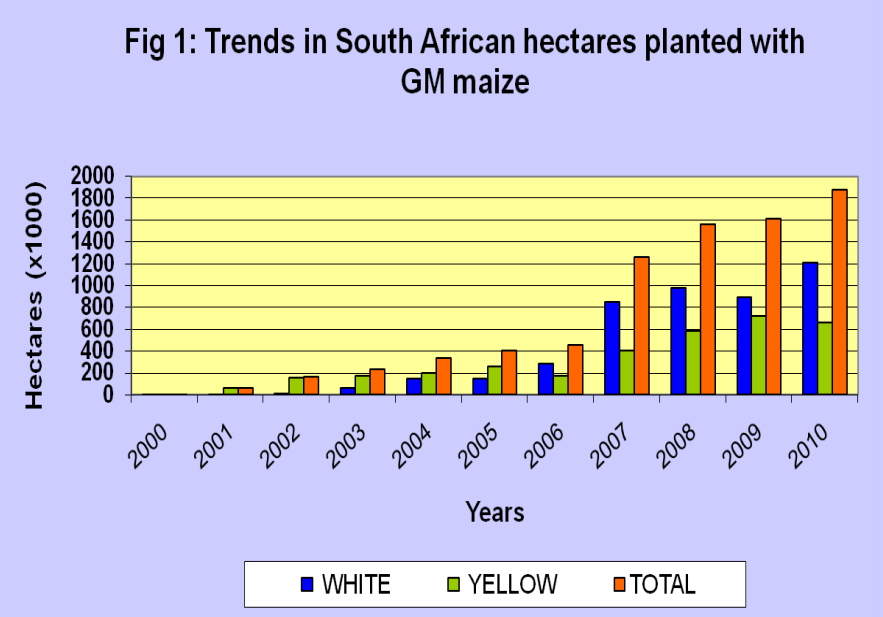
INTERIM REPORT ON THE ADOPTION OF GM MAIZE IN SOUTH AFRICA FOR THE 2009/2010 SEASON



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Pretoria, 26 March 2010

INTERIM REPORT ON THE ADOPTION OF GM MAIZE IN SOUTH AFRICA FOR THE 2009/2010 SEASON

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ACKNOWLEDGEMENTS

The author wishes to extend his appreciation to the Maize Trust that provided the funds for this survey and to all collaborators, specifically the biotech seed companies, who assisted with confidential data and inputs. The author also wishes to thank Grain SA for providing updates on historic maize crop yields per hectare, Ms. W. Jansen van Rijssen for assistance with graphics, and Dr. Ferdi Meyer of BFAP, University of Pretoria, for calculating estimated average maize grain prices.

EXECUTIVE SUMMARY

The study has a *primary objective* of surveying and analyzing GM (genetically modified) maize production that can serve as a database for stakeholders ranging from seed suppliers to producers, silo owners, grain traders, millers, food industry, consumers, and government departments. An updated overview is presented on relevant regulatory developments and analysis of permits granted. Such information may be required for imports and exports, as well as serving local markets that may have special requirements.

***The survey* is based on collating and analyzing actual seed sales data provided on a confidential basis by seed companies, calculating the hectares planted according to seeding rates for different regions, and expressing GM areas in terms of percentages of total area planted as estimated by the Crop Estimates Committee. It covers analyses by GM trait separately for white and yellow maize.**

***Global GM* crop plantings increased by 9.4% to reach 134 million hectares grown by 14 million farmers in 25 countries. The cumulative area under GM crops over 12 years stand at 950 million hectares. The US remains the global leader, followed by Brazil, Argentina, India, Canada, China, Paraguay, and South Africa retaining 8th position. Global GM maize planting covers 41.7 million hectares in 17 countries and represents 24% of all maize produced. The strongest growth in the US came from stacked traits.**

***South Africa* increased its GM area from 1.8 to 2.1 million hectares combined of the three crops: maize, soybeans and cotton, and maize comprised 87%. Producers have 79 GM maize hybrids to choose from. Total GM maize planted came to 1.878 million hectares, 1.212 million white and 0.666 million yellow, with share of the total planting at 78% of total maize, 78% for white and 77% for yellow. Insect resistance trait remained the dominant trait while stacked insect resistance and herbicide tolerance did not increase according to expectations due to seed shortage. Cumulatively, total GM maize area from 2000 to 2010 harvest**

covered 8.179 million hectares, 4.722 for white and 3.457 for yellow. GM adoption by market share and by traits was about the same for white and yellow maize.

