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Report Highlights:

South African farmers plant genetically modified (GM) corn, cotton and soybeans. South Africa's acreage of GM crops account for approximately 92 % of South Africa's cotton, 44% of corn, and 59% of soybeans.

Clearly GM products have a wide appeal with South African farmers. They appreciate that GM crops use fewer inputs and have higher yields, and are easier to manage than traditional varieties.

Includes PSD Changes: No
Includes Trade Matrix: No
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SECTION I. EXECUTIVE SUMMARY

The South African Government generally supports biotechnology: transgenic varieties of cotton, corn and soy are approved for commercial planting and account for approximately 92 % of South Africa's cotton, 44% of corn, and 59% of soybeans.

U.S. agricultural interests in South Africa are wide-ranging and diverse. Wheat is the main U.S. export, followed by many other bulk, intermediate and consumer ready products. Those affected by biotechnology issues are corn, soybeans and seeds (corn, cotton and soybean). Food aid passage through South Africa to other destinations can also be affected by South Africa's GMO policies.

South African biotechnology regulatory matters are discussed and decided by an Executive Council with representatives from eight departments. An Advisory Committee consisting of experts from around the nation carry out risk analysis on biotech products and give their recommendations to the Council for the final approval of any biotech product. The advisory committee and the Council do not meet frequently and so decisions are often delayed. Still, the regulatory structure in general is very progressive and several genetic transformation events have received approval for commercial planting. However, recently there have been some public objections from anti-GM lobby groups. These groups are demanding unscientific information from the GMO Registrar's office of the National Department of Agriculture and have effectively slowed the process for new approvals.

South Africa can play a vital role as other countries in Africa develop biotechnology policies because it has the most resources, such as scientific expertise and financial support, as well as a progressive regulatory system. Without the South African Government's leadership role in this region, the progress in agricultural biotechnology, or for that matter any technology, can be stifled by anti-technology groups.

SECTION II. BIOTECHNOLOGY TRADE AND PRODUCTION

South Africa's commercial production of GM crops

South African farmers plant genetically modified (GM) corn, cotton and soybeans. According to the International Service for the Acquisition of Agri-Biotech Application (ISAAA), South Africa's (SA) acreage of GM crops rose to 1.4 million hectares in 2006[1], placing the country eighth among the top fifteen growers of GM varieties.

Industry analysts estimate that cotton has seen the highest rate of adoption with 92% of the local crop now GM. The SA industry was also quick to adopt new GM cotton seed with stacked traits of insect resistance and herbicide tolerance that were approved in September 2005. Stacked varieties constituted 40% of cotton planted last year, while varieties with only insect resistance constituted 39% and those with herbicide tolerance 13%.

Thanks to high maize prices, total maize plantings in South Africa in 2006 increased by approximately almost 60% in both yellow and white varieties. Out of the total yellow and white maize plantings, totaling 2.7 million hectares, 44% was planted to biotech varieties. South Africans usually use yellow maize to feed animals and white maize to feed people. Pap, a grits- like porridge made from white maize, is the staple starch for most South Africans. Of the total 1.2 million hectares of biotech maize, 77% was Bt and 23% was herbicide tolerant.[2]

A South African product manager for a U.S. GM company in SA reports that about 8,000 commercial and about 2.4 million subsistence farmers in South Africa currently plant GM corn and will continue to do so.[3]

Total plantings of soybeans for 2006 were down slightly as farmers substituted maize for soybeans thanks to high maize prices. About 79% of the 214,000 soybean hectares are GM.

GM crops under development in SA

SA's Biotech industry is still embryonic. With about 40 core biotech companies, none of them listed, the country is not yet a real rival to other developing markets such as India. "Development has been random and crosses many disciplines," says Mark Fyvie, CEO of Cape Biotech, a government-funded body that promotes biotech development. "Most companies could be described as medium tech and product-oriented, rather than cutting-edge technology companies."

He goes on to say that SA is developing pockets of excellence. For example, SA has a unique and rich biodiversity, making bio-prospecting one area in which SA can compete.[4]

There are no crops under development in South Africa that will be on the market in the coming year. South African scientists in both the private and public sectors are working on GM products designed to meet Southern African market demands. They are researching new varieties of GM corn, melon, millet, lupins, soybeans, strawberries, sugar cane, cotton, apples, tomatoes, sorghum, wheat, potatoes and grapes.

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[1] James, Clive 2006
[2] ISAAA Brief 35
[3] Pretoria News, Bruce Venter, August 30, 2005
[4] Pile, Jacqui Financial Mail November 2005

Bio-Prospecting Partnership Cape Biotech is investigating a possible bio-prospecting partnership that would enable South Africa, Brazil and India to share each other's resources in order to capitalize on their rich biodiversity.

Delegates from all three countries met in August 2005 and signed a bio-prospecting memorandum of understanding. The collaboration will rollout in three stages: sharing and learning, exchanging technologies and technology transfer, and eventually shared facilities among the three countries, but this will only be potentially possible once the alignment of national policies has begun.[5]

Transgenic Sorghum In July 2006 South Africa's biotechnology Executive Council turned down an application by the Council for Scientific and Industrial Research (CSIR) to conduct laboratory and greenhouse experiments with transgenic sorghum in South Africa. Recent press coverage suggests that this decision may be reversed if the researchers can demonstrate suitable containment. Denial of a permit would make South Africa a less active partner in the collaboration between CSIR and eight other African research organizations in a $17 million project to develop a more nutritious, genetically engineered sorghum.[6]

Using genetic engineering and conventional plant breeding methods, the scientists hoped to develop a more easily digestible strain of sorghum with increased levels of vitamins A and E, iron, zinc, and essential amino acids. Kenya-based Africa Harvest Biotech Foundation International will continue to lead the research.

