SOUTH AFRICAN
COMMERCIAL MAIZE QUALITY
2011/2012

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1. Introduction

The final commercial crop figure for maize for the 2011/2012 season as calculated by the National Crop Estimates Committee was 11 830 000 tons. This is 14% more than the previous season's 10 360 000 tons. The major maize-producing region was the Free State (4 730 000 tons), followed by North West Province (2 574 000 tons) and Mpumalanga (2 504 000 tons). White maize contributed 57% to the total production, which is 1% less than the previous season.

One thousand composite samples, proportionally representing white and yellow maize of each production region, were analysed for quality. The samples consisted of 577 white and 423 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. All white maize samples were milled on the Roff laboratory mill and the whiteness index of the maize meal determined.
f. Mycotoxin analyses were performed on 100 samples representative of white and yellow maize produced per region.
g. Testing for the presence of Genetically Modified (GM) maize were performed on 100 samples representative of white and yellow maize produced per region.

Please refer to the methodologies followed on pages 57 - 61.

The maize crop quality survey is performed annually by the Southern African Grain Laboratory (SAGL). SAGL was established in 1997 on request of the Grain Industry. SAGL is an ISO 17025 accredited testing laboratory and participates in eleven international and one local proficiency testing scheme as part of our ongoing quality assurance to demonstrate technical competency and international comparability.

2. Maize Crop Quality - summary of results

2.1 RSA Grading

The maize crop was of very good quality, with 91% of both white and yellow maize, graded as maize grade one. The percentage defective kernels above and below the 6.35 mm sieve, 4.5% for white and 5.0% for yellow, were lower than the previous season's 7.0% and 6.8% for white and yellow maize respectively. Diplodia and fusarium infected kernel levels were on average 1.4% and 0.6% lower than the 2010/2011 season. Foreign matter and other colour maize did not pose any problems.

The average percentage combined deviations of white maize decreased with 2.5% and that of yellow maize with 2.0% compared to the previous season. The average percentage total deviations on South African maize this season is 0.8% lower than the ten year weighted average of 5.9%.

2.2 USA Grading

Of the 1000 maize samples graded according to USA grading regulations, 77% were graded US1, 16% US2, 4% US3, 2% US4, 1% US5 and mixed and sample grade represented less than half a percent. The samples were downgraded mostly due to the % total damaged kernels.

2.3 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 78.2 kg/hl compared to the 76.1 kg/hl of yellow maize. The hectolitre mass in total varied from 68.1 kg/hl to 82.0 kg/hl and averaged 77.3 kg/hl, equal to the ten year average. Only thirteen samples were below the minimum requirement (56.0 lbs or 72.1 kg/hl) for USA grade 1 maize.

The 100 kernel mass averaged 30.4 g which is 3.1 g lower than the previous season and also 2.6 g lower than the ten year average.

Yellow maize kernels were smaller on average than white kernels (above the 10 mm sieve). Both white and yellow maize is approximately 40 - 50% less susceptible to breakage than in the previous season. The susceptibility percentages are also the lowest of the past ten seasons. The % stress cracks varied from 0 – 27%, averaged 6% and compared with previous seasons.

The milling index varied from 53.0 to 117.0 and averaged 91.0, slightly higher than the previous season. The average milling index for yellow maize is lower (87.9) than that of white maize (93.3).

2.4 Roff milling and whiteness index (WI)

The average % extraction of total meal with the Roff mill averaged 79.2% and varied from 71.9% to 83.8% in white maize. This average is 0.8% higher than the previous season.

The whiteness index averaged 28.5 for unsifted and 23.6 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 31.0 for unsifted maize meal. Sifted maize meal averaged 22.5.

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.

2.5 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 2011/2012 crop samples was 4.0% compared to the 3.9% of the 2010/2011 samples and the weighted ten year average also 3.9%. The average protein content (8.7%) was 0.8% higher than the previous season's average and equal to the ten year weighted average. The starch content this season decreased on average with 1.0% compared to the 73.8% of the previous season. This season's starch content is however still 0.6% higher than the ten year weighted average of 72.2%.

The fat content of white maize was equal to the previous season and 0.3% higher than that of yellow maize. The protein content of white maize was 0.3% lower than that of yellow maize. The starch content of both white and yellow maize is lower than the previous season by 1.0% and 1.2% respectively.

Please refer to Table 20 on page 49.

