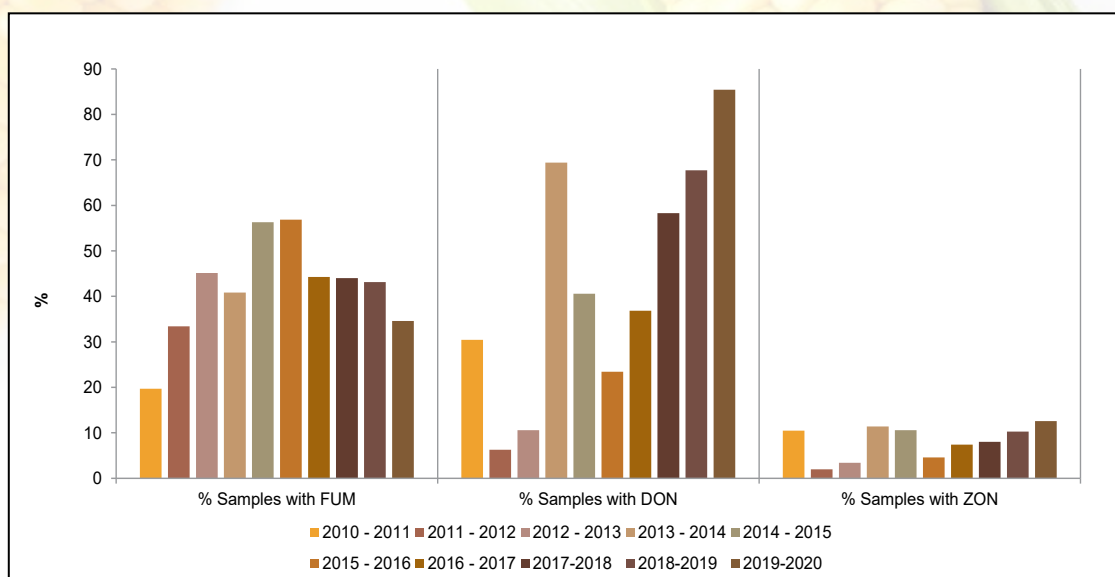


Mycotoxins

The multi-mycotoxin results of 350 maize samples tested in the 2019/20 season are reported. The samples were selected to represent white and yellow maize from all the production regions for the analysis of 13 mycotoxins with the LC-MS/MS instrument. These mycotoxins include Aflatoxin B₁, B₂, G₁ and G₂, Fumonisin (FUM) B₁, B₂ and B₃, Deoxynivalenol (DON), 15-acetyl-deoxynivalenol (15-ADON), Ochratoxin A, T2-toxin, HT-2 toxin and Zearalenone (ZON). 350 samples, representing approximately 35 - 40% of the survey samples annually, were analysed over the past 10 production seasons as part of the South African maize crop quality survey. Notable trends in the presence of specific mycotoxins in different production regions, the concentration ranges found and occurrence in white and yellow maize are observed.

This season, 90% of the samples (316 samples) contained one or more mycotoxin, mainly deoxynivalenol (85%), fumonisins (35%) and zearalenone (13%). The presence of deoxynivalenol and zearalenone, as illustrated in Graph 50, increased over the past five seasons. In 2015/16, only 23% and 5% of the samples contained DON and ZON, respectively. The fumonisin prevalence decreased over the same period, from 57% in 2015/16 to 35% this season.

Graph 50: Percentage white and yellow maize samples that tested positive for mycotoxins over 10 seasons



In three of the seven provinces represented by the samples, namely the Northern Cape, Limpopo and KwaZulu-Natal (KZN), all the samples tested contained mycotoxins. An increase in the occurrence of mycotoxins was found in the other four provinces this season. Only one white maize sample was received from the Eastern Cape. This sample was contaminated with DON, 15-ADON and ZON and the DON concentration was more than the regulated maximum allowable level of 2 000 µg/kg.