No GMO yeast in SA wine:
On May 8, 2007 South Africa's Executive Council for Genetically Modified Organisms voted against an application to permit the use of genetically modified yeast in winemaking in 20 wine- producing regions of the western and southern Cape. Professor Hennie van Vuuren, director of the British Columbia Wine Research Center at UBC in Vancouver, Canada, submitted the application in early 2006. Professor van Vuuren wanted to apply genetically enhanced malolactic wine yeast ML01 for the commercial production of wine in South Africa.

The yeast application was controversial and opposed by, among others, the South African Wine Industry Council and the GMO watchdog Biowatch South Africa, whose formal objection to the application was supported by 12 winemakers, including high-profile players like Anthony Hamilton Russell of Hamilton Russell Vineyards and Anton du Toit of Lourensford and Lanzerac Wines.

According to a January 8, 2007 in the Cape Argus newspaper, Biowatch claims that permitting this would likely result in "disastrous consequences".

"There is a ban on genetically modified wine and overwhelming rejection of all genetically modified food and drink by consumers in Europe, an important export market for South African wine," it states. "The application ... is likely to engender general suspicion among consumers, especially in South Africa's key export markets. It is also likely to jeopardize the organic wine sector."

Biowatch further claims that there is a: "real possibility" that the GM yeast could contaminate microbial diversity of areas outside the wineries, such as through waste disposal, and might also have negative impacts on human health."

[5] Mail and Guardian August 2005

[6] African Center for Biosafety July 10, 2006

After the vote a member of the South African GMO Executive Council said that the Council voted against the yeast due to economic, not scientific concerns. When asked whether it might be better to let winemakers decide whether it made economic sense to use the technology, the person didn't reply.

GM crops that SA imports
South Africa imports several GM crops/products from the United States. Please see Appendix A for the complete list of approved varieties.

Food Aid Policy
South African policy makers feel that they don't need food aid, as they are a surplus producer, and SA does not currently accept food aid donations. In fact, SA donated corn to Zimbabwe in 2003 during that country's famine.

However, U.S. food aid destined to Lesotho, Malawi, Swaziland, Zambia and Zimbabwe ordinarily passes through the port of Durban, South Africa. In order for the shipment to pass through South Africa, the GMO Registrar's Office requires several measures:

- Advance notification so that proper containment measures can be taken;
- Letter from the recipient country stating that they accept the food aid consignment and that they know that it contains GMOs;
- Milling near the port. Southern African Development Community (SADC) regulations state that if food aid has biotech content then it must be milled.

GM Crops and the US Regulatory System
South Africa does not commercially produce any biotechnology crops that were developed outside of the United States at this time. Some in the pipeline, namely the Bt potato, developed in a partnership between the Agricultural Research Council (ARC), and Michigan State University (MSU), and drought resistant soybeans could be planted commercially in the next few years.

SECTION III. BIOTECHNOLOGY POLICY

The South African Government generally supports biotechnology and encourages home-grown research. One way they support local GM research is through three regional biotech innovation centers in KwaZulu-Natal, Western Cape and Pretoria, Gauteng. Since 2003 the Department of Science and Technology budgeted about $72 million to fund six biotechnology research centers.

GMO Act South African biotechnology policy is formulated under the Genetically Modified Organisms (GMO) Act of 1997, modified by the Cabinet in 2005 in order to bring it in line with the Cartagena Protocol on Biosafety and again this year in order to address some economic and environmental concerns (more on this topic below). Environmental laws put into effect in 2004 have the potential to make the GMO approval process slower and more involved. Meanwhile, the Department of Science and Technology, under the National Biotech Strategy, continues to support biotech programs, local courts continue to uphold protection of business confidential information in GMO applications, and the regional group New Partnership for Africa's Development (NEPAD) is pursuing numerous biotech projects, and plans to host its center of excellence for Southern Africa in the Republic of South Africa.

Under the GMO Act, SA's Executive Council, responsible for making regulatory decisions, is comprised of six members: one representative from six government ministries (Agriculture

(DoA), Science & Technology, Health, Environmental Affairs & Tourism, Trade & Industry, and Department Labor, the chair of the Advisory Committee who provides scientific and technical analysis of risk assessment data, and the GMO Registrar, an official from DoA responsible for administering the Act. Due to recent changes in the GMO act, the EC now includes new members from the Departments of Water Affairs & Forestry, and Arts & Culture.

Recent Amendments to the GMO Act April 2007 the President signed in to law amendments intended to improve certain administrative aspects of the act and to ensure compliance with the Biosafety Protocol. The Parliamentary Portfolio Committee on Agriculture met in January 2006 to discuss proposed changes to the GMO Act. Lobbyists from industry, research institutions and environmental organizations bombarded legislators with highly polarized arguments including calls for tighter regulations. However the committee is only seeking to make relatively technical amendments to the Act.

