The Maize in Zambia and Malawi

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Introduction

This report presents the findings of a research on Zambia and Malawi conducted as part of the "Subsistence Crop Study," a basic information-gathering project to support developing countries.

Even as the economy continues to globalise, self-sufficiency in food, particularly in major crops, is still considered by many countries as one of the top priorities in maintaining their independence. They have taken various measures to raise the ratio of self-sufficiency in light of their specific conditions. In many African countries, where no industry other than agriculture has developed to a considerable extent, improving self-sufficiency in staple crops may be vital for the stability of the state, or as the basis for sustainable development of economic activities. A wide range of crops have served as staple food in the continent, depending on the geographic, climatic and historic background of each country. In Southeast Africa, maize cultivation has spread to wide areas since around the 16th century, when the crop was introduced from Latin America via Spain, thus providing a crucial food source for most of the population in this sub-region. This also applies to Zambia and Malawi, the two countries covered by this report, where self-sufficiency in maize is maintained at substantial levels – 73% and 96%, respectively.

This report focuses on maize as an established staple crop in the two countries. It first outlines aspects related to production including breeding/cultivation methods and cropping system, as well as other aspects such as use, processing and distribution, followed by the identification of current issues and possible future direction. Readers should bear in mind the following characteristics of maize for better and comprehensive understanding.

(1) Political crop

Being a primary calorie source for the population, maize production has traditionally been subject to various subsidy programmes for seeds and fertilizer, as well as to political manoeuvring. Its future direction should therefore be considered in conjunction with political developments.

(2) Unstable production

Maize cultivation is mostly rain-fed, which necessarily leads to substantial fluctuation in production from one year to the next. Any unfavourable weather condition such as drought creates the need to import the crop. In this sense, a high self-sufficiency ratio recorded at a year with good weather does not provide protection against the impact of diplomatic relations or international market prices.

(3) Energy crop

Maize prices are soaring in the international market as attention has been focused on the crop in recent years as a raw material for ethanol production. Since this use conflicts with its traditional use as food, countries with a fragile food production base, such as the two countries in question, may have to bear the brunt of such developments. Even the introduction of any energy crop that is not used as food, such as *Jatropha curcas*, may work against food production, if maize fields are turned into plantations for the new crop, effectively reducing the maize growing area.

Through the research and the preparation of the present report, we have found that the sustainable development of the production/distribution system for maize is a major challenge both countries are now facing. The current monoculture system solely dependent on maize needs to be reviewed in terms of risk management and sustainability. Producers are also required to adopt a more diversified cropping system by integrating other crops. It is hoped that the efforts in this direction, currently observed in government agencies concerned, will bring concrete benefits in the near future.

Chapter II: Maize in Zambia

1. Production of Maize

1-1 Overview

Maize (*Zea mays* L.) originates from Latin America. Its cultivation is considered to have started by 3000 BC at the latest. In 1492, maize caught the eye of Christopher Columbus, who reached Cuba on his voyage to discover Americas. The crop that he brought back to Spain spread immediately around the Mediterranean rim, before it was introduced to West and East Africa probably in the 16th century. At that time, the Zambian staple crops were sorghum (*Sorghum bicolor* (L.) Moench) and millet (*Eleusine coracana* Gartner), as an African original product, but gradually replaced by maize. In 1964, when the country gained its independence, maize already accounted for over 60% of the planting area of major crops. Particularly in the 1970s, the planting area and production volume of maize increased rapidly as the government introduced chemical fertilizer subsidy programmes and raised the producer price in 1970. However, the production volume plummeted due to droughts in 1979 and 1980, and has not recovered ever since despite the diffusion of hybrids. Meanwhile, the production of sorghum and millet, which had been the mainstay of diet in Zambia for millenniums, declined during the 1970s by two thirds and nine tenths, respectively. The diffusion of hybrids has not helped increase the unit yield of maize: it stands at 1.8t/ha, a level comparable to that of traditional varieties. This may be because many of the subsistence farmers cannot afford new hybrid varieties and use recycled seeds of hybrids, instead. The low unit yield may also be explained by chemical fertilizer prices, which are too high to allow sufficient fertilizer application. Zambia reportedly needs 1.2 million tonnes of maize to ensure self-sufficiency. This volume has not been attained in many of the years, thus forcing the country to depend on imports. Incidentally, most of the maize grown in Zambia is of flint varieties, with white varieties overwhelmingly preferred over yellow ones. Given that the two types of varieties have identical nutritional values, the preference may be the result of misinformation by the former colonial power, or have much to do with the spiritual culture of the local population, just as the Japanese prefer white rice.