The results of the 13 mycotoxins, including the range of concentration levels and notable trends in the mean concentration levels in white and yellow maize in the different provinces, are summarised as follows:

Aflatoxins

Only one yellow maize sample collected in North West province in Region 12, was contaminated with 10 µg/kg Aflatoxin B₁. Previously, aflatoxins were found in one white maize sample collected in 2018/19 in the Free State and also in three white maize samples collected in the North West province in the 2014/15 season.

Ochratoxin A, T2- toxin and HT-2 toxin

None were reported in locally produced commercial maize since the mycotoxin survey began in 2010/11.

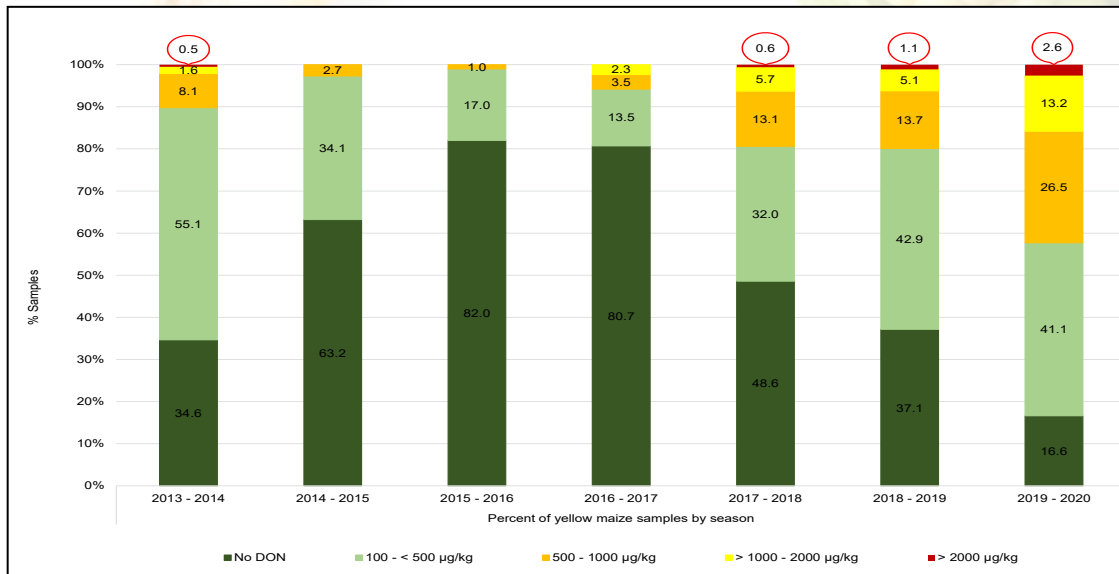
DON and 15-ADON

- Approximately 87% white maize and 83% yellow maize samples contained DON, this is a steep increase compared to previous seasons.
- The percentage of white maize samples that contained more than 2 000 µg/kg DON, the national regulated maximum allowable level in unprocessed maize for human consumption, increased to 8%. These white maize samples were collected in North West (4), Free State (6), Mpumalanga (2), Gauteng (3) and KZN (1). The DON concentration ranges are summarised in Graph 51 (white maize) and Graph 52 (yellow maize).

