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## MAIZE AND WHEAT PRODUCTION TRENDS IN SOUTH AFRICA IN A DEREGULATED ENVIRONMENT

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*Qualitative control measures and government regulation of the marketing of agricultural produce was seen as distorting the working of the market mechanism. Trade liberalisation, with tariffication of agricultural produce and the deregulation of the marketing of agricultural produce was therefore promoted. It was expected that producers of agricultural produce would respond to liberalisation efforts and deregulation in a way that would move production closer to some optimum point. An analysis of production trends for maize and wheat confirms that production of these commodities have moved closer to an optimum point, especially after the deregulation of these markets.*

### MIELIE EN KORING PRODUKSIETENDENSE IN 'N GE-DEREGULEERDE MARKOMGEWING IN SUID-AFRIKA

*kwantitatiewe beheermaatreë en owerheidsregulering het verwringing van die markmeganisme tot gevolg gehad. As gevolg hiervan, is handelsliberaliseringsinisiatiewe soos tariefowering van landbouprodukte en deregulering in die bemarking van landbouprodukte bevorder. Die verwagting was dat produsente op die inisiatiewe sou reageer op 'n wyse wat meer optimale produksie tot gevolg sou hê. 'n Ontleding van produksietendense bevestig dat mielie- en koringprodusente meer optimaal produseer na die instelling van handelsliberaliseringsmaatreëls en deregulering van die bedrywe.*

#### 1. INTRODUCTION

The purpose of this paper is to investigate the market for maize and wheat and to ascertain whether, as expected, the production of these grain crops had in fact experienced some change in production activity following the deregulation of agricultural marketing. It will further be investigated whether these changed cropping patterns, if any is toward a more optimal point or not.

Agricultural production trend analysis is often more complex than demand analysis. In addition to price, the rapid pace of technological innovation, intricate and changing government policies and sociological conditions affect output (Meyer, 1998). An analysis of the national production that highlight trends and comparative advantages of selected commodities will be discussed in the paragraphs that follow.

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The analysis investigates recent trends in these markets and is not meant to use these past trends to predict future production trends. Doing so will have various implications in a dynamic deregulated market.

## 2. FOOD SUPPLY AND FOOD SECURITY IN SOUTH AFRICA

Agriculturally speaking, South African is poorly endowed. Only 14 percent of the total surface area is available for crop production and of this area, only 1 million hectares are under irrigation (National Department of Agriculture, 1999). High potential land comprises only 21,9 percent of total arable land. Natural grazing is deteriorating at a fast rate and nature conservation areas are threatened.

The most important restriction on agricultural production is the availability of water. Rainfall is distributed unevenly over the country, with humid subtropical conditions in the east and dry desert conditions in the west. South Africa is periodically affected by severe and prolonged droughts that are often terminated by severe floods. About 65 percent of South Africa have an average rainfall of less than 500 mm which is generally regarded as the minimum for rain-fed cropping (Van Zyl, *et al*, 1996). This condition is worsened by evapotranspiration, especially in areas with relatively low rainfall.

Despite all these restrictions, South Africa is self-sufficient in the production of most major crops. In the 1980s, South Africa was self-sufficient in terms of all important field crop products (except rice) and horticultural products (except coffee, tea, cocoa and spices), thus achieving above 100 points on the Self-Sufficiency Index (SSI)<sup>1</sup> for certain field crops and 160+ for horticultural products (Table 1) (National Department of Agriculture, 1999). This implies that a large percentage of field crops and horticultural crops are available for export. For animal products, the score on a self-sufficiency index is less than 100, implying moderate imports of mainly red meat and industrial milk products. The majority of wool and mohair clips and karakul pelts have always been destined for export markets. Since 1984, South Africa has experienced a strong growth in agricultural exports and an analysis of its trade performance reveals a comfortable surplus on the agricultural balance of payments, with exports growing at a faster rate than imports (Kirsten & Van Zyl, 1996).

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<sup>2</sup>  $SSI = (Total\ Production \div Total\ Local\ Consumption) \times 100.$

**Table 1: Production, consumption and Self-sufficiency Index (SSI) of selected agricultural commodities in South Africa**

Commodity	Imports	Exports	Total supply	Consumption**		Self-sufficiency Index				
				Total	Human	95-99	91-94	85-90	85-94	
	(1 000 ton) (1995 - 1999)									
Wheat	646	240	2095	2022	1908	103.6	95.0	115.5	107.4	
Maize(White and yellow)	361	2277	8159	5957	2672	136.9	109.5	121.1	116.5	
Potatoes	2	19	1525	1185	1249	128.7	100.6	100.3	100.4	
Vegetables	18	38	2013	1592	1769	126.5	100.9	101.3	101.1	
Sugar	47	1119	2250	826	1305	272.4	163.5	162.5	162.9	
Beef	106	20	507	472	600	107.4	93.1	89.9	91.2	
Mutton, goat's meat and lamb	53	0	103	123	156	83.14	82.0	93.3	88.8	
Pork	11	1	122	107	132	114.6	96.1	100.9	99.0	
Chicken	34	4	939	741	873	126.7	99.1	99.4	99.3	
Eggs	0	3	294	226	256	130.4	101.7	101.7	101.7	
Deciduous and subtropical fruit	0	581	1749	872	946	200.5	156.5	152.3	154.0	
Dairy products	NA	NA	NA	NA	NA	129.1	NA	101.0	NA	
Condensed & powder milk	50	81	335	260	297	124.8	123.5	105.5	112.1	
Fresh milk	0	0	2827	2265	1525	119.5	100.0	100.0	100.0	
Cheese	3	1	38	32	40	100.0	100.0	100.3	100.8	
Butter	4	2	12	12	15	74.11	100.0	100.0	100.7	
Sunflower seed oil	181	25	191	257	277	273.2	60.3	87.5	76.6	
Citrus fruits	2	635	1356	496	611	0.00	235.5	254.0	246.6	
Rice	502	24	0	393	463		0.0	0.0	0.0	
<b>COMMODITY GROUP</b>										
Grains and field crops							88.2	97.2	94.0	
Horticultural crops							164.3	169.2	167.2	
Livestock products							96.0	99.0	99.3	

**Source:** National Department of Agriculture, 1999

One of the most essential roles of agriculture is to ensure a secure supply of food to the consumer at reasonable prices. However, food supply involves more than merely agricultural production. An effective food distribution system is also important. It is especially important in rural areas where the majority of the population resides. Being of a lower income group, the rural population is inclined to spend a high percentage of their earnings on food (Van Rooyen & Sigwele, 1998).