1-2 Production and Yields

1) Production and unit yield

According to FAO, 695 million tonnes of maize was produced worldwide in 2006, of which Africa accounted for 46 million tonnes. South Africa is the leader among the 50 maize-producing African countries, representing 15% of the total production in the continent. Zambia is ranked 13^{th} with 0.865 million tonnes. In the 1960s, the country produced only 0.57-0.77 million tonnes with a planting area of 0.75-0.87 million hectares, which translates into a unit yield of less than 1t/ha (Figure II-1-1). In the 1970s, it produced 0.57-1.64 million tonnes of maize on a planting area of 0.90-1.10 million hectares, with unit yield reaching 2t/ha in some years (Figure II-1-2). The introduction of chemical fertilizer subsidy programmes and the raising of the producer price by the government in 1970 may have had substantial impact on maize production. In addition to the effect of chemical fertilizer, it should be noted that the introduction of improved strains helped double the unit yield. Maize production stagnated in the 1980s mainly due to downscaling of fertilizer subsidy programmes, although the producer price was raised successively. The slump continued throughout the 1990s, and maize planting area has stayed on a par at around 0.50 million hectares. Production has rarely exceeded 1 million tonnes, only twice in the last 10 years. It is true that the levelling off of planting area is a major factor behind the stagnant production. However, we should be concerned that the unit yield has not increased from 1.8t/ha despite the introduction of hybrids. The low yield may be attributed to the use of recycled seeds without fertilizer application as chemical fertilizer and new varieties are both unaffordable for farmers. Reintroduction of traditional varieties should be considered in order to better avert the risk posed by drought and other adversities. A hybrid that only produces a unit yield of 1.8/ha has no difference from traditional varieties, which require smaller inputs and more resistant to the vagaries of weather.

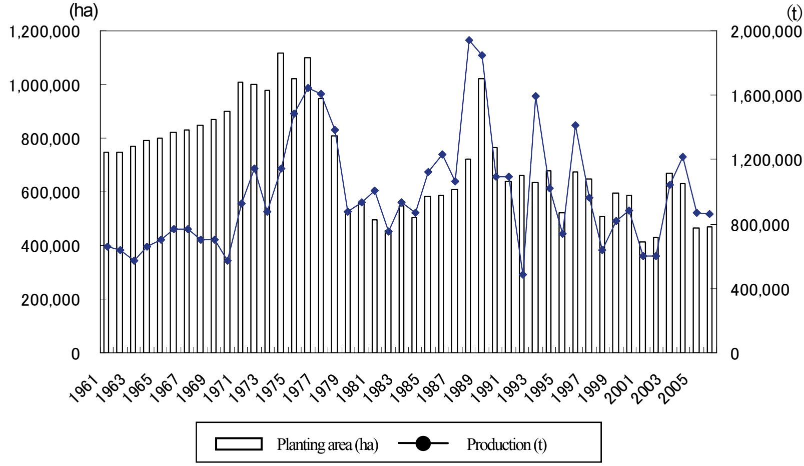

Figure II-1-1 Planting area and production of maize in Zambia
Source: Compiled by the author from FAOSTAT.

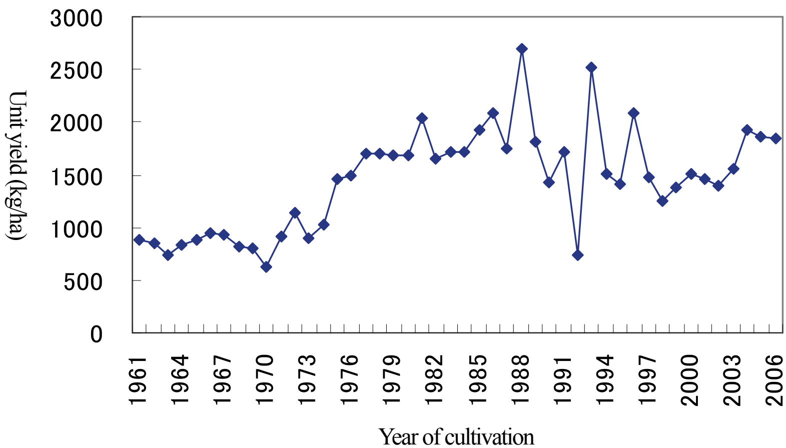

Figure II-1-2 Unit yield of maize in Zambia
Source: Compiled by the author from FAOSTAT.

2) Maize production in various parts of Zambia

Among the nine Zambian provinces, the Eastern province is the largest maize producer, followed by the Southern and Central provinces. The Luapula, Lusaka, North-western and Western provinces only register small amounts of production (Table II-1-1). Taking transport cost into consideration, production may correlate with accessibility to the capital. Unit yield stands at 1.5-2.0t/ha each year in most of the provinces, but often does not reach 1.0t/ha in the Western province. Apparently, the province is not suited for rain-fed cultivation of maize due to the smallest rainfall in the country. The 1990 agricultural census indicates that 379,784 farming households – 73% of the total – plant maize, 97% of which are smallholders with 1-9ha of land. Smallholders account for 69% of the maize planting area and 61% of total production. 52% of the smallholders plant maize on less than 1ha of land. The stagnant production and yield may be explained by the fact that smallholders cannot afford chemical fertilizer and new hybrid varieties and use recycled seeds instead with small inputs.

