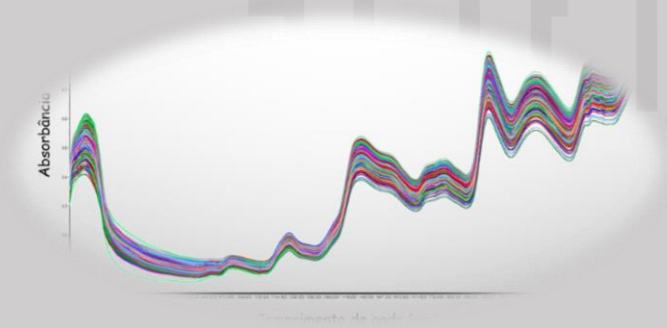
Mycotoxicological contamination in corn sold in Latin America – Year 2022

Source: Pegasus Science, January 2023

Corn is one of the most cultivated cereals in the world. In animal nutrition industries it has great relevance due to its high nutritional value. However, it is a cereal very attacked by fungi that can produce **mycotoxins**. These toxins may be present in the various stages of production of this cereal, from the field to the final stage of the process, having contact with animals or humans through food. Over the years, many mycotoxins have been discovered and studied more deeply, as well as their mechanisms of toxicity and impairment of the immune and gastrointestinal systems of animals. Thus, **monitoring** these toxic substances is essential for quick and assertive decision-making. This only became possible with the adoption of fast tools that provide **immediate and reliable results**. This system is realized using **Near Infrared reflectance spectroscopy** (NIRS) technology. Thus, this work aims to present the prevalence and mycotoxicological contamination in corn sold in Latin American countries, analyzed by Pegasus Science in the year 2022.

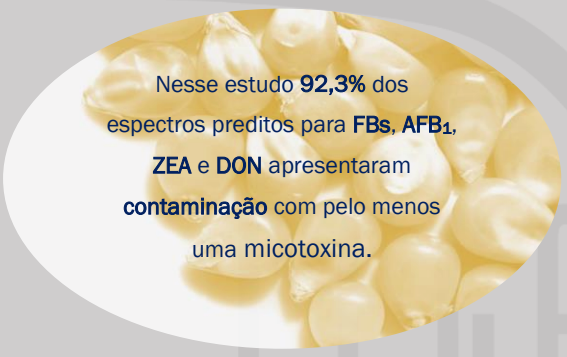
Materials and methods



Throughout the year **2022**, **12,443** spectra of **corn** samples were predicted. These spectra were originated from routine samples and sent through the Olimpo Platform, a Pegasus Science web service, connected to different NIRS equipment located in several laboratories and industries in Latin America. Each sample was previously ground in a grinder with a 1 mm sieve, homogenized and subsequently read in the NIRS equipment. Then, the spectrum was uploaded to the Olimpo platform (*www.olimpo.pegasusscience.com*) and the relevant information on each sample

was completed. Thus, the samples were predicted for the presence and concentration of fumonisins B_1 and B_2 (FBs), aflatoxin B_1 (AFB_1), deoxynivalenol (DON) and zearalenone (ZEA). The spectra were derived from corn samples sold in the following Latin American countries: Argentina (n=382), Bolivia (n=327), Brazil (n=10,645), Colombia (n=115), El Salvador (n=109), Ecuador (n=102), Mexico (n=121) and Peru (n=642) totaling 44,874 analyses. The limit of quantification (LOQ - in µg/kg or ppb) for FB_1, FB_2, AFB_1, DON and ZEN were 200, 200, 5, 350 and 30, respectively. Statistical evaluations were performed by applying descriptive statistics (mean, range, and prevalence) using Statgraphics® Centurion XV software (Statgraphics Centurion 15.2.11, Manugistics Inc., Rockville, MD).

Results and discussion



Fumonisins B_1 and B_2 (FBs)

The most prevalent toxin in Latin American countries was FBs (FB_1+FB_2), being detected in 90.6% of the samples. Its annual average was 1,922 µg/kg, and the average of positive samples was 2097 µg/kg, respectively. **Bolivia** had the **lowest** annual average for FBs (1,130 µg/kg) and **Peru the highest** annual average (2,690 µg/kg) (Figure 1). The concentration ranged from 0 (zero) to 14,077 µg/kg. The high frequency of contamination for FBs in corn samples is expected since the climate of the countries studied favors the growth of toxigenic fungi for this toxin.

