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**REPORT ON THE INVESTIGATION INTO THE  
SOUTH AFRICAN SORGHUM INDUSTRY**

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**A REPORT BY THE SORGHUM SECTION 7 COMMITTEE  
APPOINTED BY THE  
NATIONAL AGRICULTURAL MARKETING COUNCIL**

**SEPTEMBER 2006**

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**ABBREVIATIONS**

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AFMA – Animal Feed Manufacturers Association  
ARC – Agricultural Research Council  
CEC – Crop Estimates Committee  
CELC – Crop Estimates Liaison Committee  
CSIR – Centre for Science and Industrial Research  
DoA – Department of Agriculture  
FAO – Food and Agriculture Organisation  
GMO – Genetically Modified Organisms  
GSA – Grain South Africa  
GSI – Grain Silo Industry (PTY) LTD  
JSE- Johannesburg Securities Exchange (formerly SAFEX)  
NAFU – National African Farmers Union  
NAMC – National Agricultural Marketing Council  
NGO – Non- Governmental Organisation  
PDA – Provincial Departments of Agriculture  
PDI – Previously disadvantaged Individual  
PPECB - Perishable Products Export Control Board  
R & D – Research and Development  
SACOTA – South African Cereal and Oilseeds Traders Association  
SADC – Southern African Development Community  
SAFEX – South African Futures Exchange  
SAGIS – South African Grains Information Service  
SAGL – South African Grain Laboratory  
SANCU - South African National Consumer Union  
SPO - Sorghum Processors Association of South Africa  
SARS - South African Revenue services

## **EXECUTIVE SUMMARY**

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Sorghum is a tropical cereal grass that has been cultivated in southern Africa for over 3 000 years. Today, sorghum is cultivated across the world in the warmer climatic areas. It is in volume the world's fifth most important cereal grain, after wheat, maize, rice and barley. Sorghum is still largely a subsistence food crop, but is increasingly forming the foundation of successful food and beverage industries. (Prof JRN Taylor: 2003)

During 2005 the NAMC decided to establish a Committee (in terms of section 7 of the Marketing of Agricultural Products Act, 1996, (MAP Act)) to conduct an investigation into the South African sorghum industry. The Committee held its first meeting on 7 September 2005.

The terms of reference are to investigate the South African sorghum industry and to identify problems and opportunities for sustainable growth and development in the industry. Specific sorghum industry issues would be addressed with a view to making recommendations that will increase efficiencies, market access and industry competitiveness by unrestricted participation by all stakeholders.

Although sorghum is, after maize and wheat, the most important grain crop produced in South Africa it contributes only a small percentage to the total domestic grain crop. For the past five seasons South Africa produced on average 225 000 tons of sorghum per annum, which is approximately only 3% and 12% of the average domestic maize and wheat crops, respectively.

The market for sorghum consists of the food market, the animal feed market and exports. South Africa commercially processes on average 200 000 tons of sorghum per annum (5 year average). Virtually all sorghum processed is purchased from the commercial farming sector. About 90% is used for food production and 10% for animal feed.

Sorghum is mainly used for food and beverage consumption such as malt and sorghum meal. Malt is used for manufacturing sorghum beer (traditional African beer) (between 52% and 62% of total domestic demand is used for malting/brewing). Sorghum meal, also known as "Mabele", competes directly with maize meal and is served as a breakfast cereal or as soured porridge. "Ting", sorghum rice, or sometimes called "corn rice", is whole sorghum that has had the outer bran layers removed and is served instead of rice. For the past five years approximately 65 000 tons was milled and sold as sorghum meal. Processors of sorghum products for the end-consumer market find themselves in an extremely competitive environment in which consumers can easily switch to substitutes such as maize meal, rice and lager beer. Influences from the western culture and the economic climate are important determinants. The sorghum malt market (industrial malt consumption and commercial malt consumption) has shown a declining trend for the past 10 years.

The overview of the sorghum industry clearly illustrates the historically dualism and skewed participation in the sorghum industry. As indicated in the "The Strategic Plan for South African

Agriculture” the challenge to improve participation and correct the skewed distribution of land, capital and economic opportunities remains important across all sectors.

The basis for competitiveness is sustainable production. Costs need to be contained by means of relevant research, training, applied extension, efficient input and infrastructure markets, economies of scale where possible, and the efficient use of the value chain. Income needs to be increased by means of product differentiation, new export markets, and efficient processing infrastructure.

The grain industry is an important partner in the government’s continuous effort to achieve food security for all households in South Africa. This industry plays a vital role in terms of providing sufficient quantities of the grains necessary for basic staple food requirements. Government has therefore an interest to ensure that the industry remains competitive and viable.

Sorghum is crucially important to household food security in Africa as it is uniquely drought tolerant among cereals, can withstand periods of high temperature, and because of its excellent nutritional qualities. Average yields remain below 1t/ha, because sorghum cultivation in Africa is still mainly characterized by traditional farming practices with low inputs (no inorganic fertilizer or pesticides) and traditional varieties. Such low yields mean that there is often no surplus sorghum, without which processing industries cannot be created. However, where intensive agriculture is practiced with improved varieties or hybrids, yields are much higher and comparable with other major cereals. For example, in South Africa the average commercial yield in 2003/04 was 2,87t/ha for sorghum compared to 2,97t/ha for maize.

The following recommendations were made by the Section 7 Committee:

- A. *To ensure a viable and sustainable broadening participation in the sorghum industry at farm level, extension services and development programs should be based only on sound economic principals.***
- B. *Government should intensify its endeavours to convince the Minister of Finance of the importance of agricultural research in order to secure additional funding of research.***
- C. *Producers should be assisted to become more competitive by applying improved cultivation practises and cultivars. Government research and extension services should be done in partnership with the private sector to supply the most efficient services and relevant high quality products.***
- D. *PDA’s should accept the primary responsibility for dissemination of information to subsistence farmers.***
- E. *The NAMC should facilitate the establishment and co-ordination of marketing development programmes/schemes to enable subsistent producers to develop into commercial producers.***

- F. Government should change its attitude towards sorghum and accept the fact that it is an important agricultural product. The Agricultural Sector Report to the June 27 2006 meeting of the Presidential Working Group on Commercial Agriculture classified sorghum as “not attractive, competitive or large” and would not therefore receive any dedicated recourses for development.***
- G. The VAT on sorghum meal remains an issue to be discussed with the Minister of Finance.***
- H. Spoornet should formally recognise the Transport working Group of the grain industry as a forum to discuss logistical problems.***
- I. Spoornet should expedite the establishment of a Standing Committee on grain logistics involving all role players and service providers (including silo owners).***
- J. The DoA should provide continuous funding for a credible crop estimating process.***
- K. In order to differentiate between sweet and bitter sorghum production in crop estimates, the Sorghum Forum should supply the Crop estimates Committee with a detailed address list of all sorghum producers***
- L. Government should support and continue the promotion of indigenous produce and assist in enhancing the status of indigenous foods.***
- M. The Sorghum Forum should take the lead in examining ways to establish generic promotion of sorghum intended for the domestic market***
- N. Provincial Governments should recognise the nutritional value of sorghum and include sorghum in school feeding schemes and other initiatives.***

## **STRUCTURE OF THE REPORT**

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The remainder of the report is structured as follows:

Chapter 1 sets out the Committee’s composition and terms of reference with regard to the status of the sorghum industry.

Chapter 2 summarises the history of the South African sorghum industry, industry structures and intervention since deregulation as well as an overview of the market for sorghum.

Chapter 3 covers the problem statement and challenges, by providing a SWOT analysis and key challenges faced by the sorghum industry.

Chapter 4 contains the conclusions and recommendations of the Committee.

## 1. INTRODUCTION

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The National Agricultural Marketing Council (NAMC) is a statutory body and primarily functions as an advisory body to the Minister for Agriculture and Land Affairs. During 2005 the NAMC decided to establish a Committee (in terms of section 7 of the Marketing of Agricultural Products Act, 1996) to conduct an investigation into the sorghum industry. The Committee held its first meeting on 7 September 2005.

### Composition of the Sorghum Section 7 Committee

The Sorghum Section 7 Committee comprised of the following members:

Mr Zolile Duze – Chairperson	(NAMC)
Ms Rona Beukes	(DoA)
Dr Dries Booyens	(Seed producer)
Mr Koos du Plessis	(Grain SA)
Mr Paul du Plessis	(AFMA)
Ms Anna Enslin	(SAGIS)
Mr Nico Fouché	(Sorghum Forum)
Ms Aletta Geldenhuys	(SANCU)
Mr John Gordon	(SACOTA)
Mr Piet Louw	(GSI)
Mr Balfour Makhetha	(Sorghum beer distributors)
Ms Lizette Mellet	(NAMC)
Ms Lillibeth Moolman	(NAMC)
Mr Gideon Morule	(NAFU)
Mr Eric Platt	(Sorghum Processors Association)
Mr Rajiv Shrivastava	(United National Breweries (SA) Limited)
Prof John Taylor	(Sorghum researcher, University of Pretoria)
Dr Piet van der Merwe	(ARC, Grain Crops Institute)
Mr Sakkie van Zyl	(Grain SA)

### Terms of reference

The terms of reference are to investigate the South African sorghum industry and to identify problems and opportunities for sustainable growth and development in the industry. Specific sorghum industry issues would be addressed with a view to making recommendations that will increase efficiencies, market access and industry competitiveness by unrestricted participation by all stakeholders.

## **2. THE CONTEXT AND OVERVIEW OF THE SORGHUM INDUSTRY**

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### **2.1 Sorghum**

Sorghum (*Sorghum bicolor* (L.) Moench) is also known as sorghum (Internationally); mabele (Pedi, Sotho, Ndebele); amabele (Zulu) and amazimba (Xhosa).

This tropical cereal grass has been cultivated in southern Africa for over 3 000 years. Today, sorghum is cultivated across the world in the warmer climatic areas. It is in volume the world's fifth most important cereal grain, after wheat, maize, rice and barley. Sorghum is still largely a subsistence food crop, but is increasingly forming the foundation of successful food and beverage industries. (Prof JRN Taylor: 2003)

In South Africa cultivars are divided into three classes:

- Class GM: sorghum with a low tannin content known as sweet sorghum which is especially suitable for malting and milling purposes;
- Class GL: sorghum with a low tannin content known as sweet sorghum which is especially suitable for milling and animal feed purposes; and
- Class GH: sorghum with a high tannin content (bird resistant) known as bitter sorghum which is used for industrial malting<sup>1</sup>.

