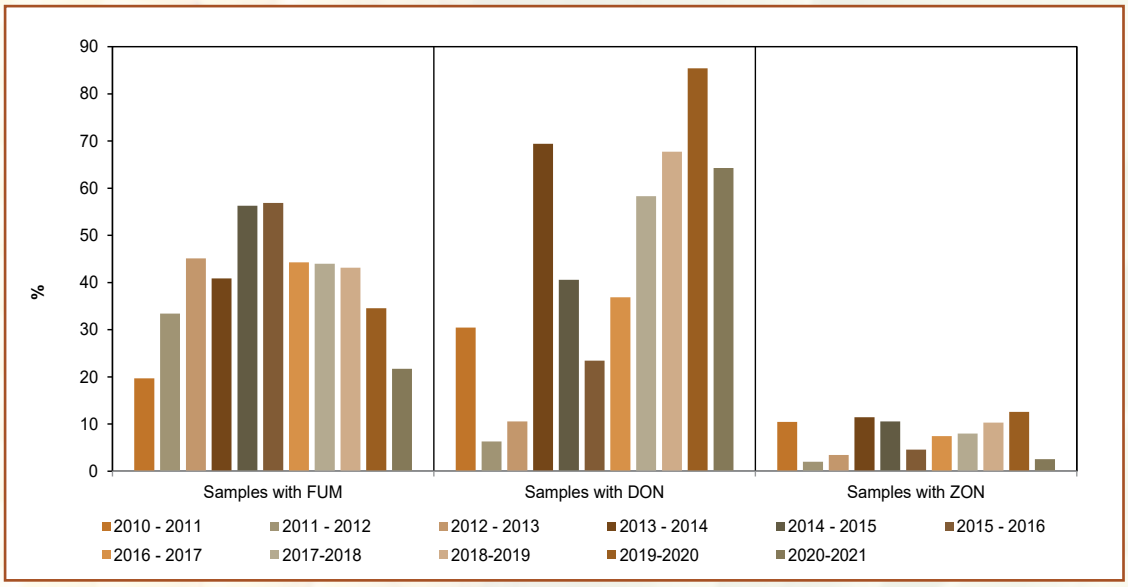
Mycotoxins

The South African commercial maize producers are privileged to have at their disposal, an excellent overview of the occurrence of the most important mycotoxins in maize, over an eleven season period and from all maize production regions in South Africa. During each of these seasons, 350 samples were selected from the maize crop survey samples, representing approximately 35 to 40% of the survey samples each season. The samples were always representatively selected for white and yellow maize from all the production regions. It must be noted that the grading defects of the maize samples were not considered in this selection, since as can be expected, no correlations were found between the visual inspection results (grading of the maize) and mycotoxin content. 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, H-T2 toxin and Zearalenone (ZON) were analysed with the LC-MS/MS instrument.

This season, 69% of the samples (240 samples) contained one or more mycotoxin, mainly DON (64%), FUM (22%) and ZON (3%). This was a notable decrease compared to the 90% occurrence in the previous season. The presence of DON and ZON, as illustrated in Graph 50, decreased for the first time in six years. The FUM prevalence decreased over the same period, from 57% in 2015/16 to 22% this season.

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



In Limpopo province, all the samples tested contained mycotoxins, as did more than 90% of samples in the Northern Cape and KwaZulu-Natal provinces. A decrease in mycotoxin occurrence was found in the other four provinces this season, ranging from an approximate 10% decrease to decreases of 84% and 83% in Mpumalanga and Gauteng respectively. In North West province, 57% of samples contained mycotoxins compared to the 83% during the previous season. In the Free State, samples containing mycotoxins decreased from 91% to 46%.

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

Aflatoxins

No aflatoxins were found. Previously, aflatoxins were found in one yellow maize sample collected in North West province in 2019/20, in one white maize sample collected in the Free State in 2018/19 and in 2014/15 in three white maize samples collected in the North West province.