Industry and research organizations are concerned that the GMO Act's jurisdiction needs clarification because both the Biodiversity Act, and the National Environmental Management Act claim authority over the GMO Act on environmental issues; this could create two regulatory paths and unnecessary duplication.

GM Commodity Clearance process stalled In response to Grains SA's (a farmers union) complaints over low grain prices last year, the EC agreed to commission a study by the department of Trade and Industry (DTI) on the potential impact of the commodity clearance of GM imports on South Africa trade. All current and new applications to the GMO Registrar's office for "commodity clearance" (as apposed to products intended for "general release" such as the stacked gene in maize) approval of GM grain are pending the outcome of this study. DTI's mandate is to ascertain the trade and price implications of the importation of GM maize. The study was supposed to be completed in March 2006 and government sources reportedly hope that it will be completed before 2007[7]. South African livestock producers hope the study is done soon so that they can import cheaper feed. South African Government insiders do not believe the embargo will be lifted because they believe "local farmers and consumers will suffer" when governments allow imported products to enter the country. They claim that food processors and retailers lower commodity prices paid to farmers, but do not pass savings on to consumers. South Africa is a signatory to the Cartagena Protocol on Biosafety, which instructs members not to impede trade in GM crops for "socio-economic" reasons, not based on science.

National Biodiversity Act This environmental legislation may have a significant impact on the GMO approval process. The National Biodiversity Act, which went into effect September 1, 2004, gives significant powers to the Minister of Environmental Affairs & Tourism (DEAT) on Biosafety issues. The law states, "If the Minister has reason to believe that the release of a genetically modified organism into the environment under a permit applied for in terms of the GMO Act, may pose a threat to any indigenous species or the environment, no permit for such release may be issued in terms of that Act unless an environmental assessment has been conducted…" Under provisions of other legislation on Environmental Impact Assessments (EIA) the GMO Act does not define "environmental assessment" and in giving special powers to the Minister, the provision does not appear to be consistent with the GMO Act (which gives similar powers to the Executive Council on which DEAT is represented). This inconsistency could create grounds for appeal of all GMO regulatory decisions, effectively slowing down the GMO approval process.

[7] www.nda.agric.za

National Biotechnology Strategy for South Africa This national strategy, implemented in 2003, was designed to stimulate the growth of biotech innovation in SA. The strategy goes a long way towards removing the uncertainties that have existed in SA for more than ten years, and which have delayed local and foreign investment in biotechnology. An official policy statement did not accompany the release of the Strategy document on biotechnology and many key decision makers (particularly in government) appear not to be completely aligned with the strategy.

The Department of Science and Technology (DST), was given the mandate to implement the strategy. This mandate has four 'legs':

- Development of world class bioscience R&D appropriate to SA strategic needs
- Creation of appropriate infrastructure and Technology Platforms
- Creation of necessary innovation support mechanisms
- Addressing the public awareness of biotechnology

Implementation of the strategy included establishment of six strategic instruments as key drivers of innovation and commercialization in the field of biotechnology. The instruments are as follows:

- Three Biotechnology Regional Innovation Centers (BRICS): LIFE*lab* (East Cost region), Cape Biotech (Western and Northern Cape) and Biopad (North and Central South Africa). Since 2003 DST has spend about $71 million on these centers.
- A National Innovation Center on plant biotechnology (PlantBio) for developing plant biotechnology in SA, with a focus on food security issues.
- A technology platform named National Bioinformatics Network (NBN) to establish and maintain national databases on biotechnology and health.

SA Department of Science & Technology Advancement/SAASTA – Public Understanding of Biotechnology Program (PUB) Another part of the National Biotech Strategy is the Public Understanding of Biotechnology Program. This program (initiated in 2003) focuses primarily on youth. The overall aim of the PUB program is to promote a clear understanding of the potential of biotechnology and to ensure broad public awareness, dialogue and debate on its current and future applications. In 2005 PUB conducted a comprehensive Biotechnology Survey. For more survey information please read Section IV of this report.

Biotechnology and the Region

The South African Government aligned itself with fourteen other Southern African nations to come up with a common regional biotechnology policy. The fourteen SADC member states are Angola, Botswana, Democratic Republic of Congo, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, South Africa, Swaziland, Tanzania, Zambia and Zimbabwe. The guidelines were developed in August 2003 at a Southern Africa Development Community (SADC) meeting and cover areas such as policy development and regulation of GM crops and GM food, the handling of food aid, and measures to increase public awareness of biotechnology and biosafety.

The guidelines assert that the region and its nations should develop compatible policy and regulatory systems that are based on either the Cartagena Protocol on Biosafety, or the African Model Law on Biosafety. The heads of member states also agreed to develop national biotechnology policies and strategies, and to increase their efforts to establish national biosafety regulatory systems. Member states were also urged to commission

studies on the implications of biotechnology for agriculture, the environment, public health and socio-economic impact[8].

SADC countries should emulate the regulatory approached pursued by developing-country leaders such as China, Argentina, Brazil, India and their regional leader, South Africa. These countries have realized the importance of being part of the biotechnology revolution and have invested in research and development, commercialized GM crop production and have established regulations that seek to promote the technology while minimizing risks to the environment.[9]

Considering the pressing humanitarian needs, Africa cannot afford to be embroiled in politicized debates over GM. Its position in international negotiation forums such as the Cartagena Protocol on Biosafety should be informed by domestic imperatives and aspirations to achieve food security. South Africa could play a leadership role as SADC's biotechnology policy develops by steering member states toward scientific analysis.