For the purpose of this study, sorghum is regarded as part of cereals that are annual plants, yielding grains used for food, feed, seed and industrial purposes, e.g. ethanol (currently not in SA). Furthermore, it has been recommended that the denomination of "cereal crops" be limited to crops harvested for dry grain and sweet stem sorghum, thereby excluding crops harvested or used green for forage, silage, grazing, etc.

**Description:** Sorghum is a cane like grass, the modern cultivars being up to 2m tall with large branched clusters of ears. The individual kernels are about 3-4 mm in diameter, similar to other grains such as wheat and barley and vary in colour from white to dark brown depending on the cultivar.

**Distribution and Habitat:** *Sorghum bicolor* originated in Africa and is widely distributed throughout the world. Different cultivars are found in different regions depending on the climate. It is adapted to a wider range of ecological conditions. It is mostly a plant of hot, dry regions; still survive in cool weather as well as waterlogged habitats.

**Growing sorghum:** Sorghum grows in a wide variety of soils and is more drought resistant than other summer grains, but it will do better when the soil is enriched with compost or fertilisers prior to planting. Cultivars have also been bred to suit different soil and climate conditions.

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<sup>1</sup> Industrial malt is used in the manufacturing of sorghum beer by means of an industrial process, as opposed to commercial malt that is used for home-brew sorghum beer.

Sorghum is prone to damage by various pests, including birds and in some parts of Africa parasitic witch weed (*Striga*). Resistant cultivars, crop rotation and early weeding help combat the latter.

**Uses and cultural aspects:** Sorghum is processed into a wide variety of nutritious traditional foods, such as semi-leavened bread, couscous, dumplings and fermented and non-fermented porridges. It is the grain of choice for brewing traditional African beers. New products such as instant soft porridge and non alcoholic malt beverages are great successes. In the competitive environment of multinational enterprises, sorghum has been proven to be the best alternative to barley for lager beer brewing.

**Nutritional value:** The nutritional values of unprocessed sorghum compared to maize are as follows:

	Protein	Sugars	Fat
Sorghum	11,6%	2,1%	0%
Whole kernel maize	9,1%	1,9%	4,4%

Sorghum porridge (Mabele) nutritional values per 100g serving compared to Super maize meal's comparative values are as follows:

	Protein	Fat	Carbohydrates	Energy
Mabele	9,7%	1,6%	76,5g	1448kj
Super maize meal	7,4%	1,0%	73,0g	1337kj

## 2.2 Historical overview of the South African sorghum industry:

The sorghum industry was managed and controlled as follows:

1946/47 – 1985/86 by the Maize Board.

1986/87 – 1996/97 by the Sorghum Board.

Until 1997, the Sorghum Board administered various arrangements relating to the marketing of sorghum. The Sorghum Board performed functions such as the furnishing of market information, market and product development, and the management of a voluntary pool system by acting as a buyer of last resort. Research was co-ordinated by the Sorghum Board and financed by a statutory levy. Market forces determined prices. Limited quantities of sorghum were exported, and an import tariff of 3% is still in place. Imports and exports of sorghum were subject to quantitative control.

On 30 November 1997, the Sorghum Board terminated its functions. All assets of the Sorghum Board were transferred to the Sorghum Trust to be used for the benefit of the whole sorghum industry.

Statutory levies in terms of the Marketing of Agricultural Products Act, 1996, were introduced to enable the Sorghum Trust to finance research and development projects and information functions.

The South African Grains Information Service (SAGIS), a section 21 Company, funded by, amongst others, the Sorghum Trust, performs the information function and provides information on imports, exports, local consumption, stocks, manufacturing figures, etc. Research as proposed by the Sorghum Forum is financed by the statutory levy administered by the Sorghum Trust, and performed by appropriate research institutions.

## 2.3 Industry Structures and Intervention:

### 2.3.1 The Sorghum Trust:

After the termination of the Sorghum Board in 1997, all assets of the Sorghum Board were transferred to the Sorghum Trust which was established in February 1999. The main objective of the Trust is to maximize income of the Trust and to provide funding for:

- Sorghum research and development projects in the interest of the sorghum industry;
- The maintenance and improvement of sorghum quality standards;
- The maintenance of information required by the sorghum industry;
- Sorghum promotion projects in the interest of the sorghum industry.

### 2.3.2 Statutory levies:

Statutory levies imposed on sorghum are summarized as follows:

**Table 1: The statutory levy on sorghum since deregulation**

Levy promulgated on sorghum (VAT excl)	Date of implementation	Lapsing date
R3,10/t	8 May 1998	31 July 2000
R3,10/t	21 July 2000	28 February 2001
R3,10/t	26 April 2001	28 February 2002
R5,00/t	5 March 2002	28 February 2003
R6,00/t	1 March 2003	28 February 2006
R7,70/t	24 February 2006	28 February 2010

Source: NAMC

The following table indicates the rate of levy collection since 1998/99:

**Table 2: Rate of levy collection**

Marketing year	Levies collected (equivalent tons)	Processed sorghum plus whole sorghum exported (levyable tons)	% collected
1998/1999	234 961	296 669	79%
1999/2000	181 195	255 400	71%
2000/2001	258 928	289 500	89%
2001/2002	116 217	251 600	46%*
2002/2003	232 551	270 000	86%
2003/2004	195 389	222 900	88%
2004/2005	208 816	222 200	94%

\*The levy regulations were published too late to collect a year's levy

Source: NAMC

### **2.3.3 The Sorghum Forum:**

The Sorghum Forum, which has a formal constitution, was established on 30 April 1997 by directly affected groups in the sorghum industry to act as mouthpiece for the sorghum industry in South Africa and to obtain transparent consensus regarding matters of mutual concern to all stakeholders in the sorghum industry. The Forum is a body representative of all its members and is open to participation by any directly affected group as defined in the MAP Act. The Sorghum Forum meets a minimum of twice a year.

### **2.3.4 The South African Grain Information Service (SAGIS):**

Timely information is essential in order to survive in a free market system. With the demise of the Sorghum Board, the sorghum industry joined hands with the maize, winter cereal and oilseeds industries to establish the South African Grain Information Service (SAGIS) during 1997.

SAGIS is an independent section 21 Company (completely financed by the 4 grain trusts) that collects, collates and publishes reliable sorghum market information according to the needs of the industry.

Statutory measures for registration, records and returns were implemented on 9 April 1998, reviewed and extended in 2002 and are still in place.

The purpose and aims of these statutory measures are:

- to compel parties to keep records and render returns; and
- to ensure that continuous, timely and accurate information is available to all role-players.

Processors and purchasers of sorghum are compelled to register with SAGIS and every exporter, importer, processor, purchaser and commercial storer must keep records and furnish monthly returns to SAGIS. During 2005, sorghum returns were submitted by 31 traders, 11 storers, 91 processors and 3 exporters/importers.

Information of individuals is dealt with in a confidential manner and no sensitive or potentially sensitive client-specific information is made available to any party without the prior approval of the party or parties whose rights may be affected.

SAGIS's monthly bulletin (SMB) is available on its website but is also distributed by means of e-mail, faxes and post. The market information (stocks, imports, exports, consumption and producer deliveries) is deemed essential for informative decision-making.

In order to make the market information available to members of the developing sector and PDI, as far as possible, SAGIS:

- Negotiate with and rely on parties directly involved in that sector (e.g. NAFU, GSA, ARC, etc.) to share the information with them; and
- Publishes the SMB, since May 2004, also in Zulu and Tswana.

### 2.3.5 The Southern African Grain Laboratory (SAGL):

The Southern African Grain Laboratory (SAGL) is incorporated under Section 21 (Association not for gain). The SAGL was established on request of the South African grain industry in 1997 after the disbandment of the Boards. SAGL provides grain analysis and related services and is regarded as a market leader in Southern Africa. The Directors of SAGL are nominated by the grain industry associations.

### 2.3.6 The Crop Estimates Committee (CEC):

Accurate crop estimates play an important role in providing real-time market information (supply) on which important decisions and actions can be based, e.g. to negotiate the best possible price, to decide what and when to plant, etc. The crop estimates and forecasts are the result of collated inputs provided and consensus reached by the various member organisations of the CEC, namely National and Provincial Departments of Agriculture, the ARC and Stats SA.

**Table 3: CEC Sorghum information ('000t)**

(Apr - Mar)	Marketing year								2005/06 (Oct 2005)
	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	
Crop estimates for sorghum	355.0	264.6	156.0	352.5	175.6	197.3	219.5	373.0	260.0

*Source: Crop Estimates Committee*

### 2.3.7 The Crop Estimates Liaison Committee:

The Crop Estimates Liaison Committee (CELC) is an official Committee of the NAMC. This Committee monitors the crop estimates process of the Crop Estimates Committee. The grain forums especially regards it as a very important platform where problems can be resolved with regard to crop estimates, being a vital part of information in the free market environment, and also affecting market prices. Since its inception in October 1998, CELC has focussed on the following:

- The establishment of a completely independent and objective Crop Estimates Committee (CEC), free of commercial bias;
- Understanding and acceptance on the part of the CEC of what is required from it by the industry and why;
- An accurate, timely and credible crop estimate as well as the finalisation of the production figures per crop at the end of the production seasons;
- The monitoring of CEC's performance and evaluating projects in connection with the crop estimating process.

The Committee meets three to four times per year. The Committee is chaired by the NAMC member responsible for the grains portfolio and market participants are members of the Committee.

### **2.3.8 Research:**

The Agricultural Research Council (ARC) has the vision to be a national and international recognized centre of excellence in agricultural science and innovation. Sorghum is a mandated crop of the ARC-Grain Crops Institute at Potchefstroom. Research projects are jointly sponsored by Government and external funding such as the funding from the Sorghum Trust. Research projects are grouped under the following five strategic goals:

- Increase access to the resource poor farmers
- Sustainable use of the natural resource base
- Competitive agriculture
- High quality and safe food
- Support and informed society

*Source: ARC Strategic Plan (2005-2008)*

The funding of research is becoming more and more problematic as government reduces its contribution, industry funds become limited and the generation of new funds from the industry becomes more difficult. Government's contribution was 100% some years ago but is on a sliding scale. No industry can survive in a globally competitive world unless supported by a world class Research and Development (R&D) programme. According to the ARC, developed and industrialised countries typically invest approximately 3% of the industries' GDP in R&D, while for South Africa, this is in the region of 1%. This has an impact on service delivery to especially the previously disadvantaged agricultural sector, which is in a great need of appropriate technologies to improve their situation.