Ochratoxin A, T2- toxin and HT-2 toxin

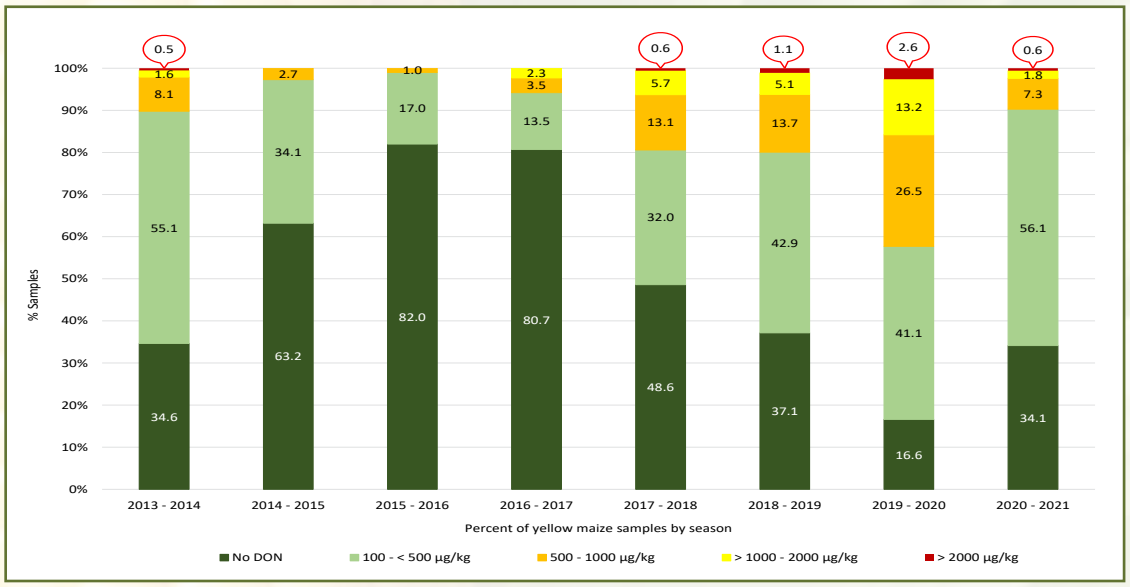
None were reported in locally produced commercial maize since the survey began in 2010/11.

DON and 15-ADON

- Approximately 63% of white maize and 66% of yellow maize samples contained DON this season, a decrease compared to the previous season, but similar to the 2018/19 results. The DON concentration ranges are summarised in Graph 51 (white maize) and Graph 52 (yellow maize). The eleven-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 eight seasons

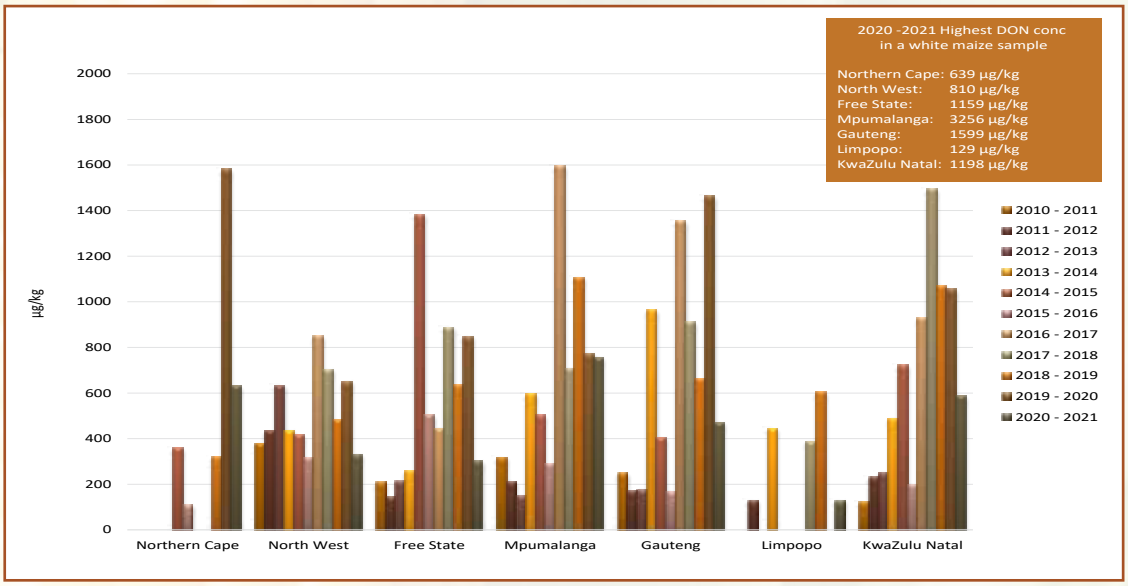
Graph 52: DON concentration range in yellow maize samples over eight seasons