Some 359 *permits* related to GMOs were issued in 2009 and 82% (295) involved maize. Part of this covered exports of some 10 086 MT of GM maize seed and import of 427 MT.

Hardly any *new genetic modifications* have been approved for commercial release since 2007. However, field trials are ongoing with drought tolerance and some 15 other new stacked gene combinations incorporating various insect resistance and herbicide tolerance genes. Investigations on occurrence of incidence of tolerance or resistance in stalk borers to the Bt gene continued and steps are being taken to strengthen compliance with refugia and combining new Bt genes.

Various GMO *regulatory developments* may have some to major impact on stakeholders. Updated regulations under the GMO amended Act were published. The S A Bureau of Standards is drafting standards for managing GMOs with commodity grain as focal point. The GMO Executive Council is investigating a draft policy on biosafety assessment of stacked genes, while also looking at requirements for GM grains in trading countries. Approvals for commodity clearance applications seem to stall. Laboratories doing commercial GMO detection tests now have to register with the Registrar. The Consumer Protection Act will enter into force on 25 April and its mandatory labeling of GM goods in Section 24 (6) remains contentious. New fees were published for application for permits. All of these developments will impact on agri-businesses and producers.

Finally, extensive production and consumption of GM maize have taken place over the past ten years without any substantiated incidents of damage to human or animal health, or to the environment. This should put the nail in the coffin of ongoing allegations of foods from GM not proven safe.

1. INTRODUCTION

The objective of the study was to survey and analyze adoption of genetically modified (GM) maize by producers in South Africa in order to establish an updated database on GM plantings, available to maize industry stakeholders as a source of information. Despite annual attacks by anti-biotechnology lobbyists on accuracy of statistics thus obtained, the survey results continue to be accepted as the best national estimates available on commercial GM areas planted. This information enables traders in maize grain and products to convey information to trading partners as may be required by customers, domestically and in other countries, and to comply with the Cartagena Protocol on Biosafety.

The report also covers updates on regulatory developments. These include new requirements for obtaining certificates on GMO status in consignments, registration of laboratories that conduct commercial GMO detection tests, strengthening of compliance with mandatory non-GM refugia areas, and publishing of amended Regulations that enabled the GMO Amended Act to enter into force on 26 February 2010. All of this impacts on seed companies, producers and grain traders.

Beneficiaries of this information include the following parties and their clients or colleagues:

AgriSA, GrainSA, grain traders, millers, silo industry, industrial processors, food and animal feed manufacturers and their clients, seed industry, CEC, SAGIS, SAGL, National Department of Agriculture, ARC, the GMO Secretariat, Executive Council, Advisory Committee, and the media.

Data in this report are based on reliable confidential statistics provided by biotechnology seed companies and cover hectares of GM maize planted and percentage of market with a breakdown per trait -- insect resistant (IR) or herbicide tolerant (HT) and stacked genes (IR/HR) -- shown separately for white and yellow maize, as well as historic data since year 2000 in order to highlight

trends. An analysis of permits granted during 2007 is also included as maize seed and grain imports and exports that are GM or may contain material of GM origin have trade relevance for the industry. Statistics are primarily based on commercial maize plantings. Additional information on smallholders adoption of GM maize is still being sourced.

2. METHODOLOGY AND APPROACH USED IN SURVEY

The survey goes through two stages so that information is refined with latest information available at each stage. Seed companies provide a breakdown of seed sales per GM trait (Bt insect resistance, glyphosate herbicide tolerance, and stacked genes for both traits), per white and yellow maize, and per seed density used (6-8 kg/ha for drier Western and Northern regions, 10-12 kg/ha for Eastern and South-Eastern regions, and 20-25 kg/ha for irrigation farming. Seed is mostly sold on seed count basis in pockets containing 60 000 or 80 000 seeds and, in fact, seed count gives a more accurate picture of area planted to a pocket than mass as an average rate of 10 kg/ha may involve 25 000 to 35 000 seeds, depending upon seed size and shape.