It is therefore crucial that South Africa maintains a competitive agricultural sector that is able to meet the demand for basic foodstuffs. Agricultural production in South Africa increased at a rate of 3,1 percent per annum between 1955 and 1990, while the population increased at a rate of 2,8 percent (Meyer, 1998). For the period 1990 to 1998, nominal agricultural production increased at an average annual rate of 13,7 percent (National Department of Agriculture, 1999). The average annual rate of inflation as measured by the consumer price index increased by an estimated 9,7 percent over the same period (SARB, 2000), indicating an increase in the annual agricultural production of 4 percent whilst the population growth has remained at almost the same level. South Africa has therefore, in the long run, no need to import food (on an average net basis) as the agricultural sector has succeeded in increasing production at a rate higher than that of population growth. South Africa does however experience shortages in certain agricultural products and therefore needs to import certain agricultural products.

Future trends in food supply. Prospects in South Africa of a dramatic future increase in agricultural production are not great. Market forces will determine the future direction of production and consumption. Given the scenario that the current low economic growth rate will continue until the year 2000, the expectation is that it will not stimulate satisfactory consumption levels. According to Agrifutura (1995), an economic growth rate of 4 percent will however stimulate consumption to such an extent that food shortages could be expected in the long run. This is highly unlikely in the medium-term, especially as the effects of AIDS are expected to further reduce the population and therefore demand for food.

Trends in field crop production. The increasing exposure of commercial farmers to market forces has set in motion large structural adjustments within the agricultural sector. Following years of over production, there has been a concerted effort to reduce field crop production (especially maize) in recent years. It is also envisaged that there will not be much scope for horizontal expansion in the production of these crops and that instead substitution amongst the crops will increase in future according to market forces.

Trends in horticultural crop production. The fruit industry is on a rapid growth path and has become the most lucrative branch of agriculture. This growth trend can largely be attributed to the growth in the export markets, particularly the opening up of export markets in Europe and the Far East. South Africa's horticultural production is to a large extent not only self-sufficient, but also focuses heavily on the export market. If fruit extracts, which are included in the domestic consumption, are taken into account, the self-sufficiency index improves even further (Table 1).

A special effort would be needed to offset the implications of possible shortages, should production of field crops continue to decline. This implies that apart from mobilising new resources South Africa would also have to optimise the utilisation of existing agricultural resources and maximise the export potential of products that have a comparative advantage. Unless this special effort succeeds, there is a strong possibility that South Africa would become a candidate for possible food aid (Meyer, 1998:21).

### **3. AGRICULTURAL CROP PRODUCTION TRENDS IN SOUTH AFRICA**

Due to more market related policies, shifts in crop production to the higher potential areas and more livestock production is expected in commercial agriculture. Meyer (1998) measures the growth in agricultural production by evaluating the components of production as consisting of area-, location-, cropping pattern- and yield effects. These effects are briefly discussed below.

*Area effects* refer to the lateral expansion of farming into new or unfarmed cropping land. High growth rates in production during the earlier years of the study are ascribed to area effects. Trends in the area under cultivation during the period 1979/80 to 1989/90 showed an annual decline of 0,7 percent. The maize area showed an annual increase of 2,2 percent over the same period. From 1990 onwards, the situation for maize started to change. The area planted to white maize decreased at an annual average rate of 0,76 percent between 1989 and 1999 and the area planted to yellow maize decreased at an annual average of 3,34 percent over the same period (National Department of Agriculture, 1999). The area planted to wheat decreased at an annual average rate of 6,57 percent between 1989 and 1999. If 1999, which was a particularly bad year for wheat is not taken into account, the annual average decrease is 3,06 percent.

Much of the growth in agricultural production in South Africa is due to area effects. Arable dry land and irrigated land showed an annual average increase

of 2,5 and 6,0 percent respectively, between 1981 and 1991; planted pastures increased at a rate of 4,7 percent. Natural grazing land showed a decrease of 0,6 percent per annum. The reduction in natural grazing land could be ascribed to substitution of grazing land for arable land, the increase of nature conservation and mining activity and the use of grazing land for non-agricultural activities.

*Location effects* refer to the shift of production activity to those areas of production activity most suited to specific products in terms of demand and supply factors. The clearest indication of changes in South African agriculture at macro level is seen in the changing contribution of field crops, horticulture crops and animal production to total farm production. Gross physical production increased by between 5 and 10 percent, but its composition is changing from high volume - low value items to high value products.

The phenomenon known as the *cropping pattern effect* refers to the substitution among products. An example of this phenomenon is where field crops, in 1980, accounted for nearly half of the total value of farm production. This has since slipped to one-third, with horticultural production approaching one quarter and livestock and animal production also increasing.

Growth in production as a result of yield effects is difficult to measure. The composite index of farm productivity has only shown an 8 percent increase since 1960. Maize yields have virtually doubled since the Second World War. The introduction of high yielding cultivars and improved technology usually enhances the yield effect.

