Mycotoxins

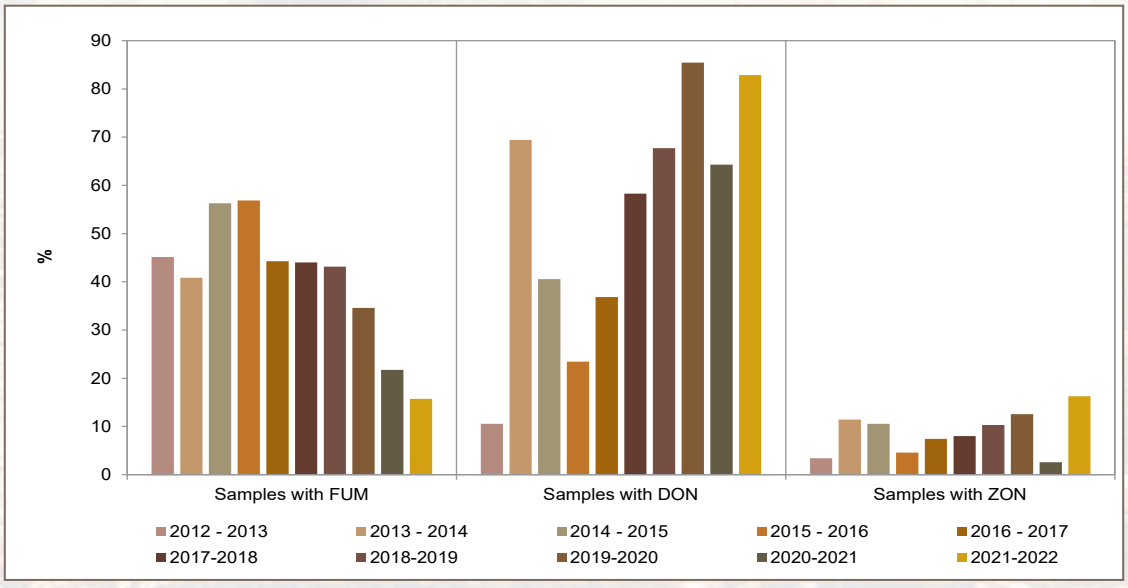
Monitoring of multi-mycotoxins in locally produced maize is included in the annual maize crop quality surveys since the 2010/11 production season. The mycotoxin results and trends highlight the advantages of long-term monitoring of mycotoxin occurrence in South African maize.

Thirteen mycotoxins including Aflatoxin B_1, B_2, G_1 and G_2, Fumonisin (FUM) B_1, B_2 and B_3, Deoxynivalenol (DON), 15-acetyl-deoxynivalenol (15-ADON), Ochratoxin A, T2-toxin, HT-2 toxin and Zearalenone (ZON) are analysed with an accredited LC-MS/MS method. Every season 350 maize crop samples are selected, representing approximately 35 to 40% of the survey samples. The samples are selected to represent white and yellow maize from all the production regions.

This season, 85% of the samples (297 samples) contained at least one mycotoxin, mainly DON (83%), FUM (16%) and ZON (16%). Mycotoxin occurrence varied slightly between the three main production regions, ranging from 78% in the Free State, 86% in Mpumalanga to 92% in North West. In KwaZulu Natal, Gauteng and Limpopo mycotoxins were found in 89%, 80% and 50% of the samples respectively. All the samples tested that originated from the Northern Cape contained DON.

Compared to the 69% of samples which contained at least one mycotoxin in the previous season, the observed increase this season was due to an increase in the DON and ZON occurrence, as illustrated by Graph 50. The fumonisin prevalence (16%) reported this season, is the smallest in both white and yellow maize over the 12 consecutive seasons starting in 2010/11.

