EVALUATION OF MAIZE RESEARCH PROJECTS

FUNDED BY THE MAIZE TRUST

AT THE ARC-GRAIN CROPS INSTITUTE

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OBJECTIVE

The purpose of the evaluation of projects was to determine the viability of research projects at the ARC-Grain Crops Institute, Potchefstroom, and whether they are in line with requirements of the maize industry, as regards both the commercial and emerging sectors. The evaluation of the projects was also intended to cover present and future perspectives. The mandate for the evaluation did not include monitoring success or progress of projects.

APPROACH AND METHODS

Although not part of project evaluation, the contractee attempted to familiarize himself with the organizational and strategic framework within which ARC institutes operate. To this end, he visited Dr. Phindile Lukhele-Olorunju, Group Executive: Grain and Industrial Crops, under whom the ARC-GCI falls, and also Dr. Luke Mumba, head of SANBio, the biotechnology network for Southern Africa, and member of the NEPAD biotechnology team in South Africa . Documents obtained in this regard include the ARC Strategic Plan for 2007/8- 2011/12 (from ARC) and the Africa's Science & Technology Consolidated Plan of Action (from SANBio). The contractee also had on hand NEPAD documents and the CAADP. The ARC Strategic Plan, developed during late 2006, is presently being revised.

While it is accepted that requests for and partial funding of research projects from external agricultural industry sectors will be driven by their requirements, it is also considered useful to understand the ARC Strategic Plan as this will provide the human resources, infrastructure capacities and partial funding of externally requested projects.

The background in terms of industry stakeholder requirements and comments received on projects, was surveyed by way of interviews, most of which involved personal meetings, some by telephonic interviews, and some through e-mailed requests. Annex 1 contains the list of parties approached. Professional arrangements made by the GCI institute included discussions with Dr Piet van der Merwe, before and after interviews, and meetings with research group managers. The appointment schedule is contained in Annex 2. Follow-up meetings were held with researchers on crop estimates modelling and with Dr. Charlotte Mienie on biotechnology, and several subsequent phone calls were made to specific researchers to clarify points. Documents provided by GCI include the brief final overview of Maize Trust funded projects to replace the draft overview received from the Trust Secretariat, and a copy of the interim maize research report.

The approach during interviews was to ascertain, firstly, what research the institute is doing that the private sector is not covering, what research the private sector is adequately doing that the institute need not duplicate, and where the private sector and the institute can collaborate on a contractual basis. Secondly, whether projects are in line with industry requirements and whether they can be technically improved.

The mandate did not include evaluation of frameworks within the ARC, industry issues or priority areas for future research, but it was considered useful to include some thoughts on these aspects as they may impact on forthcoming GCI maize projects.

RESULTS

1. Background information

The ARC strategic objectives are: new knowledge, science and information; sustainable use of natural resources; enhanced nutrition, food security and safety; enhanced ability to manage and mitigate agricultural risks; commercialization of results; and corporate services excellence. These will be supported by five strategic thrusts: new and improved technologies; transfer of these technologies; support for resource-poor farmers; agricultural competitiveness; and organizational sustainability and excellence.

It is important to note that more emphasis will be placed than in past years on basic research and on modern biotechnology. The key programmes under the objectives have direct implications for stakeholders in agriculture. The plan makes provision for local and international networks that obviously will also cover public-private partnerships. The ARC wishes to ensure protection of innovation through intellectual property rights but the final system has not been completed. At present, IPR is held by the ARC and benefit sharing can be negotiated by partners. This strategic plan was designed to be in line with various national government science programmes and strategies, and with the Consolidated African Science & Technology Plan, as well as the Strategic Plan of the Department of Agriculture.

2. Evaluation of projects

2.1 Crop Science Department (11)

2.1.1 Evaluate maize hybrids for different production systems (M101/10) - Dr Ma'ali

National cultivar trials have been ongoing for many years and are in the interest of seed companies, producers, extension officers, and others. It provides a basis for independent data that are used for the annual MIG guide booklets. Much of the expenses are carried by co-workers. Producers and seed companies require a set of science-based data that enable informed decision making by seed buyers. Breeders want additional data to augment their own and need information on comparative yields and stability, as well as cultivar by environment interaction, measurable over several seasons. Increase of entries in the short-season class and irrigation trials are supported. Breeders also wish to have an analysis of cultivar by plant population interaction and this will have to be considered in future. However, several parties expressed the view that good statistical results are not possible with so many poor quality and failed trials, reducing the number of sites with useable information.

