A comparison of Maize Production in Kenya before and during Liberalisation Period.

Lucia M. Mbithi* & G. Van Huylenbroeck**

Keywords: Agriculture - Food - Maize production - Policy - Market liberalisation.

Summary

Maize is the main food crop grown in Kenya. It is planted on 90% of all Kenyan farms and together with it's commonly intercropped crop, beans, occupies over 22% of all farmed land. In addition to being the staple food, maize production is also a source of capital and employment to a majority of the rural people. Total maize production, yield, area planted and average annual rainfall before and after market liberalisation is compared. Statistical analysis showed that both yield and total maize production increased significantly after the input and output market liberalisation while area planted with maize and average annual rainfall did not change significantly. Both yield and total production of maize show less variability in the liberalised period than before. These observations led to the conclusion that input and output market liberalisation policies could have led to increased yields and therefore increased total production of maize in general in Kenya.

Résumé

Comparaison de la production du maïs au Kenya avant et pendant la période de libéralisation

Le maïs est la principale culture vivrière cultivée au Kenya. Il est planté par 90% des exploitations du Kenya. Souvent en association avec le haricot, elle occupe plus de 22% de toute la terre cultivée. Outre qu'il soit un aliment de base, la production de maïs est également une source de capital et d'emploi à une majorité de la population rurale. La production totale du maïs, son rendement, les superficies emblavées et la pluviométrie moyenne annuelle sont comparés avant et après la libéralisation du marché. L'analyse statistique a prouvé que le rendement et la production totale ont augmenté significativement après la libéralisation du marché alors que la superficie occupée par le maïs et la pluviométrie moyenne annuelle n'ont pas changé de manière significative. En outre, le rendement et la production totale du maïs montrent moins de variabilité en période de libéralisation qu'avant celle-ci. Ces observations nous amènent à conclure que les politiques de libéralisation permettraient d'accroître les rendements et donc la production du maïs en général au Kenya.

Introduction

Kenya, a country situated at the extreme east of the African continent has a population of 28 million people (mid 1997 estimates) with an average annual growth (1991-1997) of 2.6% (15). Over 70% of this population are found in rural areas while 30% is urban. Until 1980's, the Kenyan economy was mainly a state-controlled economy, however a gradual change in the policy towards market liberalisation in all the sectors of the economy started to take shape in the mid 1980's.

Agriculture plays a multiple role in the Kenyan economy: food provision, employment creation, foreign exchange generation and provision of industrial raw materials for industrial sector. Because of the prominent role of agriculture in the economy, planners in Kenya have long considered growth of agricultural incomes as imperative to a successful development strategy. This was expressed strongly (8) and later in other development oriented documents (9,11) which aimed at improving food security and the productivity of the sector.

Output and input liberalisation in Kenya's agriculture sector like in other Sub-Saharan African countries, imply involvement of the private sector in marketing and distribution of agricultural commodities and inputs. A decrease of the government role in marketing, price control and input subsidisation is a major feature of the liberalisation policy, whose objective is to increase efficiency in resource use and to reduce government's fiscal deficits. Market liberalisation efforts in Kenya were initiated in 1985. Like in other Sub-Saharan African countries, this is a gradual process but by 1992, the government no longer controlled or subsidised agricultural inputs (16). The main features of the liberalisation policy in the Kenyan cereals' sector include, removal of subsidies, removal of value added tax, privatisation of the input market as well as the cereals market and removal of inter-regional maize trade restrictions.

In this study, the importance of maize to the Kenyan economy, main characteristics of maize production in Kenya as well as the food crop production policy before and after market liberalisation are discussed.

*P.O. Box 47759, Nairobi, Kenya.
**Department of Agricultural Economics, RUG, Coupure Links, 653, 9000 Gent, Belgium.
Received on 08.09.99 and accepted for publication on 15.03.00.

Material and Methodology

Time series data on maize crop yields, acreage and total production used in the study were obtained from FAO (2) and were supplemented with other data sources such as NCPB and Republic of Kenya (6,10). Rainfall data was obtained from the Kenyan Metorological department (4). This data included annual average rainfall of nineteen-weather recording stations throughout the maize producing areas in the country including Kiambu, Nyeri, Nanyuki, Njoro, Kitale, Kakamega, Kisumu, Kisii, Embu, Machakos, Kilifi, Kericho, Garissa, Kajiado, Nyahururu, Meru, Mombasa, Eldoret, Nakuru. The analysis captured the period before (1970-1984) as well as the period after (1985-1998) input and market liberalisation. Yield, area, total maize production and annual average rainfall before and after input and market liberalisation are compared and statistically analysed.