Many agricultural industries and non-governmental organisations have recognized their responsibility towards technology development and have, within their means, contributed towards funding of agri-science. The Sorghum Trust makes contributions to the ARC Grain Crops Institute and other beneficiaries such as Grain SA, Universities and NGO's.

Since the Sorghum Trust does not have sufficient funds to support even a basic R&D programme, a levy is absolutely essential to ensure a viable and needs-driven R&D programme. The levy funds assist in maintaining critical expertise and scientific capacity that has been developed over many years for the industry.

The Sorghum Forum annually invites all relevant research institutions such as the ARC, CSIR and universities to table research proposals to the Forum. The Forum's Research Projects Evaluation Committee (RPEC) meets once a year to evaluate and prioritise the projects in terms of norms and criteria that is accepted by the Forum. Researchers are given opportunity to explain certain aspects to the RPEC during meetings, where after the RPEC meets in camera. The RPEC's recommendations are tabled at the Forum meeting in November each year for approval, after which they are submitted to the Sorghum Trust for funding. The Trust then meets and considers these projects for funding in terms of the Trust Deed and the relevant statutory regulations as well as the availability of Trust funds. If the cost of the projects exceeds the available funds, the projects are selected considering the priorities linked to each project, up to the cumulative value that equals the available funds. The Trustees may also invite the researchers to explain certain aspects to them and may change the priority list according to their opinion.

For the four years 2001/02 until 2004/05, an average of 22% of levy funds were appropriated on projects aimed directly at previously disadvantaged individuals. These projects are primarily aimed at the empowerment of black people in terms of the cultivation of sorghum cultivars for emerging farmers, technology transfer and dissemination of information. The Sorghum Trust terminated certain unsuccessful projects which resulted in a lesser expenditure on transformation projects. Research projects considered and funded by the sorghum Trust are listed in Annexure 1.

## 2.4. The Sorghum Market

### 2.4.1 The importance of sorghum in the grain market:

Gross farm income from all agricultural products amounted to R67 103 million (see table 4) for the year that ended on 30 June 2005, which is 2% lower than the previous year. This decrease can mainly be attributed to a decrease of 9,8% in the gross income of field crops (see table 5).

The gross income from field crops amounted to R15 082 million in 2005 (a decrease of R1 633 million from 2004 to 2005). The income from maize decreased by 12,5% and that of sorghum and sunflower seed by 64,7% and 17,5%, respectively.

**Table 4: Economic indicators of the SA agriculture sector**

R' million at current prices	July 03 to June 04	July 04 to June 05	% change
Total gross farm income	68 430	67 103	-2
Intermediate expenditure	37 930	40 157	5,5
Total farm cost	54 320	57 229	5
Net farm income	15 689	12 188	-22
Terms of trade	1,03	0,9	-12,6

Source: DoA

**Table 5: Gross income from major products at current prices**

Field crops (R' million)	2004	2005	% change
Maize	7 893	6 903	-12,5
Wheat	1 983	2 008	+1,3
Sorghum	403	142	-64,7
Sugar cane	2 600	3 033	+16,6
Sunflower seed	1 237	1 021	-17,5
Tobacco	431	226	-47,6
All field crops	16 715	15 082	-9,8

Source: DoA

On average, prices received by farmers for all agricultural products decreased by 8,4%. The weighted average price of field crops decreased by 18,4%, mainly because of decreases in the prices of maize, sorghum and sunflower seed which decreased by 7,3, 28,2, and 20,9%, respectively. (DoA Economic Review of the SA Agriculture: 2004/05)

### **Sorghum prices:**

Sorghum prices are highly volatile. In a year when local sorghum production exceeds consumption for food and beverage, the sorghum price is determined by the lowest price of competing grains. Currently the sorghum price is discounted against the cheapest of white or yellow maize.

When sorghum demand exceeds production, the price for sorghum depends on the import parity price and a premium is paid for malting quality.

Local sorghum prices dropped dramatically during 2004 as a result of the big local crop. Producer prices were in the region of R1 350/t from the end of 2003 to the middle of 2004, but dropped below the level of yellow maize (R 970/t) by the end of 2004 because the excess sorghum were consumed by the feed market.

**Table 6: Indicative import parity prices of sorghum: (VAT excluded)****NOTE:**

This is only an example of how an import parity price can be calculated – it can vary according to need and negotiations.

<b>Prices for forward contracts:</b>	<b>USA Sorghum (Gulf)/ 2005/11/04 (2005/11)</b>
FOB Gulf value (\$/t) (Source: IGC)	101.00
Freight rate (20-30000 t) (\$/t)	40.00
Insurance (\$/t)	0.30
Cost , insurance and freight (\$/t)	141.30
Converted to R/t	946.53
Financing costs (R/t) (10.50% - Prime rate)	8.17
Discharging costs: Durban (R/t)	110.82
Import tariff (R/t) (3% of FOB price)	20.30
<b>F.O.R. at Durban harbour (R/t)</b>	<b>1085.82</b>
Transport costs to Randfontein (R/t)	280
<b>Delivered price (R/t)</b>	<b>1365.82</b>
Exchange rate (1\$=) 2005/11/04	6.6987

*Spoornet and market participants do not submit transport costs due to confidentiality.*

*Source: SAGIS*

### 2.4.2 Sorghum production in South Africa

Although sorghum is, after maize and wheat, the most important grain crop produced in South Africa it contributes only a small percentage to the total domestic grain crop. For the past five seasons South Africa produced on average 225 000 tons of sorghum per annum, which is approximately only 3% and 12% of the average domestic maize and wheat crops, respectively.

The Free State Province is the largest sorghum producing area in South Africa and produces on average 54% of the total domestic sorghum crop. Mpumalanga is the second largest sorghum producing province (28%), followed by the Limpopo (7%), North West Province (5.8%), and Gauteng (5%).

Sorghum production in South Africa is summarised in the following table:

**Table 7. Sorghum production in South Africa (tons)**

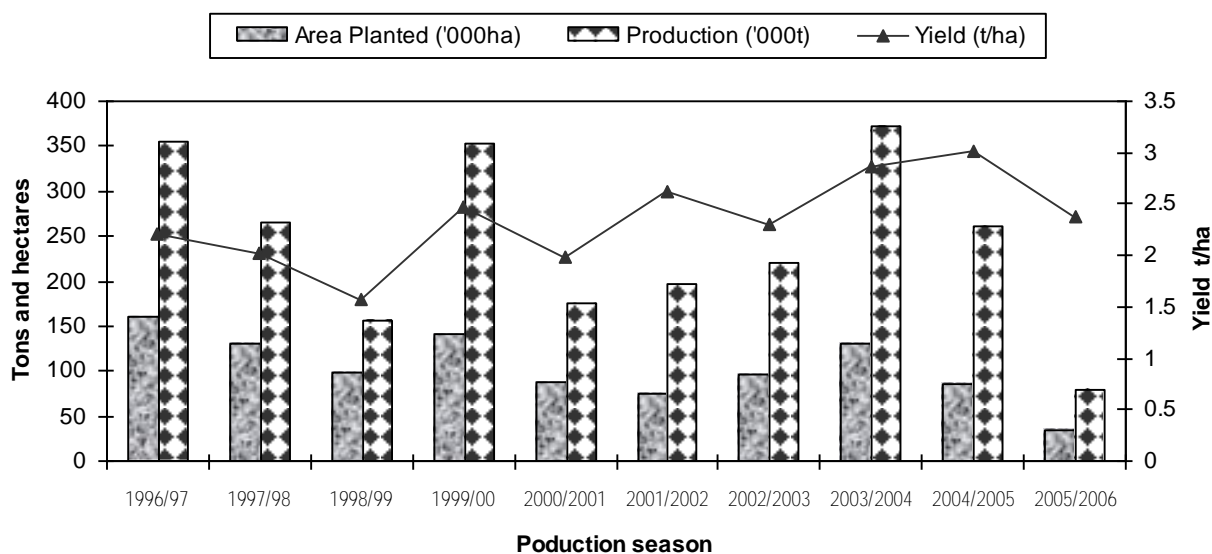
Production Season	Free State	Mpumalanga	North West	Limpopo	Gauteng	Other	Total Production
2001/02	0.00	0.00	0.00	0.00	0.00	0.00	197 275
2002/03	126 050	63 706	9 725	12 461	7 239	333	219 514
2003/04	187 250	115 780	22 650	21 950	24 670	700	373 000
2004/05	162 950	56 840	12 000	14 500	13 150	560	260 000
2005/06*	35 200	22 400	4 600	16 000	1 360	330	79 890
5 Year Ave	122 290	63 265	12 545	16 762	10 584	490	225 936
% of Total	54%	28%	5.8%	7%	5%	0.2%	100%

\* CEC's sixth production forecast

Source: National Crop Estimate Committee

During the past decade the total quantity of sorghum produced fluctuated between 450 000 and 150 000 tons, depending on the total area planted to sorghum and the yields obtained (Figure 1). Although a downward trend in the total area planted is noted, the yield per ha increased significantly, which can be attributed to the utilisation of more efficient cultivation practises and new cultivars.

**Figure 1: Domestic total sorghum area planted, production and yields**



In 2005 and beginning of 2006, sorghum producers experienced a severe cost-price squeeze. Producer prices declined drastically over the past two seasons, mainly due to the domestic oversupply situation and the strengthening of the exchange rate, while input cost, especially of imported inputs like fuel, chemicals and fertiliser kept rising because of higher international prices. At current market conditions, profitable sorghum production is questionable and many producers will be forced to reduce sorghum plantings. The extent to which sorghum will be produced domestically in future will entirely depend on the profitability of sorghum production.

### **2.4.3 Sorghum quality and grading:**

Sorghum is graded according to the standardized quality norms as validated under the Agricultural Products Standard Act, 1990 (Act No 119 of 1990) for phyto-sanitary measures and the Foodstuff, Cosmetics and Disinfectants Act 1972 (Act 54 of 1972) for safety measures.

Standards regarding Food Hygiene and Food Safety of Regulated Food Products of Plant Origin Intended for Exports have also been promulgated under the Agricultural Product Standards Act, 1990.