Field Testing

South Africa does allow field-testing of GM crops. According to a recent court ruling, the DoA must inform the public which crops are currently undergoing field trials in SA but does not have to provide details about where the trials are taking place.

In 2006, the DoA issued about 20 permits for GM field trials. Most of these permits were for corn, with a few for soybeans, potato and sugarcane. The DoA's Office of the GMO Registrar chose not to estimate the time to commercialization at the time of this report.

Stacked Events

SA requires an additional approval for a plant that combines two already approved traits, such as herbicide tolerance and insect resistance. This requirement means that companies effectively need to start from the beginning of the approval process for stacked events, even when the individual traits have already been approved.

In October 2005 Monsanto received DoA approval to launch stacked-gene cotton in South Africa. The seed combines an insecticide with a built-in resistance to weed-killer. "Farmers were looking for both traits in the same crop," said Wally Green, Monsanto spokesman, explaining why Monsanto developed the stacked-gene cotton.[10] The stacked-gene variety was created using conventional breeding techniques in which hybrid cotton was created by crossing insect-resistant plants with herbicide-tolerant ones.

In March 2007 Monsanto SA received "general release" permit clearance in terms of the GMO Act of 1997. We applied via the Directorate Genetic Resources of National Department of Agriculture for the general release of genetically modified maize that contains two traits in the same hybrid (stacked hybrid). The traits are insect resistance and herbicide tolerance (MON810 x NK603). Monsanto decided to market the stacked maize product in South Africa after the farmers' positive response to the cotton stacked gene seed.

Coexistence between biotechnology and non-biotechnology crops

Coexistence has not been an issue that has necessitated the introduction of specific guidelines or regulations in South Africa. Currently, there is no market in SA for organic corn, soybeans or cotton. The "organic" classification is limited to fruits and vegetables.

[8] www.sadc.int

[9] Khumalo, Nkululeko and George Naphambo Business Day May 2006

[10] Business Day July 2006

South African farmers do grapple with the issue of co-existence on the same farm, especially when growing both yellow and white corn. White corn, which is primarily for human consumption, often commands a higher price/ton than yellow and tolerates a 3% adventitious presence of yellow kernels before it is down graded to the price of yellow corn. In order to protect their white corn, farmers utilize spatial or temporal isolation to restrict cross-pollination. For example, if a farmer were contracted to produce non-transgenic corn then he would discuss this issue with a neighbor or plant a buffer zone of corn between plantings if the surrounding corn is transgenic. The government leaves the management of the approved GM field crops to the farmers. Soybeans and cotton, the only other two approved transgenic crops, are virtually self-pollinating and therefore are not a concern for contamination.

Labeling

Health regulations published in 2004 largely follow Codex Alimentarius scientific guidelines. They mandate labeling of GM foods only in certain cases, including when allergens or human/animal proteins are present, and when a GM food product differs significantly from a non-GM equivalent. The rules also require validation of enhanced-characteristic (e.g., "more nutritious") claims for GM food products. The regulations do not address claims that products are GM-free.

Biosafety Protocol

SA has signed and ratified the Cartagena Protocol on Biosafety (CPB). The primary responsibility for implementing the CPB has shifted from the Department of Environmental Affairs and Tourism to the Department of Agriculture (DoA). CPB implementation is meant to be gradual, and accordingly DoA's implementation will be in phases, with the most significant issues being handled first. SA, under the leadership of DoA's GMO Regulatory Office, has modified its GMO act to comply with the CPB.

The CPB will likely slow down trade with its additional bureaucratic requirements but will likely not diminish trade in GMOs in the long run.

Biotechnology Related Trade Barriers

For stacked events companies need to start from the beginning of the approval process, even when the individual traits have already been approved. The lengthy process, more than the actual legislation, is a barrier for exporting U.S. GM products to SA. For example, it is very difficult to export U.S. corn to South Africa because they haven't yet approved several varieties that are grown in the U.S.—without including stacked events. SA isn't opposed in principle to these events; they just haven't made it through the regulatory approval process yet.

The DTI's study is holding up approvals for new GM events in the GMO Registrar's office (more on this topic on pg. 9 of this report). Also, the GMO Registrar of the past 3 years has moved on to a new position with a private company. Industry and scientific insiders expressed concern that it will take the DoA many months to find and hire a qualified GMO Registrar, meanwhile applications will be piling up and approvals will be at a standstill.

There is no pending legislation that will further affect U.S. exports.

Technology Fees

Biotechnology companies operating in South Africa follow essentially the same procedure for collecting technology fees that they follow in America. This policy generally works because South Africa is a signatory to the Trade-Related Aspects of International Property Rights (TRIPS) agreement of the WTO. Trade sources relate that cotton and corn are such that

farmers have to buy new seed every year. Farmers sign a one-year licensing agreement, and the technology fee is included in the price of the bag of seed for these crops. Soybeans are more difficult. Technology developers try to collect the fee from the farmers when they deliver the harvest to the terminal. This fee can be difficult to collect because soybeans are open pollinated so seed need not be purchased each year. Also farmers often use soybeans for feed right on the farm so they might never enter commercial circulation. This challenge is not unique to South Africa, but rather is due to the intrinsic nature of the soybean.