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



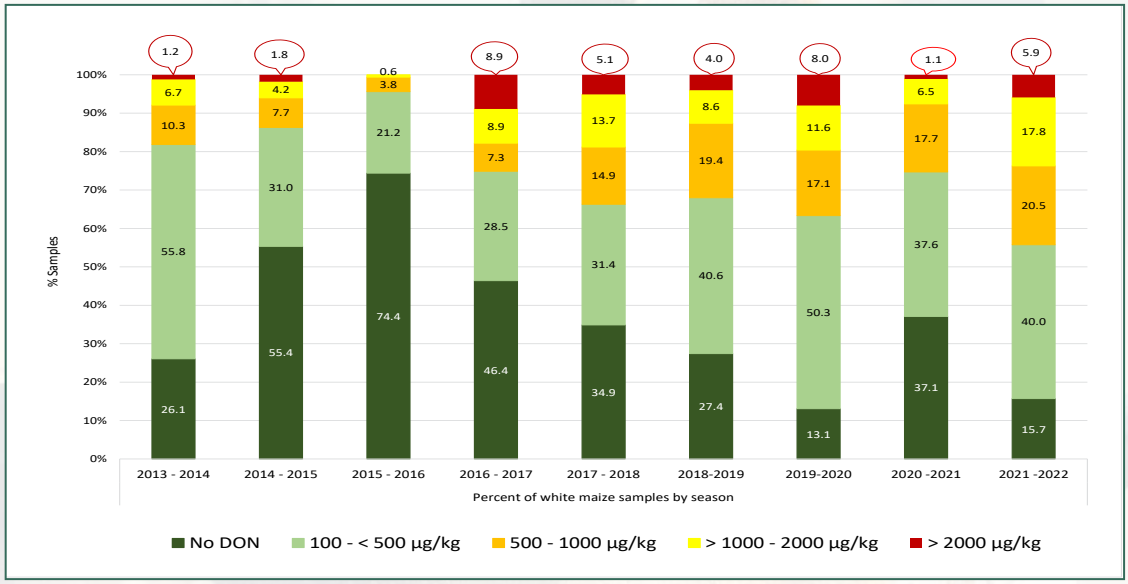
The results of the 13 mycotoxins analysed, including the range of concentration levels and notable trends in the mean concentration levels in white and yellow maize in the different provinces, are summarised as follows:

- No aflatoxins were found this season. In the 12 years of this survey (350 samples/year), aflatoxins were found in only one yellow maize and four white maize samples.
- No ochratoxin A was reported since the survey began in 2010/11.
- For the first time, T2- toxin and HT-2 toxin, were found in two samples this season. A yellow maize sample collected in Mpumalanga reported 28 µg/kg T2-toxin and 93 µg/kg HT-2 toxin and a white maize sample from KwaZulu Natal contained 30 µg/kg T2-toxin and 47 µg/kg HT-2 toxin.

