SURVEY OF THE MYCOTOXIN CONTAMINATION OF FEED COMMODITIES IN DIFFERENT REGIONS OF HUNGARY

Márta Erdélyi - Zsolt Ancsin – Andrea Bócsai – Krisztián Balogh - Miklós Mézes
Szent István University, Department of Nutrition, H-2103 Gödöllő, Hungary

Introduction

Feed supply is important for animal production and any factor that affects the security of the feed supply is a significant constraint to production. Feed spoilage by moulds may result in heating, reduced palatability and the loss of nutritive value (Christensen, 1974). In addition, the affected commodity may become contaminated with mycotoxins. The biological reactions following ingestion of one or a combination of mycotoxins vary from acute, overt disease with high morbidity and death to chronic, insidious disorders with reduced animal productivity. Fortunately, mycotoxin contamination levels in animal feedstuffs are usually not high enough to cause an overt disease, but may result in economical loss due to changes in growth, production and immunosuppression (Richard, 2007).

It has been estimated that some 30% of the world's grain crops is affected annually by fungal invasion and mycotoxin contamination, and with global warming, the threat from fungal invasion of crops is likely to increase (Garrett et al., 2006).

The accumulation of mycotoxins, both before and after harvest, largely reflects climatic conditions. Fusarium toxins (e.g. DON, ZEN, T-2 and HT-2 toxin) are produced in cereal grains in high moisture conditions around harvest (Munkvold and Desjardins, 1997), whereas pre-harvest aflatoxin contamination of maize (Payne, 1998) is associated with high temperatures, insect damage and prolonged drought conditions. During the last decade, aflatoxin producing *Aspegillus* moulds were found even in the field of different regions in Hungary (Dobolyi et al., 2011). Moreover, because *Aspergillus* can tolerate lower water activity than *Fusarium*, it is more likely to contaminate commodities both pre- and post-harvest, whereas *Fusarium* is more likely to be found as a pre-harvest contaminant (Abramson, 1998). The quantity of mycotoxins changes only moderately during fermentation (e.g. silage production); thus, if a batch of maize was contaminated with mycotoxins already at the time of being loaded into the silo, the quantity of mycotoxins will moderately decrease as a result of partial detoxification that occurs during the ensiling process (Bodra and Morgavi, 2009; Richard et al., 2007). Feed manufacturing processes do not substantially decrease the mycotoxin content of feedstuffs, and the efficiency of different chemical and/or heat treatments is questionable (Tóth et al., 2012).

Among aflatoxins, the occurrence of AFB_1 or AFG_1 is the highest in feed plants. Those are extremely toxic mycotoxins, LD_{50} in farm animals varies between 0.3 to 20 µg/kg b.w, depending on species, age and sex. Those toxins have mainly hepatotoxic effects, but also inhibit protein synthesis, therefore decrease immune response, as well. In human, International Agency for Research on Cancer (1993) has defined AFB_1, as human 1A carcinogen, and also its hydroxylated metabolites, such as AFM_1 in milk or AFB_2 in egg are potential human carcinogen.

Fusarium moulds produce trichothecene mycotoxins (e.g. DON, T-2 and HT-2 toxin) which have protein synthesis inhibitory activity, and zearalenone which has estrogenic properties, therefore this latter one is genotoxic (Steyn, 1995).

Materials and methods

Feed samples – cereal grains, extracted oil seeds (e.g. soybean meal and sunflower meal) and forages (corn, alfalfa and grass silage) were taken from farms located at different regions of Hungary, and the plants cultivated in the same region in the years 2012 and 2013, except imported soybean meal.

Analyses of mycotoxins determined in the present study were carried out with HPLC method after immunoaffinity cleanup using relevant AOAC methods for AFB_1 and zearalenone, according to Czerwiecki and Wilczyńska (2003) for DON, and Trebstein et al (2008) for T-2 and HT-2 toxin.

Results and discussion

Results of the survey are shown in Table 1. It has been revealed that proportion of positive samples was different in the different regions. It was the highest in the Southern part of the country, possibly because of the higher average temperature and the lowest rainfall during the summer season..

Table 1. Mycotoxin contamination of feedingstuffs from different regions of Hungary (mean; minimum-maximum values)

Region	number of positive samples	positive samples (%)	AFB_1 µg/kg	DON mg/kg	ZEN mg/kg	T-2 toxin mg/kg	HT-2 toxin mg/kg
Northern	4	31,2	5,93 (1,38-16,86)	0,57 (0,12-1,16)	n.d.	n.d.	n.d.
North Eastern	18	46,8	9,77 (1,71-7,38)	2,23 (0,23-12,90)	0,03 (0,01-0,05)	0,20 (0,17-0,24)	0,36 (0,30-0,40)
South Eastern	16	98,3	5,87 (1,10-19,60)	0,20 (0,06-0,39)	n.d.	0,56 (0,11-1,46)	0,86 (0,21-2,55)
Central	6	64,7	7,55 (1,30-13,80)	0,16 (0,05-0,26)	n.d.	n.d.	n.d.
Middle Western	18	51,5	1,63 (0,30-3,02)	0,31 (0,07-0,69)	0,13 (0,02-0,24)	0,33 (0,05-0,51)	0,40 (0,08-0,58)
South Western	16	94,8	2,81 (1,19-4,42)	0,40 (0,35-0,49)	0,06 (0,02-0,08)	0,61 (0,13-0,87)	0,99 (0,37-1,48)
Western	4	41,9	n.d.	n.d.	0,02 (0,01-0,03)	n.d.	n.d.

The results showed that the mean mycotoxin contamination of feedingstuffs in each investigated region was below the maximum permitted level for AFB_1 (20 µg/kg; Regulation No. 574/2011/EU) and proposals for the other analysed mycotoxins (Recommendation No. 576/2006/EC). Otherwise mean values were found to be higher in the South Eastern and South Western regions for T-2 and HT-2 toxins, for which we do not have official limit value proposal in the EU, but generally accepted the threshold value of 0.5 mg/kg for all farm animals, as it was proposed by Eriksen and Pettersson (2004). However, the results has also revealed that AFB_1 has occurred even in crops cultivated in different regions of Hungary due to the climate changes in the last decade. This was found mainly in maize silage, in which the actual value was higher than the EU maximum permitted level. T-2 and HT-2 toxin levels were also higher in some cases than the proposed threshold value, mainly in grains cultivated in Southern Hungary.

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