It can be recommended that this project be continued subject to improved management of trials and expedited submission of data.

2.1.2 Evaluation of short season maize cultivars under irrigation (M101/11) – Dr Ma'ali

The proposed new project is supported as it will supply new information for decision making by irrigation farmers. Adding analysis of cultivar by plant population interaction over seasons will enable breeders to evaluate their varieties on an additional parameter. Results from useable trials should also be incorporated in the MIG. However, not all breeders are unanimous on this and the seed industry should be consulted before publication.

2.1.3 Evaluating maize genotypes for economic viability (M101/80)- Dr.Ma'ali

The objective of trials that can generate good data for farmers for choosing seed for planting, in combination with training and demonstration, is supported. New OPVs, also called composites or synthetic varieties elsewhere, in some cases give competitive yields to some hybrids. Experience in Africa has shown that OPVs lead to farm-saved seed that soon deteriorate into mixtures with lower yields. To enable farmers to make an informed choice the trial should also include good commercial hybrids. Lower price seed does not equal sustainable farming. A more expensive hybrid seed that yields 20 % more than a good OPV is still more sustainable. Ample data from Malawi and other SADC countries are available to prove this point. Promotion of farm-saved seed will mitigate against OPV breeding and will not be supported by the seed industry. The trial should include an economic analysis to complete the basis for decision making.

2.1.4 Determine the milling quality and colour deviation of white maize cultivars (M102/10) - Mr Wong

Milling quality and whiteness have been tested for several decades and opinion is still divided whether this has reduced the incidence of soft starch and/or ivory coloured varieties. One complicating factor is the impact of environment on these qualities. Common views are that the analytical system has improved over time and real problem varieties are few, but that improved calibration and readings are needed to yield better statistical data that will preclude arguments about what new varieties should be recommended or rejected. One seed company has offered to render assistance for improving the system. An improved system will enable the ARC in collaboration with the cultivar evaluation committee, to make firm recommendations. The hardness test can also serve to provide data for the grits industry (see project 102/13).

2.1.5 Calibration of NIT for maize protein, starch and ash determinations (M102/12) - Mr Wong

These analyses will have benefit for the animal feed industry in manufacturing mixes for animal feed diets. One missing element is fatty acids (oils) which are a source of energy and advice should be obtained from AFMA. The NIR probably indicates total protein but not quality of the protein. Should this project not dovetail with proposed 191/12 that focuses on starches for bio-ethanol? What will be needed in the latter case is analysis of extractible, fermentable starch content. If separate chemicals are needed rather than NIR, the project can still use the same samples.

2.1.6 Development of methodology to evaluate the suitability of yellow maize cultivars for grit production (M102/13) - Mr Wong

This request comes from a maize industry sector that represents 3.8% of the maize market, much of the yellow grits destined for export. Firstly, should this project not dovetail or merge with 102/12, and, secondly, if millers do not see the need to collaborate, then it is not a major

industry problem and the specific party/parties who want such data may enter into a research contract with the ARC outside of the Trust?

2.1.7 System analyses for maize production under different management practices for specific agro-ecoregional zones (M103/13) - Mr Prinsloo

It will be valuable to have more information on behaviour of ultra-short season cultivars. Trials that involve several variables such as cultivars, tillage systems, sites, densities, and seasons require several years and constant input variables. Tillage systems will probably not show impact in one season.
The question is now, by proposing to change one cultivar, one site, and increasing plant densities, whether any meaningful new data could be generated in one additional season, compared to data already obtained over the past six years. The new data will be applicable to the new season and may not fit in well with previous data due to the changes. One season's data by itself may not be very meaningful due to the requirement to even out responses and interactions over environments (= seasons).