SECTION IV. MARKETING

South African farmers can be divided into two categories. Commercial farmers, usually white, are modern businessmen who sometimes have more in common with their American counterparts than with their fellow, more traditional Africans. Subsistence farmers are usually black and have small, household farms. GM products have a wide appeal with both groups. Each group appreciates that GM crops use fewer inputs and have higher yields. In fact, subsistence farmers find some GM crops easier to manage than traditional or hybrid varieties.

Seed companies have found that subsistence growers are an important market for GM crops. Distributors should be from the local area, speak the local language, and they should take time to talk with people and explain the technology and its benefits. When this care is taken, small-scale growers are generally receptive to new technologies.

Importers require assurance that no unapproved GM varieties are inadvertently contained in the shipment because South Africa's regulation for adventitious presence is only 1%. Yet, in reality their tolerance is zero, since the GMO Registrar's office won't grant an import approval for a shipment coming from a country that cultivates events that aren't approved in South Africa. If the product is milled or otherwise processed it can usually enter.

Retailers also need assurance that all the events in a product comply with South African regulations. The labeling laws in South Africa are science-based and reasonable (see Section III) and shouldn't be difficult for retailers to comply with.

Like producers, consumers fall into two main categories: the first rich and largely white, the second poor and largely black. The PUB's (see more details in Section III) biotechnology survey shows that most South Africans have no knowledge of biotechnology. This finding is not surprising given that most South Africans are more concerned with the price of food than with how it was grown. What is interesting is that despite this lack of understanding, an average of 57% indicated that different applications of biotechnology should continue[11]. The survey was launched on April 6, 2005 and concludes that the country needs better science communication about biotechnology so that people can have a clearer picture of how it affects their lives.

"We hope this will empower them to become participants in this area of science," said Helen Malherbe, coordinator of the Public Understanding of Biotechnology program, which ran the study in collaboration with another government-funded entity, the Human Sciences Research Council.

Although South African scientists are among their continent's leaders in biotechnology, the survey showed that the term "biotechnology" means nothing to 82 per cent of the general

[11] www.pub.ac.za

public. A similar proportion is unaware of the meanings of 'genetic engineering', 'genetic modification' and 'cloning'. The study, in which researchers interviewed 7,000 people in the language of the participant's choice, was designed to be representative of the adult population of South Africa. It reveals that even among the few South Africans who were aware of biotechnology, most were indifferent to it.

Malherbe said notable findings were that nearly half of those interviewed wanted to know more about medical uses of biotechnology, and about one-quarter wanted more information on genetically modified food and other agricultural uses of biotechnology.

When asked who they most trust to tell the truth about biotechnology, 24 per cent of interviewees said universities, 19 per cent said the media, and 16 per cent said the government. Respondents were even less likely to trust consumer groups, environmental organizations, religious groups, or the biotechnology industry.

A University of Cape Town virologist says the survey revealed "a huge gap between science and society". He suggests using everyday products of biotechnology such as milk and cheese as educational tools in public outreach at shopping malls and other local centers to increase public awareness.

SECTION V. CAPACITY BUILDING AND OUTREACH

Six major biotechnology projects are being implemented with USAID South Africa biotechnology funds. There are also several other ongoing or periodic activities that are being funded by USAID or other USG agencies and these are listed after the six larger projects, which are as follows:

1) Southern Africa Biotechnology Program for Cassava Improvement: USAID South Africa is working jointly with other missions in the Southern African region to fund research devoted to the improvement of cassava both as a food crop, but more importantly for the region, as an industrial starch crop, as a means to improve jobs and income for South Africa and the region. USAID/South Africa has obligated $800,000 over two years (2004 and 2005) to this research and the initial focus has been on further development and roll-out of a transgenic pest resistant variety of cassava for use as industrial starch. The project is being managed by Michigan State University in collaboration with the CGIAR.

2) The Use of Biotechnology to Develop Buchu—an Indigenous Crop
Buchu is an indigenous crop from the fynbos plant biome. Present demand for the plant in the medicinal and the essential oil industries surpasses the availability of raw material from the wild, creating a serious problem of over harvesting which has a negative effect on one of the major biodiversity hotspots on the planet. The objective of the work is to make plant material and propagation techniques available to emerging farmers in marginal areas (to which Buchu is well suited) to both provide a profitable and environmentally appropriate alternative crop and to stem the current problem of over harvesting of wild plants and the destruction of Buchu in the wild. Biotechnology techniques (marker assisted selection, genetic fingerprinting and tissue culture) are being applied where conventional propagation methods have not responded.