Table II-1-1 Production of major crops by province (2002-2003)

Crop	Central	Copperbelt	Eastern	Luapula	Lusaka	Northern	North-Western	Southern	Western	Total
Maize	19.2	8.2	32.2	1.9	2.4	7.8	4.7	19.5	4.1	100
Sorghum	22.3	14.1	5.9	2.6	0.1	10.4	17.9	10.3	16.4	100
Millet	6.3	0.2	2.2	6.0	0.1	55.7	0.9	12.0	16.5	100
Rice	0.7	0.2	48.9	3.2	0.0	32.6	0.2	0.0	14.1	100

Source: Compiled by the author from Agricultural and Pastoral Production 2004.

1-3 Cropping System, Cultivation Methods and Use

1) Cropping system

Zambia has clear rainy and dry seasons (Figure II-1-3). Vegetables are cultivated in the dry season, from May to October, while maize and other cereals are grown in the rainy season, from November to April. Although rain-fed cultivation prevails for maize, it is also grown in the dry season where irrigation facilities are available. Maize is typically grown in permanent fields. The Bemba, a farming population living in the *miombo* (sparse) woodland in the north of Zambia have been practicing shifting cultivation known as *citemene*. According to this farming method, farmers collect branches from trees in an area that is five times as large as the area to be cultivated before planting the crop. These branches are burned on the prospective field to produce the ash that supplies necessary inorganic nutrients for crop cultivation. They do not apply chemical fertilizer. The land developed by *citemene* is usually cultivated for three consecutive years. In the first year, millet, the staple crop for the population, is grown along with cassava. Following the cultivation of groundnuts in the second year, millet is replanted in the third and final year. As the yield declines, the farmers will abandon the field to move elsewhere in the following year. The growth of the trees whose branches were removed will recover in 15 to 20 years. Although the traditional *citemene* practice observed this cycle, population growth and the introduction of cash crops including maize have increased pressure on land, leading to the curtailment of the interval.

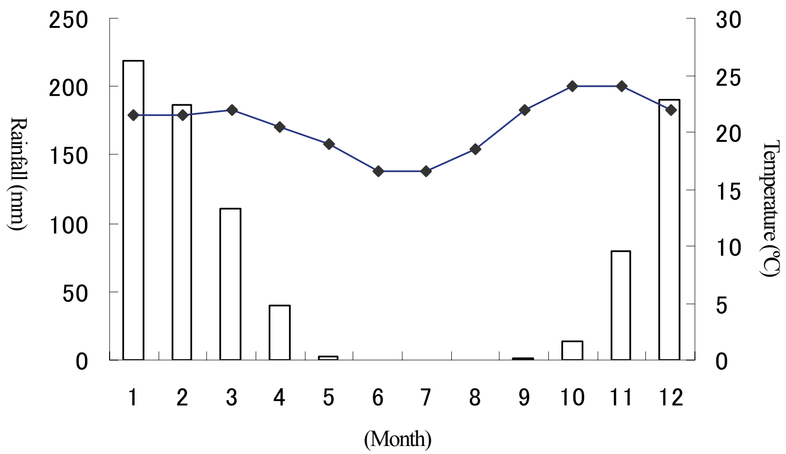

Figure II-1-3 Monthly rainfall and temperature in Zambian capital Lusaka

Since around 1986, another practice known as “farm” (semi-permanent field) cultivation has expanded rapidly. This practice has been used for growing maize hybrids as cash crop on semi-permanent fields created by removing the roots of trees, with the application of chemical fertilizer. Many of the Bemba villages have actively introduced the farm cultivation method in parallel with the *citemene* practice, resulting in the formation of a stable farming system, cultivating *citemene* (shifting fields) for subsistence crops and farms (semi-permanent fields) for cash crops. However, the adoption of policies such as the liberalisation of maize producer price and the withdrawal of fertilizer subsidy programmes has raised serious concern for the Bemba people, living far north of the capital.

2) Cultivation methods

Seeds are sown by mid-December for rain-fed cultivation during the rainy season. It is recommended to sow 20-30kg/ha of seeds with an inter-row space of 75-100cm, inter-stock space of 15-30cm and seeding rate of 4-5 stocks/m^2. Bud emergence is the best when seeds are sown at the depth of 5cm, or 3-4cm in hard soil. As regards hybrid varieties, it is recommended to apply 300-400kg/ha of D-compound (N:P:K=10:20:10) for basal dressing and 250-300kg/ha of urea for top dressing. Fertilizer application has little effect on traditional varieties. Sufficient weeding is required for the first six to eight weeks of growing.

Maize streak virus is the primary threat to maize, sometimes causing substantial drop in yields. In order to avoid this risk, farmers in rainy areas should use resistant varieties and refrain from late sowing. Other threats include diseases such as cob rot, leaf blight and rust, as well as cabbage moth and other pests. Damages by fall armyworm have also been reported in recent years.

3) Use

Zambian maize is mostly used as food, although it is also used for brewing and animal consumption. As a staple crop, most of the maize is milled and then boiled in hot water until it thickens like dough for eating. This staple food, known as *nsima* in Zambia, is very similar in its preparation to what is called *tô* in Burkina Faso and *ugali* in Kenya and Tanzania, both serving as staple food. The white flint varieties are definitely preferred over the yellow ones, which are rarely marketed.

