



Aflatoxin Contamination of Red and Black Beans in Costa Rica

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Introduction

The Mycotoxin Laboratory at CIGRAS collaborates with the Costa Rican State Phytosanitary Service (SFE) to monitor aflatoxin levels in imported agricultural commodities and with industry partners in order to assure quality control. Based on results for aflatoxin analyses conducted from 2003 to 2015, it was observed that red beans (*Phaseolus vulgaris* L.) had higher aflatoxin levels than black beans. Beans are a staple food in Costa Rica. Nonetheless, there is scarce information about aflatoxin contamination in beans, as well as the role of seed coat color and how it relates with mycotoxin contamination.

Objective

The objective of this study was to determine the level of aflatoxin contamination of two black bean varieties, two red bean varieties, and a white bean variety inoculated with *Aspergillus flavus*, in order to better understand the role of bean type in the risk of mycotoxin contamination.

Materials and Methods

The experiment was conducted in the Mycotoxin Laboratory at CIGRAS, University of Costa Rica. Treatments consisted of 5 bean varieties: Guaymi and Matambú (black beans), Cabécar and Tayni (red beans), and Surú, a white bean variety. All varieties were subjected to seed coat removal (e.g., with and without the seed coat). Twenty-five grams of seeds of each treatment were placed in 125 ml Erlenmeyer flasks, autoclaved, and inoculated with 2 ml of a 1×10^7 spore solution of a toxigenic *Aspergillus flavus* isolate, which was previously isolated from bean seeds. Flasks were placed in an incubator at 28°C, with a 12-h photoperiod for 22 days. Three flasks per treatment were used to make a composite sample to determine aflatoxin levels. Total aflatoxin contamination was measured using the AOAC method 991.31 (A-G). The experiment was replicated two times.

Results

Results showed that the *A. flavus* isolate used in this experiment could produce aflatoxins in concentrations greater than $150 \mu\text{g kg}^{-1}$ (Table 1), however, the ability of *A. flavus* to produce toxins was independent of both the bean variety and the presence or absence of the seed coat.

Table 1. Total aflatoxin ($B_1+B_2+G_1+G_2$) concentration in different seed color bean varieties inoculated with *Aspergillus flavus*.

Seed Coat Color	Bean Variety	Total aflatoxins ($\mu\text{g kg}^{-1}$)	
		With seed coat	Without seed coat
Black	Guaymi	120.5 ± 24.1	115 ± 23
	Matambú	39 ± 7.8	104 ± 20.8
Red	Cabécar	90.5 ± 18.1	28.5 ± 5.7
	Tayni	144.8 ± 29	57 ± 11.4
White	Surú	107 ± 21.4	152 ± 30.4

Conclusions

- *Aspergillus flavus* had the ability to produce high aflatoxin levels in beans under the conditions tested in this experiment. Aflatoxin contamination has not been considered to be a problem in beans, however, these his results suggest that beans should be included in local monitoring programs.
- There was no evidence of a relationship between bean seed coat color and aflatoxin contamination in the varieties examined (Guaymi, Matambú, Cabecar, Tayni and Surú). Future research should consider the examination of more bean varieties.
- Based on these results, further research is necessary to determine how and when beans can become contaminated with aflatoxins in order to determine if bean type can be considered an important risk factor.