Trends in farm income and production patterns. An analysis of farm income by main branch of activity shows important structural changes in agricultural production patterns (Meyer, 1998:14). The relative position of horticultural crops and animal products has strengthened at the expense of field crops. Shifts of crop production to the higher potential areas and livestock farming to the drier areas can be expected to continue in commercial farming areas. Livestock production will evidently replace crop production in marginal production areas as a shift to planted pastures is most evident in the marginal cropping regions. The relative share of field crops in total agricultural production has declined from 48,5 percent to 30 percent from 1980 to 1997. On the other hand, the relative share of horticulture and animal products increased from 14,4 percent to 24,2 percent and 37,1 percent to 45 percent respectively (National Department of Agriculture, 1999). These trends, according to Meyer (1998) could be attributed to the following factors:

- The effect of the drought and its consequences, i.e. crop failures and lack of drought aid measures such as in the past;
- the adoption of more market-related policies as regards grain products which will force more and more grain crop farmers to abandon agriculture;
- market-related interest rates and large carry-over debts resulting from poor crops have weakened the financial position of farmers;
- the annually deteriorating terms of trade, with prices of production inputs rising faster than producer prices;
- the adopted cheap food policy promoted by Government; and
- the economic impact of macro-economic policies on agriculture.

#### **4. PRODUCTION TREND ANALYSIS**

Agricultural production (or the quantity of a certain product) is the quantity of the product that will be offered for sale per period of time, under a given set of conditions. Factors affecting the market supply of the products selected include:

- the price of the product;
- the prices of alternative products;
- the prices of inputs;
- the objectives of the farmers;
- the number of farmers supplying the market; and
- the size-distribution of farms supplying the market.

Langley (1976:14) lists the following as the most important problems experienced with supply studies based on time series data:

- uncertainty of expectations;
- flexibility of fixed factors over time; and
- measurement of the influence of weather conditions.

An analysis that incorporates all these factors would require the use of more comprehensive multiple regression models. As the focus of this study is on trends rather than on the structural analysis of supply, further complicated by the large number of commodities selected, the use of a simple exponential



regression model is deemed more appropriate. The aim of the model is therefore to perform basic trend analysis.

Trend analysis is performed to:

- summarise time series production data in support of the contextual description;
- help to explain certain historic and future trends in the production of the crops selected.

Trend analysis is performed using the three components of supply of each commodity, namely, the area utilised, production and yield. These were taken as dependent variables, with time as the independent variable. Time was included as a trend variable to accommodate certain tendencies such as a constant rate of development over time, technological innovation, improved cultivars, the use of fertilisers and improved harvesting methods. A major assumption of this model is that past production and productivity trends would continue in future.

## 5. DATA AND MODEL USED

Time series data pertaining to the selected crops, for the period 1980/81 to 1998/99, were compiled for South Africa's nine provinces and aggregated for into two regions, *viz.* the Free State *vs.* the Rest of South Africa. Exponential functions were fitted to the time series data of production, area and yield of the selected crops. It should be noted that at the time of this study, 1997 was considered the last year of "normal" production for grain.

Regression coefficients, as well as a test of statistical significance ( $p$ ) and coefficient of determination ( $R^2$ ) were calculated. Results shown in the statistical tables that follow refer exclusively to the exponential regression function.

Algebraically the function is as follows:

$$Y = a \text{ EXP } (bX)$$

where:  $y$  = production, area or yield (dependant variable)  
 $X$  = time (1981 = 1) (independent variable)  
 $a$  = intercept  
 $b$  = slope of the regression function

Perhaps the most attractive feature of this model is that the b coefficient can be directly interpreted as the annual growth rate in the dependant y.

## 6. PRODUCTION TRENDS OF WHEAT AND MAIZE

Wheat in South Africa is produced mainly for human consumption. Small quantities of poorer quality wheat are marketed as stock feed. Roughly 60 percent of the total quantity of flour and meal is used for the production of bread (Van Rooyen & Sigwele, 1998). The composition and the various needs of the population have a major impact on the consumption of the product.

South Africa is a net importer of wheat. Wheat production in South Africa reached a peak of 3,5 million tons in 1988/89, but has fallen back sharply since then (Table A1 - Appendix). Wheat demand outstripped supply for all consecutive years since 1989/90 and this made wheat imports unavoidable. Wheat demand is strongly correlated with population growth. Other factors such as an increasing bread price and the prevailing economic situation might have a depressing effect on wheat demand.

Trend analysis of time series data for the period 1985 to 1998 shows a decrease in area under cultivation and of production of 5,7 and 1,5 percent respectively (Table 2). The total area under wheat has decreased at a rate of 5,7 percent from 1,9 million ha in 1985 to only 748 000 ha in 1998. The total area has a standard deviation of 600 000 ha from the long-term average area utilised.

**Table 2: Wheat: regression analysis of time series data, 1985-1997**

Product	Dependent variable	Average	a	b	R <sup>2</sup>	Significance
Free State	Area (ha)	813 000	116.391	-5.16	27.63	0.05357
	Production (t)	945 182	68.8122	-2.77	4.18	0.48322
	Yield (t/ha)	1.16	-47.5789	2.39	6.08	0.39530
Rest of RSA	Area (ha)	697 591	135.818	-6.14	64.11	0.00058
	Production (t)	1 220 545	20.2955	-3.15	0.82	0.75860
	Yield (t/ha)	1.75	-115.523	5.83	71.99	0.00013
Total	Area (ha)	1 510 591	127.861	-5.71	52.24	0.00349
	Production (t)	2 165 727	44.7559	-1.51	5.41	0.42358
	Yield (t/ha)	1.43	-83.1052	4.19	42.74	0.01121

\*\* Highly significant ( $p < 0.05$ )

\* Significant ( $p < 0.10$ )

Source: Calculated from database

The coefficient of variation (CV) which gives an indication of risk associated with production varies as follows: the CV of the area utilised is 27,9 percent compared to 30,5 percent in the case of production and 24,4 percent in the case of yield. The variation in both area and production is mainly caused by the fluctuating production of wheat in the Free State. The Free State and Western Cape are the most important production areas. Despite greater risk associated with wheat production, the Free State remains the most important production area due to its close proximity to the Gauteng metropolitan area.