Graph 51: DON concentration range in white maize samples over seven seasons



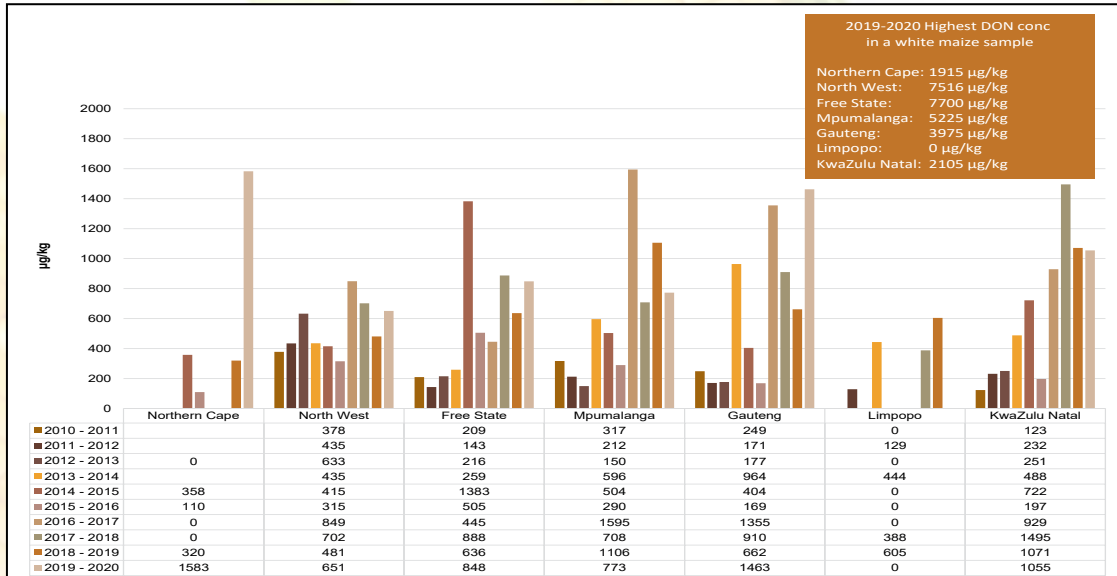
Graph 52: DON concentration range in yellow maize samples over seven seasons



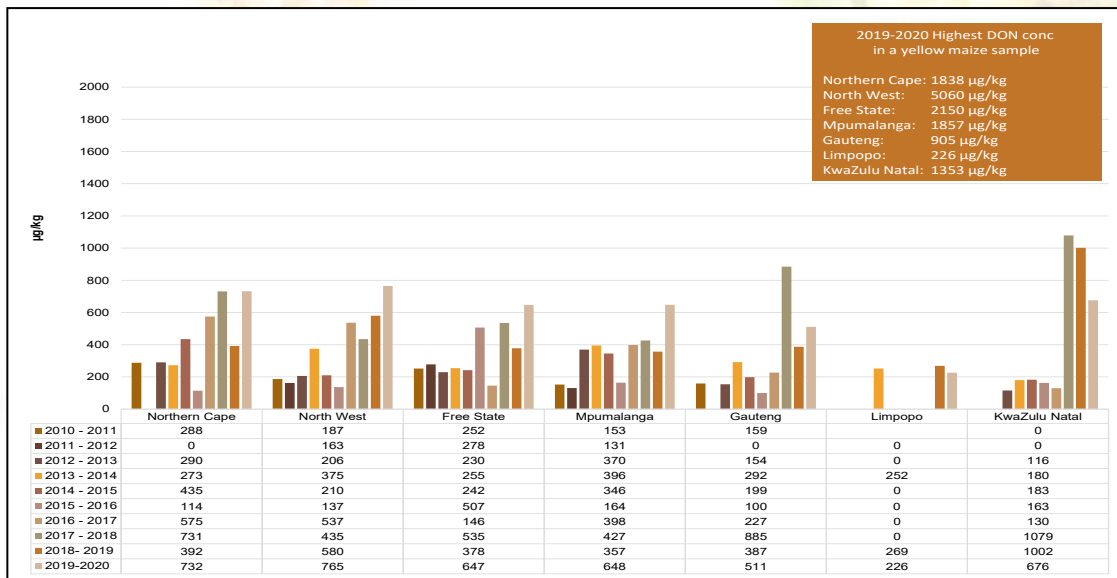
- In contrast to the previous season, the white maize samples with the highest DON concentrations were collected in North West (7 526 µg/kg) and the Free State (7 700 µg/kg). The highest DON concentration (5 060 µg/kg) reported on yellow maize over the past ten seasons, was found this season in North West.

- The annual mean DON concentrations of the positive white maize samples increased significantly in four provinces and with regards to yellow maize in five provinces. Limpopo reported no DON residues in white maize, but in contrast mean values as high as 1 583 µg/kg and 1 463 µg/kg were reported in the Northern Cape and Gauteng respectively. The 10-year mean concentrations in the seven provinces are illustrated in Graphs 53 and 54.

