



**New Partnership for  
Africa's Development (NEPAD)  
Comprehensive Africa Agriculture  
Development Programme (CAADP)**



**Food and Agriculture Organization  
of the United Nations  
Investment Centre Division**

## **GOVERNMENT OF THE REPUBLIC OF SOUTH AFRICA**

### **SUPPORT TO NEPAD–CAADP IMPLEMENTATION**

**TCP/SAF/3002 (I)  
(NEPAD Ref. 07/50 E)**

**Volume IV of V**

### **BANKABLE INVESTMENT PROJECT PROFILE**

**Biofuels (Bioethanol and Biodiesel) Crop Production: Technology  
Options for Increased Production, Commercialisation & Marketing**

*July 2007*

## **SOUTH AFRICA: Support to NEPAD–CAADP Implementation**

**Volume I: National Medium–Term Investment Programme (NMTIP)**

*Bankable Investment Project Profiles (BIPPs)*

**Volume II: Woodlands and Forest Resources for Improving Livelihoods and Income Generation**

**Volume III: Sustainable Natural Resources Management and Use Options to Improve Livelihoods**

**Volume IV: Biofuels (Bioethanol and Biodiesel) Crop Production: Technology Options for Increased Production, Commercialisation and Marketing**

**Volume V: Livestock Development: Increasing Productivity, Commercialisation and Marketing**

## NEPAD–CAADP Bankable Investment Project Profile

**Country:** South Africa

**Sector of Activities:** Agriculture

**Proposed Project Name:** **Biofuels Crop Production Project (BFCPP)**

**Project Area:** National

**Duration of Project:** 2 years

**Estimated Cost:** Foreign Exchange.....US\$0.72 million  
Local Cost .....US\$1.70 million  
**Total..... US\$2.42 million**

**Suggested Financing:**

<i>Source</i>	<i>US\$ million</i>	<i>% of total</i>
<i>Government</i>	1.21	50
<i>Financing institution(s)</i>	0.60	25
<i>Private sector</i>	0.07	3
<i>Beneficiaries</i>	0.53	2
<i>Total</i>	<b>2.42</b>	<b>100</b>

## SOUTH AFRICA:

### NEPAD–CAADP Bankable Investment Project Profile

#### *“Biofuels (Bioethanol and Biodiesel) Crop Production: Technology Options for Increased Production, Commercialisation and Marketing”*

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### Currency Equivalents

(September 2006)

Local Currency =	ZAR (Rand)
US\$1.00 =	R7.48
R1.00 =	US\$0.13

### Abbreviations

Asgi-SA	Accelerated and Shared Growth Initiative for South Africa
CAADP	Comprehensive Africa Agriculture Development Programme
DEAT	Department of Environment and Tourism
DME	Department of Minerals and Energy
DoA	Department of Agriculture
EPWP	Expanded public work Programme
GWh	Gigawatt hour
KZN	KwaZulu Natal
MTEF	Medium Term Expenditure Framework
NEPAD	New Partnership for Africa’s Development
SLM	Sustainable Land Management
UNFCCC	United Nations Framework Convention on Climate Change

## **I. PROJECT BACKGROUND**

### **A. Project Origin**

I.1. Biofuels are a fairly modern, diverse and cross-cutting sub-sector that brings together food security and energy issues.

I.2. Consideration for biofuels as an alternative energy source emanate from high and volatile world oil prices, global warming issues and generally low and fluctuating agricultural commodity prices. There are still very few leading players on the market and they include Brazil, the USA, and China. South Africa is a signatory to the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol which both aim at addressing global concerns on climate change and pollution. South Africa, by the nature and size of its economy experiences major environmental challenges and it is the largest emitter of green house gasses on the continent. Against this background, South Africa has opted to reduce dependency on fossil fuels by considering biofuels as a feasible option.

I.3. According to the Biofuels White Paper prepared in 2003, South Africa has developed a ten-year medium-term goal to promote the biofuels energy sub-sector. The country is expected to generate 10,000 GWh of renewable energy from biomass, wind, solar and small-scale hydropower productions. These provide cleaner energy sources. In support of the proposed new energy policy, Government has provided for a 30 percent tax reduction for biofuels include ethanol, which can be produced from sugar cane, grain sorghum, maize and sugar beet, while biodiesel is derived from oil-producing seeds than include sunflower and canola. South Africa had a maize surplus and the country exports 50 percent of its sugar crop this year. The cultivation of crops suitable for biodiesel is, however, limited.

