Survey of Aflatoxin and Fumonisin Contamination from Different Grain Sources in Costa Rica

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Introduction

Aflatoxins and fumonisins are fungal secondary metabolites produced by *Aspergillus* spp. and *Fusarium* spp., respectively. These mycotoxins are toxic for humans and animals and maximum levels (ML) have been established in many countries for both food and feed. In Costa Rica, total aflatoxin limits are 20 µg kg^{-1} for all cereals and legumes, and 15 µg kg^{-1} for peanuts, while for fumonisins, there currently does not exist a maximum permitted level. Futhermore, mycotoxin analyses are performed only on imported agricultural commodities, meaning that little is known about the potential impact of local sources of commodity grains in terms of mycotoxin risk.

Objective

The objective of this survey was to determine the level of contamination with aflatoxins and fumonisins in grain samples collected from different local sources in Costa Rica.

Materials and Methods

During 2015 and 2016, rice, black bean, red beans, maize, and peanuts samples were collected from farmers fields, supermarkets, cooperatives and farmers markets in the provinces of Alajuela, Heredia, San José, and Puntarenas. Samples were analyzed for total aflatoxins (B_1+B_2+G_1+G_2) and total fumonisins (FB_1+FB_2+FB_3) with a fluorometric method using immunoaffinity columns Aflatest® and Fumonitest®.

Results

- A total of 161 samples were collected and analyzed for mycotoxin contamination.

- Aflatoxins: The highest levels were 180 µg kg^{-1}, 110 µg kg^{-1}, and 48 µg kg^{-1} for white-and-red maize, yellow maize, and red beans, respectively (Figure 1 A).

- Fumonisins: The highest values were 12 mg kg^{-1} for white maize and 6.9 mg kg^{-1} for red maize-and-black beans, and 3 mg kg^{-1} for red beans (Figure 1 B).

- The most frequently contaminated grain with both aflatoxins and fumonisins was white maize (Table 1). Highest aflatoxins contamination were found in samples collected from farmers fields or from storage areas on these farms.

- Most samples collected from supermarkets contained aflatoxin levels below the ML.

Results

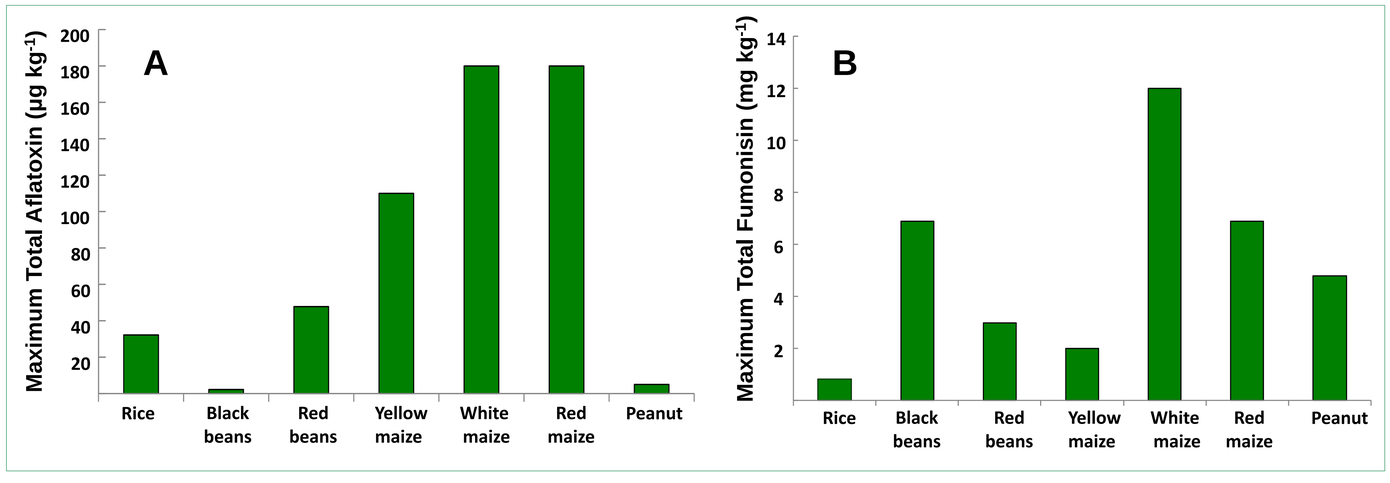

Figure 1. Maximum mycotoxin concentration in grain samples collected in four provinces of Costa Rica during 2015-2016. A) Total aflatoxins (B_1+B_2+G_1+G_2) B) Total fumonisins (FB_1+FB_2+FB_3)

Table 1. Total number of samples, average mycotoxin concentration and number of samples with mycotoxin levels above the maximum limits (ML) in grain samples collected in four provinces of Costa Rica during 2015-2016.

Grain type	Number of samples	Aflatoxins		Fumonisins	
		Average concentration	Nº samples above ML	Average concentration	Nº samples above ML*
		(µg kg^{-1})		(mg kg^{-1})	
White maize	49	9.1	7	2.53	38
Yellow maize	5	39.8	2	1.28	4
Red maize	4	64.3	3	3.1	3
Black beans	20	0.2	0	1.6	5
Red beans	30	2	1	0.75	9
Peanut	22	0.2	0	0.75	4
Rice	30	0.2	0	0	0

*Based on European Union Commission Regulation (EC) No 1881/2006 setting maximum levels for certain contaminants in foodstuffs (http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:364:0005:0024:EN:PDF)

Conclusions

- These preliminary results indicate that some crops like maize and beans may be at greater risk for mycotoxin contamination.

- Local extension programs should focus on mycotoxin prevention at the farm level, since the highest contamination levels correspondend to maize samples obtained from fields where the intended use was for human consumption.

- Health and phytosanitary authorities should coordinate regular monitoring programs for locally grown grain and grain products.

- A second survey is currently being conducted to corroborate and expand on preliminary results.

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