

Fumonisin incidence in Maize Stored in Family Farms Cribbs in the Central Region of the State of Minas Gerais, Brazil

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Summary

Fumonisin are mycotoxins produced by *Fusarium spp.* and commonly contaminate maize and maize products worldwide. This study evaluated the incidence of total fumonisin in maize, stored in 10 family farms located in the Central Region of the State of Minas Gerais, Brazil. There were four sampling periods in which were collected the samples in two months intervals, totaling 40 samples. The total fumonisin concentrations were determined using a Vican Fluorometer. Fumonisin was detected in all 40 samples, with values range from 230 to 6450 $\mu\text{g kg}^{-1}$.

Key word: *mycotoxins, food security, small farm*

Introduction

Maize is one of the three cereal crops that have the highest production and can be used for many purposes, such as animal feed, industrial uses, and is even the staple food in many developing countries. However, the percentage of raw maize samples contaminated with mycotoxins, and the levels of contamination, is very high, particularly some important toxins such as aflatoxins, deoxynivalenol, zearalenone and fumonisin. Fumonisin are mainly produced by *Fusarium verticillioides* (Voss et al., 2007). Except in extreme situations, fumonisin formation happens only before harvest or during the early stage of drying, but not in the storage stage. Thus, the control of this mycotoxin requires more attention to pre-harvest practices and to the subsequent effects of processing and

preparation of foodstuffs (Arora and Khachatourians, 2004). In animals, fumonisins are known to cause the equine leukoencephalomalacia (ELEM) in the horse and porcine pulmonary edema. Also, they have been reported to induce liver and kidney tumors in rodents and are classified as Group 2B “possibly carcinogenic to humans” (Wild & Gong, 2010).

The objective of this work was to assess the incidence of total fumonisins in maize, stored in 10 family farms in the Central Region of the State of Minas Gerais, Brazil.

Material and methods

It was randomly collected 150 maize ears in 10 family farms cribs, in four sampling periods (every two months), totaling 40 samples. The maize ears were divided in two groups: ears with well (WC) and bad (BC) husk cover. The percentage of each type was calculated, 10 ears of each type were threshed and the grains were weighed. A representative 1 kg composite sample of each corn crib was obtained following the proportion of the WC and BC ears. These grain samples were divided into three sub samples, milled and stored at -18°C until analysis. Fumonisin was quantified using a Vicam Series - 4EX Fluorometer (Bozin et al., 2006). The experimental design was completely randomized in a 3 replicates 10×4 factorial (local \times sampling period) and averages compared by Tukey test at 5% probability.

Results and Discussion

It was observed that the contamination with fumonisins range from 230 to $6450\ \mu\text{g kg}^{-1}$ in the 40 maize samples evaluated (Table 1). In the 1st, 2nd and 3rd sampling periods, the samples collected at the farm - 10 showed the highest levels of total fumonisins and those collected at the farm - 5 showed lowest contamination in the 1st and 2nd collections. The total fumonisins in most rural properties did not increase throughout the storage period, except in the farm - 5. This finding indicated that fumonisins are mycotoxins that may occur mainly in the pre-storage. In the European Union the maximum tolerable limit for this mycotoxin in maize is $1000\ \mu\text{g kg}^{-1}$. Thus, 33 (82,5%) of the 40 maize samples analyzed were contaminated with fumonisins at levels above acceptable limits for human consumption. In agreement with these, the results of Orsi et al. (2000) investigation showed that a total of 195 hibrid maize samples from State of São Paulo, Brazil, 90,2% were found to contain fumonisin B1, and 97,4% to contain fumonisin B2.

Table 1: Total fumonisins levels in maize stored in family farms cribs in Minas Gerais, Brazil

Farm	Total Fumonisin (µg kg ⁻¹)								Mean
	1		2		3		4		
1	2100	AB cde	2800	A cde	1010	B de	1950	AB abcd	1965
2	1450	B de	5150	A abc	1850	B cde	670	B d	2280
3	1700	A cde	1800	A de	2600	A bcde	1350	A cd	1862.5
4	700	B e	3700	A bcd	455	B e	1400	B cd	1563.7
5	540	BC e	230	C e	2950	A bcde	1750	AB bcd	1367.5
6	3900	A bcd	2350	B cde	3050	AB bcde	3500	AB abcd	3200
7	3250	A bcde	2550	A cde	3850	A abcd	3200	A abcd	3212.5
8	3050	A bcde	1750	AB de	1450	B cde	1100	B d	1837.5
9	1550	A de	1550	A de	480	A e	805	A d	1096.2
10	6450	A a	5550	A ab	5200	A ab	2800	B abcd	5000
Mean	2469		2743		2289.5		1852.5		

Averages followed by the same capital letter in the rows or lower case in the columns did not share significant differences at 5% probability by Tukey's test.

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