Maize is the staple food for a large section of the black population that accounts for 94 percent of white maize meal consumption (Elliott, 1991). Yellow maize is by far the most important animal feed, representing more than 60 percent of total animal feed requirements.

Almost 40 percent of South Africa's cropped land of just over 10 million hectares are planted to maize annually, occupying more land than any other crop in South Africa. The area under maize production is more stable than that of wheat, as is clear from the coefficient of variation of 12 percent, compared with the 27 percent in the case of wheat (Tables A2 and A3 - Appendix).

Trend analysis of production data for the period 1985 to 1998 shows that the area and production of white and yellow maize decreased at rates of 1,8 and 3 percent and 1,8 and 2 percent respectively (Tables 3 and 4). The long-term trend is toward more white maize and less yellow maize. A shift from white maize to wheat can also be expected, following the gradual substitution of wheat products for white maize products in the urban market place.

According to Meyer (1998), the economy of maize production in the summer grain areas has deteriorated over the last few decades because prices of maize inputs rose more rapidly than the producer price of maize. The further impact of recent droughts has weakened the producer's ability to make structural adjustments. It also seems as though the government's drought relief schemes are something of the past. Farmers are increasingly reverting to farm activities or farm enterprises that have a greater comparative advantage. The financial position of many farmers is however, preventing this adjustment from happening at a desired rate (Coetzee, 2000). The scaling down of production could, in the long term, also affect the food and livestock industry.

Maize production increased significantly from 6,1 million tons in 1970 to 10,9 million tons in 1980, after which it increased dramatically to 14,6 million tons

**Table 3: White maize: Regression analysis of time series data**

Product	Dependent variable	Average	a	b	R <sup>2</sup>	Significance
Free State	Area (ha)	696 389	51.8268	-1.92	18.46	0.12522
	Production (t)	1 591 671	1.55604	0.6	0.43	0.82466
	Yield (t/ha)	2.29	-50.2707	2.56	8.43	0.31388
Rest of RSA	Area (ha)	1 235 008	46.0347	-1.65	37.93	0.01903
	Production (t)	2 493 311	-5.64802	1.01	0.9	0.74659
	Yield (t/ha)	2.02	-52.5827	2.67	7.39	0.34695
Total	Area (ha)	1 931 396	49.8939	-1.78	35.04	0.02575
	Production (t)	4 084 982	-1.08268	0.81	0.65	0.78341
	Yield (t/ha)	2.12	-50.9766	2.59	7.74	0.33561

\*\* Highly significant ( $p < 0.05$ )

\* Significant ( $p < 0.10$ )

Source: Calculated from database

**Table 4: Yellow maize: Regression analysis of time series data**

Product	Dependent variable	Average	a	b	R <sup>2</sup>	Significance
Free State	Area (ha)	479 242	61.1283	-2.41	35.07	0.02565
	Production (t)	1 066 479	28.5933	-0.74	0.43	0.82361
	Yield (t/ha)	2.23	-32.535	1.57	2.98	0.55535
Rest of RSA	Area (ha)	1 094 357	79.3121	-3.28	53.26	0.00305
	Production (t)	2 687 661	64.5197	-2.50	10.59	0.25626
	Yield (t/ha)	2.46	-14.7924	0.78	1.33	0.69416
Total	Area (ha)	1 573 599	74.4229	-3.01	50.33	0.00449
	Production (t)	3 754 140	55.1879	-2.01	5.80	0.40693
	Yield (t/ha)	2.39	-19.235	1.00	1.87	0.64100

\*\* Highly significant ( $p < 0.05$ )

\* Significant ( $p < 0.10$ )

Source: Calculated from database

in 1981 (World Bank, 1994). The growth in production from the 1945 to the mid 1980s can, according to (World Bank, 1994) be attributed to the following:

- expansion of the area cropped as a result of effective mechanisation,
- as a result of a growth in yield that can be attributed to improved cultivation practices (The average annual yield increased from 800 kg/ha

for the period 1950-1954 to 2 300 kg/ha for the period 1977-1981 (Van Zyl, *et al*, 1987)),

- better fertilisation,
- more efficient moisture conservation methods and the use of hybrid maize seed.

## 7. CONCLUSIONS

Field crop production is prevalent in the Free State, Mpumalanga and the North West as cropping patterns of field crops especially summer cereals, show that these provinces achieved the highest farm income (Meyer, 1998). An analysis of production trends of individual maize and wheat indicates a significant downward trend in the area cultivated and production of maize and wheat. This trend could mainly be attributed to the weak financial position of crop farmers, which in turn could be ascribed to deteriorating climatic conditions in the summer rainfall areas and economic factors such as the low profitability of crop production.

It is also envisaged that there will not be much scope for horizontal expansion in the production of these crops and that instead substitution amongst the crops will increase as market forces determine future demand and supply. The increasing exposure of farmers to market forces has set in motion large structural adjustments within the sector. Bearing in mind that maize comprises approximately 40% of the cultivated area, any small shift away from maize production will have a massive impact on other smaller crops like sunflower, sorghum and soybeans.

Production should not be viewed in isolation but within a market context. Rising living standards are often associated with the use of field crops for animal production. Production trends in the feed industry show that yellow maize and grain sorghum are plagued with large surpluses. The potential effects of an increased demand for animal products on the demand for field crops appear to be considerable. Production trends in the grains for human consumption showed that for wheat, the Western Cape remains a high-risk area and the area under cultivation is expected to decrease. White maize, on the other hand, shows a surplus production could be expected in normal years with periodic shortage in others. White maize production is also expected to increase at the expense of yellow maize.