### **2.4.4 Storage of sorghum:**

Commercial storage providers of sorghum operate in the following framework:

- Storage and handling services are managed in such a way as to add value to the products of the owners of sorghum, eg. cleaning and grading.
- Effective grain silo services are rendered at market related costs and on sound business principles and are available to similar users of grain silo facilities on an equal basis.
- Sorghum is graded according to the grading regulations of the Directorate Food Safety and Quality Assurance of the Department of Agriculture. (Specific requirements eg. no siftings can be arranged).
- Any quantity of sorghum that complies with the requirements of the National Department of Health will be handled and stored subject to practical arrangements.
- The quality and quantity of sorghum is guaranteed during storage and agreed arrangements are adhered to.
- Demands of the market mechanisms that enhance the trading of sorghum are supported and used.
- Silo certificates are made available to the owners of sorghum for trading purposes.
- The sorghum specified on a silo certificate will on presentation of the silo certificate be supplied to the holder thereof after all relevant costs have been paid.
- Grain silo service tariffs are available at the beginning of a marketing period at head offices and grain silos.

In addition to these services, storage facilities to previously disadvantaged individuals include the following:

- The storsers of sorghum provide a means whereby previously disadvantaged individuals get access to mainstream marketing opportunities.

- Any quantity of sorghum (how little it might be) delivered in bags or bulk will be received and stored in silos and/or marketed through silos as long as it complies with the sanitary and phyto-sanitary requirements.
- A full range of marketing tools / possibilities are available from silo owners.
- Storers inform emerging producers on an ad hoc basis of quality regulations, prices, price structures, marketing opportunities and storage services that are available.
- Extension services are generally available to assist farmers in an advisory capacity.

#### 2.4.5 Sorghum consumption:

The market for sorghum consists of the food market, the animal feed market and exports.

The sorghum market is summarized in the following table:

**Table 8: The market for sorghum**

Marketing years	Total sorghum available (production, stock, & imports)	Exports	Industrial malt	Commercial malt	Meal	Rice, grits and other	Total food	Total feed	Total consumption
1997/1998	419 900	57 100	36 270	87 286	53 373	2 410	179 339	63 727	243 066
1998/1999	407 700	58 100	38 901	81 514	52 800	3 300	176 500	58 200	234 700
1999/2000	304 100	23 500	28 300	85 900	56 700	3 000	173 900	36 400	210 300
2000/2001	419 100	39 900	32 800	90 400	61 200	1 800	186 200	23 300	209 500
2001/2002	302 100	48 200	28 700	84 300	75 800	1 100	189 900	16 200	206 100
2002/2003	319 000	66 200	20 500	74 900	77 900	1 100	174 400	21 900	196 300
2003/2004	288 000	48 800	21 100	73 900	73 700	200	168 900	10 100	179 000
2004/2005	422 700	37 600	25 600	76 400	76 800	200	179 000	10 000	189 000
2005/2006	437 400	38 200	24 600	78 300	87 900	100	190 900	12 000	202 900

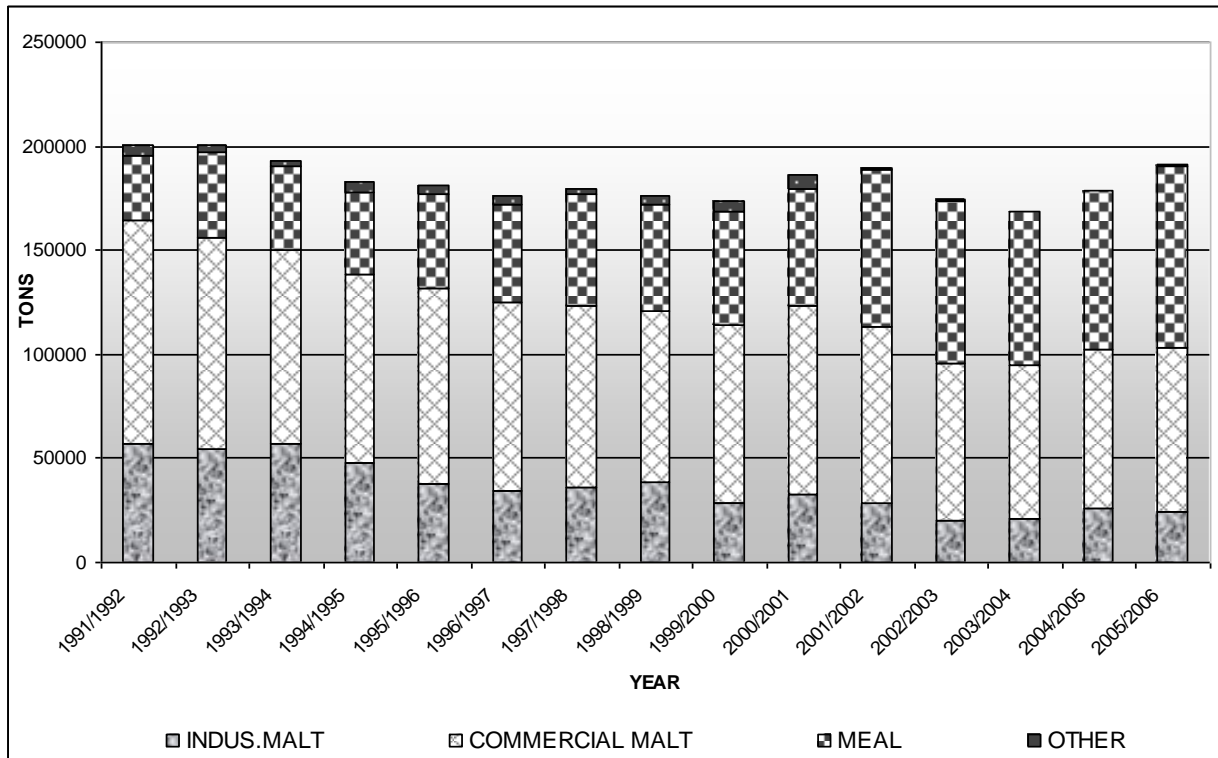
Source: SAGIS

The animal feed market comprises of sorghum processed for pet food, poultry and livestock. The utilization of sorghum in the feed market is inconsistent and opportunistic.

The food market comprises of sorghum processed for malt, meal and other food such as rice and grits (mostly for brew). The average share of the food market of the total consumption is 86,5% for the past 9 years. VAT on sorghum meal is still in place after various requests to the Departments of Finance and Agriculture for exemption were unsuccessful.

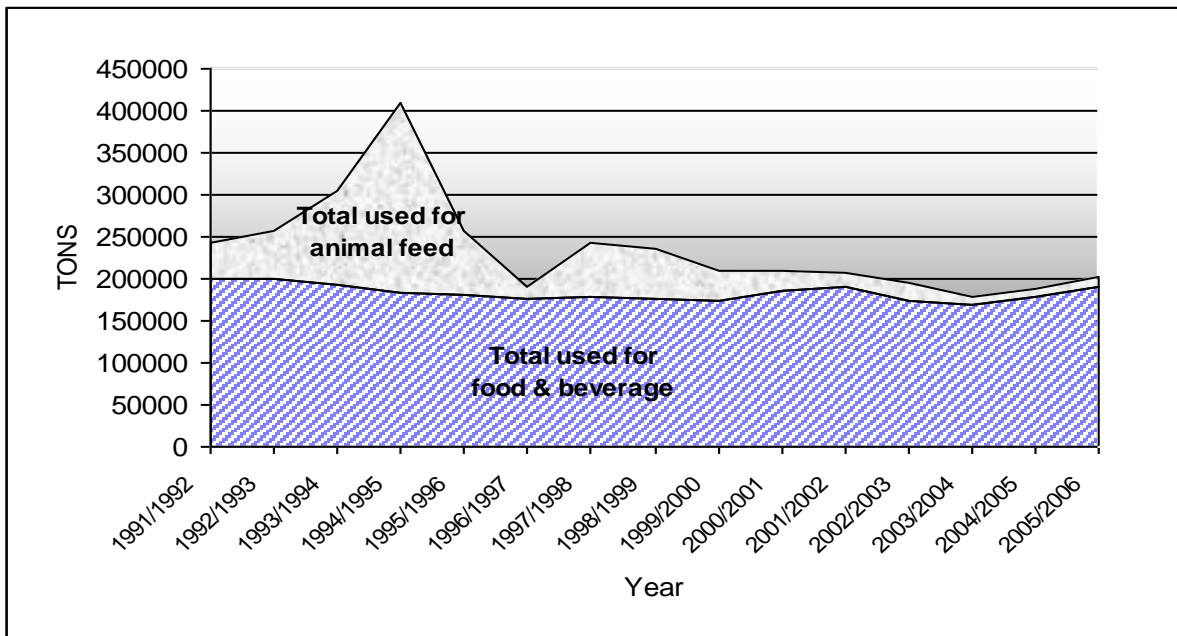
The average share of sorghum processed for animal feed is 13,5% for the past 9 years, and shows a decreasing trend.

**Figure 2. Total consumption of South African sorghum in the food and beverage markets**



Source: SAGIS

**Figure 3. Total consumption of South African sorghum in the animal feed and food & beverage markets**



Source: SAGIS

As can be seen in Figures 2 and 3, the industrial and commercial malt consumption decreased since 1991, while the consumption for sorghum meal increased from 31 565t in 1991/92 to 87 900t in 2005/06. Sorghum used in the animal feed market decreased drastically since 1996, from 147 545t to 12 000t in 2005/06.

Sorghum is mainly used for food and beverage consumption such as malt and sorghum meal. Malt is used for manufacturing sorghum beer (traditional African beer). Between 52% and 62% of total domestic demand is used for malting/brewing. Sorghum meal, also known as “Mabele”, competes directly with maize meal and is served as a breakfast cereal or as soured porridge “Ting”, sorghum rice, or sometimes called “corn rice”, is whole sorghum that has had the outer bran layers removed and is served instead of rice. For the past five years an average of 78 420t per year was milled and sold as sorghum meal.

Processors of sorghum products find themselves in an extremely competitive environment in which consumers can easily switch to substitutes such as maize meal, rice and lager beer. Influences from the western culture and the economic climate are important determinants.

The use of sorghum as an animal feedstuff is well researched and documented over the years. Price is the main determining factor as to whether maize or sorghum is used for animal feed. In ruminants the combination of sorghum with other grain sources and the use of steam flaked sorghum gives a product with a similar nutritional value as maize. The reasons why feed manufacturers are sometimes reluctant to use sorghum, results from the effect of locality and season on the nutritional value of the sorghum (larger variation in nutrient composition than maize), as well as the possibility of tannins in the sorghum. The combination of problems of grain availability, bin space, cleaning, and processing along with uncertainty regarding consumer demand place sorghum at a disadvantage relative to maize.