3) Epidemiological Study on Porcine Cysticercosis in Emerging Farmer Areas
Porcine Cysticercosis is a serious disease found mostly in rural populations of black farmers and their families. The disease is cause by ingestion of the eggs of the pork tapeworm,

which are shed by animals and humans carrying the pork tapeworm. These eggs then lodge in nerve tissue throughout the body of their hosts (human or pig), and if in the brain, can cause epilepsy and death. Among smallholder farmers in South Africa, pigs are mostly free range and thus spread the eggs throughout the countryside infecting other pigs as well as humans. In South Africa traditional "hut pigs" are very important livestock for rural emerging farmers as valuable sources of protein and income. The presence of pork tapeworm eggs in these areas is a critical issue, which limits both pork consumption and sales and affects human heath. Prior to this study, standard but unreliable tests provided an estimate that only 10% of these pigs were infected with porcine Cysticercosis. This study validated and further developed a biotechnological diagnostic test (ELISA-monoclonal antibody-based parasite antigen test, enzyme-linked immunoelectrotransfer blot), which showed that the rates of infection among free range pigs, was approximately 33-47%. This diagnostic test has proven to be 4 times more effective in diagnosing porcine Cysticercosis and has alerted both agricultural and health officials in the area to the extent of the problem for both swine production and human health. (Study concluded in March 2005).

4) Use of Biotechnology to Investigate Potential Use of Indigenous plants for zoonotic helminthes (porcine Cysticercosis) diseases in South Africa. This is a research project running concurrently with item 3 above. Under this grant, the researchers are using interviews, surveys and biotechnological techniques (genetic finger printing, tissue culture) to identify indigenous plants which are currently used for treatment of porcine Cysticercosis in humans and animals and will lead to the identification of sound business opportunities for emerging smallholder farmers and entrepreneurs to grow and market these plants on a more systemic, safe and economic basis as well as make treatment for this disease more widely available.

5) Creating Salt Tolerant Apricot Rootstocks for Resource Poor Farming Communities in the Eastern Cape Province through In-Vitro Mutation Breeding Many emerging farming communities in South Africa are unable to utilize agricultural land cost-effectively due to unfavorable growth conditions for fruits and food crops. High salinity soils significantly restrain the cultivation of agricultural crops. Areas have been identified as excellent apricot growing areas but face a soil salinity problem. Using in-vitro mutation South African scientists are striving to develop salt tolerant apricot tree rootstock to allow emerging farmers to grow, market and process apricots economically in these areas.

6) Use of Biotechnology to Propagate/Domesticate *Sceletium tortuosum*, a Natural Botanical This research began in January 2004 through a grant from USAID with the goal of finding the most cost effective and best practice of propagating *Sceletium tortuosum* for use by smallholder farmers as a high value crop in arid, marginal areas. There is a patent registered on the active ingredient of the plant (mesembrine) for treatment of mental disorders and until recently the plant has only been available through wild harvesting. There is already serious over-harvesting. The project has used biotechnology techniques (marker assisted selection, genetic fingerprinting, and tissue culture) to develop varieties for field trials and initial commercial production by a community of the disabled and has also developed a rapid and simple protocol for extracting and quantifying the concentration of the active ingredient so that producers can easily have the analysis done and certified for the market (which is expected to leverage higher profits for these smallholder farmers).

The USG is also funding and/or planning a number of other biotech-related activities:

- promoting South African linkages to ASARECA (Association for Strengthening Agricultural Research in Eastern and Central Africa) and organizations in other parts of Africa working to increase the efficiency and impact of agricultural research, and to

harmonize standards for seeds, and to ensure free flow of seeds around region. (USAID)

- supporting development of intellectual property protection related to biotech innovation. (USAID)

- AfricaBio is a non-governmental, non-political and non-profit biotechnology organization based in South Africa that advocates for stakeholders in the research and development, production, processing and consuming sectors. The bulk of its funding comes from the private sector. USAID and other US organizations provide periodic funding for training and capacity building activities and production of biotechnology informational materials.

- Funding the testing and rollout strategy for the pest resistant Bt Potato in South Africa. This research, originally begun in Egypt, was transferred to South Africa due to Egyptian resistance to field trials and commercialization plans. (USAID)

- Hosted Embassy Science Fellow in 2004 and 2006 to support plant biotech research in South Africa, with a side trip to Botswana. (State/USDA)

- Farmer to Farmer workshop in 2006 to provide farmers and policy-makers from Uganda, Tanzania, Malawi, Mozambique, Kenya, Madagascar, Maruitius, and South Africa with information on GM policy. (USDA)

- 23 Members of Parliament from Kenya, Malawi and South Africa visited GM test plots in South Africa in May 2006. (USDA)

Suggestions for additional engagement with a focus on stronger research and regulatory capacity:

- Expand biotech R&D capacity and linkages in a long-term, sustainable way through the establishment of a regional center of excellence in biotech research--by replicating USDA's ARS-French cooperative research model, albeit on a smaller scale, or by setting up a biotech research institute similar to that set up in Egypt by USAID.