The demand for field crops is a derived demand. People do not buy maize

and wheat for instance, but maize and wheat meal. The market for final crops is often characterised by intervention, concentration and monopolistic tendencies due to past policies. White bread, maize meal, rice and potatoes are substitutes for each other as consumer products, bread and margarine, maize meal and sugar are clearly complementary, and therefore the price, production and consumption levels of one product affect those of other products.

It thus appears that the markets for various field crops are inter-linked with one another and with the market for animal products. Effective local demand will be a function of economic conditions rather than of production conditions in agriculture itself. Economic recovery and growth are prerequisites for the future welfare of agriculture. Local markets are therefore the cornerstone of agricultural development and can reduce agriculture's vulnerability to foreign instability. Future growth in agricultural production is also highly dependent on agricultural entrepreneurship, technical innovation and capital investment.

Deregulation and liberalisation of South African grain markets has given rise to a general downward trend in grain production. Should this trend continue, government should make every effort to stabilise grain markets because of grain's strategic importance as staple food.

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**APPENDIX**



**Table A1: Wheat: Area and production trends by province, 1985/86 – 1998/99**

Marketing <sup>1</sup> year	Western Cape	Northern Cape	Free State	Eastern Cape	KwaZulu/ Natal	Mpumalanga	Northern province	Gauteng	North West	Total
<b>Area utilized (ha):</b>										
1985/86	625 000	105 000	875 000	113 000	12 000	36 000	116 000	8 000	71 000	1 951 000
1986/87	635 000	103 000	830 000	144 000	12 000	25 000	99 000	7 000	81 000	1 926 000
1987/88	608 000	96 000	864 000	36 000	13 000	29 000	8 000	15 000	60 000	1 729 000
1988/89	602 000	96 000	1 119 000	36 000	13 000	31 000	12 000	8 000	68 000	1 985 000
1989/90	477 000	81 000	1 113 000	36 000	13 000	26 000	10 000	8 000	67 000	1 831 000
1990/91	335 000	53 000	1 030 000	6 000	6 000	21 000	4 000	3 000	93 000	1 551 000
1991/92	328 000	54 000	947 000	7 000	5 000	17 000	3 000	2 000	71 000	1 434 000
1992/93	335 000	55 000	300 000	6 000	5 000	7 000	2 000	3 000	34 000	742 500
1993/94	418 000	52 000	531 000	15 000	4 000	8 000	10 000	2 000	25 000	1 065 000
1994/95	398 000	55 000	515 000	16 000	4 000	12 000	11 000	3 000	25 000	1 039 000
1995/96	400 000	56 000	819 000	17 000	4 000	11 000	11 400	3 000	43 000	1 363 000
1996/97	403 000	68 000	702 000	17 000	5 000	17 000	20 000	1 800	60 000	1 293 800
1997/98	400 000	65 000	790 000	13 000	5 800	22 000	17 000	3 000	66 500	1 382 300
1998/99	300 000	36 000	350 000	5 000	5 000	9 000	9 000	2 000	32 000	748 000
Average (ha)	469 182	73 273	813 000	39 273	8 273	20 273	26 036	5 636	58 000	1 510 591
Std deviation (ha)	125 364	22 769	262 097	46 172	4 197	9 931	40 606	4 007	22 926	422 155
CV (%)	26.7	31.1	32.2	117.6	50.7	49.0	156.0	71.1	39.5	27.9
Range: Minimum	328 000	52 000	300 000	6 000	4 000	7 000	2 000	2 000	25 000	742 500
Maximum	635 000	105 000	1 119 000	144 000	13 000	36 000	116 000	15 000	93 000	1 985 000
<b>Production (t):</b>										
1985/86	755 000	173 000	446 000	34 000	31 000	76 000	61 000	8 000	96 000	1 680 000
1986/87	690 000	208 000	1 156 000	28 000	48 000	51 000	36 000	10 000	94 000	2 321 000
1987/88	851 000	220 000	1 660 000	29 000	51 000	91 000	40 000	18 000	175 000	3 135 000
1988/89	718 000	272 000	2 126 000	36 000	61 000	100 000	36 000	23 000	226 000	3 598 000
1989/90	619 000	246 000	896 000	19 000	24 000	47 000	12 000	11 000	129 000	2 003 000
1990/91	491 000	227 000	713 000	17 000	24 000	68 000	12 000	8 000	142 000	1 702 000
1991/92	496 000	228 000	1 108 000	11 000	20 000	67 000	17 000	9 000	177 000	2 133 000
1992/93	627 000	276 000	252 000	18 000	20 000	45 000	9 000	9 000	62 000	1 318 000

Table A1: (Continued)