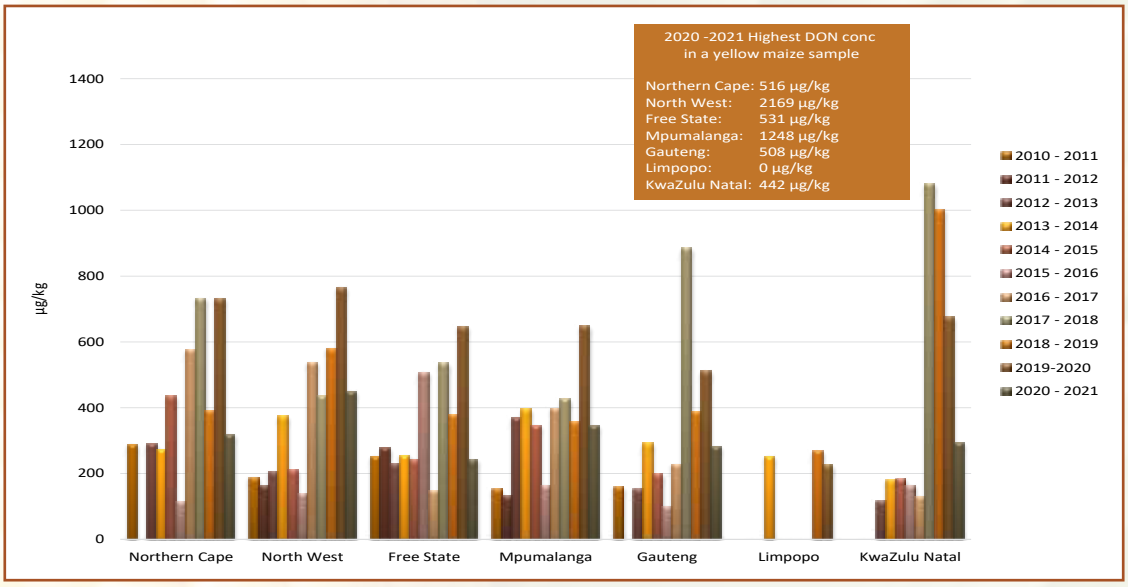
- One percent of the white maize samples (collected in Mpumalanga) contained more than 2000 µg/kg DON, the national regulated maximum allowable level in unprocessed maize for human consumption. This is a decrease of 7% compared to the previous season when white maize samples with DON levels exceeding 2 000 µg/kg were collected in five of the production provinces.

- The white maize samples with the highest DON concentrations were collected in the Free State (1 159 µg/kg), Mpumalanga (3 256 µg/kg), Gauteng (1 599 µg/kg) and KwaZulu- Natal provinces (1 198 µg/kg).
- In yellow maize, similar to the previous two seasons, the highest DON concentration (2 169 µg/kg) was found in a sample from North West.
- Lower mean DON concentrations of the positive maize samples, compared to the previous season, were observed in white maize in five provinces and in all seven provinces in yellow maize. In Limpopo, DON was reported in white maize but not in yellow maize.

GRAPHS 53: WHITE MAIZE DON MEAN CONCENTRATION (µg/kg) PER PROVINCE OVER ELEVEN SEASONS



GRAPH 54: YELLOW MAIZE DON MEAN CONCENTRATION (µg/kg) PER PROVINCE OVER ELEVEN SEASONS



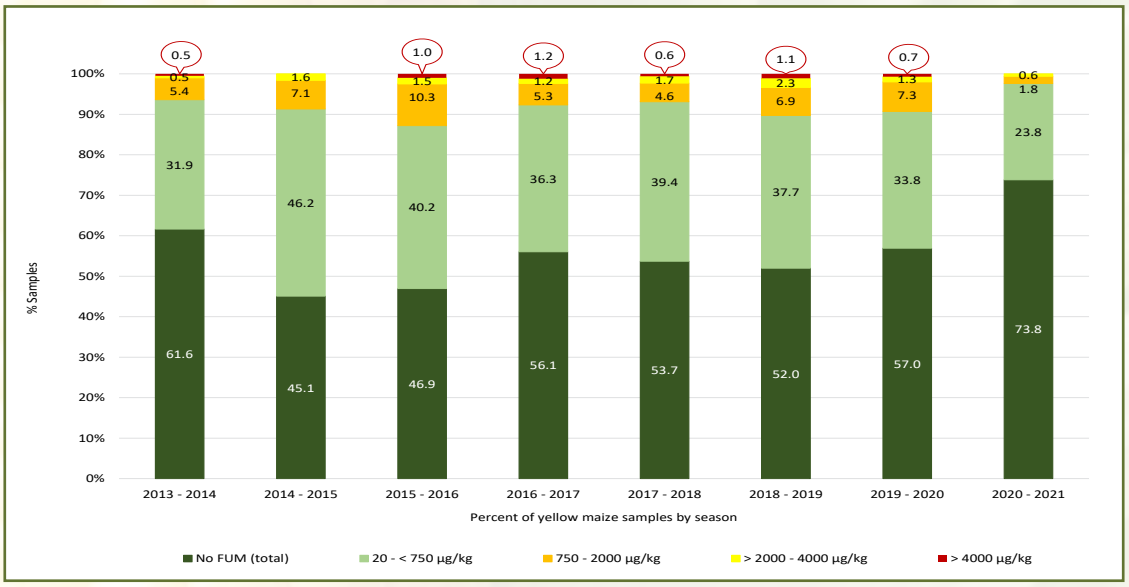
- When 15-ADON is found to be present in a sample, the sample also contains DON, mostly when the DON concentration level exceeds 500 µg/kg. This season, 82% of the samples did not contain 15-ADON, a 17% decrease in occurrence compared to the previous season. The mean 15-ADON concentration of the positive samples was 128 µg/kg.