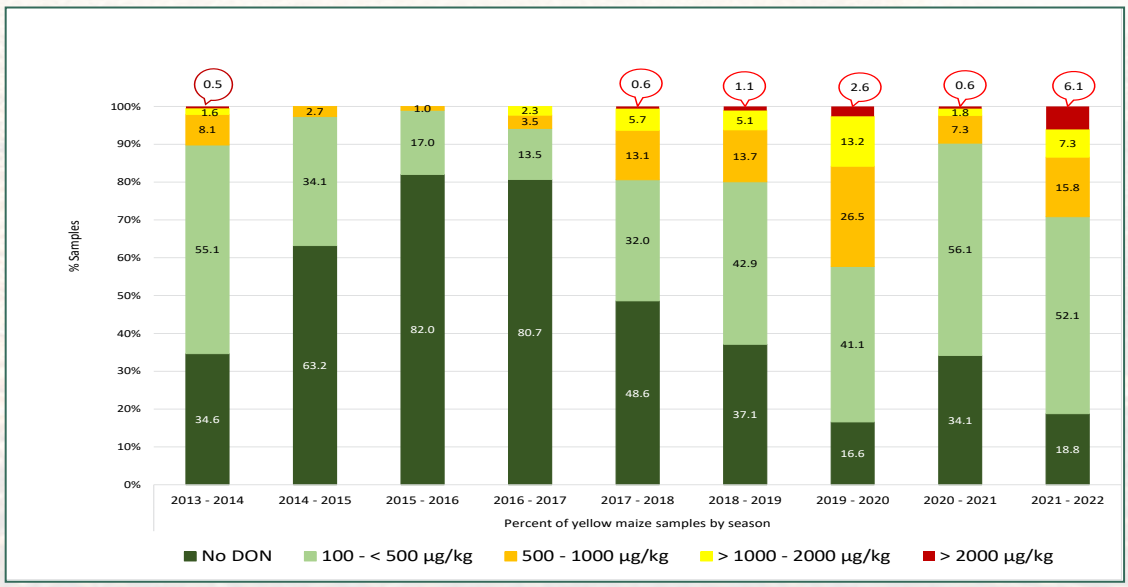
DON and 15-ADON

- Approximately 84% of the white maize and 81% of the yellow maize samples were contaminated with DON, an increase compared to the previous season but similar to the 2019/20 results. The DON concentration ranges are summarised in Graph 51 (white maize) and Graph 52 (yellow maize). The ten-year mean DON concentrations in the seven provinces are illustrated in Graphs 53 and 54.

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



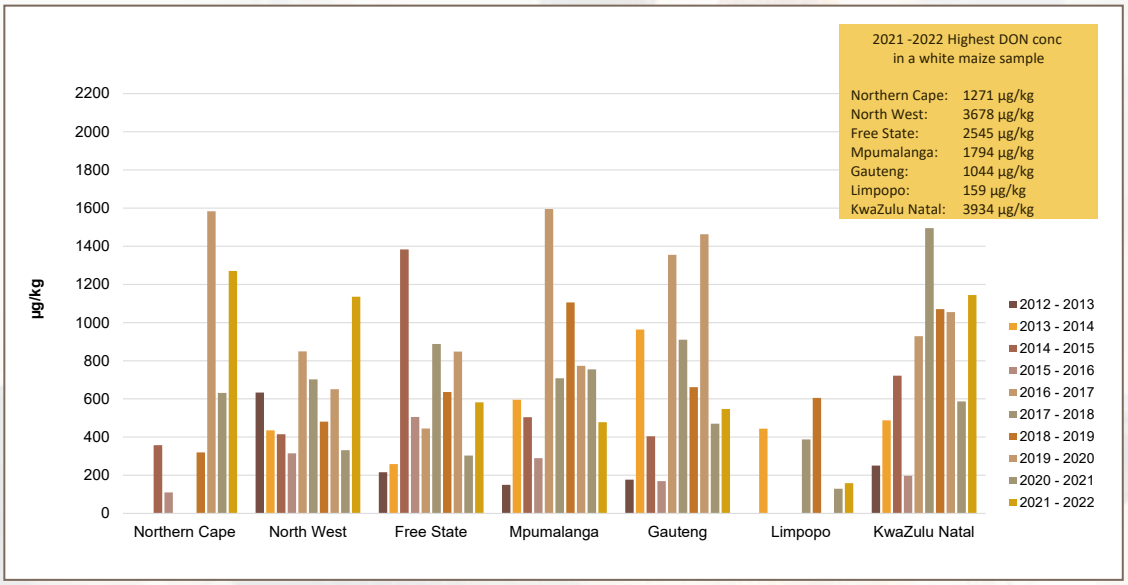
Graph 52: DON concentration range in yellow maize samples over nine seasons