Marketing <sup>1</sup> year	Western Cape	Northern Cape	Free State	Eastern Cape	KwaZulu/Natal	Mpumalanga	Northern province	Gauteng	North West	Total
1993/94	743 000	252 000	789 000	25 000	15 000	38 000	39 000	8 000	67 000	1 976 000
1994/95	738 000	365 000	451 000	38 000	22 000	72 000	22 000	9 000	115 000	1 832 000
1995/96	800 000	270 000	800 000	33 000	13 000	47 000	46 000	9 000	108 000	2 125 000
1996/97	806 000	345 000	1 217 000	18 000	24 000	78 000	65 000	8 000	139 000	2 700 000
1997/98	550 000	284 000	1 080 000	22 000	21 000	88 000	68 000	16 500	154 000	2 283 500
1998/99	535 000	205 000	536 000	9 000	20 000	47 000	35 000	11 000	133 000	1 531 000
Average (t)	684 364	248 818	945 182	26 182	29 909	63 818	30 000	11 091	126 455	2 165 727
Std deviation (t)	115 776	49 392	552 444	8 886	16 053	20 104	16 709	4 867	50 210	660 394
CV (%)	16.9	19.9	58.4	33.9	53.7	31.5	55.7	43.9	39.7	30.5
Range: Minimum	491 000	173 000	252 000	11 000	13 000	38 000	9 000	8 000	62 000	1 318 000
Maximum	851 000	365 000	2 126 000	38 000	61 000	100 000	61 000	23 000	226 000	3 598 000
<b>Average yield (t/ha):</b>										
1985/86	1.21	1.65	0.51	0.30	2.58	2.11	0.53	1.00	1.35	0.86
1986/87	1.09	2.02	1.39	0.19	4.00	2.04	0.36	1.43	1.16	1.21
1987/88	1.40	2.29	1.92	0.81	3.92	3.14	5.00	1.20	2.92	1.81
1988/89	1.19	2.83	1.90	1.00	4.69	3.23	3.00	2.88	3.32	1.81
1989/90	1.30	3.04	0.81	0.53	1.85	1.81	1.20	1.38	1.93	1.09
1990/91	1.47	4.28	0.69	2.83	4.00	3.24	3.00	2.67	1.53	1.10
1991/92	1.51	4.22	1.17	1.57	4.00	3.94	5.67	4.50	2.49	1.49
1992/93	1.87	5.02	0.84	3.00	4.00	6.43	4.50	3.00	1.82	1.78
1993/94	1.78	4.85	1.49	1.67	3.75	4.75	3.90	4.00	2.68	1.86
1994/95	1.85	6.64	0.88	2.38	5.50	6.00	2.00	3.00	4.60	1.76
1995/96	2.00	4.82	0.98	1.94	3.25	4.27	4.04	3.00	2.51	1.56
1996/97	2.00	5.07	1.73	1.06	4.80	4.59	3.25	4.44	2.32	2.09
1997/98	1.38	4.37	1.37	1.69	3.62	4.00	4.00	5.50	2.32	1.65
1998/99	1.78	5.69	1.53	1.80	4.00	5.22	3.89	5.50	4.16	2.05
Average (t/ha)	1.52	3.79	1.14	1.47	3.78	3.72	3.02	2.55	2.39	1.48
Std deviation (t/ha)	0.31	1.54	0.48	0.99	0.97	1.54	1.80	1.16	1.00	0.36
CV (%)	20.78	40.63	41.68	67.27	25.75	41.47	59.79	45.56	41.83	24.20
Range: Minimum	1.09	1.65	0.51	0.19	1.85	1.81	0.36	1.00	1.16	0.86
Maximum	2.00	6.64	1.92	3.00	5.50	6.43	5.67	4.50	4.60	1.86

CV: Coefficient of variation

Source: National Department of Agriculture, 1999 (as adapted)

**Table A2: White maize: Area and production trends by province, 1985/86 - 1998/99**

Production year	Western Cape	Northern Cape	Free State	Eastern Cape	KwaZulu/Natal	Mpumalanga	Northern province	Gauteng	North West	Total
<b>Area utilized (ha):</b>										
1985/86	564	4 131	809 907	1 405	39 132	122 096	55 638	59 940	915 985	2 008 798
1986/87	600	4 056	928 643	6 428	54 980	141 375	55 623	75 370	1 051 089	2 318 164
1987/88	700	2 204	791 155	13 230	41 465	158 119	71 416	86 446	1 087 981	2 252 716
1988/89	1 000	5 898	768 699	14 736	37 318	149 458	42 441	26 354	1 115 177	2 161 081
1989/90	900	2 809	663 184	22 300	29 387	118 347	33 538	57 743	1 036 750	1 964 958
1990/91	1 210	5 756	473 975	22 061	28 714	109 786	31 215	46 729	997 049	1 716 495
1991/92	1 033	2 860	711 493	12 026	27 876	134 269	36 395	61 761	893 670	1 881 383
1992/93	1 049	3 814	726 713	12 278	22 026	112 908	35 008	61 569	1 007 783	1 983 148
1993/94	1 335	4 608	711 670	12 486	30 530	150 463	34 499	54 882	1 026 528	2 027 001
1994/95	1 000	3 000	460 000	14 400	29 000	152 000	19 500	53 000	669 000	1 400 900
1995/96	1 000	10 000	683 000	16 000	35 000	199 000	16 000	49 000	895 000	1 904 000
1996/97	1 000	3 000	674 000	6 000	33 000	194 000	22 000	50 000	811 000	1 794 000
1997/98	0	3 000	665 000	5 000	36 000	210 000	16 500	53 700	808 000	1 797 200
1998/99	0	3 700	682 000	4 000	37 000	237 000	34 000	60 000	772 000	1 829 700
<b>Average</b>	814	4 203	696 389	11 596	34 388	156 344	35 984	56 892	934 787	1 931 396
<b>Std deviation</b>	229	2 081	130 950	5 723	8 534	24 528	15 545	14 720	119 198	241 721
<b>CV (%)</b>	24.2	46.6	18.6	42.7	25.0	17.4	39.6	25.6	12.3	12.3
<b>Range: Minimum</b>	564	2 204	460 000	1 405	22 026	109 786	16 000	26 354	669 000	1 400 900
<b>Maximum</b>	1 335	10 000	928 643	22 300	54 980	199 000	71 416	86 446	1 115 177	2 318 164
<b>Production (t):</b>										
1985/86	1 169	18 925	1 658 195	2 912	164 346	378 273	119 058	126 404	979 676	3 448 958
1986/87	1 200	19 165	1 476 634	12 359	163 869	400 236	100 925	182 186	1 217 321	3 573 895
1987/88	1 500	10 432	1 439 809	22 023	115 488	388 662	92 004	195 045	1 511 356	3 776 319
1988/89	1 800	33 321	2 235 157	27 058	136 159	523 739	90 808	87 690	3 230 528	6 366 260
1989/90	1 590	16 492	1 587 649	39 694	102 137	365 238	55 200	160 276	2 033 443	4 361 719
1990/91	2 252	19 480	1 170 389	40 796	106 087	374 223	81 575	142 941	1 892 124	3 829 867
1991/92	242	16 201	554 785	2 078	53 516	207 254	21 545	63 601	332 422	1 251 644
1992/93	1 627	22 457	1 967 010	25 907	74 967	378 401	45 013	173 777	1 727 285	4 416 444