Graphs 53: White maize DON mean concentration (µg/kg) per province over ten seasons



Graph 54: Yellow maize DON mean concentration (µg/kg) per province over ten seasons

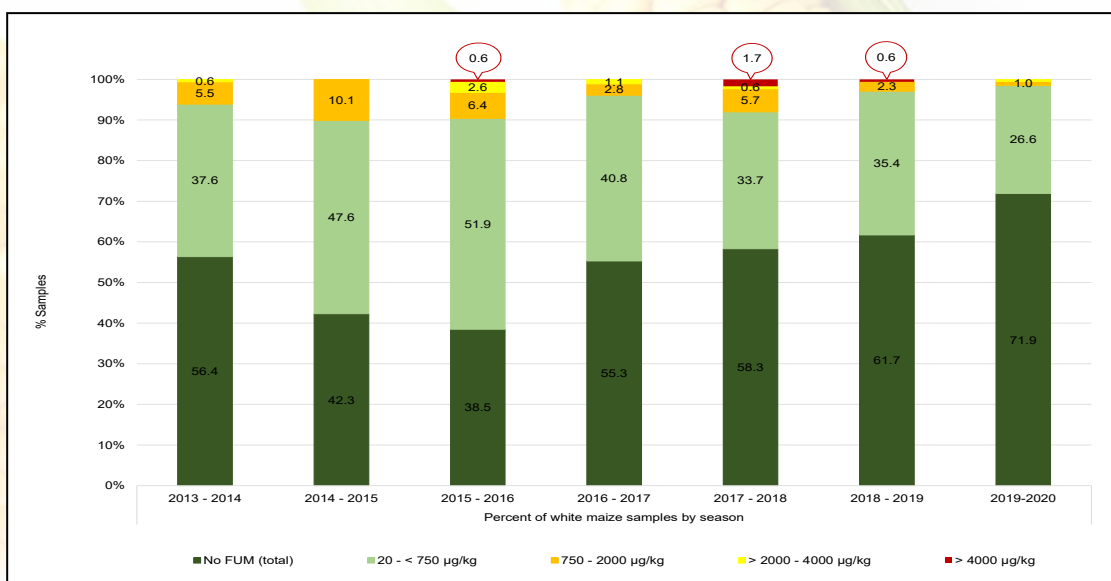


- 15-ADON is always present in samples that contain DON, mostly when the DON concentration exceeds 500 µg/kg. Due to the increase in DON concentrations, a 16% increase in 15-ADON occurrence was reported. This season 34% of the 350 samples tested contained 15-ADON, with a mean concentration of 208 µg/kg.

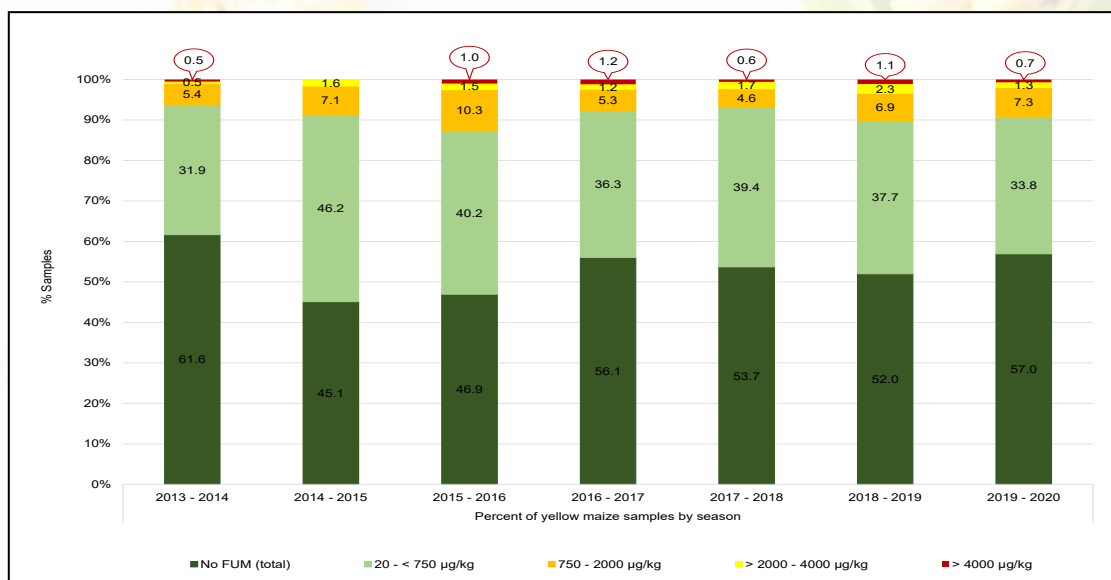
Fumonisin (FUM Total = FB1 + FB2 + FB3)