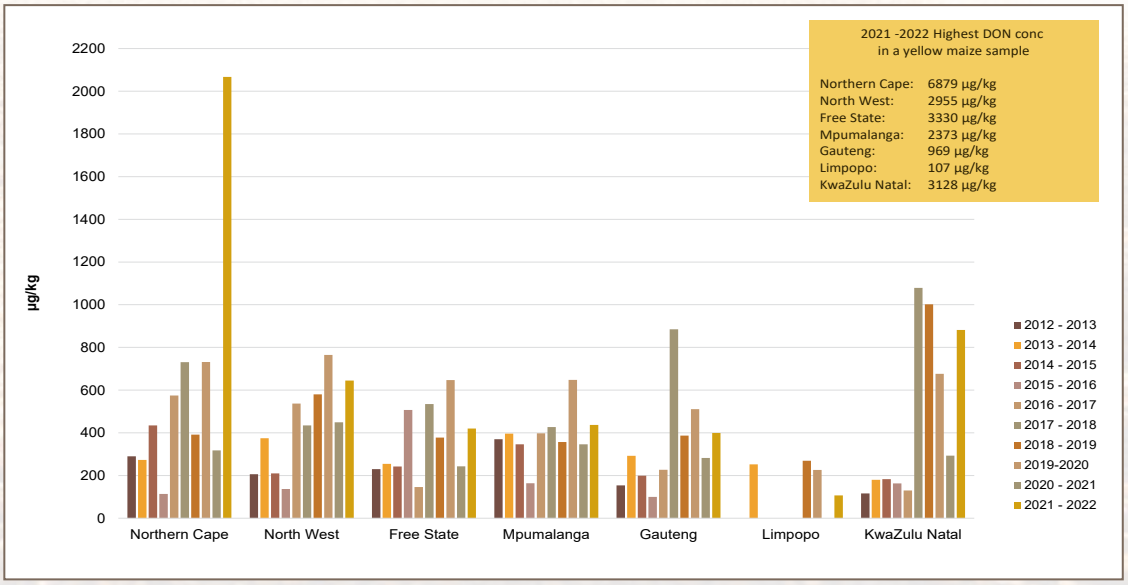
- 5.9% of the white maize samples collected in North West, the Free State and KwaZulu Natal contained more than 2 000 µg/kg DON (the South African regulated maximum allowable level in unprocessed maize for human consumption). This is an increase of 4.8% compared to the previous season.
- The white maize samples with the highest DON concentrations were collected in the Northern Cape (1 271 µg/kg), North West (3 678 µg/kg), the Free State (2 545 µg/kg), Mpumalanga (1 794 µg/kg), Gauteng (1 044 µg/kg) and KwaZulu Natal (3 934 µg/kg).

- In yellow maize, only 18.8% of the samples did not contain DON, while 6.1% contained more than 2 000 µg/kg DON. Samples with DON concentrations exceeding 2 000 µg/kg were found in five provinces.
- Higher mean DON concentrations compared to the previous season, were observed in white and yellow maize samples in six provinces.

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



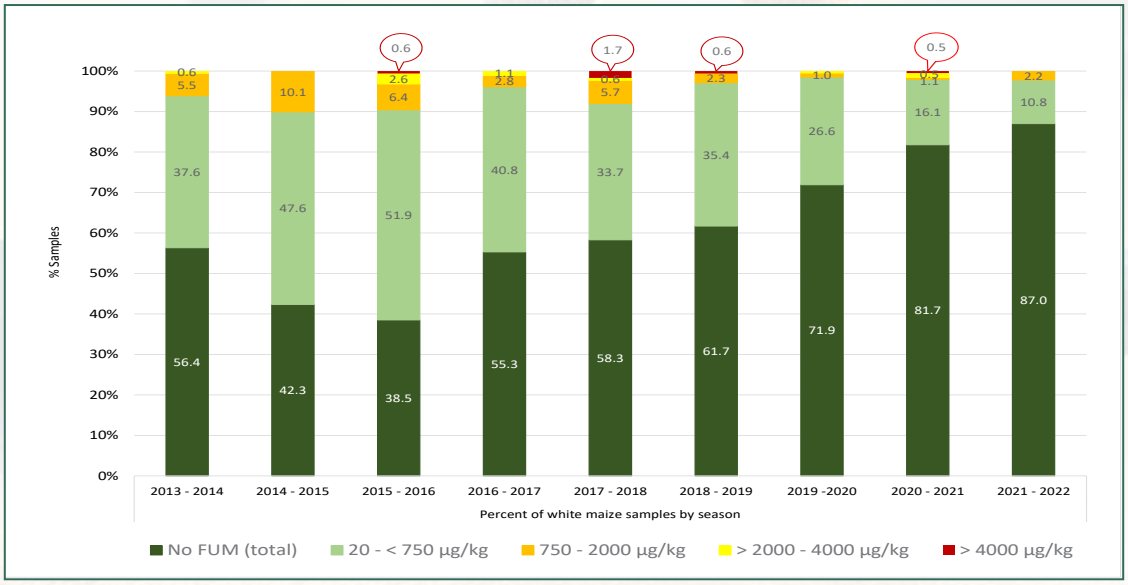
Graph 54: Yellow maize DON mean concentration (µg/kg) per province over ten seasons