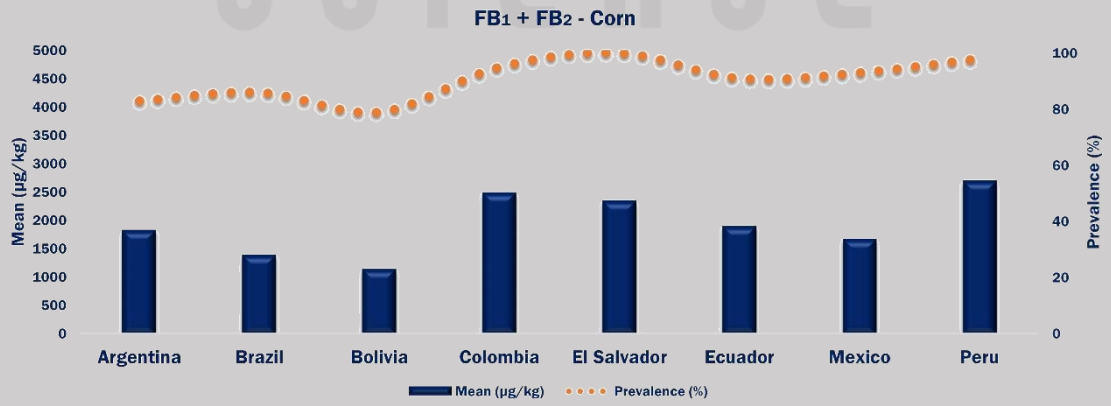


Figure 1: Mean concentration and prevalence of fumonisins B_1 and B_2 (FBs) in maize samples from Latin American countries obtained via NIRS in 2022.

Zearalenone (ZEN)

The second most prevalent toxin was ZEN, being observed in 27% of the analyzed samples. The annual average and the average of positive samples were 18 and 63 µg/kg, respectively. Argentina and Bolivia had the lowest annual averages for ZEA (7 µg/kg) while Brazil had the highest annual average (38 µg/kg). The concentration ranged from 0 (zero) to 898 µg/kg (Figure 2). Historically, the prevalence and averages of contamination by **ZEN in corn were low**, but in the year 2022 there was a **significant increase** in the levels of this mycotoxin, mainly in some regions of **Brazil**, which explains its higher annual average.

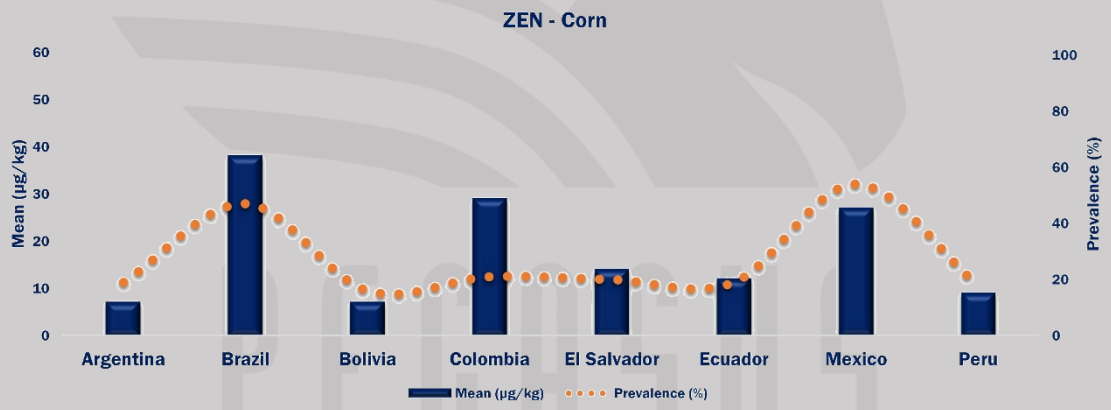


Figure 2: Mean concentration and prevalence of zearalenone (ZEN) in maize samples from Latin American countries obtained via NIRS in 2022.

Deoxynivalenol (DON)

DON was detected in 21% of the samples, being the third most prevalent mycotoxin in this survey. Its annual average was 109 µg/kg and the average of positive samples was 423 µg/kg. **El Salvador** and **Argentina** had the **lowest annual averages** for DON (0 and 19 µg/kg), respectively, while **Colombia, Mexico and Peru** had the highest annual averages (186, 192 and 191 µg/kg). The variation was from 0 (zero) to 2,560 µg/kg (Figure 3). Generally, this toxin is one of the **least prevalent in corn**, but in the year 2022 an **increase** in its prevalence and concentration was observed, mainly in some regions of Brazil.