1-4 Breeding and Production Limiting Factors

1) Breeding

Agricultural experiment and research in Zambia dates back to 1922, when it was still under colonial rule. The activities initially focused on cash crops grown by European settlers including maize, cotton and tobacco. Comprehensive experiment and research started in 1953, when the predecessor of the present Zambia Agricultural Research Institute (ZARI) was established. The structural adjustment program implemented in the 1990s explored the possibility of involving the private sector in experiment and research projects, traditionally run by the government. This effort culminated in the creation of a new research organization as agricultural research trust, in addition to the existing national agricultural research institute. Some of the experiment and research activities, including improvement in crop varieties, are now conducted by private companies including seed providers. Some research activities are also conducted by government agencies other than the Ministry of Agriculture and Cooperatives, including the National Institute for Scientific and Industrial Research Institute (NISIR) established in the Ministry of Science, Technology and Vocational Training. Furthermore, the School of Agricultural Sciences of the University of Zambia (UNZA) conducts its own research activities. Thus, five entities are currently involved in agricultural experiment and research activities in Zambia, namely (1) the Agricultural Research Institute of the Ministry of Agriculture and Cooperatives, (2) a parastatal agricultural trust, (3) NISIR, (4) UNZA School of Agricultural Sciences and (5) the private sector. Recently, private companies such as Zamseed, Seedco, MRI Seed and Pannar have been involved in maize breeding, as well as the technical service division of Zambia Agricultural Research Institute of the Ministry of Agriculture. The institute's objectives for maize breeding include the development of varieties resistant to non-biological stresses such as aridity, low nitrogen and low pH, as well as to biological stresses including grey leaf spot, leaf blight and stored products pests. UNZA addresses bio-fortification issues related to Zn, Fe and vitamin A within the framework of the QPM (quality protein maize) Challenge Programme implemented in cooperation with the Nippon Foundation. As noted above, the Zambian people overwhelmingly prefer white varieties of maize. Since no natural linkage has been identified between vitamin A content and grain colour, it is possible to develop a white variety with greater vitamin A content. Under the government-sponsored Fertilizer Support Programme (FSP), Zamseed now markets 11 hybrids and six open pollinated varieties, and enjoys a 30-50% market share. Hybrids account for some 75% of its sales. According to the timing of breeding, hybrids are categorized into the early-, medium- and late-maturing groups, which are given series numbers of 400, 600 and 700, respectively. For farmers' convenience, they are also classified according to adaptability to the three agricultural ecosystems found in Zambia. Zamseed conducts independent variety breeding activities in its 1,000 ha experimental farm on the outskirts of Lusaka. This farm was transferred to Zamseed from ZARI, which suffered a major outflow of researchers as its variety breeding research came to a standstill following its privatization in 1995, thus affecting the conservation of genetic resources. The company currently manages all those assets along with the genetic resources of CIMMYT. MRI, another private company, has developed the very first hybrid variety (MM752) in Zambia. The company has a 30-32% market share within the governmental Fertilizer Support Programme (FSP). The potential yield of recently developed varieties in Zambia amounts to 4-5t/ha for open pollinated varieties including Pool 16, MMV400 and MMV600, and 4-10t/ha for hybrids.

2) Production limiting factors

The primary factors limiting production seem to be the scale of farming households and extensive agriculture. A considerable yield (4.5t/ha) would be expected if appropriate fertilizer application and watering were ensured along with weeding and pest/disease control. As it is, however, 97% of the maize growers are smallholder households, often headed by a woman. With only five or six workers available per household, maize farming may be characterised as subsistence agriculture. It is also a rain-fed, extensive agricultural practice, only using hoe and other simple implements. The potential yield cannot be achieved as the use of chemical fertilizer and improved seeds are substantially limited. At the same time, the attractiveness of maize as cash crop is now fading. Maize production suffers further constraints as growers are switching to cotton and other more easily cashable crops.

1-5 Production Issues

Maize accounted for some 60% of the crop growing area in the 1970s and 1980s. This ratio has fallen below 30% since the 1990s, largely because commercial farmers have shifted from maize to exportable crops with higher added values such as cotton, soya and sunflower. The loss of maize's attractiveness as cash crop is ominous in the face of continued dependence of the Zambian population on maize as staple crop. The hybrid varieties introduced to increase production has not lived up to expectations, as their yields stand on a par with those of indigenous varieties. Given that maize requires a substantial amount of water for growth, some of the current planting areas are not deemed suitable for maize production. Cultivating the crop in such areas is not considered to be a wise choice. Reintroduction of indigenous varieties of sorghum and millet is a possible option if Zambia is to ensure stable production of staple crops for food security purposes. Until maize was introduced to Africa four centuries ago, people must have been fed with the traditional cultivation technique developed over thousands of years for sorghum and millet, which used to serve as staple crops. Indeed, millet is still grown in the north of the country, where maize cultivation is disadvantageous in economic terms. Millet and sorghum are grown in wide areas in the west, where the unit yield of maize is the lowest due to insufficient rainfall (Table II-1-2). Thus, the promotion of maize monoculture, led by the former colonial power and the government after the independence, is far from being a success. Bearing in mind the principle of "right crop for right land," any improvement of the living standard of Zambian farmers should start with the re-evaluation of traditional crops suited for the local agricultural environment to raise self-sufficiency in food, followed by the identification and introduction of viable cash crops.