Results and Discussion

Importance of maize in the Kenyan economy

Maize, a crop whose history in East Africa dates back to the 16th century, holds a special place in the Kenyan economy. It is grown in 90% of all Kenyan farms and on over 22% of all farmed land in Kenya (7,8). Importance of maize to the Kenyan economy ranges from food provision to income generation. Maize production accounts for 25% of agricultural employment. The various ways in Kenya in which maize is utilised include provision of food, feed, seed, and raw material for industrial processing. Figure 1 shows proportions of maize in Kenya going to different uses in the 1990's.

Most of maize produced in Kenya is used for human consumption (over 87% of the total maize utilised in the 1990's). The crop forms the main component of the population's diet and its 1990's per capita consumption is 92 kg/year. The per capita maize consumption is higher in rural areas as compared to urban areas where maize is substituted for by wheat and rice. Rural maize consumption accounts for more than 90% of the total maize demand in the country (5). It supplies 40-45% of the total calories and 35-40% of the protein consumed in the country (13). The growth of demand of maize is estimated at 4% per annum (8).

The proportion of grain maize used as animal feed represents over 3.5% of the total maize utilised. This proportion shows a high variation from year to year, being higher in years of surplus in comparison to those of less production. Grain maize is not a preferred animal feed in Kenya. However after the cobs have been harvested, the rest of the crop provides an excellent forage for cattle, which is commonly used as fodder for the livestock in form of fresh or dried plant. This additional application of maize plant as fodder clearly gives an added value to the maize crop.

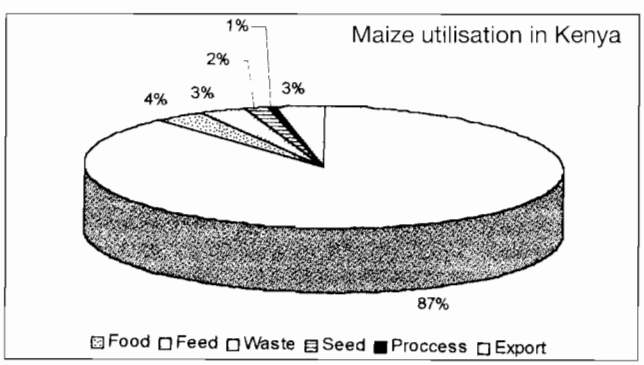

Figure 1. - Maize utilisation in Kenya in the 1990's
Source: Compiled from FAO.

Over 3% of the total maize available in the country are estimated to be lost. The quantity of maize lost on average equals the amount exported and is over two times the amount going in to processing. The trend of maize losses reveals that losses are higher in years when there is a surplus production in the country. This is mainly due to poor storage facilities. In 1998, there was a surplus maize production in the eastern province of Kenya, however large quantities of maize from this harvest were spoiled by Large Grain Borer (*Prostephanus truncatus*). Grain spoilage by this insect is aggravated by presence of air, moisture and heat (1). This borer was introduced in Kenya in 1981 and causes severe damage on the cob (12).

The amount of maize exported accounts for another 3% of the total maize utilisation. The quantities exported vary from one year to another subject to domestic production. There is no trend presented by the amount of maize exported but the quantities exported in years of surplus production are larger than those exported in years of low production.

The proportion of maize used to provide seeds is over 1.5% of the maize utilised. This proportion has a significant importance as it shows the willingness of maize farmers to keep maize from one season to another for seed provision. This is a common practice especially among the small-scale farmers in Kenya. The amount of maize kept for seed from one season to another is variable but shows no trend.

Maize processing in Kenya accounts only for 0.8% of total maize utilisation. This is due to the fact that maize is mainly perceived as a staple food only. There is a failure to appreciate the wide industrial applications of maize (11), which in turn has leads to inadequate support for non-food processing of the cereal.

Maize production characteristics in Kenya

Maize in Kenya is grown virtually in all altitudes from the sea level at the coastal area to over 1600 m above sea level in the Kenya highlands. The temperature experienced in these regions also varies greatly from an average of 16.5-24.7°C at the highlands and the lowlands respectively.