I.4. There are plans to increase commercial production of biofuels starting with soya which is targeted to produce 80,000 tons per annum for biodiesel production and other crops are under consideration. South Africa is the continental leader on biofuels development. It is projected that biofuels could have the potential to produce 10 percent of South Africa’s petrol and diesel needs by 2010. However, for South Africa to integrate biofuels into the mainstream economy, the country will have to significantly expand the production of the crops from which fuels are derived.

### **B. General Information**

I.5. The grain industry is one of the largest in South Africa, producing between 25 percent and 33 percent of the total gross agricultural production and with a value of some R12-billion. The largest area of farmland is planted with maize, followed by wheat and, to a lesser extent, sugarcane and sunflowers.

I.6. Crops are traditionally grown for human and animal consumption. Several factors determine what makes a good biofuel feedstock. These include the crop’s content of starch (for ethanol production) or vegetable oil (for biodiesel), its potential for agricultural expansion, its suitability to the South African climate and its cost.

(i) *Ethanol Candidate Crops*

I.7. The potential crops for ethanol production are maize, sugar and sorghum. Table 1 below shows the production trends in South Africa for the three crops between the 2001/02–2005/06 production seasons.

Table 1: Ethanol Production Potential Crops Production and Yields 2000/01–2004/05					
Planting season	2000/01	2001/02	2002/03	2003/04	2004/05
<b>Maize</b>					
Plantings (ha)	2,673,905	3,016,880	3,184,950	2,843,300	2,929,500
Production (t)	7,486,840	9,731,830	9,391,450	9,482,000	12,180,300
Yield (t/ha)	2.80	3.23	2.95	2.33	4.16
<b>Sorghum</b>					
Plantings (ha)	88,300	75,250	95,497	130,000	98,240
Production (t)	171,221	220,000	219,514	373,000	297,300
Yield (t/ha)	1.94	2.92	2.30	2.87	3.03
<b>Sugar</b>					
Plantings (ha)	429	432	430	427	429
Production (t)	23,876	21,157	23,013	20,419	19,095
Yield (t/ha)	2,729	2,400	2,763	2,412	2,235

Source: Agricultural Statistics Directorate, Department of Agriculture.

(ii) *Maize*

I.8. Maize is an important and widely grown grain crop in South Africa. It is mainly grown for human consumption as a staple food and animal stock feeds. Maize and grain sorghum may have the best potential as ethanol feed stocks. Both have a high content of starch. Maize is also among the most efficient potential feedstock. The estimated area that South African commercial maize producers have planted to maize during the current 2005/06 season is 1,567 million ha, which is 0.1 percent more than the previous estimate. The ratio of white to yellow maize plantings is 63:37 compared to the previous seasons’ 60:40. The expected white maize plantings are 985,000 ha, while yellow maize plantings are 582,200 ha. The area planted to maize in the subsistence agricultural sector is estimated at 432,246 ha, and the expected maize crop for this sector is 317,056 tons. During the 2003/2004 marketing season, at a gross value of US\$1.04 billion maize was the second largest gross value contributor to the agricultural sector. The 2004/2005 season received adequate rains that resulted in harvests of 12.18 million tons and this resulted in an over–supply and a subsequent drop in the price of maize. The producer price ranged from US\$58.13 to US\$170.63 per tonne.

I.9. Maize is the largest locally produced field crop, and the most important source of carbohydrates in the Southern African Development Community (SADC) region. South Africa is the main maize producer in the SADC region and maize is exported to other countries in the region.

I.10. According to the provincial maize distribution for the 2004/05, the Free State produced the largest quantity of maize at 36.4 percent of the total national contribution. 32.8 percent was grown in the Northwest while Mpumalanga produced 19.8 percent. Gauteng produced 4.4 percent of the total maize output. KZN, the Northern Cape and Limpopo produced 2.7 percent, 1.7 percent and 1.5 percent of the total annual contribution respectively. The Eastern and Western Cape produced the lowest contribution of 0.6 percent and 0.1 percent respectively.

**(iii) Grain Sorghum**

I.11. Grain sorghum has a starch content of about 75 percent, which is very high. The production forecast for sorghum remained unchanged at 79,890 tons with an expected yield of 2.38 t/ha. The area under sorghum cultivation has not grown significantly, however there has been remarkable growth in the yield, which can mostly likely be attributed to better varieties.