Table II-1-2 Production of major crops by province (2003-2004)

(in tonnes)

Crop	Central	Copperbelt	Eastern	Luapula	Lusaka	Northern	North-Western	Southern	Western	Total
Maize	207,865	84,855	298,087	18,879	33,148	76,960	40,742	239,796	56,344	1,056,676
Sorghum	4,139	2,860	1,801	927	239	1,568	4,631	7,246	6,908	30,319
Millet	2,078	72	745	2,004	40	18,493	295	3,984	5,478	33,189
Rice	232	109	5,150	693	8	5,520	143	0	5,334	17,189

Source: Compiled by the author from Agricultural Production 2006.

2. Marketing and Processing of Maize

2-1 Comparison with Other Staple Crops

Maize is the most important staple crop in Zambia. Its planting area and production volume* is far greater than those of other crops (Table II-2-1). Smallholders account for 79% of maize production in the country. Other staple crops include cassava, sweet potato, sorghum and millet. Cassava is cooked directly, or floured before cooking as with maize, sorghum and millet.

Table II-2-1 Planting area and production of major food crops (2006/07 cropping season)

Crop	Growing area (ha)	Production (t)
Maize	872,812	1,366,158
Of which: Large farmers	54,446	287,089
Smallholders	818,366	1,079,069
Sorghum	31,596	12,773
Rice	20,067	18,317
Millet	56,817	21,707
Cassava	(n.a.)	1,146,142
Irish potato	3,305	22,771
Sweet potato	29,476	75,664

Source: Ministry of Agriculture and Cooperatives.

Based on a nationwide survey conducted in 2004 (number of samples: 8000),

*Zambia requires some 1.2 million tonnes of maize per annum to satisfy domestic demand.

Zulu, Jayne and Beaver (2007) made some observations on the cropping pattern and income sources of smallholders. First, household of approximately 80% has produced the maize as a staple food; importance of this crop has outstanding In terms of the number of growers, groundnuts (42%) and cassava (39%) is next in line, followed by sweet potato (19%) and sorghum (10%) (Table II-2-2). Looking at the composition of income (total of sales and on-farm consumption) for all households by crop, cereals including maize have the largest share with 35%, followed by roots and tubers with 18% (Table II-2-3). Thus, it has been found that maize is the most important crop both in terms of the number of growers and share in household income.

As compared with other staple crops (cassava, sweet potato, sorghum), maize is more susceptible to drought, and its production may be hit substantially by bad weather. Furthermore, inputs such as chemical fertilizer and improved seeds are essential for realizing a high yield. Sufficient maize production is simply impossible without those inputs. As the government liberalized the distribution of products and inputs and scaled down subsidy programmes in the 1990s, the prices of inputs rose, and the producer price of maize declined, in remote areas. Thus, the farther a farmer lives from the capital, the less favourable is the condition for producing and selling maize.

Table II-2-2 Crop production as percentage of farming households (2003/2004)

Crop	% of households producing
Maize	79.9
Groundnuts	42.1
Cassava	38.8
Sweet potato	18.8
Mixed & ground	17.2
Cotton	10.5
Sorghum	10.3

Source: Zulu et al. (2007), p.7.

Table II-2-3 Production income shares in farming households (%, 2003/04)

Income source	% of total income
Crop production	72.5
(of which) Cereals	35.1
Roots and tubers	17.7
Beans and oilseeds	9.6
Non-food cash crops	5.5
Fruits and vegetables	4.6
Other crops	0.1
Animal products	5.1
Off-farm activities	21.7

Note: Data include on-farm consumption as evaluated at market prices.

Source: Zulu et al. (2007), p.5.

Table II-2-4 presents the growth rates of planting area and production for major food crops. While the growth for staple grains including maize was minimal, considerable production growth was achieved for cassava and sweet potato. This may be explained by the following factors: (1) the improvement of productivity for roots and tubers thanks to the diffusion of improved varieties; and (2) the shift of production from maize to cassava and other crops, particularly in remote regions of northern Zambia, as a result of rising chemical fertilizer prices due to the scaling-back of the subsidy program.

Table II-2-4 Growth rates of planting area and production for selected crops(1991-2004)

Crop	Area	Production
Maize	0.2	0.6
Sorghum	-0.3	0.4
Millet	0	0.6
Cassava	1.6	3.3
Sweet potato	4.6	6.6

Source: Janye et al. (2007), p.10.