2.1.8 Estimating methods for grain yield across South Africa using systems/statistical analysis and crop modelling (M103/15) - Ms Durand and Mr Du Toit

A modeling system that can add value to crop forecasting is invaluable to food production, price stability and trade. Note has been taken that the models have been upgraded and refined through the several years that the project has been in existence. It is also appreciated that researchers have been sent overseas to gain more experience and learn from other countries. There is no unanimity amongst parties consulted on the degree of accuracy obtained by the model compared to estimates from other sources and the final crop harvested. General consensus seems to be that the model needs to be further refined and adapted by using international and local experience. No personal visit could be arranged with the CEC as they indicated that they would need time to extract data from records and need to comply with protocols for information release. The various views expressed could, therefore, not be further investigated from data at the CEC. One side question is the extent to which the increasing production of fresh maize for marketing into urban areas and small-scale farmer use of fresh maize as household food may present a minor source of error as such areas may lead to low grain harvest (note average yield of 0.4 - 0.5 MT per ha for smallholder farmers).

Continued development and application of this crop production estimation model can be supported if refined to render more accurate crop estimates as a major input into CEC.

2.1.9 Evaluation of biological, organic and inorganic substances associated with improved plant growth, yield and biotic and abiotic stress tolerance traits in maize (M104/13) - Mr Baloyi

This project is needed in view of increasing marketing of new "natural and/or biological" products, and organic farming, all of which is accompanied by claims on major benefits. These claims are rarely substantiated by independent research data are available.

2.1.10 The impact of crop rotation and fertilisers on sustainability and economic issues to developing farmers in the North West Province (M105/80) - Mr Baloyi

Improved cropping practices data will be most helpful for resource-poor farmers. This project makes use of many variables: 6 crop rotations, 3 fertilizer regimes, 3 sites, 3 years and this will

lead to many interactions that will complicate interpretation over the short term. One could question whether the number of variables could be reduced and whether a more simple design over a longer term might not provide more insight. Some unclear results include high yield with sunflower mono-cropping, probably due to fertilizer carry-over. Researchers concluded that results are in accordance with expectations, namely, no clear impacts over 2-3 years. Will results become more clear when the project runs out in 2008?

2.1.11 Maize cultivar evaluation under different soil fertility conditions for resource poor farmers (M121/81) - Mr Prinsloo

These trials have run for 8 years and should by now provide sufficient information. It is assumed that they serve various purposes: generating data for extension, training and farmer choices of cultivars.

2.2 Production Systems Department (4)

2.2.1 Comparison of integrated crop rotation, tillage systems and fertiliser application on economic and sustainable crop production on the Highveld (M105/10) - Dr Nel

This project runs out this year. There were no clear explanations on why maize did not show increased yield after groundnut or cowpea, but 10% after soya.

2.2.2 Evaluation of cost effective and sustainable tillage practices in land utilisation for crop production (M105/11) - Dr Nel

With two tillage systems, three cultivars and two replications over three seasons it may it insufficient to obtain meaningful impact. Especially soybeans on sandy soils may take several seasons to establish adequate Rhizobia populations for N-fixing to benefit follow-on maize. Progress will show whether the trial should be extended for another two seasons. Three replications may have added degrees of freedom for improved statistical analysis.

2.2.3 Investigating maize root diseases in a crop rotation trial (M105/12)- A.Nel

Crop rotation is a standard practice to reduce build-up of soil-borne pathogens. Such build-up is usually aggravated by monoculture and double cropping systems. A final analysis of pathogens in the Vaalhartz trial can add useful information.

2.2.4 The role of soil microbiology in maize production (M106/10) - Mr Rhode

This is considered an important project for two reasons: obtaining independent data on alluded beneficial impact of biological farming, and to establish baseline data for other ecological studies such as GM crops. GM crop impact on soil organisms is one of the requirements for regulatory biosafety assessments and such requirements are meaningless in the absence of baseline data. It appears that groups of microbes will be measured initially. It is hoped that the study could identify a number of beneficial microbes to focus on in later years such as Rhizobia and Azospirrilium.

2.2.5 Fertiliser monitoring for maize production (M121/15 and M121/34) - Mr Deale

The fertilizer stakeholders seem satisfied with the work done to date to monitor adherence to quality standards and would like a continuation of the project. Initial data showed some 9% of samples tested were below standards. Such monitoring has benefits for producers.