I.12. Sorghum cultivation is suited to the climates of the Free State and Mpumalanga, where hundreds of thousands of tonnes are already produced for food. There is a great deal of room for expansion of the crop’s production in Northwest province.

**(iv) Sugar Cane**

I.13. South Africa is among the top ten producers of sugarcane, and half of the crop is exported. Sugarcane is grown in 15 areas extending from northern Pondoland in the Eastern Cape through the coastal belt and Midlands of KwaZulu–Natal to the Mpumalanga Lowveld. An estimated 2.5mt of sugar is produced each season. Some 50 percent is marketed in southern Africa, with the rest exported to Africa, the Middle East, North America and Asia. The South African sugar industry contributes R1.7–billion to the country's foreign exchange earnings. The three categories of sugar producers are estates, small–scale farmers and large–scale growers. Sugar estates produce 12 percent of the sugar while small–scale farmers and large–scale farmers produce 13 percent and 75 percent respectively.

I.14. Sugar cane is one of the most viable feedstock for production of biofuel. The most cost–efficient way to produce ethanol from sugar cane is through co–production that is as part of the sugar production process. Sugarcane has highest yield and could be the cheapest of all potential ethanol feed stocks.

**(v) Biodiesel Potential Crops**

I.15. The oil from sunflower, soya beans. Groundnuts and canola among other crops can be extracted to produce biodiesel.

Table 2: Biodiesel Potential Crop Production 2001/02–2005/06					
Planting season	2001/02	2002/03	2003/04	2004/05	2005/06
<b>Sunflower</b>					
Plantings (ha)	521,695	667,510	606,450	530,000	460,000
Production (t)	638,320	928,790	642,610	648,000	620,000
Yield (t/ha)	1.22	1.39	1.06	1.22	1.35
<b>Soya Beans</b>					
Plantings (ha)	134,150	124,150	100,130	135,000	150,000
Production (t)	226,210	223,000	136,520	220,000	272,500
Yield (t/ha)	1.69	1.80	1.36	1.63	1.82
<b>Groundnuts</b>					
Plantings (ha)	165,250	94,160	49,850	71,500	42,800
Production (t)	183,840	120,185	60,005	115,000	74,388
Yield (t/ha)	1.11	1.28	1.20	1.61	1.74
<b>Canola</b>					
Plantings (ha)	27,000	31,200	44,200	44,250	41,200
Production (t)	19,000	34,000	40,770	32,000	47,370
Yield (t/ha)	0.74	1.09	0.92	0.72	1.15



**(vi) Soya Beans**

I.16. Soya beans are planted between November and December. It grows in warm, fertile, clayish soils under dry-land conditions. Production of the crop has significantly increased because of the crop's health attributes: vegetable protein. It is mainly used for animal feeds that take up 73 percent. Less than 20 percent for human consumption and 7 percent for oil and oil cake production. The production forecast for soya beans increased by 6.1 percent to 413,995 tons and the expected yield is 1.72 t/ha. The area planted to soya beans was increased by 1,000 ha or 0.4 percent to 240,570 ha, compared to the previous estimate. The production forecast for soya beans increased by 6.1 percent to 413,995 tons and the expected yield is 1.72 t/ha.

I.17. Soya beans is grown in Mpumalanga (58 percent), Free State (14 percent), KZN (12 percent). Limpopo, Gauteng and Northwest produce small quantities. Some of the crop is grown in the eastern part of the country. Although soya beans grow under relatively dry conditions, it can even be grown as late as January in the western parts.

**(vii) Sunflower**

I.18. It is assumed that soya beans and sunflower seeds hold more potential as feedstock for biodiesel in South Africa. While soya bean oil content which is about 18 percent is lower than in other feedstock, it has potential for expansion especially in the wetter provinces. In addition, farmers can sell its biggest by-product, protein.

I.19. Sunflower is a major crop in South Africa. Its seeds have an oil content of about 40 percent, making it well suited for biodiesel production. In addition, both soya beans and sunflower can be rotated on farms with maize. The production forecast for sunflower seed is 527,720 tons, and the expected yield is 1.12 t/ha.