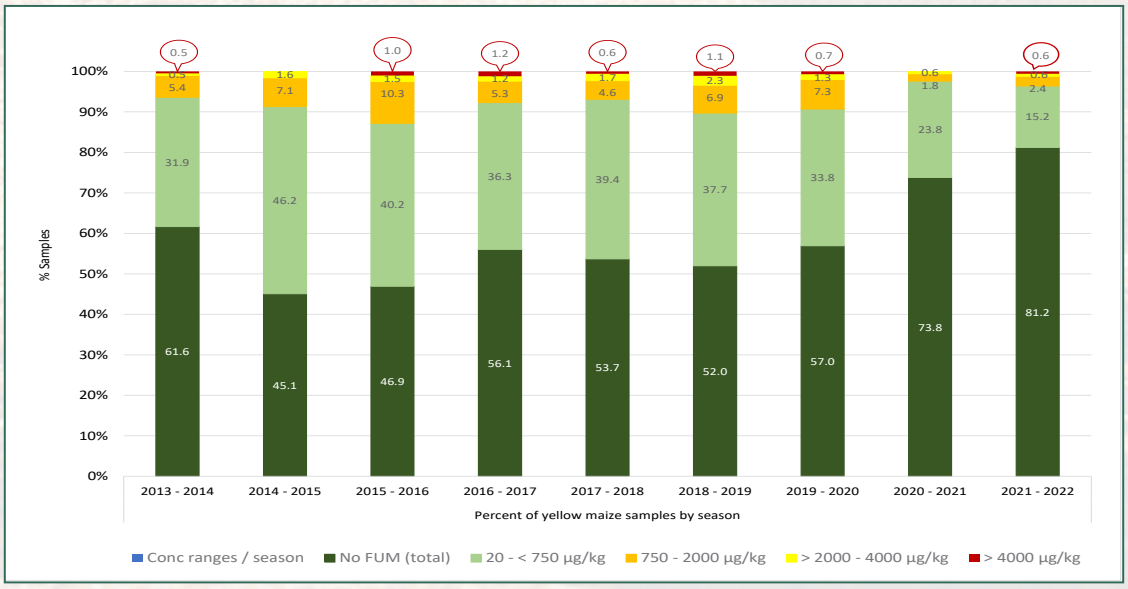
- As a rule of thumb, when a sample is found to contain 15-ADON, the sample most often also contains DON, mostly when the DON concentration exceeds 500 µg/kg. This season, 84% of the samples did not contain 15-ADON. The mean 15-ADON concentration of the positive samples was 158 µg/kg.
- It is important to take note of the steady increase in DON occurrence. This season, 23.7% of the white maize samples were found to contain concentration levels exceeding 1 000 µg/kg.