- This season, only 28% of the white maize samples contained fumonisins, showing a continuous decrease in contamination from the 62% in 2015/16. In contrast, more yellow maize samples contained fumonisins, approximately 43%, similar to the previous four seasons.
- The highest concentration FUM measured in white maize (3 911 µg/kg) was just slightly less than the national regulated maximum allowable level in unprocessed maize for human consumption, namely, 4 000 µg/kg. A yellow maize sample from the Northern Cape with a concentration of 5 928 µg/kg exceeded this level. The concentration ranges of the samples with fumonisins over the past seven seasons are summarised in Graph 55 (white maize) and Graph 56 (yellow maize).

Graph 55: FUM concentration range in white maize samples over seven seasons

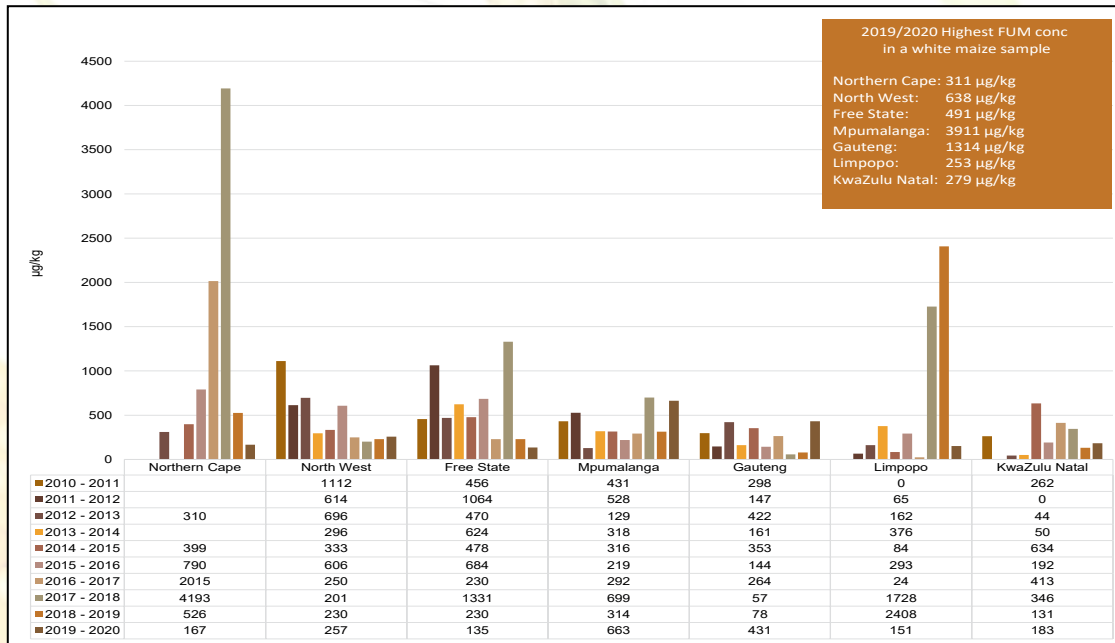