2.3 Plant Breeding & Biotechnology Department (9)

2.3.1 Breeding for Grey Leaf Spot resistance in maize (M141/12) - Dr AP Fourie

This project should be seen in conjunction with M141/16. Several major seed companies have already successfully incorporated GLS resistance genes into their lines and hybrids. The value of this project, in association with M141/16, lies, firstly, in finding marker genes to facilitate marker assisted breeding, and, secondly, to identify other sources of resistance that are different and can supplement or replace present resistance genes. Such resistance could be made available to the seed trade in existing genetic backgrounds, or incorporated into elite inbreds for release under licence agreements. GLS is considered an important production constraint in some regions.

2.3.2 Development and application of molecular markers in maize breeding (M141/16) - Dr Mienie

Refer to comments under GLS in M141/12 above. In view of the new biotech lab facilities at GCI, this project will enable Dr Mienie and staff to utilize the facilities more efficiently, and tie in with the recent ARC Strategic Plan. Two comments arise: liaison and interaction with other marker genes/molecular genetics diagnostics facilities within the ARC and outside the ARC, and establishing adequate human resources. The two comments relate to synergism in networking and building capacity. The identification of QTLs is also supported by seed companies. It is likely that local subsidiaries of multinationals may derive less direct benefit from this project as they have their own global projects, but that South African companies, especially new entrants, have a stronger need for the results from genetic diagnostics.

2.3.3 Maize cultivar development (M161/10) - Dr AP Fourie

This project overlaps with M191/10 and GCI should consider merging the two. The comments relating to M161/10 will be applicable to M191/10. The need for maize breeding activities in South Africa is different for various stakeholders: established multinationals and local seed companies, smaller local companies, and new entrants. The first group has a need only for special developments applicable to inbred lines and breeding populations having traits and disease resistance to overcome local and regional constraints. The second and third groups may not have extensive international contacts with international breeders or proprietary inbreds and hybrids, and need locally adapted germplasm and material ready for commercial use. There are several hundred maize hybrids and a range of OPVs available to South African producers, even though only 20-25 make up the bulk of seed sales. It may be advisable to define the target users of the products from the proposed projects. In the same light, these projects should see SADC as a target market, especially as regards seed exports. Development of new inbreds with resistance to specific diseases such as GLS or Stenocarpella, and/or having special quality traits such as hard endosperm will have application for most seed companies and producers, and drought tolerance is becoming increasingly important. Breeding of conventional new inbreds, hybrids and OPVs will benefit mostly small and new enterprises. The question should be asked whether the latter target market should not engage in contract breeding by GCI. It has become clear that GM maize is becoming the mainstream in South Africa (and in some other countries) to the extent that conventional non-GM markets will find it increasing difficult to source GM-free grain. GCI should consider whether to release inbreds and hybrids in a conventional form for users to convert them to GM, or to enter into agreements to incorporate GM traits from local or global origin and release material in GM form. An option is to have material in both conventional and GM form. Despite present SADC policies, the region will move to GM hybrids within a few years.

2.3.4 Fingerprinting of maize genotypes (M161/11) - Dr Mienie

This project can add value to the maize industry for reasons set out under M141/16 and as supporting services to M161/10. The vision of licensing and income from royalties is valid. One valuable objective would be to genetically characterize the main South African germplasm (inbreds, composites and hybrids) in the GCI gene bank.

2.3.5 Participatory evaluation and identification of maize varieties for smallholder farmers (M161/80) - Ms Masindeni

The basic objective of evaluating good OPVs in field trials in comparison with hybrids is in order. The comment that OPVs may be more tolerant to drought and poor soils needs to be substantiated by this project as many investigations elsewhere do not support that expectation. The ultimate objective is not clear. OPVs cannot be an end objective, rather a stepping stone to improve household food security under smallholder farming systems. The trend to hybrids in Malawi, Zambia, and (previously) Zimbabwe clearly showed how hybrids add to food security. The IGC 2006/7 report confirms that result. It is accepted that subsistence farmers are cash-strapped. The objective should be to lift them out of the poverty trap by giving them a choice between cultivars that will help to achieve this. Unbiased extension is needed. A cost-benefit analysis should be included in the project.