The Zambian government has been focusing its attent ion on the emergence of cassava in recent years as a supplementary crop to maize.* The advantages of cassava may be found in: greater resistance to drought as com pared with maize and adapt ability to poor soil conditions; little requirement of inputs including chemical fertilizer; high potential for processing (cassava flour, chips, starch, etc.); the possibility of levelling on-farm consumption (avail ability in necessary quantity at any time) as the harvest does not concentr ate on a short period of time; the potential of cassava meal as additional ingredient of the staple food (*nsima*),
which eliminates the necessity of changing the traditional diets. However, cassava also has some disadvantages. For example, it requires a long period of growth before harvest (9-24 months), causing a competition with other crops for space where land is scarce. The bitter varieties require detoxification, which in turn requires the knowledge of relevant techniques. Its quality deteriorates rapidly after harvest. Also, cassava is more "bulky" than maize, causing more difficulties

* According to interviews at the Ministry of Agriculture and Cooperatives and Zambia Agricultural Research Institute.

in transport or processing.*

In light of their resistance to drought, sorghum and millet are also considered as potential alternatives to maize. As with cassava, they have advantages over maize in requiring less chemical fertilizer and lower costs for production. However, they cannot be expected to replace maize as staple food because of their inferiority in taste. They also have the disadvantage of longer growth periods, except for improved varieties.

2-2 Processing Industry

In most cases, maize is floured and then boiled in hot water until it thickens like dough for eating. This traditional staple dish, known as *nsima* or *nshima*, is put on the table almost at every meal in Zambia and Malawi. Kenya and Uganda also have a similar staple called *ugali*. For this reason, maize milling has been performed in extensive areas of Southeast Africa using various techniques.

Maize meal, known as "mealie meal" in Zambia, is largely classified into the first-grade breakfast meal and the second-grade roller meal.** Both of those maize meal products are processed in large plants and supplied to urban consumers (Photo II-1). In rural areas, maize meal is mostly processed with small milling machine known as hammer mills (Photo II-2). It is less expensive for rural people to bring maize grains produced on-farm or purchased at the market and have it milled by a hammer miller, than to purchase a commercially produced product. This practice has spread rapidly nationwide since the mid-1990s, when the government withdrew its price support programme for maize meal, effectively raising its retail prices (Kodamaya, 2003).

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* It is for this reason that cassava flour is more expensive when it is processed in urban areas. As of October 2007, the price of cassava flour at a supermarket in the capital Lusaka (12,450 kwacha = about $3.3 per 5 kg) was 36% higher than that of high-quality maize meal (breakfast meal), which was 9,150 kwacha = about $2.4 per 5 kg.

** As of October 2007, the price (per 10 kg) of breakfast meal at a supermarket in the capital Lusaka stood at 16,450 kwacha (about $4.3), which was almost 40% higher than that of roller meal (11,750 kwacha = about $3.1).

Photo II-1 Maize meal in a Lusaka market

Photo II-2 Hammer milling in a rural area

Zambia has 35 maize milling companies (as of 2007), which are involved in a fierce competition. In addition, about 7,000 hammer mills are reportedly registered in rural areas. In this highly competitive environment, no company has a commanding market share in the milling industry. The share of the leading company, National Milling Corporation Ltd. (NMC) is estimated to be only 22%[*]. The following is a brief outline of NMC.

Case study: National Milling Corporation Ltd. (NMC)

NMC (Photo II-3) is a 100% subsidiary of a US company Seaboard Corporation, and emp loys some 1,000 workers. Its predecessor, National Milling Company, incorporated with South African capital in 1993 following the privatization of a state-run company went into bankruptcy after three years of operation. The present NMC was incorpor

Photo II-3 National Milling Corporation

[*] These figures are based on an interview with the Managing Director of National Milling Corporation Ltd. (October 2007). They are all estimates, for no official statistics is available on market shares for maize meal.

ated through acquisition. Major products processed by NMC include maize meal, flour and animal feed. The company's sales totalled some $60 million in 2006. NMC procures about 200,000t of maize per year, both from large-scale farms and smallholders. Purchases from smallholders are made at its 62 storehouses nationwide, at the purchase price of the Food Reserve Agency (FRA, see below), which is 38,000 kwacha per 50kg. The purchase price for large farmers is 10% higher than for smallholders, in consideration of the higher quality of maize supplied. Although no government regulation exists for the prices of maize meal, political pressure does exist for lowering the prices. The supply of cheap maize to the market by the FRA also affects business management, exerting downward pressure on maize meal prices. Moreover, unpredictable intervention of the government in external trade in agricultural products, such as export or import ban, is a negative factor for NMC, which is involved in export to neighbouring countries and the import of raw materials.

Photo II-4 Roots of *Rhynchosia venulosa* used for *maheyu* production

Other products processed from maize include various beverages. For example, the beverage made from crushed, porridge-like maize known as *maheyu* or *munkoyo* (see Photo 2 on the frontispiece page) is not only produced at home in both urban and rural areas for domestic consumption but also sold in markets. Extract from the roots of *Rhynchosia venulosa* (Photo II-4), finger millet, sugar and other ingredients may be added to the

Photo II-5 *Chibuku*

beverage to produce sourness and weetness.It contains little alcohol if any (Yoneya and Miyamoto, 1999, p. 84).