- Support a regional approach, especially to build regulatory capacity in SADC countries, through collaboration with strong regional organizations such as ASARECA

SECTION VI. REFERENCE MATERIAL

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AfricaBio *GMO Indaba* (Vol. 4, No.2, April 2006)

AfricaBio *GMO Indaba* (Vol. 4, No.3, July 2006)

Internet resources:

AfricaBio: www.africabio.com

Asian Development bank: www.adb.org

Agbiotechnet: www.agbiotechnet.com

South African Agency for Science and Technology Advancement: www.fest.org.za

Department of Science and Technology: www.dst.gov.za

Department of Agriculture: www.agri

Agricultural Research Council: www.arc.agric.za

Public Understanding of Biotechnology: www.pub.ac.za

Southern Africa Development Community: www.sadc.inc

International Service for the Acquisition of Agri-biotech Applications: www.isaa.org

Focus on the Global South: www.focusweb.org

Intermediate Technology Development Group: www.itdg.org

South Center: www.southcenter.org

Third World Network: www.twnside.org.sg/bio.htm

International Service for the Acquisition of Agri-Biotech Applications: www.isaaa.org

APPENDIX A. TABLE OF APPROVED BIOTECHNOLOGY PRODUCTS

Crop	Trait Category	Applicant (s)	Event (s)	Trait Description(s)	Reviewed uses within South Africa
Cotton	Insect resistant	Monsanto	Bollgard II, line 15985		General release Importation/exportation Commercial planting Food and/or feed
Maize	Insect resistant	Syngenta	Bt11	Produced by inserting the *cry1Ab* gene from *Bacillus thuringiensis* subsp. kurstaki,	General release Importation/exportation Commercial planting Food and/or feed
Maize	Herbicide tolerant	Monsanto	NK603	Introduction, by particle bombardment, of a modified 5-enolpyruvyl shikimate-3-phosphate synthase (EPSPS)	General release Importation/exportation Commercial planting Food and/or feed
Soybean	Herbicide tolerant	Monsanto	GTS40-3-2	enolpyruvylshikimate-3-phosphate synthase (EPSPS) encoding gene from the soil bacterium *Agrobacterium tumefaciens*.	General release Importation/exportation Commercial planting Food and/or feed
Cotton	Herbicide tolerant	Monsanto	RR lines 1445 & 1698	Glyphosate herbicide tolerant cotton produced by inserting a glyphosate tolerant form of the enzyme 5-enolpyruvyl shikimate-3-phosphate synthase (EPSPS) from *A. tumefaciens* strain CP4.	General release Importation/exportation Commercial planting Food and/or feed
Cotton	Insect resistant	Monsanto	Line 531 / Bollgard		General release Importation/exportation Commercial planting Food and/or feed
Maize	Insect resistant	Monsanto	MON810 / Yieldgard	Inserting a truncated form of the *cry1Ab* gene from *Bacillus thuringiensis* subsp. kurstaki HD-1.	General release Importation/exportation Commercial planting Food and/or feed
Maize	Insect resistant Herbicide tolerant	Monsanto	MON810 x NK603		General release (Excludes events that have obtained general release clearance before commodity clearance)Importation for use as food or feed

Crop	Trait Category	Applicant (s)	Event (s)	Trait Description(s)	Reviewed uses within South Africa
Maize	Insect resistant Herbicide tolerant	Monsanto	MON810 x GA21		Commodity clearance (Excludes events that have obtained general release clearance before commodity clearance)Importation for use as food or feed
Maize	Insect resistant Herbicide tolerant	Pioneer Hi-Bred	TC1507	Produced by inserting the *cry1F* gene from *Bacillus thuringiensis* var. *aizawai* and the phosphinothricin N-acetyltransferase encoding gene from *Streptomyces viridochromogenes*.	Commodity clearance (Excludes events that have obtained general release clearance before commodity clearance)Importation for use as food or feed
Maize	Herbicide tolerant	Monsanto	NK603	Introduction, by particle bombardment, of a modified 5-enolpyruvyl shikimate-3-phosphate synthase (EPSPS)	Commodity clearance (Excludes events that have obtained general release clearance before commodity clearance)Importation for use as food or feed

Crop	Trait Category	Applicant (s)	Event (s)	Trait Description(s)	Reviewed uses within South Africa
Maize	Herbicide tolerant	Monsanto	GA21		Commodity clearance (Excludes events that have obtained general release clearance before commodity clearance)Importation for use as food or feed
Maize	Insect resistant	Syngenta	Bt11	Produced by inserting the *cry1Ab* gene from *Bacillus thuringiensis* subsp. kurstaki,	Commodity clearance (Excludes events that have obtained general release clearance before commodity clearance)Importation for use as food or feed
Maize	Herbicide tolerant	AgrEvo	T25		Commodity clearance (Excludes events that have obtained general release clearance before commodity clearance)Importation for use as food or feed
Maize	Insect resistant	Syngenta	Bt176		Commodity clearance (Excludes events that have obtained general release clearance before commodity clearance)Importation for use as food or feed
Oilseed rape	Herbicide tolerant	AgrEvo	Topas 19/2, Ms1Rf1, Ms1Rf2, Ms8Rf3		Commodity clearance (Excludes events that have obtained general release clearance before commodity clearance)Importation for use as food or feed
Soybean	Herbicide tolerant	AgrEvo Aventis	A2704-12	Glufosinate ammonium herbicide tolerant soybean produced by inserting a modified phosphinothricin acetyltransferase (PAT) encoding gene from the soil bacterium *Streptomyces viridochromogenes*.	Commodity clearance (Excludes events that have obtained general release clearance before commodity clearance)Importation for use as food or feed