**(viii) Groundnuts**

I.20. The area under groundnut production decreased from 71,500 in 2004/05 to 42,800 in 2005/06. About 16.5 percent of the crop is grown under irrigation. Groundnuts are mainly grown in the north western parts of the country around the north western Free State which grows 44.4 percent of the crop, the North West where 30.4 percent of the national output is produced, and the Northern Cape which produces 21 percent. Groundnuts are planted in mid October to mid November. The crop is sensitive to low temperatures. Groundnuts contribute about 1.3 percent to the gross value of field crops, and the estimated gross value over a five year period was US\$45 million. Production is generally influenced by costs of production, input costs and demand factors.

**(ix) Canola**

I.21. The cultivation of canola has grown virtually from no industry since early 1990s, to a production area of 30,000 ha currently, with two processing plants in place in the Western Cape where it grows favourably. Other areas are also being considered. The crop has a unique fatty acid composition, which makes it healthy for human consumption. It contains less saturated fat than other plant oils. It competes with other oil seeds such as sunflower seed and soya beans on the local market. Applications include food, stock feeds (oil cake good source of protein for animal feed) and industrial use. Production and demand are projected to grow.

## **II. PROJECT AREA**

II.1. Biofuel crop production is diverse, and most of the crops have always been grown in the different provinces for traditional human and animal consumption. There are concerted efforts and initiatives underway to explore biofuel crop options, project economics, and viability and sustainability issues. Most of the work is taking place in Limpopo, Mpumalanga and KZN provinces.

## **III. PROJECT RATIONALE**

III.1. The South African Cabinet approved a proposal by the Departments of Minerals and Energy, Agriculture and Land Affairs, and Science and Technology, to explore biofuels as an important component of South Africa’s energy mix. These can be blended with diesel and petrol or used in place of products such as paraffin.

III.2. Government expects that the growth of a biofuels industry will contribute to job creation and the emergence of small-scale farmers as well as to a lowering of greenhouse gas emissions, diversification of fuel supplies and a reduction of South Africa’s crude oil import bill.

III.3. There are concerted efforts through the Department of Minerals and Energy (DME) to promote the production of environment-friendly biodiesel and bioethanol — fuels manufactured from crops such as maize. Government has identified biofuels as a key industry in its Accelerated and Shared Growth Initiative (Asgi-SA) because of its potential to create jobs, stimulating rural development and lessening the country's dependence on oil. Development of a local biofuels industry will form part of the initiative to boost South Africa’s average growth rate to 6 percent between 2010 and 2014.

III.4. The development of biofuels fits in within the NEPAD-CAADP framework of development priorities that are aimed at restoring agricultural growth, rural development and food security in the African region. Biofuels provide the potential for development of rural infrastructure, improved market access, and sustainable livelihoods.

## **IV. PROJECT OBJECTIVES**

IV.1. The objectives of increasing and diversifying crop production are to ensure optimal use of agricultural resources including land and water to develop the agricultural and energy sectors. At primary production level, farmers will grow crops that will provide feed stock to the petroleum industry at secondary level.

IV.2. The project will embrace small-scale emerging farmers who would now transform from subsistence farming into cash crop farming. Farmers will earn incomes from extraction of juice while also benefiting from the seed for consumption. The project will also provide alternative energy sources, which would reduce over reliance on imported petroleum products.

## V. PROJECT DESCRIPTION

V.1. The project entails accelerated production of biofuel crops to meet food security and energy needs. The economy is undergoing diversification from the traditional production of crops for food consumption to energy production of ethanol and biodiesel country wide. There is focus to increase land under cultivation to ensure sustainable and sufficient throughput especially for the purposes of fuel production. Candidate crops and areas of cultivation are still being identified. Feasibility, sustainability and viability issues are also still under consideration.

V.2. ***Incubation Project.*** The Department of Agriculture (DoA) in conjunction with the Agricultural Research Council (ARC) are working towards development of the biofuel sector. Biodiesel technology is being applied to a biodiesel project by establishing an incubator project at Tompi–Seleka Farmers Centre of Excellence. The ARC and the Department have already signed a Memorandum of Understanding for a joint venture development of the project. The project entails opening up more than 10,000 ha of cropping land for crop material in the Sekhukhune area in Limpopo.

V.3. ***Sugar beet development.*** Trials to ascertain the economic rationale, viability, suitability and sustainability of sugar beet have been conducted over the years in the Limpopo province. Based on the results, commercial trials will be implemented during the current financial year. Necessary social facilitation has taken place. Irrigation schemes such as Tyefu, Ncora and Qamata are targeted for the project where the farmers will allocate portions of each scheme to sugar beet production.