- ## Fumonisins (FUM Total = $FB_1 + FB_2 + FB_3$)
  - This season, only 13% of the white maize samples contained fumonisins, showing a continual decrease in contamination level from 62% in 2015/16. The yellow maize samples that contained fumonisins decreased from approximately 53% in 2015/16 to 19% this season.
  - The maximum FUM in individual white maize samples also decreased when compared to the previous season. The highest levels were 1 333 µg/kg found in North West and 1 113 µg/kg in KwaZulu Natal. Only one yellow maize sample was found with FUM more than 4 000 µg/kg (the South African regulated maximum allowable level FUM $B_1 + B_2$ in unprocessed maize for human consumption). This sample was from the Northern Cape and contaminated with 18 301 µg/kg FUM.
  - The concentration ranges of the samples with FUM over the past nine seasons are summarised in Graph 55 (white maize) and Graph 56 (yellow maize).

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

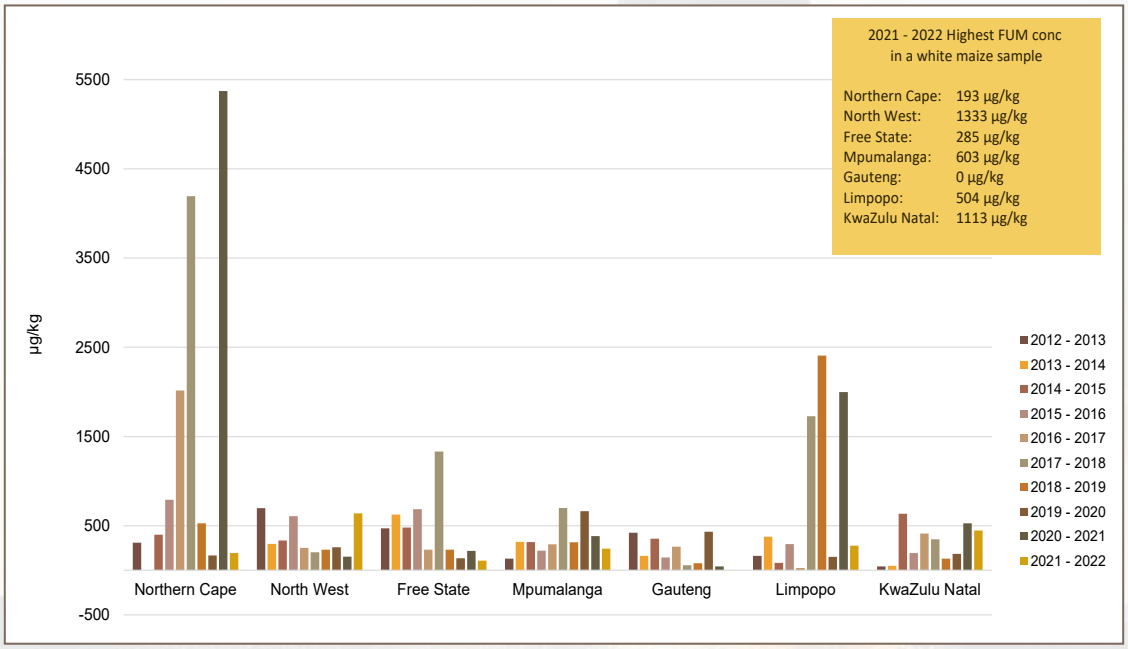


Graph 56: FUM concentration range in yellow maize samples over nine seasons

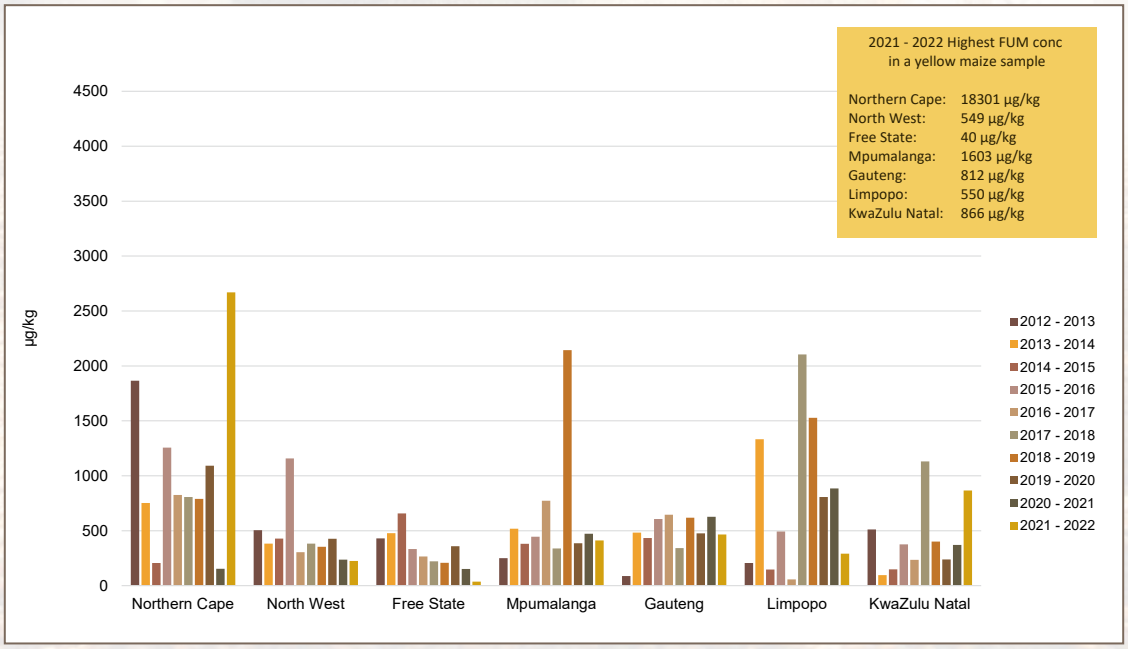


- The white maize mean FUM concentrations decreased in all six of the provinces, except in North West. The ten-year FUM mean concentration variations in white maize in the seven provinces are illustrated in Graph 57.
- The mean FUM concentration in the yellow maize samples increased only in the Northern Cape and KwaZulu Natal. These trends are illustrated in Graph 58.