Fumonisins (FUM Total = FB1 + FB2 + FB3)

- This season, only 18% of the white maize samples contained fumonisins, showing a continual decrease in contamination from the 62% in 2015/16. The yellow maize samples that contained fumonisins decreased from approximately 43% in the previous 4 seasons to 26% this season.
- Although the number of samples containing fumonisins decreased, FUM in the range of 4000 µg/kg (the SA regulated maximum allowable level in unprocessed maize for human consumption) was found in white maize from the Northern Cape (5 373 µg/kg) and Limpopo (3 952 µg/kg). The highest FUM (2 648 µg/kg) in a yellow maize sample was found in Mpumalanga.The concentration ranges of the samples with FUM over the past eight seasons are summarised in Graph 55 (white maize) and Graph 56 (yellow maize).

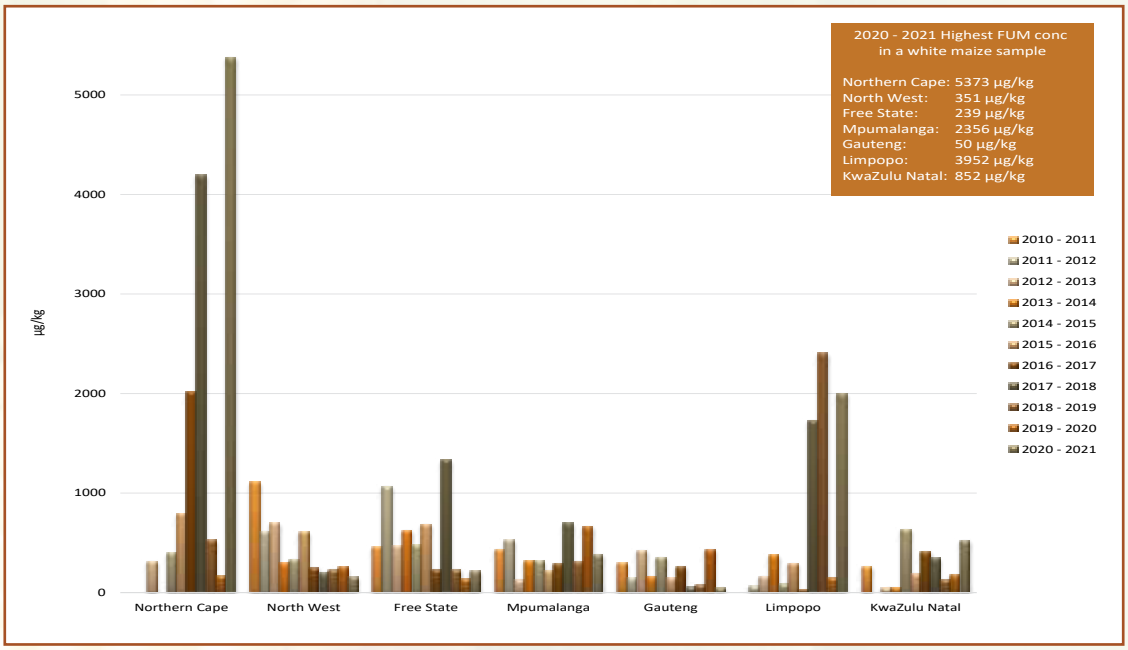
Graph 55: FUM concentration range in white maize samples over eight seasons