#### **2.4.6 The beer market:**

Sorghum processed for malt comprises the biggest share of the market for sorghum.

In the 1930s the government prohibited any private companies or individuals to brew and sell sorghum beer (today officially referred to as Traditional African Beer). All sorghum brewing companies which were not part of government were declared illegal. This brewing right was then passed on to the municipalities, on condition that all income from sorghum breweries should be allocated to the development of black townships and villages. The municipalities then assigned this responsibility to the Industrial Development Corporation.

South Africans consume well over 5 billion litres of alcoholic beverages per year. The figure could be nearer to 6 billion litres, depending on one’s estimate of the amount of total sorghum beer consumed. Roughly two-thirds of the alcohol consumed in South Africa is lager beer (officially referred to as malt beer) and sorghum beer. Malt beer consumption in SA, at about 56 litres per capita per annum is not especially high compared to the Czech Republic for example, where per capita consumption is more than 150 litres per annum.

According to a Research Report on the Liquor Industry in January 2004, market share per alcoholic category was as follows:

Sorghum beer	23,6 %
Malt beer	42,6 %
Wine	17,4 %
Spirits	13,3 %
Other	<u>3,1 %</u>
	100 %

When a clear beer is manufactured from sorghum malt, the excise duty on this beer would be the same as for beer brewed from barley malt. The National Treasury also promulgated regulations whereby sorghum beer and sorghum beer powder be known as “Traditional African Beer” and “Traditional African Beer Powder”.

Commercially Traditional African beer is brewed with malted sorghum and maize meal. It has a shelf live of only four to six days, depending on the season. It is a product that has to be manufactured, distributed and consumed in less than a week.

There are 2 categories of sorghum beer:

- Industrial sorghum beer: produced and packed under health hygiene and quality standards as stipulated by SABS;
- Home brew sorghum beer: produced at home from commercial sorghum malt and other ingredients (quality not controlled by authorities); and Instant beer powder, where all ingredients are included and the addition of water is required.

Sorghum beer (Umqombothi) is rich in B vitamins. It is regarded more as a food than an alcoholic beverage, and the sour taste is highly refreshing.

In February 2005 excise duties on alcoholic beverages have been increased by between 9.4 and 20 percent as part of the government's latest Budget. Traditional African beer (sorghum-based) was not subject to any duty hikes. Malt beer was set for a duty increase of 9,5% in nominal terms (5,3% real), to R33,65 per litre of absolute alcohol from R30,73 previously. This represents a rise to about 57,2 cents per average 340ml can from 52,24 cents.

The level of excise duty payable on clear sorghum beer manufactured from sorghum malt is having a negative effect on the sorghum industry, as it impedes on the development of a new market for sorghum malt. The sorghum malt market (Industrial malt consumption and Commercial Malt consumption) has shown a declining trend for the past 10 years.

### 2.4.7 Sorghum stock position and exports:

**Table 9: Sorghum stock position**

(Apr - Mar)	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06
Opening stock	36.3	87.6	73.3	24.0	130.5	25.2	43.4	49.4	182.5
Producer deliveries	381.3	300.6	177.8	392.6	171.2	214.0	215.8	367.9	249.9
Imports	2.3	0.0	53.0	0.0	0.4	75.1	28.8	5.4	5.0
Surplus	0.0	19.5	0.0	2.5	0.0	4.7	0.0	0.0	0.0
Available	419.9	407.7	304.1	419.1	302.1	319.0	288.0	422.7	437.4
Processed	243.1	234.6	210.3	209.5	206.1	196.3	179.0	189.0	208.7
Net receipts(-)/dispatch(+)	23.4	41.7	14.8	0.7	3.8	1.6	2.0	3.1	5.2
Deficit	0.0	0.0	0.1	0.0	0.7	0.0	3.5	2.4	0.0
Exports	57.1	58.1	23.5	39.9	48.2	66.2	48.8	37.6	38.2
Utilised:	323.6	334.4	282.2	288.6	276.9	275.6	238.6	240.2	252.1
Stock on hand	96.3	73.3	21.9	130.5	25.2	43.4	49.4	182.5	185.3

Source: SAGIS

South Africa is a net exporter of sorghum. Trade with other African countries remained low compared to other grains. The main reason for this could be the fact the other African countries produce more sorghum than SA. Exports during 2004 and 2005 were mainly to African countries. Sorghum export markets were mainly to Botswana where quality specifications are a limiting factor. To maintain the export opportunities to Botswana it is of great importance to comply with prescribed specifications.

### 2.4.8 Future marketing prospects for bio fuels

The possible manufacturing of renewable fuels, such as ethanol, is receiving a lot of attention and sorghum could in future benefit from developments in this regard. Some market participants are of the opinion that this could stabilise the grain industry, but also benefit new entrants to the industry and stimulate rural development. Over the longer term the manufacture of bio-ethanol from grains could offer a solution to the problem of surplus production, as well as create an expanded market for the increased production of grains such as maize, sorghum and oilseeds.

Issues to be addressed before large scale processing of maize and sorghum can proceed include:

- the impact on food security and food prices;
- acceptability of by-products to the feed industry; and
- government participation and legislation.

The availability of sorghum for specific products could be a problem.

### **3. PROBLEM STATEMENT AND CHALLENGES**

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#### **3.1 SWOT ANALYSIS**

In determining the current circumstances and challenges in the sorghum industry, the following summarises the SWOT analysis for the markets of sorghum:

##### **3.1.1 Industrial malt and commercial malt:**

###### **Strengths:**

- Well established product; sorghum beer is a traditional drink and closely associated with the culture and heritage of people of South Africa. Almost all malt beer consumed in South Africa is produced in the country.
- Nutritious food product; Industrially brewed sorghum beer has a low alcohol content (3,2%), high nutritional value and a rich source of nutrients namely proteins, carbohydrates, complex starch, energy, vitamins and minerals.
- Healthy product: when used in moderation, it can make a substantial contribution to the consumer's diet.

###### **Weaknesses:**

- Shrinking market: the trend amongst African consumers is to move to drinking clear beer as they move up the income scale.
- Promotional drive is low, not much is spent on promotion of malt.
- Distribution; distribution of beer is either by own fleet, or by contracted fleet or in rare cases by distributors/retailers using their transport to collect from the brewery/depot/distributor. The distribution system has to be very reliable and flexible in order to make drinkable sorghum beer available to the consumers within the shortest time to avoid spoilage.
- Image – unless perceptions can be changed, decline could continue.
- Quality can sometimes be poor: poor quality of sorghum malt has resulted in Traditional African Beer brewers partially substituting industrial enzymes for sorghum malt reducing the demand for the malt.

###### **Opportunities:**

- Capacity in the market; sorghum is the best alternative to barley for lager beer brewing.
- Marketing campaign to promote consumption.
- New entrants ensure more exposure to the benefit of the entire market.
- Utilise government sentiments;
- Dietary features: better features than other alcoholic drinks.
- Lager beer brewing where the starch component is sorghum.
- Government's perception on sorghum should be changed.

###### **Threats:**

- Enzymes; industrial enzymes used in the place of sorghum malt.
- Price;
- Substitutes;

- Image;
- Westernization aspirations and branding;
- HIV Aids;
- Germination/ climatologically conditions (not possible to import as it must germinate in SA);
- Availability of sorghum
- In competition with other consumer needs/expenses for the consumer rand
- Malt beer legislation
- The DoA regard sorghum as not competitive and unattractive and no resources would be spent on the sorghum industry. (According to the Presentation made at the Presidential Working Group meeting on agriculture on the 27th of June 2006)

### **3.1.2 Sorghum meal:**

#### **Strengths:**

- Familiar African product;
- Nutritious and healthy product; sorghum is processed into a variety of attractive and nutritious traditional foods.
- Capacity for market expansion;
- Growing market – consumption is increasing
- Not genetically modified
- Non allergenic and gluten free

#### **Weaknesses:**

- VAT on sorghum meal;
- Unknown by some consumers
- Price fluctuations; generally high processing costs.
- Promotional drive; difficult to change into a symbol of prosperity while being associated with poor and marginal areas.

#### **Opportunities:**

- Government and institutional markets: feeding schemes; research is essential to unleash sorghum's capacity to be the cornerstone to food security.
- Continued requests for the removal of VAT;
- Promotion; sorghum's anti-oxidant benefits are currently being investigated.
- Fortification; the CSIR is developing a "super sorghum" with improved nutritional traits. This research project aims to develop more nutritious and easily digestible sorghum varieties that contain increased levels of pro-vitamin A, vitamin E, iron, zinc, amino acids and protein. Major sorghum food processing technologies will also be optimized for the new cultivars.
- Value added products, eg. Morvite (instant soft porridge) attractive to both manufacturers and consumers. Value addition to by-products of sorghum processing eg. edible coatings for fruits and nuts, wallboards for housing and biodegradable packaging materials.
- Exports; a dependable supply and good quality sorghum can gain export markets.

- Gluten free;
- Government's perception on sorghum should be changed.

**Threats:**

- Substitutes;
- HIV Aids;
- Excluded from school feeding schemes in some provinces.
- The DoA regard sorghum as not competitive and unattractive and no resources would be spent on the sorghum industry. (According to the Presentation made at the Presidential Working Group meeting on agriculture on the 27th of June 2006)

**3.1.3 Sorghum in Animal Feed:****Strengths:**

- Attractive in mixed fowl foods.
- Non GM. In future non GM animal feed may become important.
- Non allergenic and gluten free

**Weaknesses:**

- VAT on sorghum.
- Not listed on Safex – can not hedge on Safex.
- Large differential in price between food and feed value.
- Lower energy value than maize.

**Opportunities:**

- Continued requests for the removal of VAT;
- Multigrain animal feeds for niche market animal products.

**Threats:**

- Erratic supply of sorghum
- Lack of additional silo bins at feed mills to handle sorghum
- Animal Producers perceptions regarding feeding value of sorghum.