This *first estimate* completed in November 2008 of GM maize plantings was based on discussions and meetings with six seed companies that market GM seed (Pannar, Pioneer, Monsanto, Link Seed, Agricol, and Klein Karoo Saad that had acquired the seed division of Afgri). This past season was characterized by more uncertainty than in past years. Estimated seed sales based on orders received and expectations of final sales, were supplemented by the CEC intention to plant survey, Grain SA's analyses on trends and risks of increased plantings, and personal comments obtained from interviews with leading farmers and maize industry experts. Forecasts ranged from 2.2 to 2.6 million hectares. Seed sales carried most weight in coming to an average estimate of 2.4 million. However, December and January plantings pushed the area up to over 2.7 million.

NOTE:
It is expected that, when the final seed sales data and the final CEC crop estimates are in, the total GM maize area planted will

have increased beyond the 1.9 million hectares, but the GM market share might drop slightly from the data presented in this interim report's first conservative estimates.

It continues to be difficult to obtain data on smallholder/emergent farmer use of GM maize but partial information is being supplied by some companies this market and will be included in the final report.

3. RESULTS

3.1 Global overview

Annual overviews are compiled by ISAAA (the International Service for the Acquisition of Agri-Biotech Applications), an international non-profit organization. These overviews are released by way of international media conferences and published as Briefs. Salient points from the 2009 Brief 41 (C. James, 2009, "Brief 41: Global Status of Commercialized Biotech/GM Crops: 2009", available in executive summary format on www.isaaa.org) are updated from 2008 as follows:

- **Global planting of GM crops increased from 125 to 134 million hectares (9.4%) in 2009.**
- **These crops were planted by 14 million farmers in 25 countries, 13 million being smallholder farmers.**
- **Cumulative area under GM crops since 1996 now amounts to 950 million ha, double the 2005 cumulative area.**
- **For 2009, the USA leads with 64.0 million ha, followed by Brazil 21.4, Argentina 21.3, India 8.4, Canada 8.2, China 3.7, Paraguay 2.2, and South Africa with 2.1 million ha. The remaining 17 countries (in order of magnitude) are Uruguay, Bolivia, Philippines, Australia, Burkina Faso, Spain, Mexico, Chile, Colombia, Honduras, Czech Republic, Portugal, Romania, Poland, Costa Rica, Egypt, and Slovakia.**

- **Developing countries planted 46% of total GM area.**
- **In addition to the 25 countries growing GM crops, another 32 have approved products from biotech crops for import as food and/or feed, and/or for trial planting. These 762 approvals involve 155 genetic modifications in 24 crops.**
- **Soybean remained the major GM crop (69.2 million ha = 77% of global 90 million ha), followed by maize (41.7 million ha = 24% of global 158 million ha), cotton (16.1 million ha = 49% of global 33 million ha) and canola (5.9 million ha = 21% of global 31 million ha).**
- **The major trait was herbicide tolerance at 62% share of total 134 million ha GM, followed by double and triple stacked traits at 21%, and insect resistance at 16%.**
- **Cumulative farmer benefits for 1996 - 2008 were US$ 52 billion, and pesticide savings amounted to 356 000 MT active ingredients.**
- **Most growth in adoption now comes from developing countries, driven by Bt cotton in China and India, and soybeans in Brazil. India is field testing vegetables (brinjal, cabbage, cauliflower, okra, potato) and agronomic species (cotton, maize, sorghum, groundnuts, rice). China is field testing GM petunia, tomato, papaya, sweet peppers, poplar, rice, and maize.**
- **Future GM growth will come from new countries, new traits and new crops like rice.**

GM maize global production on 41.7 million ha (24% of global maize) took place in the US, Argentina, Brazil, Canada, South Africa, Uruguay, Philippines, Spain, Chile, Honduras, Czech, Romania, Portugal, Poland, Slovakia, and Egypt (in declining order of area planted). Egypt's entry into growing Bt maize was based on cooperation with South Africa and joint development of the GM hybrid.