There are two rainfall peaks in Kenya, which represent two rainfall regimes in which maize is produced: March to May and September to November [Table 1 (3)]. Utilisation of these rainfall regimes varies from one ecological zone to another.

In general most of the farmers in the country utilise March rainfall as their major cropping season. Variability in seasonal precipitation is a common phenomenon in all agroecological zones of Kenya. Variability in rainfall is manifested in quantity, intensity and distribution in re-

lation to crop growing season. It is highest in semi-arid areas and lowest in moist transitional zones.
Most of the farmers in the lowland tropics, moist transitional and the high tropics areas grow maize once a year. The maize varieties grown are of a relatively late maturing as compared to those planted in the drier zones. The moist transitional and the high tropics constitute the rift valley province and the western Kenya regions. These regions are the country's cereals basket, and grow maize hybrid varieties that are late maturing. On the other hand, farmers in the drier zones (the semi-arid and the dry transitional) practice double cropping systems, utilising the two rainfall regimes and growing maize varieties that are early maturing as compared to those planted in the more moist regions. In these regions, mainly the coast, Katumani and Makueni composite maize varieties are grown. Double cropping is a major farming characteristic in agroclimatic zones that experience a two distinct rainfall pattern and in those with a high population pressure.

Intercropping is another farming characteristic in Kenya. Maize is commonly intercropped with pulses (beans being the most preferred). Other pulses intercropped with maize include cow peas, peas, green and black grams. Pulses are preferred not only because of their Nitrogen fixing ability and therefore enriching the soil but also because these crops are the main supplements to maize.
Most of the small-scale farmers (farms less than 2 hectares) in all the agroclimatic zones in Kenya intercrop maize. The proportion of the small-scale farmers intercropping maize is highest in the dry transitional areas. This is also the region with the highest population pressure (table 1). Intercropping maize is a strategy by the small-scale farmers to maximise the total output from their small farms. Moist transitional areas have the least proportion of farms intercropping with maize while the semi-arid have the largest proportion (77%). The main reason of intercropping maize in semi-arids is to diversify crop production in order to avoid risks of crop failure in times of drought years. However it has been observed (14) that semi-arid farmers e.g. those of Machakos district in the eastern province of Kenya have no comparative advantage in maize production, but rather grow maize for food security reasons. The existence of both small scale and large-scale maize farms in Kenya reveals the dualistic nature of the Kenyan agriculture. Maize production is dominated by small-scale farmers who produce over 75% of the total produce (7,11).

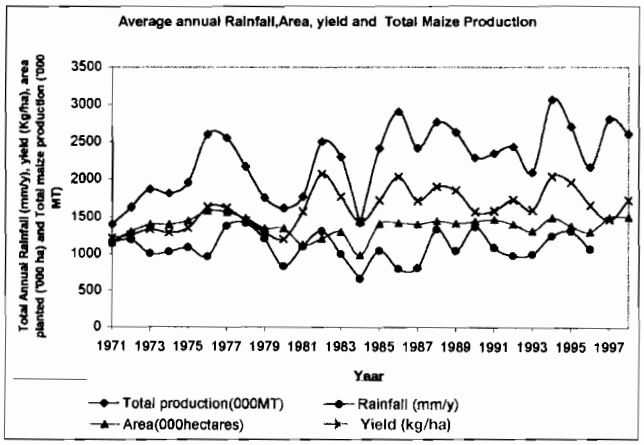

Figure 2. - Maize Production in Kenya for the period 1971-1998. Source: compiled from FAO STAT (2).

Total production, area planted yield of maize and average annual rainfall in Kenya

Average annual rainfall, total production, area planted and maize yield for the past 28 years (1971-1998) is shown in figure 2. The figure shows a year to year variation of the above factors.

