SOUTH AFRICAN
COMMERCIAL MAIZE QUALITY
2010/2011

Acknowledgments
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1. Introduction

The calculated final commercial crop figure for maize for the 2010/2011 season by the National Crop Estimates Committee was 10 360 000 tons. This is 19 % less than the previous season's 12 815 000 tons. The major maize-producing region was the Free State (4 051 500 tons), followed by North West Province (2 332 500 tons) and Mpumalanga (2 190 000 tons). White maize contributed 58 % to the total production, which is 3 % less than the previous season's 61%.

The maize crop quality survey is done annually by the Southern African Grain Laboratory (SAGL).

693 composite samples, proportionally representing white and yellow maize of each production region, were analysed for quality. The samples consisted of 413 white and 280 yellow maize samples.

The quality attributes which were tested for, include:
a. RSA grading:
All samples were graded according to the following factors, as defined in the South African grading regulation: defective kernels above and below 6.35 mm sieve, total defective kernels, foreign matter, other colour, total deviation and pinked kernels.
b. USA grading according to regulations on all samples to determine the following factors: Grain density expressed as Hectolitre mass, heat damaged, total damaged, broken corn and foreign matter (BCFM) and other colour.
c. Nutritional values (on all samples): Fat, protein and starch.
d. Physical Quality factors (on all samples): Hectolitre mass, 100 kernel mass, kernel size, breakage susceptibility, stress cracks and milling index.
e. Roff milling and whiteness index were done on all white maize samples.
f. Mycotoxin analyses were performed on 77 samples representative of white and yellow maize produced per region.
g. Testing for the presence of Genetically Modified (GM) maize were performed on 77 samples representative of white and yellow maize produced per region.

Please see methods on pages 55 - 59.

2. Maize Crop Quality - summary of results

2.1 RSA Grading

The maize crop was of average good quality, with 69 % of the samples graded as maize grade one (64 % of white samples and 76 % of yellow samples). The persentage defective kernels above and below the 6.35 mm sieve compared with the 2009/2010 season and averaged 7.0 % for white and 6.8 % for yellow maize. Diplodia and Fusarium infected kernel levels were on average 0.4 % and 0.2 % higher than in the previous season. Foreign matter and other colour maize did not pose any problems.

The average percentage total or combined deviations on white maize increased by 0.6 % to 7.5 % this season. The average percentage total deviations on South African maize this season is 1.2 % higher than the ten year weighted average of 6.2 %.

2.2 USA Grading

Of the 693 maize samples, 28 % were graded US1, 36 % US2, 17 % US3, 12 % US4, 5 % US5, 1 % mixed grade and 1 % sample grade, according to USA grading regulations. The samples were downgraded mostly due to the % total damaged kernels.

2.3 Nutritional Values

The fat, starch and protein nutritional components are reported as % (g/100g) on a dry base.

In general, white maize tend to have a higher fat content than yellow maize, but a lower starch content. No clear trend can be observed with regards to the protein content.

The average fat content of the 2010/2011 crop samples was 3.9 % compared to the 4.0 % of the 2009/2010 samples and the weighted ten year average of 3.9 %. The average protein content (7.9 %) was 0.4 % lower than the previous season's average and 0.8 % lower than the ten year weighted average. The starch content this season increased on average with 1.7 % compared to the weighted ten year average of 72.1 % and 0.9 % compared to the previous season.

The fat content of white maize was similar to the previous season and 0.5 % higher than that of yellow maize. The protein content of white maize was 0.1 % higher than that of yellow maize. The starch content of both white and yellow maize is up from the previous season by 1.0 % and 0.8 % respectively.

Please refer to Table 11 on page 36.

2.4 Physical Quality factors

Hectolitre mass/Bushel weight is applied as a grading factor in the USA grading regulations. White maize had an average hectolitre mass of 77.7 kg/hl compared to the 76.2 kg/hl of yellow maize. The hectolitre mass in total varied from 69.0 kg/hl to 81.8 kg/hl. Only seven samples were below the minimum requirement (56.0 lbs or 72.1 kg/hl) for USA grade 1 maize.

The 100 kernel mass averaged 33.5 g which is 1.2 g lower than the previous season but 0.5 g higher than the ten year average.

Yellow maize kernels were smaller on average than white kernels (above the 10 mm sieve). The breakage susceptibility for white maize on average is similar to the previous season and slightly less susceptible than yellow maize. The % stress cracks varied from 0 – 31 %, averaged 5 % and compared well with previous seasons.

The milling index varied from 40.2 to 111.7 and averaged 87.5, slightly lower than the previous season. The average milling index for yellow maize is lower (85.8) than that of white maize (88.6).

2.5 Roff milling and whiteness index (WI)

The average % extraction of total meal with the Roff mill averaged 78.4 % and varied from 70.7 % to 82.3 % in white maize. This average is 0.6 % higher than the previous season (2009/2010).