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

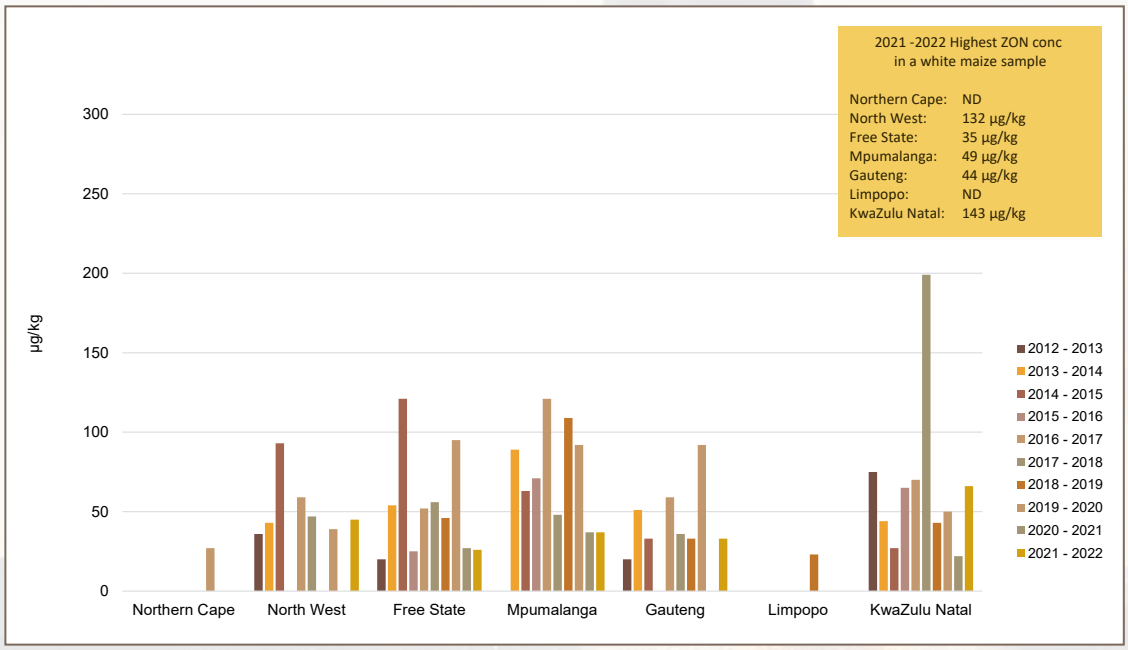


Graph 58: Yellow maize FUM (total) mean concentration (µg/kg) per province over ten seasons

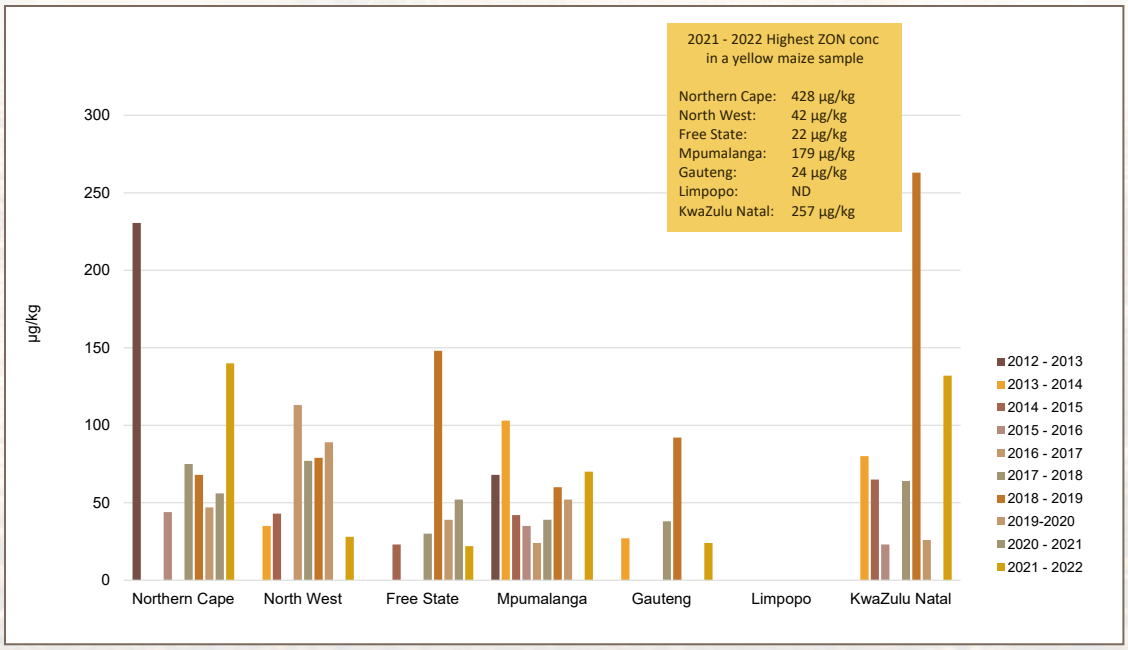


- ## Zearalenone
  - No zearalenone was found in white maize samples from the Northern Cape and Limpopo and also none in yellow maize sampled in Limpopo. The ZON occurrences in the seven provinces are illustrated in Graphs 59 and 60.
  - The highest concentration ZON measured in individual samples were in yellow maize samples from the Northern Cape (428 µg/kg) and KwaZulu Natal (257 µg/kg).

Graph 59: White maize ZON mean concentration (µg/kg) per province over ten seasons



Graph 60: Yellow maize ZON mean concentration (µg/kg) per province over ten seasons



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).