Area planted with maize, yield and total production show the same trend as that followed by the average annual rainfall. Climatic factors, particularly rainfall affect greatly maize production in Kenya as the crop is grown under dry-land farming conditions.
Area planted with maize on average showed an increasing trend in the 1970's. However from the beginning of 1980 this changed to a declining and stagnating trend, which has continued up to date. The mean area before liberalisation period (1985) was about 1.3 million hectares, with a standard deviation of about 173. The increase in area planted with maize in the 1970's was mainly due to expansion of agricultural land. More land especially in the marginal areas was

Table 1
Maize production characteristics in Kenya

Zone	Altitude	Average Seasonal Temperature (°C) Max.	Min.	Total seasonal precipitation March-Aug (mm)	Total seasonal precipitation Sept-Feb (mm)	Total between seasons precipitation June-Aug (mm)	Variability in seasonal precipitation (%CV)	% of farmers were March rains are major season	Average time to maturity in days	Population Density (person km^2)	% of farmers double cropping maize	% of farmers intercropping maize Small (<2ha)	Large (>2ha)
Low land tropics	<800	29.4	20.0	300-1000	349	219	36	99	120	121	35	78	50
Dry mid-aititudes Semi-arids	7000-1300	27.9	16.1	<600	414	13	52	48	114	210	60	88	77
Moist-mid aititudes	1100-1500	28.3	15.9	>500	585	293	32	96	163	310	60	77	50
Dry transitional	1100-1700	25.3	14.0	<600	460	45	40	46	144	398	76	95	-
Moist transitional	1100-2000	23.3	13.4	>500	545	338	27	98	181	331	40	89	16
High tropic	>1600	23.0	10.0	>400	384	326	32	89	213	238	22	90	39

Source: Hassan (3).

put under maize production. Substitution of traditional crops mainly sorghum, millets and root crops especially in the drier parts of the country was another source of the increase in land planted with maize. Increasing demand for maize was due to increase in population as well as change of people's taste and attitudes towards these traditional crops. The area planted with maize reached a maximum of 1.59 million of 0.995 million hectares in 1982 and 1984 respectively. This drop in area is associated with the 1984 drought, which affected most parts of the country. In mid 1980's, area planted with maize reached a stagnation point of about 1.40 million hectares. This trend presents a land constraint that has been aggravated by population pressure. This implies that there is a limited scope for increasing the current area planted with the crop. For most of the years, area planted with maize was above the mean area.

The mean area under maize production during the liberalisation period is about 1.4 million hectares, with a standard deviation of about 65. It reached a maximum of 1.51 million in 1994 and a minimum of 1.30 hectares in 1993.
During the two periods analysed, there is no significant difference in area planted with maize. However a major difference in area under maize production in the two periods is that although there is a yearly variability in both periods, this variability is higher in the period before liberalisation than in the period after. This could be due to the policy changes encountered in the two periods.

The average yield of maize before liberalisation was about 1.47 Mt/hectare with a standard deviation of about 247. The highest yield of 2.07 Mt/hectare were obtained in 1982, while the smallest yields of 1.20 MT/ha were obtained in 1984, a drought year. Yields of maize after liberalisation are on average higher than those obtained before liberalisation period. They gave a mean of about 1.75 MT/ha, with a standard deviation of about 177 and reached a maximum of 2.04 MT/hectare in 1994. There is a significant difference between maize yields obtained in the period before and those obtained during the liberalisation period.
Yields during the two periods showed year to year variation, but the variation is lower during the liberalised period than before.

Total production is a direct product of yield (kg/ha) and area planted with maize (hectares). In general, there is a variation in total production from year to year with no clear trend.
Increases in total maize production of the 1970's were due to increase in area under maize production as well as increase in yield while those of the period from 1980 were mainly due to increase in yields. The increased yields were a result of adoption of improved and high yielding maize hybrids and their associated production technologies as area planted with maize reached a stagnation point.
The average annual total maize production in the liberalised period is significantly higher (mean value of 2.5 million metric tons) than that obtained in the period before (mean value of 1.95 million metric tons). Variability of the production is less in the liberalised period (standard deviation of about 283) than that of the period before (standard deviation of about 407).
Average annual rainfall affects maize production directly by affecting yields and indirectly by affecting farmers' decision on the area planted with maize. There is no significant difference in average rainfall between the two periods analysed (Table 2).

Table 2
Total maize production, yield, area planted and the rainfall before and after market liberalisation

	Mean	No.	Std. Deviation	2-tailed sig. (95% con. Int.)
Maize production ('000 MT)				
Before liberalization	1954.2	14	406.8	
After liberalization	2541.9	14	283.7	
Difference	-587.7			0.0024
Average annual rainfall (mm)				
Before liberalization	1140.5	12	173.8	
After liberalization	109.2	12	191	
Difference	48.6			0.594
Area ('000 ha)				
Before liberalization	1333.1	14	172.7	
After liberalization	1424.6	14	65.0	
Difference	-91.52			0.081
Yield (kg/ha)				
Before liberalization	1456.4	14	246.7	
After liberalization	1705.3	14	176.9	
Difference	-288.8			0.0126

Conclusions

The area planted with maize in Kenya seems to have reached a stagnation point. Due to population pressure, possibilities of increasing maize production through increasing the area seem to be limited. A strategy to increase maize production would therefore have to include improvement of production per unit area. Production increase should mainly be realised through technological development.