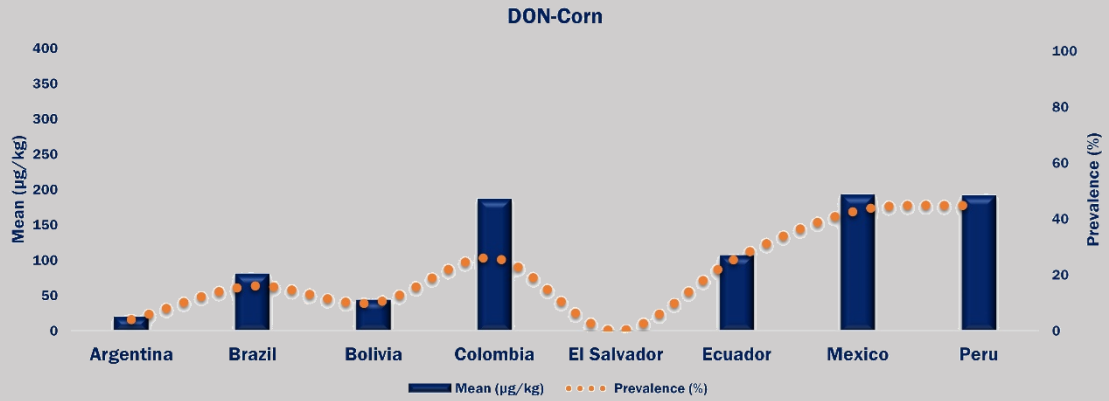


Figure 3: Mean concentration and prevalence of deoxynivalenol (DON) in corn samples from Latin American countries obtained via NIRS in 2022.

Aflatoxin B_1 (AFB_1)

The annual average of AFB_1 and the average of positive samples were 1.6 and 9.4 µg/kg, respectively. Therefore, it was the least prevalent mycotoxin in this survey (17.4%). **Ecuador** had the **lowest annual average** for AFB_1 (0.4 µg/kg) while Mexico had the highest annual average (4.8 µg/kg). The concentration ranged from 0 (zero) to 37 µg/kg (Figure 4). Although some countries (El Salvador and Mexico) have shown higher prevalence for AFB_1, this mycotoxin has been showing low levels, **high prevalences and concentrations have not been observed** due to better control of the processes that can cause the presence of this toxin.

Figure 4: Mean concentration and prevalence of aflatoxin B_1 (AFB_1) in maize samples from Latin American countries obtained via NIRS in 2022.

The monitoring of mycotoxins in corn must be permanent, as the concentration can vary greatly between batches of grain. The use of **NIRS** to predict mycotoxins allows **quick feedback**, allowing a larger and more frequent number of analyzes to be performed, guaranteeing **greater safety** for the use of the cereal in animal and human food.

The most important and prevalent mycotoxins in corn sold in Latin American countries showed some commonly observed **differences** over the last few years. The main findings of the present survey were the **high** prevalence of **FBs**, an increased prevalence and contamination by **ZEN** and **DON**, and **a low to moderate prevalence** of **AFB_1**.

Conclusion

The risk that each mycotoxin poses to the production system must be measured through **continuous monitoring of the raw materials** used in feed production. The use of technologies that are fast and reliable help the Company make a **more assertive and economical decision-making process**.

In addition to the average concentration and prevalence of each mycotoxin, other factors must be observed in order to know the real degree of exposure risk: simultaneous occurrence of different mycotoxins; sensitivity of each animal species, in their different ages and sexes, and environmental, sanitary, genetic and nutritional factors to which the animals are submitted. To learn more about how to assess all of these factors, contact the Pegasus Science team for complete access to the MYCOTOXINS RISK management tool available in real time.

Pegasus works smart on mycotoxins, providing assistance in:

- *Analysis of mycotoxins through NIRS;*
- *Mycotoxin Risk Assessment in real time;*
- *Training on good sampling practices;*
- *Mycotoxicological and nutritional mapping of grains stored in silos and warehouses;*
- *Consulting on mycotoxins and mycotoxicosis;*
- *Evaluation of experiments with corn hybrids with an economic focus on grain yield and animal production.*

Contact us to find out more!!!

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