V.4. ***KZN sugar cane production.*** The KwaZulu Natal area provides prospects for biodiesel production and government and the private sector are taking the lead. Established sugar farmers aim to redistribute at least 78,000 ha of sugar producing land to black farmers by 2015, with the government committing funds towards the first phase of the programme.

V.5. ***Sorghum breeding.*** There is some on–going research to breed high yielding and hybrid sorghum varieties and cultivars to improve grain quality, production of sweet sorghum cultivars for ethanol production and cultivars that exhibit yield stability.

V.6. ***Breeding and identification of improved sweet sorghum varieties for ethanol production.*** The sub–project focuses on the development of sweet sorghum cultivars adapted to different growing environments to produce high yields of ethanol per area. Juice will be extracted from stalks for production of ethanol, will be used for blending with petroleum products.

V.7. ***Maize seed multiplication scheme.*** The sub–project emanates from the need to produce well performing, affordable and available and accessible OPV for small holder farmers. This will also provide scope for increased maize production that could be channelled towards ethanol production.

## VI. INDICATIVE COSTS

VI.1. Huge investment will have to be channelled toward the initiative for both primary and secondary production. Much of it during the early project implementation phase will be sunk costs that will go towards research and development, capacity building and exposure programmes. On the refinery side, more capital investment outlays will be necessary to put in place compatible technologies for biodiesel and ethanol conversion processes. Transportation facilities and related infrastructure will be required.

VI.2. The initial development costs for the biofuel research and development projects are indicated below:

Phase	Est. Cost (US\$)
Incubation sub-project	375,000
Sugar beet	1,250,000
KZN sugar cane production	750,000
Sorghum Breeding	25,000
Breeding and identification of improved sweet sorghum varieties for ethanol production	25,000
<b>Total</b>	<b>2,425,000</b>

VI.3. A total of US\$2,425,000 will be required during the initial project development phase of the project.

## VII. PROPOSED SOURCES OF FINANCING

VII.1. The field of biofuels has generated significant interest among different stakeholders, and the private sector is keen on the development of the sector. While a number of initiatives are being undertaken at private sector level, it is still difficult to quantify such contribution towards biofuels. Huge investment inflows that include FDI are anticipated as the project unrolls into full scale secondary production. There could also be some NGOs who may be keen on funding project components. However, during the project development phase, it is important that the government takes a lead role in financing the sub-projects as this entails sunk costs that cannot be recouped. The possibility of PPP arrangements is envisaged into the future. Refinery companies may want to finance out grower programmes to provide guarantee of raw material for processing.

VII.2. The government of South Africa is expected to allocate resources from its Public Sector Investment Programmes to the Departments of Agriculture and Minerals and Energy to increase crop production as well as R&D for high yield crop varieties and conversion technologies. The project will be financed from Treasury through the Department of Agriculture. Relevant implementing agencies will in turn receive funds from the DoA. Some of the project components have already received funding in the current financial year. Any material contributions from stakeholders have not been quantified as due to lack of effective co-ordination, which renders the compilation of stakeholder contributions futile.

## VIII. PROJECT BENEFITS

VIII.1. Biofuel projects have a number of benefits that accrue at both macro and micro levels; to the country and farmers and industry, with the manufacturing and petroleum industries standing to gain most.

- Biofuels have the potential to turn around the economic prospects of South Africa, and their capacity is arguably comparable to the mining sector.
- High productivity; creates the possibility to switch from fossil fuels yielding competitive products and fuel; and creates employment and enhances local economies in rural areas.
- Development of the biofuels sector will ensure realisation of government’s objectives of integrating small-scale farmers into the mainstream economy and reduce unemployment as farmers become economically empowered as they engage in cash crop production from which they earn incomes, which will improve their standard of living. This would assist government in realising its objective of bridging the gap between the first and the second economies and significantly reducing unemployment.
- Some bio fuel crops such as sweet sorghum produce juice for ethanol production while at the same time offering seed for consumption.
- Secondary value addition processes produce some edible by-products that can be consumed as food thereby enhancing nutrition.
- There will be significant foreign currency savings through substitution of crude oil with bioethanol blending. At the same time foreign currency earning from biofuel exports is also realised.
- Biofuels such as ethanol and biodiesel are renewable energy sources that provide clean and environmentally-friendly fuel options with eco-environmental spin-offs.
- Biofuels can significantly reduce global dependence on volatile oil prices as they provide a cheaper hedging option against such volatility
- Many trickle-down benefits will be felt. Apart from employment generation, opportunities will also be created in refining, blending and distributing the biofuels
- The sector is fairly new and significant capacity building and skill development will take place.
- The secondary activities of fuel extraction and refining will result in technology transfer especially from leading world players such as Brazil, China and the US.