Maize is often used for brewing, too. Indeed, the consumption of maize for brewing amounts to some 15,000 tonnes per year. Maize is used not only as an ingredient of beer, but also as main ingredient of *Chibuku* (Photo II-5), a local alcoholic beverage mostly consumed by the low-income and rural population. This beverage, produced in large amounts in factories, is largely made from maize, sorghum and lactic acid, and has an alcohol content of 6%. *Chibuku* is a very popular drink in Malawi and Zimbabwe, as well as in Zambia.

2-3 Marketing of Products and Inputs

Until 1992, the prices and distribution of maize was tightly controlled by the state. During this period, the purchase of maize from producers was monopolized by Namboard (National Agricultural Marketing Board) and Provincial Co-operative Unions. Buying posts were established in villages all over the country. Maize thus collected was transported and sold in block to millers in urban areas, for sale in the retail market after processing. The price at each stage of the distribution process (producer price, selling price to millers, and retail price of maize meal) was fixed by the government. Those prices were applicable nationwide and did not change throughout the year. The government at that time focused its policy on ensuring sufficient production of maize as staple crop through the provision of incentives and supplying it at low prices to urban consumers in particular. Thus, the government set a high producer price as an incentive to maize farmers, while maintaining the retail price at a low level to help consumers procure their staple food. As a result, the producer price exceeded the retail price, effectively forcing the government to provide subsidy to bridge the gap. This placed a permanent financial burden on the government (Kodamaya, 2003).

Since 1993, the governmental intervention in the distribution and prices of maize, as described above, has been reduced in a bid to promote liberalization. Concrete measures included the winding up of Namboard and the deregulation of producer and retail prices (abolition of subsidy), as well as the liberalization of chemical fertilizer distribution and the withdrawal of related subsidy programmes. The abolition of subsidy programmes for chemical fertilizer meant to the farmers an increase in its prices. The abolition of maize purchasing by Namboard and privatization of maize distribution, as well as the abolition of the nationally applicable fixed buying price, signalled to the farmers that they were no longer able to sell their products at a fixed price by bringing them to the consolidating stations designated by the government, and that they had to negotiate directly with merchants on the selling price, instead. Producers in remote areas had to face even higher fertilizer prices to cover the additional transport cost. What is worse, they were obliged to sell maize at a lower price, for the purchasing merchants would subtract the extra transport cost from the purchasing price. Thus, the farther a farmer lives from a major consuming area, the more disadvantageous becomes the commercial production of maize. Indeed, many farmers have ceased production of maize since the introduction of liberalization measures, particularly in the northern part of Zambia, where maize production had spread rapidly under the governmental price support scheme (Shimada, 2007, pp. 111-2).

The government has partially reintroduced subsidies for chemical fertilizer. These subsidies are provided through the Fertilizer Support Programme in the form of selling chemical fertilizer at a discount through agricultural cooperatives. The resumption of a subsidy programme is driven by the fact that small farmers can hardly afford to utilize chemical fertilizer due to recent hikes in its prices (Table II-2-5). From 2003 through 2006, the government distributed 45,000 tonnes of chemical fertilizer each year at a 50% subsidy under the programme[*] (Jayne et al. 2007, p. iv). Although the programme was scaled down in 2007, the subsidy rate was raised to 60%, which means that chemical fertilizer is now available at 40% of the market prices. Only cooperative members may purchase chemical fertilizer at the subsidized prices, but the cooperative participation rate is not high. It is not certain that the provision of subsidies for chemical fertilizer through agricultural cooperatives has benefited the poor, for participation in a

[*] It is estimated that 50,000 to 60,000 tonnes of chemical fertilizer is purchased in the private commercial market, and that 28% of small farmers use chemical fertilizer for maize production (Janye et al. 2007, p.17-19).

cooperative requires the payment of membership fees and there is no incentive to join a cooperative for poor farmers who cannot afford fertilizer even at the subsidized prices.*

Table II-2-5 Trend of chemical fertilizer prices in Lusaka

(US$/t)

Fertilizer	2000	2001	2002	2003	2004	2005	2006
Urea	285	295	285	315	385	455	490
D-Compound (NPK:10-20-10)	290	295	295	315	390	400	490

Source: Golden Valley Agricultural Research Trust.

Figure II-2-1 presents maize distribution channels in recent years. The buyers of maize from producers may be classified into large private buyers and small merchants. Many of the large private buyers have been engaged in maize transport since the era of governmental intervention in distribution on behalf of Namboard or cooperative unions. Large buyers purchase maize from producers or pickup service operators mainly for sale to millers. Small merchants, on the other hand, are newcomers after liberalization. Various types of small merchants are in operation: in some cases, producers act as small merchants by selling their products directly to consumers in the local market, while in others, pickup service operators play the role of such merchants by buying products from farmers for direct sale to retailers (Kodamaya, 2003).