2.3.6 Maize breeding: Inbred lines and cultivar development (M191/10) - Dr AP Fourie

See comments under M161/10

2.3.7 Genetic characterisation of *Stenocarpella maydis* tolerance in maize (M191/11) - Ms Moremoholo

Modern approaches in breeding for disease resistance involve a combination of genetically analyzing the post plant and the pathogen. This project ties in with several others and the collaboration with other ARC institutes is supported.

2.3.8 Development of quality protein maize (QPM) with marker-assisted breeding (M191/80) - Ms Masindeni

The benefits of QPM (high-lysine or opaque-2) maize for human, poultry and pig nutrition are well recognized and proven over 40 years. The project should be evaluated in terms of, firstly, present government policy of supplementing basic foods with nutrients (and the efficiency thereof); secondly, availability of commercial lysine from SA Bio-Products in KZNatal; thirdly, present efforts by at least two companies to market QPM in KwaZulu-Natal, and, fourthly, the failure over 40 years to make QPM a main component of maize production in any country. If QPM cultivars are accepted by subsistence farmers, it will have a valuable nutritional value and will tie in with the Harvest Plus bio-fortification global project. Will QPM have to meet the same grain quality criteria as other cultivars? If not, the consequences of QPM entering mainstream grain pools will have to be considered. There is a valuable collection of QPM material in the GCI genebank and more from CIMMYT. Are these being evaluated extensively at present?

2.3.9 Development and evaluation of maize genotypes suitable for increased biofuel extraction (M191/12- Dr Fourie

Biofuels will be part of future maize production and the technology is changing very rapidly in both cultivar composition and in the distillation process, ranging from GM cultivars with high amylase and extractable starch to GM microbes in extraction/conversion to new distillation

processes. Some seed companies are having their cultivars evaluated in the USA for extractable/convertible starches. Some have access to latest international cultivars for biofuel. The question should be asked whether the proposed budget and time scale are sufficient for a local breeding programme for biofuel cultivars. In summary: the private sector is already engaged in developing hybrids for biofuels and has access to appropriate germplasm. Perhaps GCI should first conduct a literature study on the latest biofuel technologies and liaise with the private sector to establish where GCI should position their research.

2.4 Crop Protection Department (7)

2.4.1 Integrated management strategies for the stalk borer complex in maize (M131/10) - Prof Van Rensburg

An integrated approach using pesticides, plant resistance and Bt genes represents a holistic view of combining the best available technologies. It is considered important to monitor and assess possible development of insect tolerance to all three technologies. Pre-release efficacy tests and likelihood of pest resistance development for traits like Bt are also needed to meet regulatory requirements.

2.4.2 Stand reducing insects of maize (M131/11) - Dr Drinkwater

The project has generated useful information that has been included in a handbook and will now run out in one year. Main target pests were black maize beetle and wireworm.

2.4.3 Integrated management strategies for streak disease in maize (M131/12) - Dr Flett

The streak research at Vaalhartz has contributed to a number of MSV resistant inbreds that are being evaluated in hybrid combinations. The project runs out in one year. The breeding programme has been ceased.

2.4.4 Integrated control of maize ear rots (M141/10) - Dr Flett

Maize ear rots represent a major problem area for human and animal health and grain marketing. Refinement of techniques should lead to better results. Environmental conditions and insect damage are important contributors to incidence of rots and mycotoxins. Solutions to ear rots and resultant mycotoxin production are of high importance for all major parties in the maize industry.

2.4.5 Integrated control of maize common rust, northern corn leaf blight and eyespot (M141/11) - Dr Craven

These fungal diseases have been around for many years and breeders have developed resistant cultivars but the pathogens still account for periodic outbreaks and in some regions, endemic presence. This may be due to new pathogen strains and/or foreign germplasm present in new hybrids. Therefore, it is required to evaluate new sources of resistance genes and screen for new strains of the pathogens. The technical approach followed is supported but artificial infection must continue as natural infection is often unpredictable.