The US remained the major maize producer by far and its 34 million ha GM maize comprised 50% triple stacked traits. Brazil commenced with three GM maize hybrids in 2008 and by 2009

planted 5 million ha or 38% of its total maize area. Eleven genetic modifications ("events") have been approved for release. Maize production in Argentina declined to 2.58 million ha in favour of soybeans and 83% of this maize is GM of which 50% is stacked traits. Nine events have been approved.

The global trends are shown in Figure 1 below, and Figure 2 and Figure 3 on p.10.

FIGURE 1

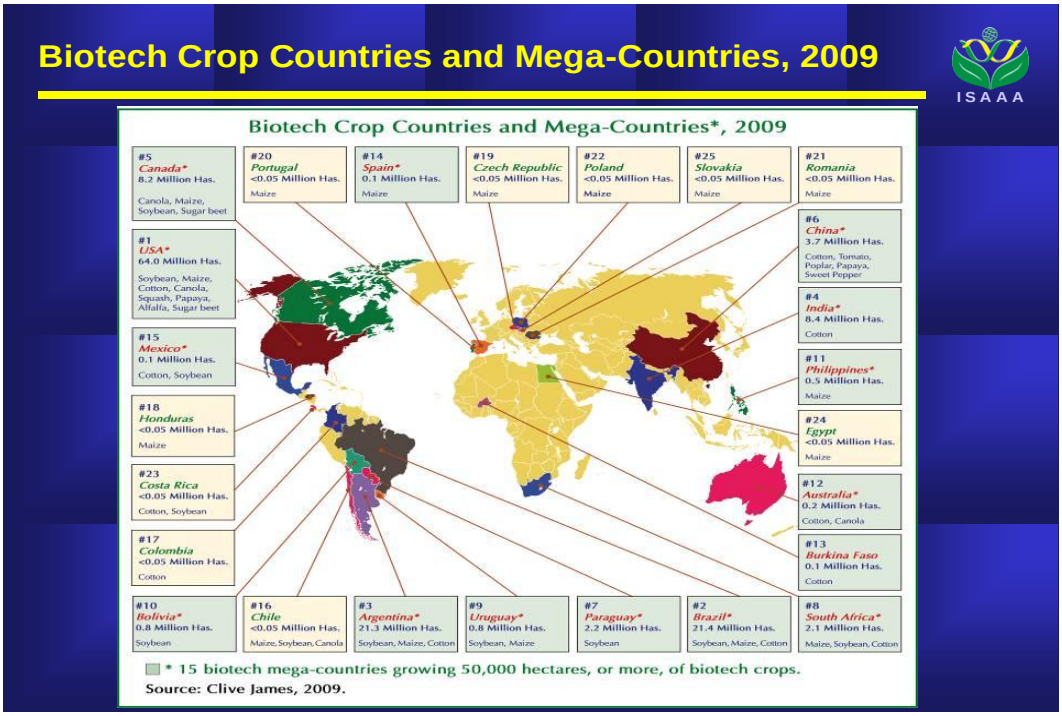