VIII.2. Biofuels can be blended with diesel and petrol or used in place of products such as paraffin. Government hopes that the growth of a biofuels industry will contribute to job creation and the emergence of small-scale farmers as well as to a lowering of greenhouse gas emissions, diversification of fuel supplies and a reduction of South Africa’s crude oil import bill. Development of a local biofuels industry will form part of the initiative to boost South Africa’s average growth rate to 6 percent between 2010 and 2014.

VIII.3. The beneficiaries will be:

- **Small farmers.** Emerging–farmer programme, which is one of the first large local programmes to focus on small–scale farmers. Small–scale farmers could potentially supply up to 30 percent of the maize required as feedstock for the petroleum industry. Farmers benefit from out–grower schemes that come with comprehensive grower plans, inputs, financing arrangements and mentorship.
- **Commercial farmers.** Commercial farmers have been in the past most adversely affected by the fall in the maize price. Producing for the alternative lucrative biofuel market could provide better economic returns.

## IX. IMPLEMENTATION ARRANGEMENTS

IX.1. **Policy development.** A team, led by the Department of Minerals and Energy, will include representatives from the Departments of Water Affairs and Forestry, Science and Technology, Trade and Industry, Transport, Agriculture and Land Affairs, the National Treasury and the Presidency. Private oil refinery investors have plans to set up ethanol plants in the traditional maize–producing provinces of Free State and Northwest.

IX.2. **Institutional collaboration.** The project will promote active interaction and collaboration amongst shareholders. There will be more direct interaction with universities such as the Free State, Pretoria, and Limpopo, Cape Town among others. There will also be need for international exchange programmes with universities in the USA. Countries with advanced technologies that are experienced in the sector will also provide invaluable lessons and exposure to the South African industry. These include Germany, China and Brazil.

IX.3. **Coordination.** The Department of Agriculture has a key co–ordination role between farmers and other stakeholders on the primary production and supply side and the value addition level where it will interact with players on behalf of the farmers to safeguard their interests. There will also be policy co–ordination, disbursement of funds to stakeholders such as farmers.

IX.4. **Research and development.** Institutions such as the ARC have a vital role to undertake research and development so that the biofuel sector develops on sound and well–researched concepts.

IX.5. **Farmers.** They will have the responsibility to grow feed stock for the industry and participating in government trial programmes to ensure development of high yield and quality crop varieties.

## X. TECHNICAL ASSISTANCE REQUIREMENTS

X.1. While potential for the country to benefit from the production of biofuels is high, extensive R&D programmes are essential. Exposure from other leading biofuel producers like Brazil is also important. There is need for human capital development within the sector. While technical capacity is required at technological level, it is equally important that such assistance be also provided at primary production level so that industrial specifications and requirements are met. Technical assistance would be required from FAO, universities and technology institutions.

## XI. ISSUES AND PROPOSED ACTIONS

XI.1. Table 4 below shows the identified list of activities that relate to project implementation. The average timeframe for the project which are mainly linked to R & D are outlined below:

Table 4: Issues and Proposed Actions	
Action	Target timeframe
Development of biofuel production strategy	2006/07
Establishing resource requirements	2006/07
Establishing optimal crop mix for biofuel production	2007/08
Feasibility studies on plant construction	2007/08
Developing long-term farmer outreach programmes	2007/09
<b>Sorghum Breeding R&amp;D</b>	
Seed increase of superior material for evaluation and release to small holder farmers	2006/07
Identification of improved lines	2006/07
Development of recombinant inbred lines	in progress
Identification of drought and insect resistant seed	2006/07
Development and selection of new cross breed lines	2006/07
<b>Breeding and identification of improved sweet sorghum varieties for ethanol production R&amp;D</b>	
Planting of selected (51) new varieties on station	2006/07
Seed increase and evaluation at various localities; four selected varieties	2006/07
Cross breeding	2006/07
Seed increases of selected varieties	2006/07
<b>Maize seed multiplication scheme</b>	
Capacity building of participants and extension	2006/07
Production of pre-basic and basic seed of farmer preferred OPVs	2007/08

## XII. POSSIBLE RISKS

XII.1. These would comprise:

- **Lack of biofuel strategy:** There is currently no clearly defined biofuel strategy and policy and this may result in delays in the development and growth of the industry. This may discourage some of the stakeholders who may lose interest in actively participating.
- **Inadequate state support to the sector:** Biofuels is a new sub sector that requires a lot of research and development, and the government has to be seen to be taking a lead role in the development of the sector in order to entice other players including the private sector. As such, massive state support is required, without which there could be high risk of failure if no adequate financial support is given as government may have other competing and priority needs.
- **Environmental degradation:** The development of the biofuel industry will require intensified crop production, and if there are no proper environmental, soil management and crop rotation programmes soil erosion will occur.

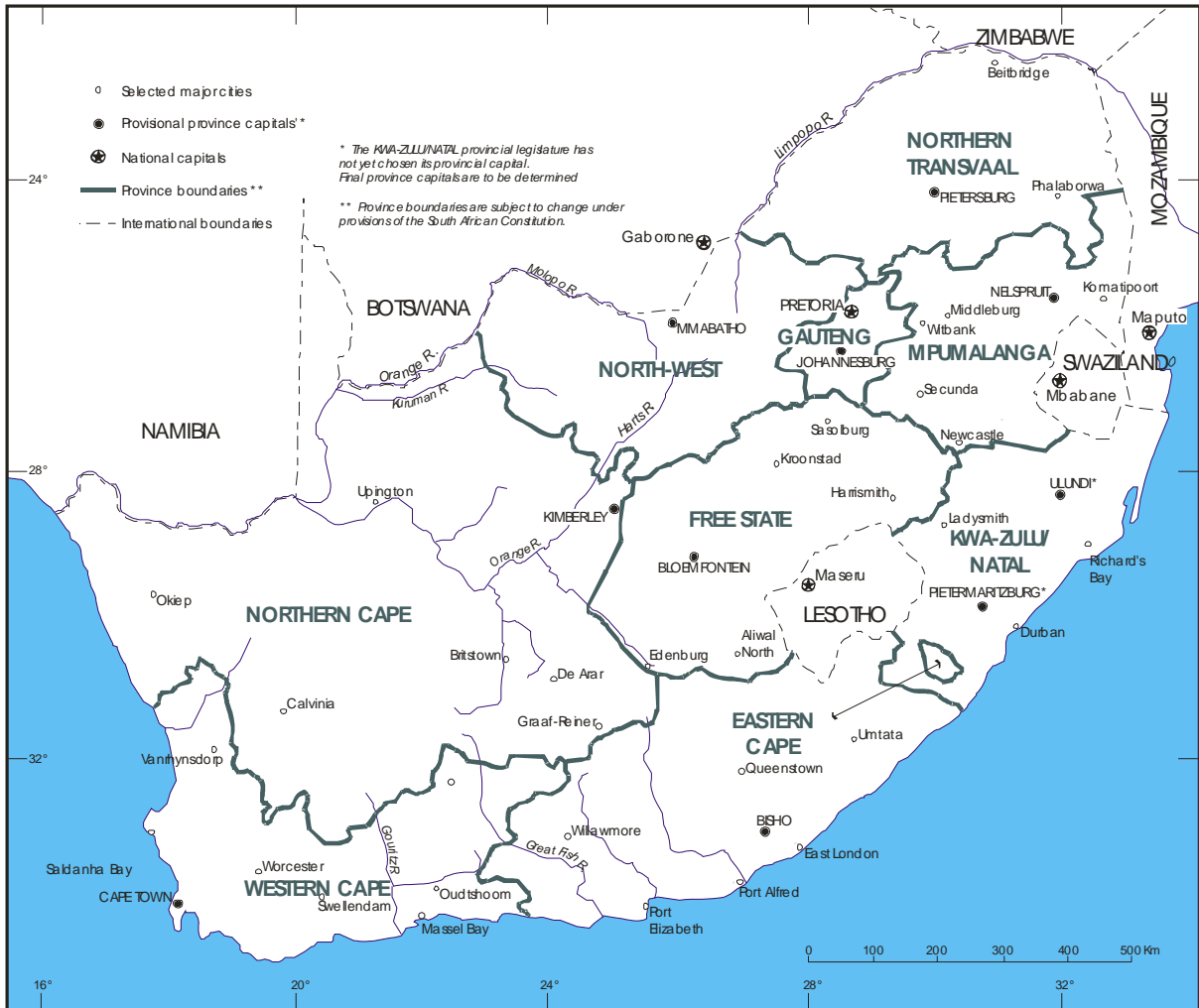
- **Food security:** Food security can be threatened as there will be competing needs between human consumption, stock feeds and the petroleum industry. A balance of all the competing needs has to be struck.
- **Price fluctuations:** There is a possibility of price fluctuations and price instability and farmers may fail to realise favourable prices, and farmers may still need to diversify crop production to reduce this risk.
- **Price takers:** Farmers may end up being price takers as they may not have much influence over commodity prices especially if they participate in crop out-grower programmes where they are provided with inputs in advance. Furthermore, they are tied to specific contracts with the input providers, and this might not provide them much option to look for alternative markets.
- **Demise of traditional fuel sector:** Caution needs to be taken there is no shift in focus to the development of the biofuels at the expense of the traditional synthetic fuel industry.
- **High biofuel production costs:** The initial extraction of ethanol and biodiesel at the end of the value chain is likely to be characterised by high production costs and unfavourable process economics. Subsidies may be required to support the processes. Such high costs may deter refineries from taking high throughput volumes and market access for farmers may be unpredictable.



