postizanje optimalnih rezultata u stočarstvu.

**Kjučne reči**: mikotoksin, analize, kontaminacija, Evropa.

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