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

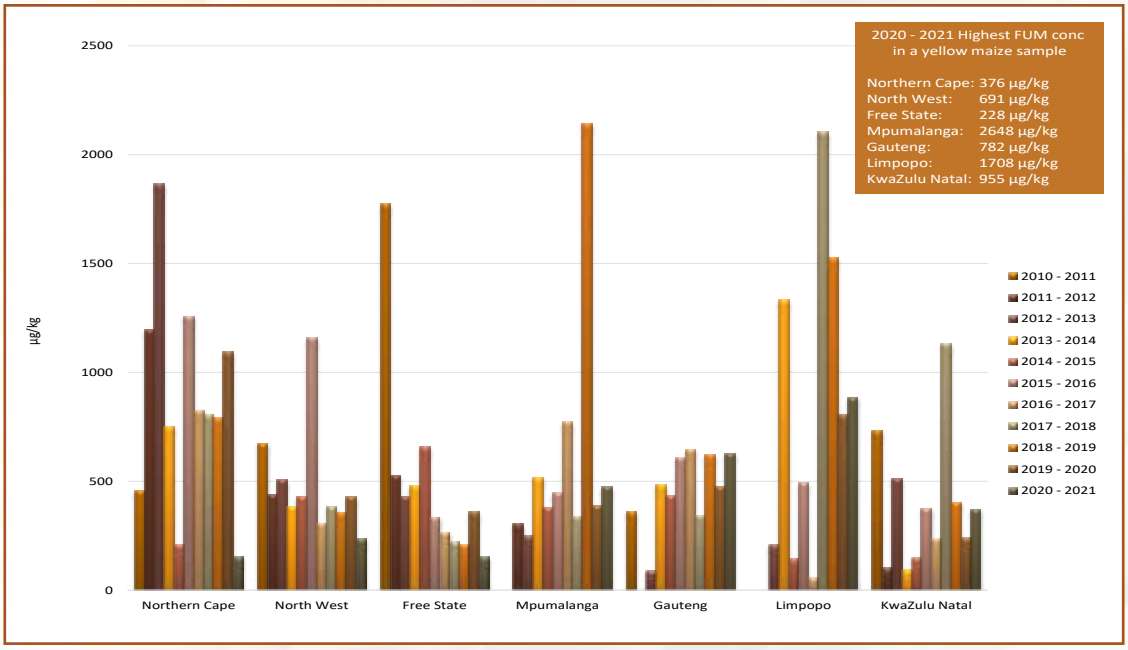


- The white maize mean FUM concentrations were low in four production provinces, but increased in the Northern Cape, Limpopo and KwaZulu-Natal. The eleven-year FUM mean concentration variations in white maize in the seven provinces are illustrated in Graph 57.
- The mean FUM concentration in yellow maize ranged from 152 µg/kg in the Free State to 884 µg/kg in Limpopo. These trends are illustrated in Graph 58.

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



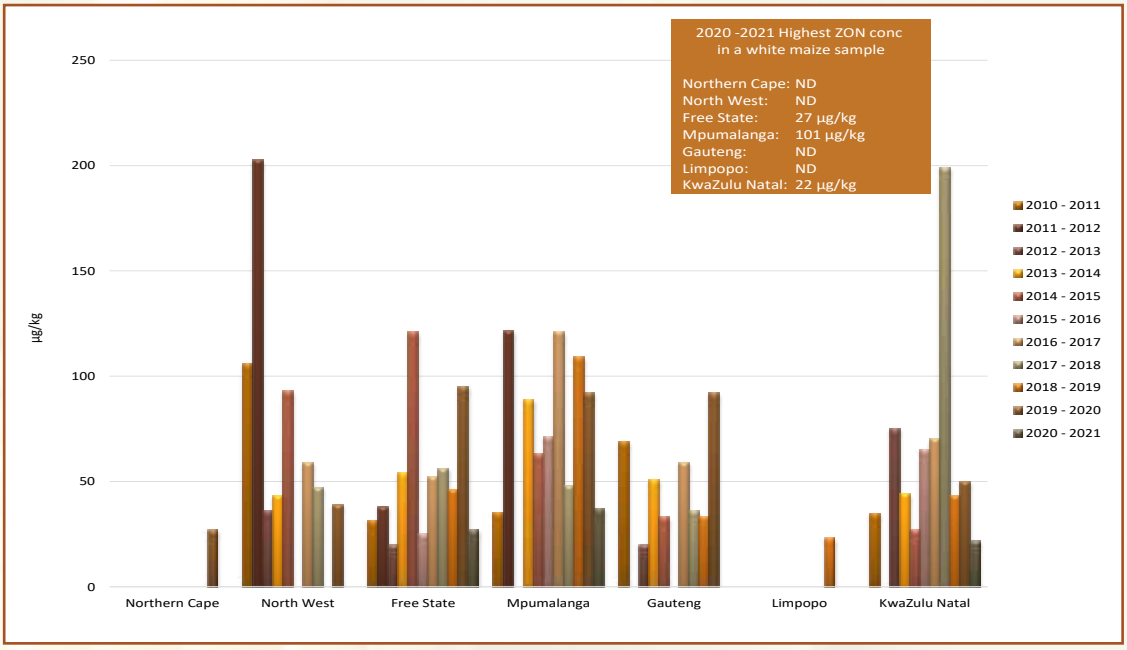
Graph 58: Yellow maize FUM (total) mean concentration (µg/kg) per province over eleven seasons