**3.2 Key Challenges**

The previous sections illustrate the *status quo* in the sorghum industry. In consideration of the above, the following 3 key challenges need to be addressed in order to improve the efficiency of the sorghum industry:

### 3.2.1 Skewed participation

Although sorghum is a traditional crop of Africa, it was never cultivated to a great extent in South Africa (South Africa produced 1,79% of Africa's total sorghum production in 2004). However, sorghum is a suitable crop for subsistence farmers. In a review by the NAMC into statutory levies, it was noted that the emerging sector's contribution of total production of sorghum was only 0,5% (1 100tons by approximately 500 emerging farmers) for the past 2 years.

The overview of the sorghum industry clearly illustrates the historically dualism and skewed participation in the sorghum industry. As indicated in the "The Strategic Plan for South African Agriculture" the challenge to improve participation and correct the skewed distribution of land, capital and economic opportunities remains important across all sectors. The sorghum industry has made a firm commitment towards the principle of black economic empowerment in the industry, the details of which are still to be negotiated in terms of the BEE charter. Despite some commendable efforts, the task of comprehensive and full-scale empowerment remains incomplete and thus remains one of the main challenges facing the industry at all levels of the value chain.

### 3.2.2 Constrained competitiveness and profitability

According to a study by Dirk Esterhuizen of the University of the Free State, the value chain for sorghum is marginal in terms of international competitiveness.

At a workshop held on competitiveness by the NAMC on 29 June 2005, participants agreed that the basis for competitiveness is sustainable production and a consolidated agricultural industry plan. Costs need to be contained by means of relevant research, training, and applied extension, efficient input and infrastructure markets, economies of scale where possible, and efficient use of the value chain. Income needs to be increased by means of product differentiation, new export markets, and efficient processing infrastructure.

There is a common acceptance of a range of factors constraining performance in the grain industry and thus affecting competitiveness and profitability in the sorghum industry. These factors include inter alia the following:

- Extension and support services
- New and proposed legislation that constrain competitiveness, e.g. Property Tax, Water Act, etc.
- High production costs
- Labour productivity and costs (quality of unskilled labour)
- Funding of research infrastructure and capacity
- Quality concerns in the value chain (quality of inputs, grain, grain products, imported grain)
- Restricted access to affordable finance.
- Access to timely, relevant and accurate market information
- Infrastructure and logistical issues.

- International agricultural policies distorting grain markets.
- Surplus production
- Deficit production
- Volatile currencies
- Crime factors (at all points of the value chain)
- Sustainable environmental management
- Low and variable rainfall and limited good arable land

### 3.2.3 Food security

Section 27 of the Constitution of South Africa states that every citizen has the right to have access to sufficient food and water and that the State must, by legislation and other measures within its available resources, avail to progressive realization of the right to sufficient food.

*(Section 27: Right of access to health care, food, water and social security)*

The grain industry is one of the largest and most strategic industries in agriculture. Former Minister for Agriculture and Land Affairs, Ms Thoko Didiza, mentioned at the Grain SA congress 10 March 2004, that South Africa has a large food insecure population that places a responsibility on both government and civil society to ensure food security for majority of the population, even though there is no overall shortage of grains in the country.

South Africa faces the following key food security challenges:

- Ensuring that enough affordable food is available to all, now and in the future
- Empowering citizens to make optimal choices for nutritious and safe food
- Ensuring that there are adequate safety nets and food emergency systems
- Possessing adequate and relevant information to ensure analysis, communication, monitoring, evaluation and reporting on the impact of food security programmes on the target population

The Minister also referred to the following issues:

- The supply and availability of food continues to be a concern for some SADC countries as well.
- A precise means of addressing this food security problem in the region has not yet been finalised.
- Government has committed itself to regional and continental agreement relating to the creation of a food reserve system (FAO conference 2003). This matter is being investigated by the DoA /SADC.

Another aspect of the food security challenge, is the negative impact of food aid on the South African commercial and emerging agricultural sector. This element would also have to be taken into account in considering a regional food security system. Particular concerns of member countries would have to be incorporated in finding most appropriate solutions for all in accordance with their specific domestic needs. Other external factors such as exchange rate, regional and local supply and demand factors, climatic conditions and world commodity prices

can influence the availability as well as pricing of grain commodities. These factors have major impacts on the affordability of food for poor households.

The grain industry is an important partner in the government's continuous effort to achieve food security for all households in South Africa. This industry plays a vital role in terms of providing sufficient quantities of the grains necessary for basic staple food requirements. Government has therefore an interest in ensuring that the industry remains competitive and viable.

Sorghum is crucially important to food security in Africa as it is uniquely drought tolerant among cereals, can withstand periods of high temperature and because of its excellent nutritional qualities. Average yields remain below 1t/ha, because sorghum cultivation in Africa is still mainly characterized by traditional farming practices with low inputs (no inorganic fertilizer or pesticides) and traditional varieties or land races. Such low yields mean that there is often no surplus sorghum, without which processing industries cannot be created. However, where intensive agriculture is practiced with improved varieties or hybrids, yields are much higher and comparable with other major cereals. For example, in South Africa the average commercial yield in 2003/04 was 2,87t/ha for sorghum compared to 2,97t/ha for maize.

In 2004, the Department of Science and Technology and the Council for Scientific and Industrial Research (CSIR) produced a recipe book called South African Indigenous Foods, which reflects the rich traditions of generations of South African women. The book was the result of a poverty-alleviation project and was selected as a gift for guests at the inauguration of President Thabo Mbeki on 27 April 2004. Dishes such as morogo (an indigenous green leafy vegetable), mealie bread, polokwe (fresh mealie balls), semphemphe pudding (wild melon pudding), mabele porridge (sorghum porridge), masonja (mopani worms and ground peanut dish), and isigwampa (a vegetable and mealie dish) are featured. The recipes were collected as part of a project aimed at commercialising and promoting South African indigenous foods, and was funded by the Department of Science and Technology and implemented by CSIR Food, Biological and Chemical Technologies. While some dishes and beverages were the starting point for new products that are being commercialised, the recipe book contains a broader range of dishes prepared by generations of women. Copyright of the book has been ceded to IndiZAFoods, the Section 21 Company created to facilitate the commercialisation of the indigenous food products. Proceeds from the sale of the book will be re-invested into community initiatives.

## **4. RECOMMENDATIONS**

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### **4.1 Broadening participation in the sorghum industry.**

The successful entering and establishing of new sorghum producers largely depends on three key areas:

#### **4.1.1 Long term profitability of sorghum production**

As in any business operation, the long-term profitability is of critical importance for sustainable production. Sorghum producers that are unable to cover their input costs in the long run, will be forced to reduce their sorghum plantings and to switch to alternative crops that are more profitable. Furthermore, if commercial sorghum producers are unable to cover their expenses under prevailing market conditions, it is doubted if developing producers will survive without extensive government assistance.

#### **4.1.2 Successful knowledge transfer to new entrants**

A large constraint that is observed in developing agriculture in general, is the lack of knowledge and technical know-how of subsistence farmers. The commercialisation of developing sorghum producers will only succeed if information regarding all aspects of the production and marketing of sorghum, as well as financial management, is successfully transferred to and applied by new entrants.

First economy:

- Sorghum production guidelines for farmers and extension workers
- Organise farmers days at research trials
- Provision of and training of extension officers

Second economy:

- Sorghum production guidelines for beginner farmers
- Demonstrations of improved varieties and production practices
- Training of PDA's (extension) and mentor farmers

#### **4.1.3 Availability of adequate financial resources to new entrants**

The redistribution of land in potential sorghum producing areas and the provision of start-up capital to developing sorghum producers alone will not assure the broadening of participation in the sorghum production sector. Development programs should encompass the financial assistance to new farmers for an extended period to ensure that these farmers build-up enough financial reserves to survive difficult market conditions.

**Recommendations:**

- A. To ensure a viable and sustainable broadening participation in the sorghum industry at farm level, extension services and development programs should be based on sound economic principles.***
- B. Government should intensify its endeavours to convince the Minister of Finance of the importance of agricultural research in order to secure additional funding for research.***
- C. Producers should be assisted to become more competitive by applying improved cultivation practises and cultivars. Government research and extension services should be done in partnership with the private sector to supply the most efficient services and relevant high quality products.***
- D. PDA's should accept the primary responsibility for dissemination of information to subsistence farmers.***
- E. The NAMC should facilitate the establishment and co-ordination of marketing development programmes/schemes to enable subsistent producers to develop into commercial producers.***
- F. Government should change its attitude towards sorghum and accept the fact that it is an important agricultural product. The Agricultural Sector Report to the June 27 2006 meeting of the Presidential Working Group on Commercial Agriculture classified sorghum as "not attractive, competitive or large" and would not therefore receive any dedicated recourses for development.***
- G. Government should enforce its acts and regulations and should promote a dispensation that provides for a safe and fair socio-economical environment within which the sorghum industry and the agricultural sector at large can develop and thrive.***

**4.2 Improving competitiveness and profitability**

The competitiveness and profitability of sorghum production and marketing depends on the following factors:

**4.2.1 Expanding the market for sorghum**

- The production of bio-ethanol from sorghum (industrial use of sorghum)
- The inclusion of more sorghum products in food aid schemes
- The exploitation of niche markets such as clear sorghum beer, health food, breakfast cereals and indigenous foods.

#### 4.2.2 International market access and trade policy

- Ensuring that South African sorghum export regulations are in line with the minimum export standards required by countries that mainly import sorghum from South Africa with particular reference to health and safety.
- Ensuring that imported sorghum meets the regulations and standards local produced sorghum needs to comply to.
- Identifying of possible new export markets for sorghum and sorghum products in especially neighbouring countries.

#### 4.2.3 Information and communication

- Accurate and timely information regarding sorghum acreage planted and production – on national, provincial and regional level.
- Reliable information about projected sorghum consumption, exports and imports.

#### 4.2.4 Technology innovation and transfer

- Research to address specific needs of producers and processors, to enhance the profitability of sorghum production and to increase the demand for sorghum.

#### First economy:

- Improved hybrid cultivars
- Improved malting quality
- Improved production practices such as precision farming and bio-farming
- Ethanol production
- Adopt production systems that lower production costs and increase profitability
- Develop alternative products and add value to products
- Exploit niche markets

#### Second economy:

- Improved Open Pollinated varieties (OPV)
- Improved malting qualities of OPV cultivars
- Conservation farming principles developed
- Low cost pest control
- Improve nutrition of sorghum
- Develop and propagate on-farm storage and processing technologies

#### 4.2.5 Technical standards

Ensure that the current regulations and standards that are in force are still in touch with the needs of the sorghum sector.