Table A2: (Continued)

Production year	Western Cape	Northern Cape	Free State	Eastern Cape	KwaZulu/Natal	Mpumalanga	Northern province	Gauteng	North West	Total
1993/94	2 043	20 803	2 196 839	29 626	166 922	561 336	74 548	254 839	2 426 115	5 733 071
1994/95	2 000	22 302	712 922	19 058	69 417	252 425	26 229	90 258	806 953	2 001 564
1995/96	6 000	45 000	1 990 000	45 000	115 000	618 000	45 000	200 000	2 228 000	5 292 000
1996/97	7 000	17 000	1 815 000	14 000	107 000	471 000	44 000	159 000	1 980 000	4 614 000
1997/98	0	21 000	1 694 000	14 000	109 000	650 000	40 000	155 000	1 700 000	4 383 000
1998/99	0	28 000	1 785 000	10 000	95 000	827 000	42 000	179 000	1 175 000	4 141 000
<b>Average</b>	2 030	22 184	1 591 671	21 751	112 779	456 842	62 708	155 001	1 660 016	4 084 982
<b>Std deviation</b>	1 383	8 944	532 653	13 826	37 745	116 980	30 357	54 509	782 979	1 436 138
<b>CV (%)</b>	71.0	40.2	34.5	57.1	32.7	28.9	44.4	35.8	46.8	35.9
<b>Range: Minimum</b>	242	10 432	554 785	2 078	53 516	207 254	21 545	63 601	332 422	1 251 644
<b>Maximum</b>	6 000	45 000	2 235 157	45 000	166 922	618 000	119 058	254 839	3 230 528	6 366 260
<b>Average yield (t/ha):</b>										
1985/86	2.07	4.58	2.05	2.07	4.20	3.10	2.14	2.11	1.07	1.72
1986/87	2.00	4.73	1.59	1.92	2.98	2.83	1.81	2.42	1.16	1.54
1987/88	2.14	4.73	1.82	1.66	2.79	2.46	1.29	2.26	1.39	1.68
1988/89	1.80	5.65	2.91	1.84	3.65	3.50	2.14	3.33	2.90	2.95
1989/90	1.77	5.87	2.39	1.78	3.48	3.09	1.65	2.78	1.96	2.22
1990/91	1.86	3.38	2.47	1.85	3.69	3.41	2.61	3.06	1.90	2.23
1991/92	0.23	5.66	0.78	0.17	1.92	1.54	0.59	1.03	0.37	0.67
1992/93	1.55	5.89	2.71	2.11	3.40	3.35	1.29	2.82	1.71	2.23
1993/94	1.53	4.51	3.09	2.37	5.47	3.73	2.16	4.64	2.36	2.83
1994/95	2.00	7.43	1.55	1.32	2.39	1.66	1.35	1.70	1.21	1.43
1995/96	6.00	4.50	2.91	2.81	3.29	3.11	2.81	4.08	2.49	2.78
1996/97	7.00	5.67	2.69	2.33	3.24	2.43	2.00	3.18	2.44	2.57
1997/98	0.00	7.00	2.55	2.80	3.03	3.10	2.42	2.89	2.10	2.44
1998/99	0.00	7.57	2.62	2.50	2.57	3.49	1.24	2.98	1.52	2.26
<b>Average</b>	2.50	5.28	2.29	1.88	3.28	2.92	1.74	2.72	1.78	2.12
<b>Std deviation</b>	1.33	1.02	0.68	0.63	0.90	0.69	0.62	0.98	0.70	0.66
<b>CV (%)</b>	53.5	19.3	29.9	33.9	27.3	23.5	35.7	36.1	39.4	31.4
<b>Range: Minimum</b>	0.23	3.38	0.78	0.17	1.92	1.54	0.59	1.03	0.37	0.67
<b>Maximum</b>	6.00	7.43	3.09	2.81	5.47	3.73	2.81	4.64	2.90	2.95

CV: Coefficient of variation

Source: National Department of Agriculture, 1999 (as adapted)

Table A3: Yellow maize: Area and production trends by province, 1985/86 - 1998/99