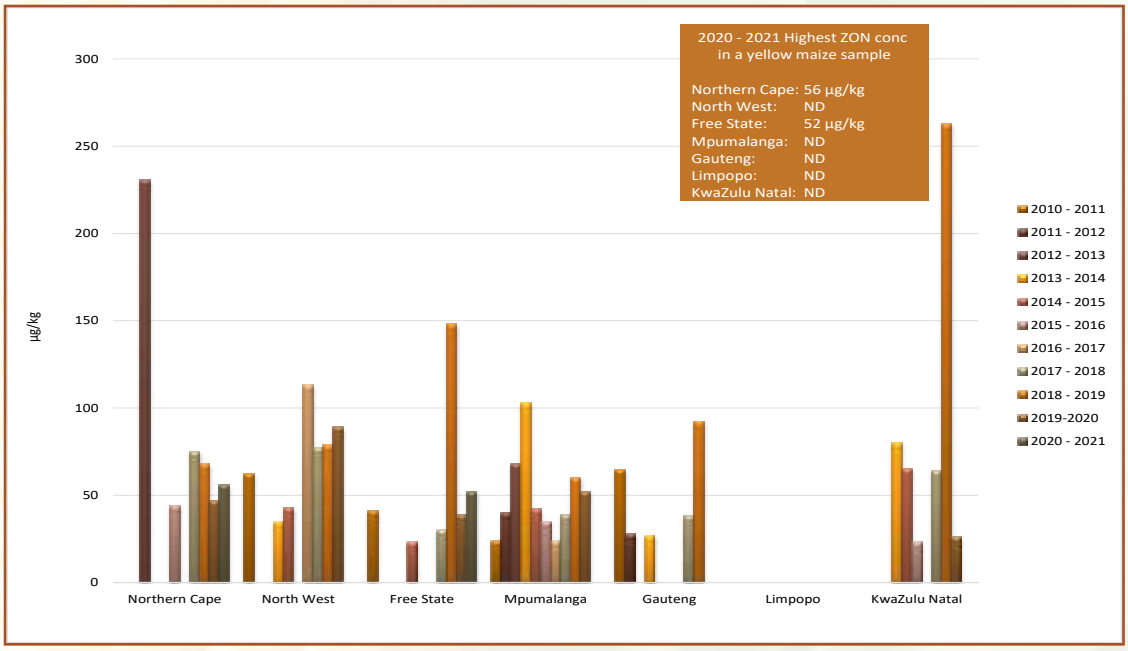
Zearalenone

- No zearalenone was found in white maize produced in the Northern Cape, North West, Gauteng and Limpopo nor in yellow maize produced in North West, Mpumalanga, Gauteng, Limpopo and KwaZulu-Natal. 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 (101 µg/kg) was reported in Mpumalanga this season.
- The multi-mycotoxin results over eleven consecutive seasons, provide an excellent South African perspective of commercially produced maize. The variation in occurrence and concentration levels of DON, 15-ADON, FUM and ZON confirmed that the mycotoxin risk varies significantly between production seasons in the different production regions and also maize class.

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



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



The multi-mycotoxin results over eleven consecutive seasons provide an excellent South African perspective of the commercially produced maize. The variation in occurrence and concentration levels of DON, 15-ADON, FUM and ZON confirmed that the mycotoxin risk varies significantly between production seasons in the different production regions and maize class.

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*).