The whiteness index averaged 31.0 for unsifted and 22.5 for sifted maize meal. Sieving the sample eliminates differences in the readings as a result of particle size.

The whiteness index of the previous season averaged 27.7 for unsifted maize meal. Sifted maize meal averaged 22.4.

The higher the WI value, the whiter the meal. The main contributing factors causing lower WI values are the percentage defective kernels, the presence of another colour maize like yellow maize as well as cultivar.

2.6 Mycotoxins

The average mycotoxin levels were lower than in previous seasons. The Fumonisin level averaged 139 µg/kg (ppb) and ranged from 0 to 1 401 µg/kg. The average Fumonisin level last season was 251 µg/kg. The highest Deoxynivalenol (DON) level detected was 883 µg/kg compared to the 1 845 µg/kg of the previous season. The average DON level was 49 µg/kg, 206 µg/kg the previous season. Zearalenone levels averaged at 5 µg/kg with a maximum of 187 µg/kg. Zearalenone were not detected in any of the samples of the previous season.

No Aflatoxin, Ochratoxin A or T-2 Toxin were detected in the samples.

The European Union specifies the following maximum levels for mycotoxins on maize:

Fumonisin

- Unprocessed maize with the exception of unprocessed maize intended to be processed by wet milling, 4 000 µg/kg.
- Maize intended for direct human consumption, maize-based foods for direct consumption, with certain exceptions, 1 000 µg/kg.
- Maize-based breakfast cereals and maize-based snacks, 800 µg/kg.
- Processed maize-based foods and baby foods for infants and young children, 200 µg/kg.
- Milling fractions and other milling products with particle size > 500 µm not used for direct human consumption, 1 400 µg/kg.
- Milling fractions and other milling products with particle size ≤ 500 µm not used for direct human consumption, 2 000 µg/kg.

DON

- Unprocessed maize, with the exception of unprocessed maize intended to be processed by wet milling, 1 750 µg/kg.
- Milling fractions and other milling products with particle size > 500 µm not used for direct human consumption, 750 µg/kg.
- Milling fractions and other milling products with particle size ≤ 500 µm not used for direct human consumption, 1 250 µg/kg.

Zearalenone

- Unprocessed maize with the exception of unprocessed maize intended to be processed by wet

- milling, 350 µg/kg.
- Maize intended for direct human consumption, maize-based snacks and maize-based breakfast cereals, 100 µg/kg.
- Processed maize-based foods for infants and young children, 20 µg/kg.
- Milling fractions and other milling products with particle size > 500 µm not used for direct human consumption, 200 µg/kg.
- Milling fractions and other milling products with particle size $\leq$ 500 µm not used for direct human consumption, 300 µg/kg.

In the USA, specified maximum levels for Fumonisin in maize and maize by-products used in animal feeds varies between 5 000 and 100 000 µg/kg based on the particular type of animal. Maximum levels in the final animal feed varies between 1 000 and 50 000 µg/kg, also depending on the type of animal. Suggested levels for DON in animal feed varies between 5 000 and 10 000 µg/kg in grains and grain by-products and between 1 000 and 5 000 µg/kg in final feeds depending on the category of animal.

2.7 Genetic Modification (GM)

The SAGL screened 77 (11 %) of the crop samples to test for the presence of Cry1Ab (based on MON810 which is a *Bt* maize event) and CP4 EPSPS (Roundup Ready).

The crop quality samples received by the SAGL are composite samples per class and grade, made up of individual deliveries to grain silos.

SAGL used the EnviroLogix QuickComb kit for bulk grain to quantitatively determine the presence of genetically modified maize.

The limit of detection for the Cry1Ab trait is 0.8 % and the detection range 0.4 % to 5 %. 97 % of the samples tested positive for Cry1Ab with values larger than 0.4 % (Limit of quantification (LOQ)).

The limit of detection for the CP4 EPSPS trait is 0.5 % and the detection range 0.25 % to 5 %. 88 % of the samples tested positive for CP4 EPSPS with values larger than 0.25 % (LOQ).

Values higher than 5 %, the highest value of the detection range for both traits, are reported as > 5 %.

3. Production regions

The RSA is divided into 36 grain production regions. Regions 1 to 9 are winter rainfall areas (Western Cape), as well as the Eastern Cape and Karoo where very little commercial maize is being produced.

Region 10 is Griqualand West and region 11 Vaalharts. Region 34 falls within Gauteng, region 35 within the Limpopo Province and region 36 within KwaZulu-Natal.

The main production regions are:
a) Regions 12 to 20 which are all within the North West province,
b) Regions 21 to 28 in the Free State,
c) Regions 29 to 33 in Mpumalanga.

The contribution of the three main production areas was as follows:
a) The Free State contributed 39 % of which 64 % was white maize and 36 % yellow maize.
b) North West contributed 23 % of which 78 % was white maize and 22 % yellow maize.
c) Mpumalanga contributed 21 %. Yellow maize contributed 59 % compared to the 41 % of white maize.

South African Provinces