Production year	Western Cape	Northern Cape	Free State	Eastern Cape	KwaZulu/Natal	Mpumalanga	Northern province	Gauteng	North West	Total
<b>Area utilized (ha):</b>										
1985/86	1 797	21 861	668 415	43 458	67 371	513 811	30 589	109 802	694 605	2 151 709
1986/87	1 761	19 628	493 846	38 435	54 028	499 164	33 778	100 091	571 035	1 811 766
1987/88	1 338	21 019	451 925	28 941	66 549	443 922	2 239	72 864	387 771	1 476 568
1988/89	1 058	22 915	483 341	23 639	62 052	476 424	21 505	133 997	420 298	1 645 229
1989/90	1 117	14 993	497 523	12 621	62 550	475 418	11 720	84 358	377 234	1 537 534
1990/91	807	13 218	454 602	11 114	53 487	481 267	12 038	87 424	377 486	1 491 443
1991/92	894	18 891	422 697	18 827	57 719	494 950	8 465	89 116	493 658	1 605 217
1992/93	1 432	22 426	529 317	17 341	61 284	538 599	12 373	95 186	401 864	1 679 822
1993/94	1 665	23 951	607 720	18 768	61 720	593 671	9 310	99 576	460 119	1 876 500
1994/95	1 700	20 000	470 000	17 600	61 000	508 000	5 500	107 000	360 000	1 550 800
1995/96	3 000	17 000	425 000	24 000	58 000	447 000	4 000	62 000	363 000	1 403 000
1996/97	3 000	22 000	485 000	9 000	64 000	441 000	5 000	78 000	460 000	1 567 000
1997/98	1 000	17 000	360 000	5 000	54 000	345 000	3 500	78 300	295 000	1 158 800
1998/99	1 000	19 000	360 000	5 000	51 000	313 000	3 000	60 000	263 000	1 075 000
<b>Average</b>	1 541	19 564	479 242	19 553	59 626	469 373	11 644	89 837	423 219	1 573 599
<b>Std deviation</b>	579	3 225	72 626	9 717	4 241	40 384	9 986	18 375	99 825	206 759
<b>CV (%)</b>	38.5	16.4	14.5	42.0	7.0	8.1	72.5	19.4	22.4	12.5
<b>Range: Minimum</b>	807	13 218	422 697	11 114	53 487	443 922	2 239	62 000	360 000	1 403 000
<b>Maximum</b>	3 000	23 951	668 415	43 458	67 371	593 671	33 778	133 997	694 605	2 151 709
<b>Production (t):</b>										
1985/86	3 723	100 155	1 368 505	90 039	282 946	1 591 863	65 456	231 556	742 902	4 477 145
1986/87	3 339	92 741	785 264	73 899	164 013	1 413 148	61 287	241 943	661 346	3 496 980
1987/88	1 892	99 507	822 451	48 174	185 350	1 091 174	2 885	164 401	538 667	2 954 501
1988/89	1 979	129 460	1 405 419	43 404	226 402	1 669 512	46 012	445 851	1 217 552	5 185 591
1989/90	2 000	88 038	1 191 060	22 465	217 401	1 467 221	19 289	234 152	739 894	3 981 520
1990/91	1 476	91 039	950 644	20 519	233 921	1 700 153	25 498	292 065	680 858	3 996 173
1991/92	1 980	109 010	295 453	31 905	182 599	884 595	26 529	98 785	72 269	1 703 125
1992/93	3 149	135 393	1 348 962	38 843	219 862	1 876 066	23 847	276 161	738 680	4 660 963

Table A3: (Continued)

Production year	Western Cape	Northern Cape	Free State	Eastern Cape	KwaZulu/Natal	Mpumalanga	Northern province	Gauteng	North West	Total
1993/94	3 577	157 022	2 136 871	44 374	154 462	2 122 850	20 291	460 738	1 192 341	6 292 526
1994/95	3 000	137 698	585 078	46 942	168 083	830 575	3 771	185 242	399 547	2 359 936
1995/96	18 000	105 000	1 190 000	69 000	190 000	1 482 000	11 000	315 000	922 000	4 302 000
1996/97	15 000	151 000	1 205 000	26 000	193 000	1 064 000	14 000	186 000	1 020 000	3 874 000
1997/98	5 000	152 000	800 000	20 000	155 000	810 000	8 000	209 000	540 000	2 699 000
1998/99	7 500	152 000	846 000	20 000	127 000	857 000	5 000	150 000	410 000	2 574 500
Average	5 115	121 433	1 066 479	42 540	192 860	1 347 154	23 776	249 350	705 433	3 754 140
Std deviation	4 486	21 873	469 976	20 592	36 147	381 031	20 232	104 881	312 296	1 232 047
CV (%)	112	19	43	43	18	26	73	39	43	31
Range: Minimum	1 476	88 038	295 453	20 519	154 462	830 575	2 885	98 785	72 269	1 703 125
Maximum	18 000	157 022	2 136 871	90 039	282 946	2 122 850	65 456	460 738	1 217 552	6 292 526
Average yield (t/ha):										
1985/86	2.07	4.58	2.05	2.07	4.20	3.10	2.14	2.11	1.07	2.08
1986/87	1.90	4.72	1.59	1.92	3.04	2.83	1.81	2.42	1.16	1.93
1987/88	1.41	4.73	1.82	1.66	2.79	2.46	1.29	2.26	1.39	2.00
1988/89	1.87	5.65	2.91	1.84	3.65	3.50	2.14	3.33	2.90	3.15
1989/90	1.79	5.87	2.39	1.78	3.48	3.09	1.65	2.78	1.96	2.59
1990/91	1.83	6.89	2.09	1.85	4.37	3.53	2.12	3.34	1.80	2.68
1991/92	2.21	5.77	0.70	1.69	3.16	1.79	3.13	1.11	0.15	1.06
1992/93	2.20	6.04	2.55	2.24	3.59	3.48	1.93	2.90	1.84	2.77
1993/94	2.15	6.56	3.52	2.36	2.50	3.58	2.18	4.63	2.59	3.35
1994/95	1.76	6.88	1.24	2.67	2.76	1.63	0.69	1.73	1.11	1.52
1995/96	6.00	6.18	2.80	2.88	3.28	3.32	2.75	5.08	2.54	3.07
1996/97	5.00	6.86	2.48	2.89	3.02	2.41	2.80	2.38	2.22	2.47
1997/98	5.00	8.94	2.22	4.00	2.87	2.35	2.29	2.67	1.83	2.33
1998/99	7.50	8.00	2.35	4.00	2.49	2.74	1.67	2.50	1.56	2.39
Average	3.32	6.21	2.23	2.18	3.23	2.87	2.04	2.78	1.67	2.39
Std deviation	1.19	0.79	0.77	0.39	0.56	0.66	0.63	1.13	0.77	0.69
CV(%)	52.1	13.7	35.6	18.5	16.8	22.6	31.6	39.1	46.0	28.9
Range: Minimum	1.41	4.58	0.70	1.66	2.50	1.63	0.69	1.11	0.15	1.06
Maximum	6.00	6.89	3.52	2.88	4.37	3.58	3.13	5.08	2.90	3.35

CV: Coefficient of variation

Source: National Department of Agriculture, 1999 (as adapted)