#### 4.2.6 Food Safety and hygiene

The "Standards Regarding Food Hygiene and Food Safety of Regulated Agricultural Food Products of Plant Origin Intended for Export" was promulgated by the DoA on the 13th of May 2005. These standards require that food products are handled under hygienic conditions through all stages of the supply chain, from primary production to the point of export. All off-farm Food Business Operators (FBO's) will be required to apply to principles of HACCP (Hazard Analysis and Critical Control Point) along the entire food supply chain. These standards and regulations also require record keeping, and that FBO's are able to recall or withdraw product from anywhere in the trade chain, should it pose a health risk.

The sorghum industry is committed to comply to all food safety and hygiene regulations, namely to ensure that all sorghum and sorghum products during production, handling, storage, processing and distribution are safe, wholesome and fit for human consumption, and further to conform to safety requirements and that all products are labelled as prescribed by law. Food safety refers to the assurance that food will not cause harm to the consumer when it is prepared and/or consumed according to its intended use.

Programmes such as traceability-recall procedures and efficient management of chemical, physical and biological hazards are implemented and maintained in the sorghum industry.

The preparation and handling of foodstuffs as well as the facility in which the foodstuffs are prepared and handled, must comply with the relevant legislation as well as with certain company standards. Amongst others, it is a requirement in terms of the legislation that a Certificate of Acceptability be issued for the said food premises. The legislation details that no person shall handle food or permit food to be handled on a food premises in respect of which a valid Certificate of Acceptability has not been issued or is not in force.

The amount of man-made pesticides applied to foodstuffs and their residue allowed to be present in products at market level are regulated by various sets of legislation and inspected by the Department of Health and the Department of Agriculture respectively.

#### ***Recommendations:***

- H. The VAT on sorghum meal remains an issue to be discussed with the Minister of Finance.***
- I. Spoornet should formally recognise the Transport Working Group of the grain industry as a forum to discuss logistical problems.***
- J. Spoornet should expedite the establishment of a Standing Committee on grain logistics involving all role players and service providers (including silo owners).***
- K. The DoA should provide continuous funding for a credible crop estimating process.***

- L.** *In order to differentiate between sweet and bitter sorghum production in crop estimates, the sorghum industry should supply the Crop estimates Committee with a detailed address list of all sorghum producers*
- M.** *Government should support and continue the promotion of indigenous produce and assist in enhancing the status of indigenous foods.*
- N.** *The Sorghum Forum should take the lead in examining ways to establish generic promotion of sorghum intended for the domestic market*

### **4.3 Ensuring Food Security**

Hunger and malnutrition are not solely caused by a shortage of food. The primary causes of hunger in some countries have been political unrest and corrupt governments, poor transportation and infrastructure and, of course, poverty. All of these problems must be addressed if we are to ensure real worldwide food security.

With regard to food security in South Africa, it is necessary to make a distinction between food security on a national level and household food security. During the past decade South Africa has not experienced problems with food security on a national level. At the current level of domestic agriculture production and international trade, no problems are foreseen in the near future. However, a point of concern is the food security at household level and a major factor contributing to this problem is the lack of adequate household income. Food affordability at household level is a point of concern, and a major factor is the lack of adequate household income and the level of unemployment and poverty.

To address household food insecurity, vulnerable communities should be first identified and a comprehensive assessment of the factors contributing to food insecurity in those communities should be done. Thereafter, appropriate actions can be implemented. Sorghum production does have the potential to play a positive role in ensuring household food security in certain rural areas. These areas and the need of the community should be first identified and then appropriate extension programs can be launched if subsistence sorghum production is found to be a viable option in the specific area.

Rural women have always made an active contribution to agricultural production and family subsistence. In sub-Saharan Africa, 70% of the population depends on agriculture as the sole source of income and women and children contribute 60-80% of the labour, mainly in small-scale farming with manual labour: ploughing, planting, weeding, spraying, harvesting and processing. After all these efforts, 30% to 90% of crops are lost to drought, disease, and pests, weeds and poor storage.

Lately the HIV/AIDS plague has more than decimated the farm labour so badly needed to increase food production, thus exacerbating dependency, conflicts, ill-health, malnutrition and the resurgence of communicable diseases such tuberculosis and hepatitis. (Dr Margaret Karembu: The Free Market Foundation: 2006)

While the governments of developing countries are becoming more aware of the role of women in food production and food security macro-economic and agricultural policies and programmes in many countries have not adequately helped rural women to make use of resources.

Governments' policy support must include improving rural women's access to agricultural, financial and social services such as education, health, sanitation and clean water supply. Moreover, women's access to land needs to be considered as the foundation of all economic activities and social development. Awareness must be fostered among policy makers, planners, village heads and male farmers of the benefits resulting from women's access to land in terms of family and national food security. Research should therefore be directed to identifying possibilities for surplus food production by subsistence farmers and marketing opportunities for non-officially priced agricultural produce. Furthermore, decision-makers in peasant organizations, marketing bodies and parasitical organizations supporting grassroots associations need to be gender-sensitized to increase their awareness of existing gender biases in marketing infrastructures. This should lead to measures correcting existing marketing imbalances and prompted marketing opportunities for food and tradable crops, thereby improving food security at household and national levels. (Chana Majake, Chief Executive Officer, Commission on Gender Equality, South Africa) The Committee agrees to these statements.

***Recommendations:***

- O. Provincial Governments should recognise the nutritional value of sorghum and include sorghum in school feeding schemes and other initiatives.***

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## ANNEXURE 1

**CONTRIBUTION OF THE SORGHUM TRUST TO RESEARCH PROJECTS:  
1998/1999 TO 2005/2006**

1998 / 1999

PROJECTS	INSTITUTION	VALUE (RAND)
<b>Cultivar evaluation</b>		
<i>Evaluation of sorghum cultivars</i>		
Evaluation of new and commercial viable sorghum cultivars (G06/01)	ARC-GCI	106 607
<i>Quality studies on sorghum</i>		
Malt quality of sorghum cultivars (GM07/01)	ARC-GCI	70 344
Determination of processing qualities of sorghum cultivars (GM07/02)	ARC-GCI	49 379
<b>Crop protection</b>		
<i>Stem borers in sorghum</i>		
The role of plant resistance in integrated pest management of stem borers on sorghum (GM 23/02)	ARC-GCI	96 669
Identification of molecular markers (QTL's) for stem borer resistance in sorghum (GM 23/05)	ARC-GCI	37 239
<i>Root and stem rot in sorghum</i>		
The effect of root rot pathogens on sorghum (GM 26/01)	ARC-GCI	28 234
Quantification of host x pathogen interactions (GM 26/03)	ARC-GCI	51 485
Quantification of factors that predisposition sorghum genotypes (GM 26/04)	ARC-GCI	36 743
Development of modern molecular identification analysis for root rot pathogens (GM26/05)	ARC-GCI	38 004
Evaluation of sorghum lines and emerging farmer varieties for resistance against economically important leaf diseases (GM 28/01)	ARC-GCI	28 931
<i>Panicle diseases in sorghum</i>		
Ratio between genetical, sito plasmic and induced sterility (GM 26/05)	ARC-GCI	56 431
<b>Plant improvement</b>		
<i>Breeding for disease resistance in sorghum</i>		
Breeding for resistance to ergot, root rot and seedling wilt disease (GM 35/04)	ARC-GCI	21 142
<i>Breeding for insect resistance in sorghum</i>		
Breeding for resistance to stem borers and aphids	ARC-GCI	59 610
<i>Breeding for improved agronomical characteristics in sorghum</i>		
Breeding for malting quality in sorghum (GM 37/02)	ARC-GCI	34 690
Breeding for combine ability in sorghum (GM 37/03)	ARC-GCI	58 318
SUBTOTAL (30% of ARC Budget)	ARC-GCI	787 205
Enzyme peeling (dehulling / decortication) of sorghum grain	CSIR	85 000
<b>TOTAL EXPENDITURE</b>		<b>872 205</b>

1999 / 2000

	INSTITUTION	VALUE (RAND)
<b>Cultivar evaluation</b>		
<i>Evaluation of maize and sorghum cultivars and varieties</i>		
Evaluation of maize and sorghum cultivars and varieties for different production systems	ARC-GCI	99 111

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(M101/01)		
<b>Grain quality of maize and sorghum</b>		
Determine the malting and processing quality of sorghum cultivars and varieties (M102/10)	ARC-GCI	116 146
<b>Weed science</b>		
Effect of temperature stress and herbicides on sorghum seed germination and seedling vigour (M112/01)	ARC-GCI	61 613
<b>Plant nutrition</b>		
<b>Soil fertility optimisation</b>		
N and P Norms as related to soil analysis	ARC-GCI	94 773
<b>Crop protection</b>		
<b>Insect pests of maize and sorghum</b>		
Management of aphids in sorghum (M131/01)	ARC-GCI	52 561
The role of host plant resistance in integrated management of sorghum stem borers (M131/02)	ARC-GCI	55 036
<b>Diseases of maize and sorghum</b>		
Integrated control of sorghum ergot (M141/01)	ARC-GCI	65 188
Integrated control of stress related diseases in sorghum (M141/02)	ARC-GCI	67 144
Control of leaf diseases in sorghum (M141/03)	ARC-GCI	64 405
Integrated control of grain moulds (M141/04)	ARC-GCI	45 071
<b>TOTAL EXPENDITURE (40% of ARC budget)</b>		<b>721 048</b>

## 2000 / 2001

	INSTITUTION	VALUE (RAND)
<b>Cultivar evaluation</b>		
<b>Evaluation of maize and sorghum cultivars and varieties</b>		
Evaluation of sorghum cultivars and varieties for different production systems (M101/01)	ARC-GCI	112 135
<b>Grain quality of maize and sorghum</b>		
Determine the malting and processing quality of sorghum cultivars and varieties (M102/01)	ARC-GCI	148 344
<b>Weed Science</b>		
<b>Seed quality</b>		
Effect of temperature stress and herbicides on sorghum seed germination and seedling vigour (M112/01)	ARC-GCI	109 302
<b>Plant nutrition</b>		
<b>Soil fertility optimisation</b>		
N and P Norms as related to soil analysis (M121/01)	ARC-GCI	149 644
<b>Crop protection</b>		
<b>Insect pests of maize and sorghum</b>		
Management of aphids in sorghum (131/01)	ARC-GCI	89 372
The role of host plant resistance in integrated management of sorghum stem borers (M131/02)	ARC-GCI	101 070
<b>Diseases of maize and sorghum</b>		
Integrated control of sorghum ergot (M141/01)	ARC-GCI	107 621
Integrated control of stress related diseases in sorghum (M141/02)	ARC-GCI	105 572
Control of leaf diseases in sorghum (M141/03)	ARC-GCI	15 146
Integrated control of grain moulds (M141/04)	ARC-GCI	67 510
<b>TOTAL EXPENDITURE (50% of ARC budget)</b>		<b>1 005 716</b>