Two important factors that in the observed period have affected both the area planted and the yield of maize are the climate (mainly rainfall amount and distribution) and the policy/economic environment. As climate and weather (represented by the average annual rainfall), although fluctuating and having influenced maize performance, were not significantly and systematically different over the observed period, one hypothesis is that the main difference between the liberalisation period and that before is the policy environment. Although area planted with maize still stagnates at around 1.4 million hectares during the liberalisation period, average yields in this period seems to have increased, resulting to a higher total production.

Another observable difference between the two periods is that variation in total production as well as in maize yield decreased in the liberalised period. This confirms the hypothesis that liberalisation policies have lead to an increase in maize production in Kenya as well as to a decline in the year to year variation of the yields and the total production. The market liberalisa-

tion policy offers farmers increased maize market opportunities. This removes the farmers' uncertainty of sale of their produce during the years of surplus. In addition to increased maize prices this factor positively affects farmer decision making of producing maize.

Further research with more advanced econometric methods will concentrate on explicatory factors such as relative input/out price ratio, output and input evolutions and relative prices between different commodities.

Literature

1. Dowswell C.R., Paliwal R.L. & Cantrell P.R., 1996. Maize in the third world. pp. 35-52. Westview press, Colorado.
2. Food and Agriculture of the United Nations, 1970-1998. FAOSTAT, Agriculture, Rome.
3. Hassan R.M., 1996. Planting strategies of maize farmers in Kenya: a simultaneous equation analysis in the presence of discrete dependent variables. Agricultural Economics, **15**, 137-149.
4. Kenya Meteorological department, 1961-1995. Rainfall and temperature statistics. Nairobi, Kenya.
5. Maritim H.K., 1982. Maize marketing in Kenya. An assessment of inter-regional commodity flow pattern. Ph.D. thesis, 10. Berlin.
6. National Cereals and Produce Board (NCPB), 1999. Maize purchases, sales and fertiliser consumption statistics, Nairobi, Kenya.
7. Pearson S., Monke E., Sellen D., Nelson W.A., Mukumbu M. & Avillez F., 1995. Agricultural Policy in Kenya. Applications of the Policy Analysis Matrix. Cornell University Press. USA. 43, 50-51
8. Republic of Kenya, 1986. Sessional paper No. 1 of 1986 on Economic Management for renewed growth. Government Printer, Nairobi. 62-87
9. Republic of Kenya, 1994. Sessional paper No. 2 of 1994 of National Food Policy. Government Printer, Nairobi. 20.
10. Republic of Kenya, 1996. Statistical abstracts. Government Printer, Nairobi. 128.
11. Republic of Kenya, 1997. National development plan 1997-2000. Government printer, Nairobi. 55-56.
12. Rowland J.R.J., 1993. Dryland farming in Africa. Macmillan Press Ltd. London. 234-235.
13. Thomas S.J., Stephen J., Mukumbu M. & Jiriyengwa S., 1997. Maize marketing and pricing in Eastern and Southern Africa. In Byerlee D. and Eicher C.K. (editors). Africa's emerging maize revolution. Lynne Rienner Publishers. Inc. London. 213-243.
14. Tiffen M., Mortimore M. & Francis G., 1994. Maize and food security in semi-arid Kenya. John Willey and sons. 249-254.
15. World bank, 1988. World development indicators. CD-ROM Oxford University Press.
16. World Bank, 1994. Adjustments in Africa: Reforms, Results and the road ahead. Oxford University Press US. 88.

Lucia Mary Mbithi: Kenyan. Former Ph.D. student at Department of Agricultural economics, University of Gent, Coupure Links 653, 9000 Gent, Belgium. Current address: P.O. Box 47759 Naïrobi, Kenya
Van Huylenbroeck G., Belgian. Professor, Department of Agricultural economics, University of Gent, Coupure Links 653, Gent, Belgium.