2.6 Mycotoxins

The average Fumonisin level (Sum of B_1, B_2 and B_3) on all 100 samples tested was 182 µg/kg (ppb) and ranged from 0 to 4 419 µg/kg. This average is higher than the previous season's 139 µg/kg. Of the 100 samples tested, 33 samples tested positive for fumonisin levels and the average of these positive results was 551 µg/kg. The previous season, 18 samples (23%) of the samples tested positive, with an average of 595 µg/kg.

The highest Deoxynivalenol (DON) level detected was 485 µg/kg compared to the 883 µg/kg of last season. The average level of all samples tested this season was 10 µg/kg, 49 µg/kg the previous season. 17 samples (22%) tested positive for DON last season compared to the 4 of this season. The average of the positive results increased from 221 µg/kg in 2010/2011 to 262 µg/kg in 2011/2012.

Five samples tested positive for 15-acetyl-deoxynivalenol (15-ADON) residues. The average of the 5 positive results was 38 µg/kg, with the highest level detected 85 µg/kg. The highest DON and 15-ADON levels were detected on the same sample as would be expected.

Only two samples tested positive for Zearalenone, the lowest value being 200 µg/kg and the highest 297 µg/kg, averaging 249 µg/kg. The previous season, 6 samples (8%) tested positive, with the average of the positive results being 56 µg/kg.

Mycotoxin levels lower than the limit of quantitation (< LOQ) was seen as having tested negative for calculation purposes. Please see mycotoxin results in Table 22 on pages 52 – 55.

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

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

Aflatoxin
- Maize and rice to be subjected to sorting or other physical treatment before human consumption or used as an ingredient in foodstuffs, 5.0 µg/kg (B_1) and 10.0 µg/kg (Sum of B_1, B_2, G_1 and G_2).

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 ≤ 500 µm not used for direct human consumption, 300 µg/kg.

Ochratoxin A

- Unprocessed cereals, 5.0 µg/kg.
- All products derived from unprocessed cereals, including processed cereal products and cereals intended for direct human consumption with the exception of food for infants and young children, 3.0 µg/kg.

In the **USA**, the Food and Drug Administration (FDA) actions levels for **Aflatoxin** in animal feeds vary between 100 µg/kg and 300 µg/kg, depending on the species of animal. The action level for all commodities intended for human consumption is 20 µg/kg.

Advisory maximum levels for **DON** in animal feed varies between 5 000 and 10 000 µg/kg in grains and grain by-products and 1 000 to 5 000 µg/kg in final feed, depending on the class of animal as well as the percentage portion of the diet represented by the grain.

Spesified levels for **Fumonisin** in maize and maize by-products used in animal feeds varies between 5 000 µg/kg and 100 000 µg/kg based on the particular type of animal and proportion of the diet. Maximum levels in the final animal feed varies between 1 000 µg/kg and 50 000 µg/kg, also depending on the type of animal and proportion of the diet represented by the maize or maize by-products.

Advisory limits for **Fumonisins** (FB_1 + FB_2 + FB_3) in foodstuffs are as follows: Degermed dry milled maize products (e.g. flaking grits, maize grits, maize meal, maize flour with content of < 2.25%, dry weight basis), 2 000 µg/kg. Degermed dry milled maize products (e.g. flaking grits, maize grits, maize meal, maize flour with content of > 2.25%, dry weight basis), 4 000 µg/kg.

2.7 Genetic Modification (GM)

The SAGL screened 100 (10%) of the crop samples to test for the presence of the Cry1Ab, Cry2Ab and/or CP4 EPSPS traits. Important to remember is that 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 detection range for the Cry1Ab trait is 0.4% to 5%. 97% of the samples tested positive for Cry1Ab with values larger than 0.4% (Limit of quantification (LOQ)).

The detection range for the Cry2Ab trait is 0.5% to 5%. 27% of the samples gave values larger than the LOQ of 0.5% (positive results).

The detection range for the CP4 EPSPS trait is 0.25% to 5%. 93% 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 all three traits, are reported as > 5%. This methodology has a precision coefficient of variation of 20%.

Please see page 61 for a summary of the Events and Trade names/Brands represented by these three traits.

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 40% of which 63% was white maize and 37% yellow maize.
b) North West contributed 22% of which 79% was white maize and 21% yellow maize.
c) Mpumalanga contributed 21%. Yellow maize contributed 64% compared to the 36% of white maize.

The three main production areas contributed 83% of the total maize production in the RSA.

See chart for the different provinces and the list of Grain Production regions, Grain Handlers and silos (pages 11 - 14).

South African Provinces