Crop	Trait Category	Applicant (s)	Event (s)	Trait Description(s)	Reviewed uses within South Africa
Cotton	Insect resistant	Syngenta	Cot 102/ Cry1Ab		Trial release Importation / exportation Field testing
Maize	Herbicide tolerant	Syngenta	GA21		Trial release Importation / exportation Field testing
Cotton	Herbicide tolerant	Syngenta	Heb 134001-134100		Trial release Importation / exportation Field testing
Vaccine		Cato Research	VRX496		Trial release Importation / exportation Field testing
HIV vaccine	Vaccine	MSD	MRK Ad5		Trial release Importation / exportation Field testing
Sugar-cane	Increased carbohydrate content	SASEX	1-2-3-3		Trial release Importation / exportation Field testing
Cotton	Herbicide tolerant	Monsanto	MON88913 (RR flex enhanced RR)		Trial release Importation / exportation Field testing
Cotton	Insect resistant Herbicide tolerant	Monsanto	MON88913 x Bollgard II		Trial release Importation / exportation Field testing
Maize	Herbicide tolerant	CSIR	Safe Maize		Trial release Importation / exportation Field testing
Maize	Insect resistant Herbicide tolerant	Monsanto	MON810 x NK603		Trial release Importation / exportation Field testing
Maize	Insect resistant	Syngenta	3243M		Trial release Importation / exportation Field testing
Cotton	Herbicide tolerant	Syngenta	Glyphosate resistant		Trial release Importation / exportation Field testing
Soybean	Drought resistant	ARC	P5CR		Trial release Importation / exportation Field testing

Crop	Trait Category	Applicant (s)	Event (s)	Trait Description(s)	Reviewed uses within South Africa
Cotton	Insect resistant	Syngenta	COT102, lines 3169, 3826-3829		Trial release Importation / exportation Field testing
Cotton	Insect resistant	Calgene	Stacked Bt event		Trial release Importation / exportation Field testing
Cotton	Insect resistant Herbicide tolerant	Stoneville	Stacked Bollgard II & RR (1445)		Trial release Importation / exportation Field testing
Cotton	Insect resistant	Syngenta	COT101, COT102, line 3169		Trial release Importation / exportation Field testing
Cotton	Herbicide tolerant	Stoneville	LL25		Trial release Importation / exportation Field testing
Potato	Insect resistant	ARC	Bt event		Trial release Importation / exportation Field testing
Maize	Insect resistant	Pioneer Hi-Bred	TC6228		Trial release Importation / exportation Field testing
Maize	Insect resistant Herbicide tolerant	Aventis	ZMA101		Trial release Importation / exportation Field testing
Sugar-cane	Insect resistant Herbicide tolerant	University of Natal	Glufosinate ammonium		Trial release Importation / exportation Field testing
Potato	Insect resistant	First potato Dynamics	*Bt event		Trial release Importation / exportation Field testing
Maize	Herbicide tolerant	Monsanto	*NK603	Introduction, by particle bombardment, of a modified 5-enolpyruvyl shikimate-3-phosphate synthase (EPSPS)	Trial release Importation / exportation Field testing
Maize	Herbicide tolerant	AgrEvo	T25		Trial release Importation / exportation Field testing
Wheat	Herbicide tolerant	Monsanto	RR		Trial release Importation / exportation Field testing

Crop	Trait Category	Applicant (s)	Event (s)	Trait Description(s)	Reviewed uses within South Africa
Maize	Insect resistant	Pioneer Hi-Bred	*TC1507	Produced by inserting the *cry1F* gene from *Bacillus thuringiensis* var. *aizawai* and the phosphinothricin N-acetyltransferase encoding gene from *Streptomyces viridochromogenes*.	Trial release Importation / exportation Field testing
Cotton	Insect resistant Herbicide tolerant	Monsanto	*Stacked Bollgard I & RR		Trial release Importation / exportation Field testing
Maize	Insect resistant	Monsanto	*Stacked MON84006		Trial release Importation / exportation Field testing
Soybean	Herbicide tolerant	Monsanto	*GTS40-3-2	produced by inserting a modified 5-enolpyruvylshikimate-3-phosphate synthase (EPSPS) encoding gene from the soil bacterium *Agrobacterium tumefaciens*.	Trial release Importation / exportation Field testing
Cotton	Herbicide tolerant	Monsanto	*BXN		Trial release Importation / exportation Field testing
Canola	Herbicide tolerant	AgrEvo	*Ms8Rf3		Trial release Importation / exportation Field testing
Maize	Herbicide tolerant	Monsanto	*GA21		Trial release Importation / exportation Field testing
Cotton	Insect resistant	Monsanto	*Bollgard I		Trial release Importation / exportation Field testing
Cotton	Insect resistant	Monsanto	*Bollgard II Line 15985		Trial release Importation / exportation Field testing
Maize	Insect resistant	Novartis (Syngenta)	*Bt 11	Produced by inserting the *cry1Ab* gene from *Bacillus thuringiensis* subsp. kurstaki,	Trial release Importation / exportation Field testing
Maize	Herbicide tolerant	Dow Agroscience	DAS 1507		Importation Contained use
C. gluta-micum AM919	Amino acid (isoleucine production)	SA Bioproducts			Importation Contained use
E.coli VNII	Amino acid (threonine) production	AECI Bioproducts			Importation Contained use
Maize	Insect resistant	Pioneer Hi-Bred	TC6228		Importation Contained use

*Approvals originally granted under an amendment of the Agricultural Pest Act, 1983
Note: Approvals are granted for a specific period only. Thus, not all the events listed above are being tested at this moment.