FIGURE 2

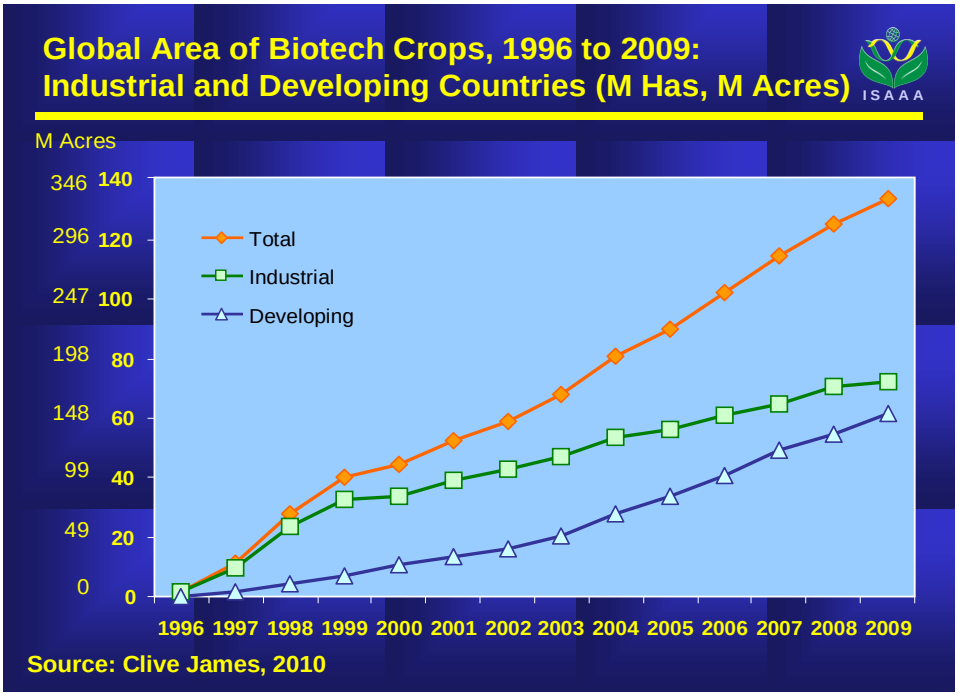
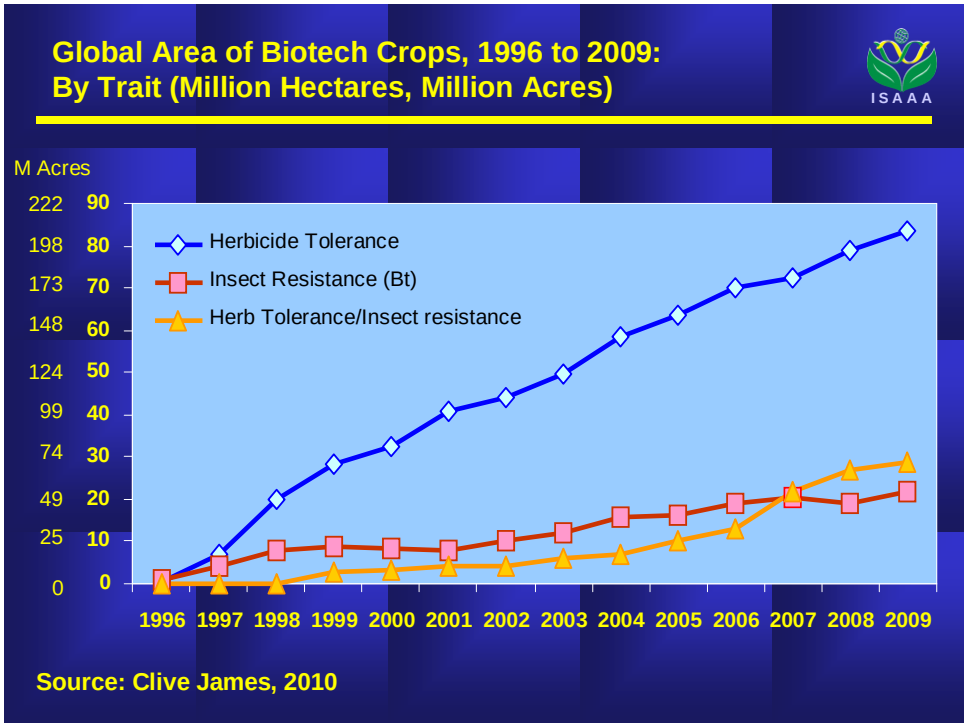


FIGURE 3



3.2 South African overview, results and discussion

The final estimate of genetically modified maize (GM) plantings was based on discussions and meetings with seed company representatives (Afgri, Agricol, Klein Karoo Saad, Linkseed, Monsanto, Pannar, and Pioneer) that are marketing GM maize seeds and/or GM technology. Klein Karoo Saad had acquired the seed operation of Afgri in 2009. Syngenta is a biotechnology developer and licenses its genetic traits rather than directly marketing its seeds in South Africa.