Graph 56: FUM concentration range in yellow maize samples over seven seasons

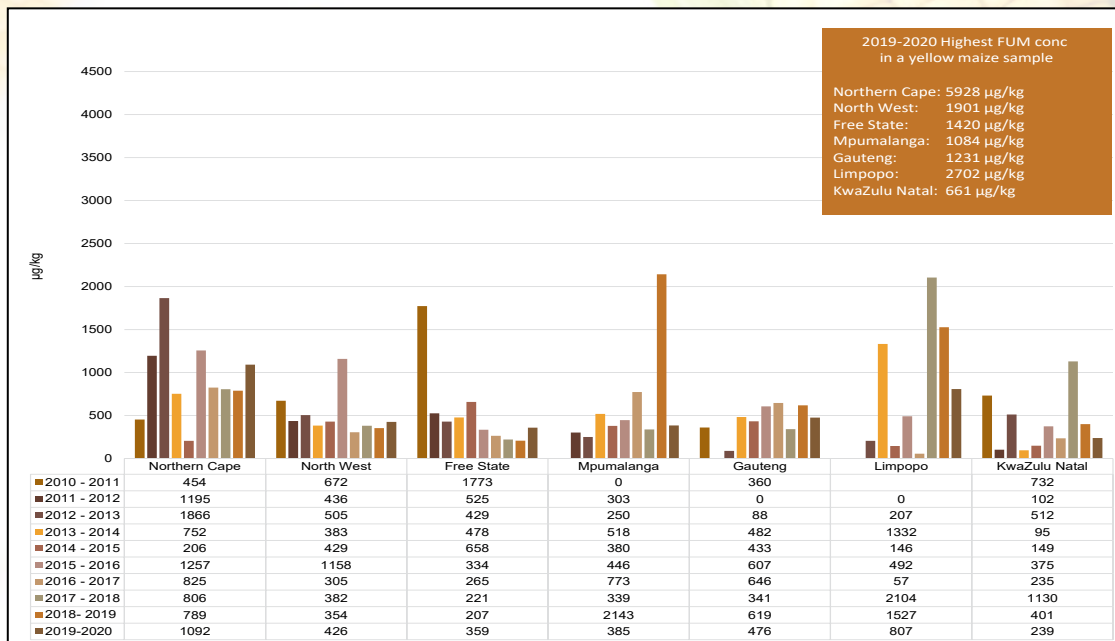


- A decrease was observed in the white maize mean FUM concentration in three of the seven provinces over the last three production seasons. The 10-year FUM mean concentration variations in white maize in the seven provinces are illustrated in Graph 57.
- The mean FUM concentration in yellow maize ranged from 239 µg/kg in KZN to 1 092 µg/kg in the Northern Cape and increased only slightly in the North West and Free State. These trends are illustrated in Graph 58.

Graph 57: White maize FUM (total) mean concentration (µg/kg) per province over ten seasons



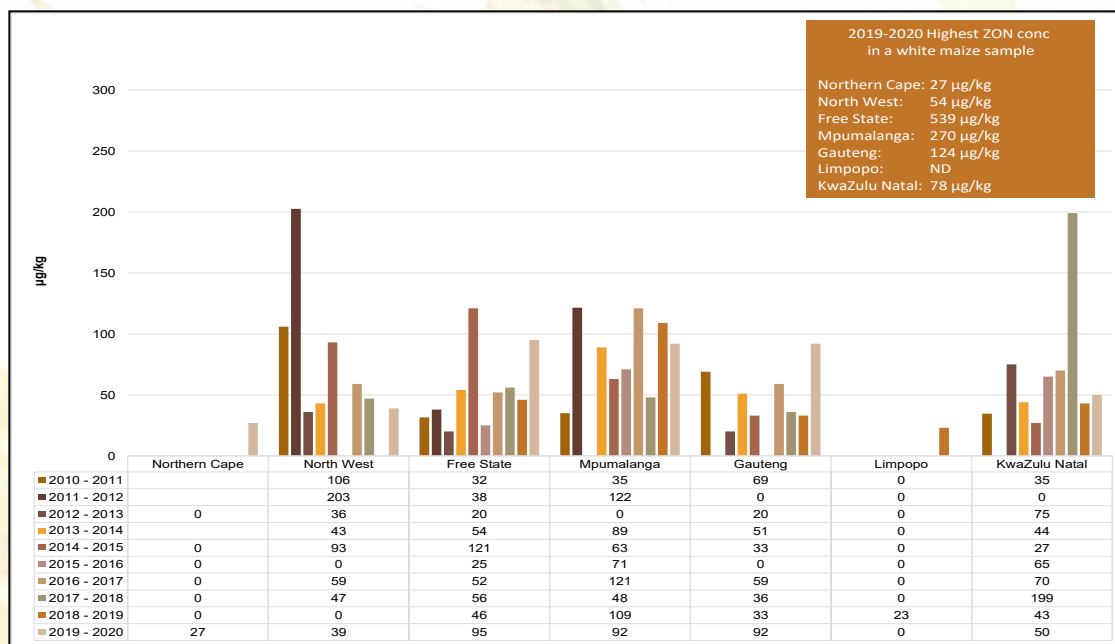
Graph 58: Yellow maize FUM (total) mean concentration (µg/kg) per province over ten seasons