## ANNEXES

- Annex 1: Map of South Africa**
- Annex 2: Biodiesel Candidate Crops**
- Annex 3: Profile of Biodiesel Ethanol Candidate Crops**

**Annex 1: Map of South Africa**



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**Annex 2: Biodiesel Candidate Crops**

Crop	Temperature requirements	Water requirements	Soil requirements	Average yield per ha	Oil content	Production levels (tons p.a.)
Soybean	Annual summer crop. Minimum of 25°C for all growth stages.	An annual rainfall above 600mm. Constant supply through out the growing season.	Variety of soils. Heavy clay soils, arcadia types, or even sandy soils.	1.5–2 tons dry land	18–22%	200,000–300,000
Sunflower	Annual summer crop. Short grower. 26°C up to 34°C optimum for growth.	Normally under dry land of 550 mm per annum.	Variety of soils from sands to clays. Best in sandy loam to clay soil types. Good drainage.	1.2–1.8 tons dry land	39–50%	500,000–700,000
Groundnut	Annual summer crop. Ideal maximum temperature of 25°C	Rainfall of 500mm per annum under dry land.	Light coloured, light textured with good drainage & low organic matter. Sandy type that is loose and friable.	1.1–1.8 tons dry land	42–52%	60,000–70,000
Canola	Cool–season crop. Winter annual crop. Optimum temperature between 5°C and 10°C	Minimum annual rainfall of 400 mm water through growing season. Irrigation very important in summer rainfall areas.	Medium textured well–drained soils. Clay loam soils.	1–1.5 tons dry land	42–45%	30,000–45,000
More crops will be investigated and added to the list as need arises.						

**Annex 3: Profile of Biodiesel Ethanol Candidate Crops**

Crop	Temperature requirements	Water requirements	Soil requirements	Average yield per ha	Production levels	Ethanol/sugar content
Maize	Annual summer crop 140 days frost-free period.	550–750 mm rain per annum Irrigation enhances yield per unit area.	Sandy loam to loamy soils types.	2.5–3 tons under dry land 5 tons irrigated.	8–10 million tons p.a.	75% starch (sugar content).
Sugar cane	Perennial subtropical crop. Annual mean temperature of between 26 to 32°C.	750–1200 mm per annum Irrigation is necessary where rainfall is lower.	Sandy loam soils with pH between 6.0 to 7.7	66.5 tons (average of last five years)	2–3 million tons p.a. of sugar.	80% starch (sugar content)
Sorghum	Annual summer crop Entire season frost free (20–30°C)	400–750 mm per annum Irrigation enhances yield	Variety from sands to cracking black clays. Good drainage with 5–8.5 pH levels	2.1 tons under dry land 3.5 tons irrigated.	200,000–450,000 tons p.a.	72% starch (sugar content)
Wheat (*)	Annual winter crop Cool moist season for growth.	600 mm per annum Irrigation is necessary in summer rainfall areas.	Loamy to sandy loam Avoid acidic soils with high Al <sup>+</sup> content.	2–2.5 tons under dry land 5 tons irrigated.	1.5–3 million tons p.a.	60% starch (sugar content).

(\*) Not covered in the candidate crops for the bankable projects – More crops will be investigated and added to the list as need arises.