3.3 Genetic modifications (events)

South Africa retained its 8th ranking on the ISAAA list of biotech crop countries with 2.1 million ha planted in 2007 of which 1,9 million or 86% is maize, most of the balance is herbicide tolerant soya plus a minor area under GM cotton.

Maize genetic modifications approved for commercial release are:

1997/8: Bt insect resistance Mon 810, Monsanto

- **2002: RR glyphosate tolerance NK 603, Monsanto**
- **2003: Bt 11 insect resistance + herbicide tolerance, Syngenta**
- **2007: Bt insect resistance + glyphosate tolerance, Mon810 x NK603, Monsanto.**
- **2007: Bt insect resistance + herbicide tolerance, MON 00603-6 x MON 00810-6**

3.3 GM hybrids and intellectual property protection

Modern varieties and hybrids enjoy three types of intellectual property protection, apart from relevant provisions agreed upon in contractual agreements between seller and buyer. These cover patent rights only on the components and technologies associated

with the specific genetic modification trait (in terms of the Patents Act), trade marks such as YieldGard® (under the Trademark Act), and plant breeders' rights on the cultivar (under the Plant Breeders Rights' Act). Research, innovation and development of products having benefits for society in their application, enable the innovator to enjoy certain protection and deriving benefits as prescribed in the Universal Declaration of Human Rights.

In the case of GM cultivars, it is more than a legal provision: (a) conditional approvals for commercial cultivation granted under the GMO Act require post-release monitoring of the GM crop by the producer and the seller, (b) knowing who is growing GM crops is necessary for separation of conventional and GM grains, and to manage cross-pollination, (c) progenies of GM crops (= grain) may segregate for the novel traits so that management of the next generation crop may be compromised, and, finally, (d) protection offers an opportunity for innovators to recoup research investment by way of royalties. None of these cornerstones can function when farm-saved material is used for replanting.

Entries of GM maize hybrids on the official 2009 list of over 2 000 cultivars that enjoy plant breeders' rights under the Plant Breeders Rights Act 15 of 1996 show that a total of 175 maize cultivars have plant breeders' rights of which 79 are GM hybrids. Of these, 42 carry the Bt insect resistant trait, 19 the herbicide tolerance trait and 18 have both traits stacked.

3.4 *GM maize adoption in 2009/2010*

South African area planted in 2009 to GM crops rose by 19% to reach 2.145 million hectares, thereby maintaining its number 8 position amongst the 25 countries that grow commercial GM crops. Maize has increased from 1.688 million hectares in 2008/9 to 1.878 million this season, an increase of 11.3%, and comprised 87% of total South African GM area, soybeans making up 12% and cotton 1%. It is anticipated that the GM maize area may further increase by as much as 100 000 ha when the final survey is completed on actual seed sales, this being due to the larger than expected commercial planting.

White GM maize increased by 16% over last season to reach a 78% share of the total white area. The biotech traits were made up of 81.2% Bt single gene, 9.6% herbicide tolerant single gene, while the combined stacked traits dropped to 9.2%. This sudden reverse trend in stacked market share was due to recall of several top hybrids and inadequate seed supplies of other stacked gene hybrids.

In the case of yellow GM, the area increased by 3.7% due to the swing towards white maize, and comprised 77% of the yellow area. The biotech shares amounted to 48.9% for single Bt, 23.0% for singe herbicide tolerance and 28.1% for stacked traits. The latter shows where white stacked share would have stood if adequate seed had been available. A second observation is that, although yellow GM had a three-year lead on white GM maize introduction, subsequent growth in adoption and trends in traits were the same for white and yellow maize.

3.5 Adoption trends of GM maize over 11 years.

Cumulatively, 4.722 million commercial hectares of white maize had been grown since 2002, 3.457 million of yellow and a combined area of 8.179 million. Details are shown in Table 1 below and Table 2 on p.14.