## 2001/ 2002

	INSTITUTION	VALUE (RAND)
<b>Cultivar evaluation</b>		

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<b>Evaluation of maize and sorghum cultivars and varieties</b>		
Evaluation: Cultivars & Varieties for different production systems (M101/01)	ARC-GCI	111 728
Evaluation: Cultivars & Varieties: Small-holder farmers (M101/81)	ARC-GCI	34 673
<b>Grain quality of maize and sorghum</b>		
Determine the Malting & Processing Quality of cultivars & Varieties (M102/01)	ARC-GCI	143 623
<b>Diseases of maize and sorghum</b>		
Integrated control of sorghum ergot (M141/01)	ARC-GCI	106 042
<b>Drought resistance in maize and sorghum</b>		
Participatory evaluation & Identification of sorghum varieties for small-holder farmers (M161/81)	ARC-GCI	93 423
<b>TOTAL EXPENDITURE (50% of ARC Budget)</b>		
		<b>489 489</b>

**2002 / 2003**

	INSTITUTION	VALUE (RAND)
<b>Cultivar evaluation</b>		
Evaluation of sorghum cultivars and varieties for different production systems (M101/01)	ARC-GCI	59 589
Evaluation of sorghum cultivars and varieties for small-holder farmers (M101/81)	ARC-GCI	57 283
<b>Grain quality</b>		
Determine the malting and processing quality of sorghum cultivars and varieties (M102/01)	ARC-GCI	96 230
<b>Seed quality</b>		
Effect of temperature stress and herbicides on sorghum seed germination and seedling vigour	ARC-GCI	66 299
<b>Soil fertility optimisation</b>		
N & P norms of sorghum as related to soil analysis (M121/01)	ARC-GCI	118 690
<b>Crop protection (plant pathology)</b>		
Integrated management of sorghum diseases (M141/05)	ARC-GCI	134 597
<b>Crop protection (drought)</b>		
Participatory evaluation and identification of sorghum varieties for small-holder farmers in the Northern Province (M161/81)	ARC-GCI	181 505
<b>SUBTOTAL (50% of ARC budget)</b>		
		<b>714 193</b>
Farmer Development: Commercialisation of emerging farmers	Grain SA	20 000
<b>TOTAL EXPENDITURE</b>		
		<b>734 193</b>

**2003/ 2004**

	INSTITUTION	VALUE (RAND)
<b>Crop Science</b>		
Evaluation of sorghum cultivars and varieties for different production systems (M101/01)	ARC-GCI	66 007
Determine the malting and processing quality of sorghum cultivars and varieties (M102/01)	ARC-GCI	104 848
<b>Production systems</b>		
Phytotoxicity resulting from pre-emergence herbicides in sorghum (M111/01)	ARC-GCI	60 164
N & P norms of sorghum as related to soil analysis (M121/01)	ARC-GCI	131 276
<b>Crop protection (plant pathology)</b>		
Screening of SA sorghum cultivars for aphids (M131/03)	ARC-GCI	63 539
Integrated management of sorghum diseases (M141/05)	ARC-GCI	148 536
Integrated management of grain moulds of sorghum (M141/06)	ARC-GCI	75 883
<b>Developing agriculture</b>		
Evaluation of sorghum cultivars & varieties for small-holder farmers	ARC-GCI	59 728
Participatory evaluation and identification of sorghum varieties for small-holder farmers in the Northern Province (M161/81)	ARC-GCI	191 284

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<b>SUBTOTAL (50% of ARC budget)</b>		<b>*901 265</b>
Farmer Development: Commercialisation of emerging farmers	Grain SA	20 000
<b>TOTAL EXPENDITURE</b>		<b>921 265</b>

\* R128 430,26 of this amount (R901 265) was paid on 21 July 2004, in the next financial year.

**2004 / 2005**

	<b>INSTITUTION</b>	<b>VALUE (RAND)</b>
<b>CROP SCIENCE</b>		
M101/01 - Evaluation of Cultivars & Varieties for different production systems	ARC-GCI	101 460
M101/81 - Evaluation of sorghum cultivars & varieties for small-holder farmers	ARC-GCI	0
M102/01 - Determine the malting & processing quality of sorghum cultivars & varieties	ARC-GCI	125 036
<b>PRODUCTION SYSTEMS</b>		
M111/01 - Phytotoxicity resulting from pre-emergence herbicides in sorghum	ARC-GCI	24 090
M121/01 - N+P Norms for Sorghum as related to soil analysis	ARC-GCI	35 427
<b>CROP PROTECTION</b>		
M131/03 - Screening of SA sorghum cultivars for aphids	ARC-GCI	88 492
M141/05 - Integrated management of sorghum diseases	ARC-GCI	157 207
M 141/06 - Integrated management of grain molds of sorghum	ARC-GCI	99 177
M161/81 – Participatory evaluation and identification of sorghum varieties for small-holder farmers in the Northern Province	ARC-GCI	66 741
<b>SUBTOTAL (50% of ARC budget)</b>		<b>697 630</b>
Farmer Development: Commercialisation of emerging farmers	Grain SA	22 000
Identification & Evaluation of Sorghum Cultivars and Varieties for small-holder farmers	Grain SA	71 124
Sorghum Forum / Intsormil White Sorghum Workshop	UP	29 250
<b>TOTAL EXPENDITURE</b>		<b>820 004</b>

**2005 / 2006**

	<b>INSTITUTION</b>	<b>VALUE (RAND)</b>
<b>Crop Science</b>		
M101/01 - Evaluation of Cultivars & Varieties for different production systems	ARC-GCI	110 636
M102/01 - Determine the malting & processing quality of sorghum cultivars & varieties	ARC-GCI	138 142
<b>Crop Protection</b>		
M131/03 - Screening of SA sorghum cultivars for aphids	ARC-GCI	103 228
<b>Weed / Seed Control</b>		
M111/01 - Phytotoxicity resulting from pre-emergence herbicides in sorghum	ARC-GCI	24 626
<b>SUBTOTAL (50% of ARC budget)</b>		<b>*376 632</b>
Integrated management of sorghum diseases	UFS	*98 520
Integrated management of grain molds of sorghum	UFS	*91 900
Identification & Evaluation of Sorghum Cultivars and Varieties for small-holder farmers	Grain SA	137 647
<b>TOTAL EXPENDITURE</b>		<b>704 699</b>

\*50% of these amounts were paid in the next financial year (2006/7)

**Annexure 2:****Major sorghum producing countries (top 20)**

	Sorghum production (tons)	
1 United States of America	11,731,710	
2 Nigeria	8,028,000	F
3 India	6,500,000	*
4 Mexico	6,300,000	*
5 China	3,090,000	F
6 Sudan	2,600,000	*
7 Argentina	2,160,000	
8 Brazil	2,103,450	
9 Australia	1,900,000	
10 Ethiopia	1,784,282	F
11 Burkina Faso	1,481,212	*
12 Egypt	950,000	F
13 United Republic of Tanzania	650,000	F
14 Mali	650,000	F
15 Venezuela	600,000	F
16 Niger	580,000	*
17 Chad	560,000	F
18 Cameroon	550,000	F
19 Uganda	420,000	
20 Ghana	399,300	F

F = FAO estimate | \* = Unofficial figure

Note: South Africa 373,000

Source FAO 2004 data

**Annexure 3:****Sorghum worldtable**

<b>Period</b>	<b>WORLD - Production ('000 t) (a)</b>	<b>WORLD - Trade ( '000 t) (a)</b>	<b>WORLD - Consumption ('000 t) (a)</b>	<b>WORLD - Stock ( '000 t) (a)</b>
1996/97	69549	6189	67667	4594
1997/98	58947	6820	59039	4502
1998/99	59905	6561	59070	5416
1999/00	59083	8143	60409	4881
2000/01	53377	7627	54642	3748
2001/02	58312	7256	57273	4795
2002/03	52743	5912	53661	3879
2003/04	58924	6206	58111	4692
2004/05	58148	5364	58357	4483
2005/06	58879	5780	58470	4892
2006/07	57342	5520	57983	4251

**Footnotes**

- a) - 2006/2007 Forecast  
b) - 2005/2006 Average for the period Jul 2005 - Jun 2006.  
\* International Season: Jul - Jun

Source: International Grains Council  
USDA - Unites States Department of Agriculture

*Source: SAGIS*

**Annexure 4:****African countries' production of sorghum (2004 data)**

<b>Country</b>	<b>Production (tons)</b>	<b>Percentage of Africa's sorghum production</b>
Algeria	700	0.003
Benin	190 000	0.910
Botswana	32 000	0.153
Burkina Faso	1 481 212	7.094
Burundi	74 171	0.355
Cameroon	550 000	2.634
Central African Republic	42480	0.203
Chad	560 000	2.682
Congo	54 000	0.259
Cote d'Ivoire	70 000	0.335
Egypt	950 000	4.550
Eritrea	56 743	0.272
Ethiopia	1 784 282	8.545
Gambia	25 000	0.120
Ghana	399 300	1.912
Guinea	6 000	0.029
Guinea-Bissau	15 000	0.072
Kenya	120 000	0.575
Lesotho	46 000	0.220
Madagascar	1 000	0.005
Malawi	45 000	0.216
Mali	650 000	3.113
Mauritania	68 000	0.326
Morocco	14 000	0.067
Mozambique	314 000	1.504
Namibia	6 000	0.029
Niger	580 000	2.778
Nigeria	8 028 000	38.449
Rwanda	163 772	0.784
Senegal	132 400	0.634
Sierra Leone	21 000	0.101
South Africa	373 000	1.793
Sudan	2 600 000	12.452
Swaziland	600	0.003
Tanzania	650 000	3.113
Togo	180 000	0.862
Tunisia	1 000	0.005
Uganda	420 000	2.012
Zambia	19 000	0.091
Zimbabwe	80 000	0.383
	<b>20 803 660</b>	<b>100.00</b>

*Source: FAO 2004 data*