2.4.6 Variation between F. verticillioides isolates and their ability to produce fumonisins, infect maize kernels and their resultant population dynamincs

This fungus is common in maize grain but its ability to produce highly toxic fumonisins is subject to its strains, environment and host plant, and complex interactions between these. Developing

control measures and resistance to infection and fumonisin production will depend upon a better understanding of the pathogen and its interaction. One facet will be covered in this project, namely, the various isolates. Collaboration with external institutions is commendable.

Incidence and severity of these leaf diseases are sporadic and may lead to significant yield losses. Ongoing studies on new resistance genes are important for the industry.

2.4.7 Integrated nematode control in maize (M151/10) - Dr H Fourie

Nematodes are considered a significant problem in certain farming areas and the availability of resistance genes that showed consistent tolerance in local tests will lead to locally adapted cultivars and inbreds for release. This will bring benefit to many farmers who experience yield losses.

2.5 Crops Sciences & Technology Transfer Department (4)

2.5.1 Improved grass control systems in maize (M111/13) - Ms Smit

There are some differences between the project summary and the interim report in respect of cultivars used and the RR counterpart of CRN 3505. No mention was made of control by way of spraying Roundup on maize plants in the trials. These were different trials and in the light of poor germination of some weed seeds, it became difficult to judge the project on the basis of information submitted. The intended integrated weed control outcome was not evident.

2.5.2 Herbicide related crop damage (M111/15) - Dr Saayman-du Toit

The need to monitor compliance of agro-chemicals quality, especially in the light of import of cheaper products, is considered necessary. Government is apparently not conducting any monitoring. It is not possible to comment on the outcome of the project in the absence to date of a response requested from AVCASA.

2.5.3 Evaluation of normal and abnormal maize seedlings / Vigour and germination of maize seed (M112/10) - Dr Saayman-du Toit

The seed industry is monitored by government (official seed testing lab) in terms of compliance with germination standards. Standards are applicable at the point when the seed is sold. There are no regulatory standards for vigour as it is a complex physiological measurement dependent upon seed quality, farming practices and environmental field conditions. It usually serves only as an in-house indicator for seed management. Information from external sources indicates that such quality problems have been minimal. The seed industry has conveyed its objection to this project to GCI relating to sampling practices, vigour tests and lack of registration of the GCI lab with government, as is required when seed testing is done for external parties. These objections are considered valid.

2.5.4 Maize Information Guide (MIG) (M181/10) - Mr Els

This has been an ongoing project that gets its information from other projects.

3. General Comments

3.1 ARC frameworks

While these comments fall outside the mandate for evaluating GCI maize projects, it is felt that the broader picture has impact on how institutes function. Some aspects that may be subject to improvement in order to create an enabling institutional environment are as follows :

- Encouraging an internal ARC set of networks such as biotechnology, plant breeding, plant pathology, etc. This can avoid duplication and encourage synergy through teamwork across institutes
- External networks with other research institutions such as BRICs (Biotech Regional Innovation Centres), and universities; also internationally.
- Intellectual property rights protection is important for Public-Private-Partnerships and for institutes
- Marketing ARC institutes domestically, regionally and internationally

(it is acknowledged that these aspects are already receiving attention)

3.2 Agricultural industry requests

Some considerations in evaluating projects in relation to requests and expectations from agricultural stakeholders include the following:

- Requests, needs and priorities from industry and producer groups are different and may sometimes be in conflict
- The global trend is towards specialized cultivars for specialized application. This trend will be accelerated dramatically over the next decade as result of modern biotechnology and extended industrial applications. The system for assessing cultivar characteristics and recommendations for approval of new cultivars will have to change. The future is contracted production and identity preservation from the seed to the end user. It is not possible to capture desired special traits in one cultivar and this will impact on plant breeding and research projects. Specialized cultivars are the backbone of the plant, fruit and vegetable industries, as a well-established example
- Qualities desired by industry sectors in cultivars cannot always be backed by exact empirical research data— the expression of many traits are primarily determined by the environment and farming practices, and some traits are negatively correlated

3.3 ARC- Grain Crops Institute projects

General observations on aspects to be considered when evaluating projects include:

- The trend in research is networking, partnerships, and consortium funding, and while GCI is already applying that, there may be room for extending such networks

- Combining utilization of laboratory facilities and diagnostics between ARC institutes and with external parties, will promote cost efficiency and synergy
- It is assumed that researchers, as well as stakeholders, conduct surveys on extensive available research reports before considering new or ongoing projects. This has not always come through clearly in cases like crop rotation, pathogen surveys and biofuels projects
- It is also assumed that crop rotation studies (and in combination with pathogen surveys) always have the variables on the same specific field plots as impact may take several years to manifest. Moving the plots to another site on farm or to another farm will detract from combined data over years or sites
- The objective of new research vs demonstration and training is not always clear in projects such as some crop rotation and cultivar trials (some may have a dual purpose)
- Room exists for improved interaction between projects, for example, crop rotation trials may also accommodate pathogen surveys and impact studies on soil microbes
- No specific mention has been made to collaboration with the Foundation for Farmer Development and other similar bodies in research or demonstration projects aimed at emerging farmers. Such collaboration will strengthen impact

3.4 Areas identified as priorities by stakeholders (not in order of priority)

- Grain fungi and mycotoxins
- Marker genes and insect/disease resistance
- Environmental impact studies related to developing baseline data for biosafety assessments of GM crops. To date, such data have been forthcoming from international sources, but are largely absent when new GM crop innovation in South Africa is to be introduced. These data are also essential for post-release monitoring of GM crops
- Independent monitoring and investigation into unique traits like Bt insect resistance under field conditions, such as reported reduced efficacy of the trait under certain conditions. The same applies to alleged weed resistance to herbicides in herbicide tolerant GM crops
- Independent monitoring of fertilizer quality.
- Independent investigation into impact and efficacy of biological and organic systems, and new substances claimed to promote plant growth and production
- Ongoing improvement of crop estimates modeling
- Drought resistance in cultivars (several international breakthroughs have been made in GM technology)
- Support services, training and extension for the emergent farming sector

ANNEX 1: LIST OF APPOINTMENTS AT ARC-GCI (24 April 2007)

Two sessions have been scheduled to accommodate you and Dr Cronje. Herewith the programme for the sessions, as well as the different maize projects within each department.

Date: Tuesday, 24 April 2007

Time:

09:00 - 09:30 Dr PJA van der Merwe: R&T Manager (Room B114 - Hendrik Schoeman Building)

09:30 - 10:00 Mr MA Prinsloo: Department Manager Crop Science (Room B110 - Hendrik Schoeman Building)

10:00 - 10:30 Dr MJ du Plessis: Department Manager Production Systems (Room 4 - JPF Sellschop Building)

10:30 - 11:00 Dr K Mashingaidze: Department Manager Plant Breeding & Biotechnology (Room C104 - Hendrik Schoeman Building)

11:00 - 11:30 Prof AH Mc Donald: Department Manager Crop Protection (Room E120 - Hendrik Schoeman Building)

11:30 - 12:00 Dr AEJ Saayman-du Toit: Department Manager Crop Sciences & Technology Transfer (Room D11 - Hendrik Schoeman Building)

12:00 - 12:30 Dr PJA van der Merwe: R&T Manager - discussion with regard to findings/report (Room B114 - Hendrik Schoeman Building)

ANNEX 2: LIST OF PARTIES CONTACTED FOR INPUTS

(All but 5 contributed by way of personal interviews,
telephone interviews or by e-mail)

- Afgri Seed
- Animal Feed Manufacturers Association
- AgriSA (only re NARF)
- Agricol
- ARC Head Office (Dr Olorunju)
- AVCASA
- CropLife
- Dept Agriculture (NARF)
- Dept Agriculture (Crop Estimates Committee)
- Fertilizer Society of SA
- GrainSA
- Link Seed
- Monsanto
- National Association of Maize Millers
- Pannar
- Pioneer
- SANBio (only re biotechnology networks)
- South African National Seed Organization
- Syngenta
- University of KZ-Natal (Dr. Shanahan)
- University of Stellenbosch (Prof. Retief)

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