TABLE 1: AREA PLANTED TO GM WHITE MAIZE
2000-2010 HARVEST YEARS BY TRAITS (HECTARES x 1000)

YEAR	Bt	HT	Bt + HT	TOTAL
2000	0	0	0	0
2001	0	0	0	0
2002	6	0	0	6
2003	60	0	0	60
2004	144	0	0	144
2005	142	5	0	147
2006	221	60	0	281
2007	712	139	0	851
2008	696	218	61	975
2009	660	160	226	1046
2010 *	984	117	111	1212
TOTAL	3625	699	398	4722

TABLE 2: AREA PLANTED TO YELLOW MAIZE
2000-2010 HARVEST YEARS BY TRAITS (HECTARES X 1000)

YEAR	Bt	HT	Bt + HT	TOTAL
2000	3	0	0	3
2001	59	0	0	59
2002	160	0	0	160
2003	176	0	0	176
2004	197	0	0	197
2005	249	14	0	263
2006	107	68	0	175
2007	391	137	0	528
2008	406	159	23	588
2009	376	159	107	642
2010 *	326	153	187	666
TOTAL	2450	690	317	3457

Note: Bt = insect resistance; HT = herbicide resistance, Bt + HT = stacked traits
*** = Provisional estimates for 2010**

More detailed analyses will be contained in the final report.

3.6 GM traits under test

Field trials are ongoing with existing approved genetic modifications ("events") in new hybrid combinations, and with new events not yet approved for commercial release. The latter include the following (IR = insect resistance, HT = herbicide tolerance):

- **Drought tolerance trait in third year of testing (Monsanto 87460)**
- **Repeat testing maize 98140 (tolerance to glyphosate and ALS inhibiting enzymes (Pioneer)**
- **Repeat testing stacked traits, 98140 x Mon810 (Pioneer)**
- **Repeat testing TC1507, stacked IR+HT (Pioneer)**
- **Repeat testing NK603 (Monsanto)**
- **MON 89034, IR**
- **MON 89034 x NK603, stacked IRx HT**
- **GA21, HT (Syngenta)**
- **Bt11 x GA21, stacked IR x HT (Syngenta)**
- **TC1507 x MON810, IR + HT (Pannar)**

- **Maize 59122, IR (Pioneer)**
- **Bt 11, IR + HT(Pannar)**
- **TC 1507 x MIR162, IR + HT(Pioneer)**
- **Maize 98140 x TC1507 x MON810, IR+ HT (Pioneer)**
- **TC1507 x MIR162 x NK603, IR + HT (Pioneer)**
- **TC1507 x MON810 x MIR162, IR + HT (Pioneer)**

NOTE: It is required under international guidelines that each genetic modification (event) carries a unique identifier code as indicated above. Although some stacked trait combinations seem to be the same, they may be inserted on different chromosomes and in different hybrid genetic backgrounds, both which may affect efficacy of trait expression; hence, the need for extensive field testing. The use of these events is subject to licensing and cross-licensing agreements.

Seed companies are in the process of testing hybrids for water use efficiencies, using conventional and GM breeding techniques. There is also an international public-private initiative on developing drought tolerance maize for Africa called WEMA (Water Efficient Maize for Africa) to this effect. Another international consortium is the IMAS project that aims to develop maize hybrids with improved efficiencies in uptake of nutrients from degraded African soils.

3.7 Analysis of GMO maize permits

Implementation of the GMO Act and its regulations is based on a permit system. Permits are required for imports and exports of both commodities and seeds (and microbes, vaccines), GMOs for contained use in laboratories and greenhouses, field trials or seed for multiplication and breeding, and general conditional releases for commercial planting.

The permits issued in 2009 numbered 359 of which applications for maize came to 295 or 82% (cotton only 27 and soybeans 12). Most maize permits dealt with small samples for research, breeding, multiplication or parental lines for seed production. As

in 2008 and 2009, GM maize seed for sales grew in importance with 427 MT being imported and 10 086 MT being exported.