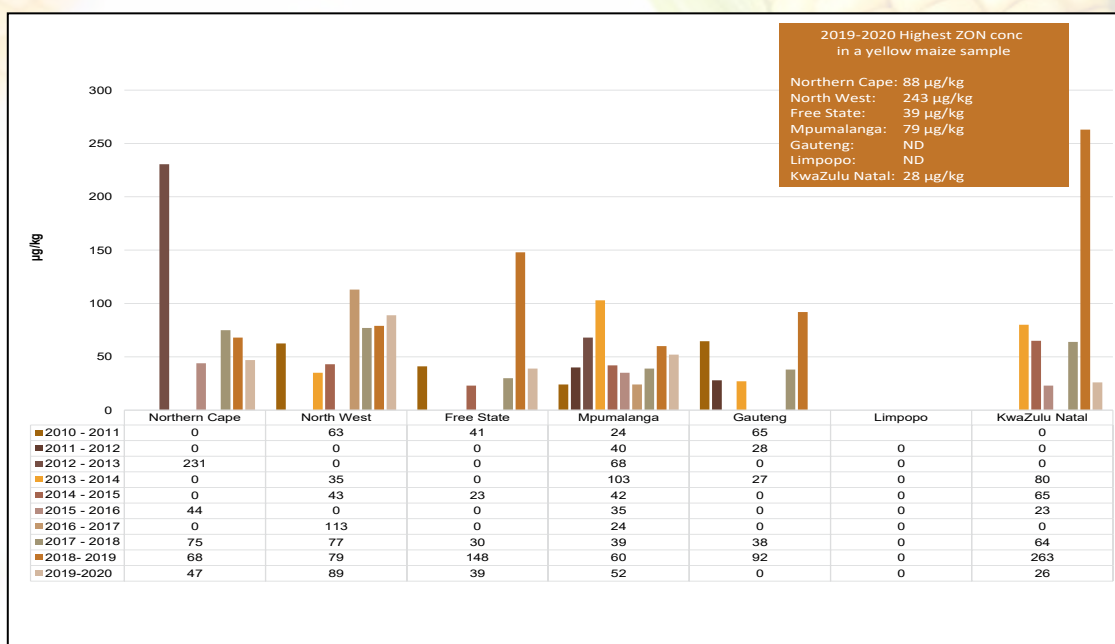
Zearalenone

- ZON was not found in the Limpopo province nor in the yellow maize produced in Gauteng. ZON was found for the first time in white maize produced in the Northern Cape. The ZON occurrences in the seven provinces are illustrated in Graphs 59 and 60 by reporting the mean ZON concentrations found in white and yellow maize.
- The highest concentration ZON in an individual white maize sample since commencement of the survey in 2010/11, namely 539 µg/kg, was reported this season in a sample from the Free State.

Graph 59: White maize ZON mean concentration ($\mu\text{g}/\text{kg}$) per province over ten seasons



Graph 60: Yellow maize ZON mean concentration ($\mu\text{g}/\text{kg}$) per province over ten seasons



The multi-mycotoxin results over 10 consecutive seasons provide an excellent perspective of the South African commercially produced maize. The increased occurrence and concentration levels of DON confirmed that mycotoxin risk varies significantly between production seasons in the different production regions and maize classes.

International mycotoxin regulations

Information with regards to mycotoxin regulations per region and country, can be obtained from the Mycotoxins.info webpage supported by Biomin (<http://www.mycotoxins.info/regulations>).