There seems to be no record of permits having been granted for import of GMO commodity maize grain. The reason may be two-fold: firstly, the 2009 and current expected local surplus production and, secondly, the regulatory stance on not approving grain containing traits that do not have benefits for South Africa (corn rootworm Bt). The standard procedure is for the technology owner to apply for commodity clearance for grains that may contain a defined set of genetic events. If approved, it paves the way for grain traders to apply for import permits. Various applications for commodity clearance are in process at the GMO Executive Council but they are either on hold or have been referred back to the applicant for response to questions.

3.8 Incidence of potential stalk borer resistance to Bt maize

Further monitoring of incidences of apparent resistance of stalk borers to the Bt gene was ongoing during the 2008/9 season. Most cases involved high density irrigation production where inadequate steps had been taken for planting of refugia with conventional maize. Seed companies generally provide a small free sample of conventional maize in each pocket of Bt maize.

A joint workshop with the Department of Environment, Department of Agriculture, ARC and North-West University scientists, and biotech stakeholders drafted the following recommendations:

- **That biotech seed companies ensure more stringent monitoring of planting of refugia**
- **That inspectors of the Department of Agriculture increase their monitoring of Bt maize plantings**
- **That approval of stacked Bt genes for commercial use be expedited**
- **That different Bt genes be used and that combinations with GM and bio-control against insects be considered.**

3.9 Regulatory developments

The GMO Act is comprehensive and its scope covers all genetic modification technologies, as defined, on all organisms, from registration of facilities where GMO work is done to application on-farm. Approval for GMO activities is based on a permit system.

Salient points of new regulatory developments can be summarized as follows and practical implications are to be analyzed for inclusion in the final report:

- **The GMO Act 15 of 1997 had been amended in 2007 to accommodate aspects of the Cartagena Protocol on Biosafety, to update definitions and amend various aspects in general contents. The much delayed amended regulations have been published and the President signed the amended Act to enter into force on 26 February. At first glance it seemed that certain proposals submitted by stakeholders have been ignored and that other new requirements can be questioned.**
- **The Registrar of GMOs is in process of required registration of all laboratories rendering GMO detection and analysis commercial services.**
- **The Registrar also requires from grain exporters a certificate of testing by a registered lab on the GMO status of the consignment. Presence of GM components under 1% is considered non-GM.**
- **New rates for permit applications have been published for 2010.**
- **Grain traders should take note of compliance with requirements of the Protocol, notably the Advance Informed Agreement from the importing country (= prior informed consent = import permit) and Notification of shipment, apart from identification, packaging, handling, storage requirements of consignments that are or may contain GM contents.**
- **The contentious inclusion of mandatory labeling in the published Consumer Protection Act para 24 (6) has been kept in its original format without recognition of objections**

submitted by members of the food chain. The paragraph reads:

"In addition to the requirements of section 28, any person who produces, supplies, imports or packages any prescribed goods must display on or in association with the packaging of those goods a notice in the prescribed manner and form that discloses the presence of any genetically modified ingredients or components of those goods in accordance with applicable regulations".

- **The South Africa National Standards division of SABS is proceeding with drafting of standards related to management of imports that may contain events not yet approved in South Africa. What started as a draft for managing imported commodity GM grains, moved to consignments having unapproved events, and now moved to GMOs and their products, components and derivatives. This move into trade issues may be seen as a risky adventure.**
- **Other issues under consideration by regulators include proposals for managing biosafety assessments of stacked traits, requirements for GM commodities in trade partner countries, and pollen flow studies. The latter is being conducted by Department of Environment in collaboration with Norway, a questionable arrangement.**

3.10 Media coverage

Media coverage on the South African GM maize adoption (including cotton and soya beans) was combined with the annual ISAAA global report release that took place in February. The South African information conveyed was based on the first survey completed in October and extensive exposure was obtained in printed and radio media. The latter included some six live radio interviews. A more complete report on media coverage will be contained in the final report.

Mention was made of the Maize Trust support for the survey. The standard allegations by anti-biotech lobbyists were repeated: the ISAAA and the local statistics were labeled fraudulent, foods from GM plants have not been proven safe,

multinationals will control the food chain, farmers lose the right to save seed, etc. In this process reference was also made to the Maize Trust.

END ==========

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========== ANNEXES TO FOLLOW IN FINAL REPORT