Examining the trend of maize prices in the post-liberalization period from 1994 through 2005, Jayne et al. (2007, pp.12-13) reports that real maize meal prices declined by 40% during this period, while real wholesale maize prices almost remained on a par. They attribute this downward trend in maize marketing margins at the distribution stage to the shift from the *de facto* oligopoly by a few

* The cooperatives sell inputs in packages, each containing eight bags of chemical fertilizer (50 kg per bag) and 20 kg of improved seeds, effectively precluding any purchase below this threshold, which corresponds to the requirement for growing maize on a hectare of land. As of October 2007, the (subsidized) price of inputs per package stood roughly at 327,000 kwacha ($83.5) at Chongwe on the outskirts of Lusaka (the price of a package containing the cheapest seed, based on data published in *AMIC Bi-Monthly Market Information Bulletin*, Ministry of Agriculture and Cooperatives, 1-15 October 2007).

maize-processing firms in the pre-liberalization period to a more competitive market structure in milling and retail after liberalization, and conclude that the liberalization of distribution has brought benefits to consumers.

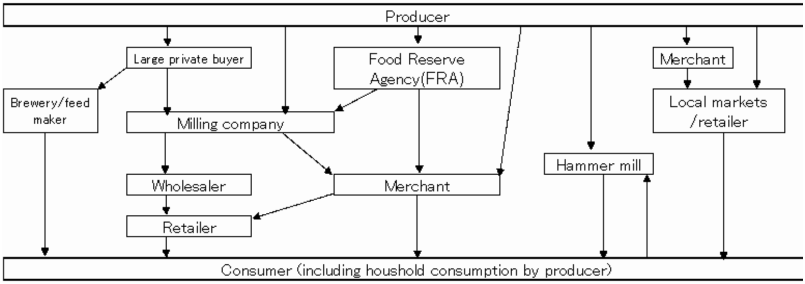

Figure II-2-1 Maize distribution channels in Zambia
Source: Interviews.

Following the liberalization of maize prices and distribution, the government created the Food Reserve Agency (FRA) in 1995. The FRA was given the mandate to stockpile a certain amount of food including maize in preparation for food shortage in the country and to release the stockpiled food to the market once such shortage occurs. In practice, however, the FRA also influences the prices and distribution of maize by buying and selling a certain percentage of gross domestic maize production at fixed prices. The purchasing activity is focused on small farmers in disadvantaged areas, where private merchants and companies do not operate due to the poor land transport infrastructure. The FRA purchases maize on 700 sites nationwide at a uniform price,* which is higher than the market price. Under this scheme, the FRA bought 386,000 tons (27% of gross production) and 396,000 tons (29%) of maize in 2006 and 2007, respectively.** In a sense, the Zambian government reconciles liberalization and intervention, by

* The buying price for 2007 is 38,000 kwacha (about $10) per 50kg.

**The purchase volumes were obtained in an interview with the Executive Director of the FRA on 17 October 2007. Production data are based on the statistics made available by the Ministry of Agriculture and Cooperative. Cooperatives are responsible for purchasing maize at the buying posts. Transport from the buying posts is contracted out to private companies.

basically leaving maize distribution in the hands of the private sector, while buying the crop through the FRA in disadvantaged areas. The purchasing activity by the FRA has the function of ensuring outlets for small maize farmers living in geographically handicapped areas. At the same time, however, some criticize this function on the grounds that it distorts market, affecting the business of private distributors and processors. Table II-2-6 shows the balance of maize supply and demand.

The government also regulates the export and import of maize. Export volume is determined once domestic maize production has been measured for the year (20,000 tons for 2007). Only licensed companies may export maize. A license system is also adopted for import. A 15% duty is charged on imported maize. Although the import duty is intended to protect domestic producers, some argues that it works against maize-buying farmers and urban dwellers by raising retail prices (Zulu, Jayne and Beaver, 2007). Also, the FRA may directly intervene in export or import. In recent years, the FRA has imported 150,000 tonnes of maize in 2001, 42,000 tonnes in 2002 and 49,000 tonnes in 2005. In 2006, however, it exported 230,000 tonnes of maize following a good harvest.

Table II-2-6 Forecast of maize supply-demand balance

(t, marketing year 2007/08)

Supply	Stockpile carried over	433,031
	Production	1,366,158
	Gross supply	1,799,188
Demand	Home consumption	1,132,880
	FRA stockpile	250,000
	Animal feed	65,000
	Brewing	15,000
	Seeds	18,000
	Loss	68,308
	Gross demand	1,549,188
Surplus		250,000

Source: Ministry of Agriculture and Cooperatives.

Note: A marketing year runs from May to April.

2-4 Socio-cultural Dimensions of Production and Consumption

Government officials, researchers and private businessmen state that maize is not a simple staple crop, but a political crop in Zambia. This statement underlines the overwhelming importance of maize as staple food as compared with other crops: the failure of a policy regarding maize production or distribution may result in the downfall of policymakers, and this prospect gives the government a compelling reason for intervening in the market of this crop. Indeed, rising maize meal prices have caused civil unrests in Zambian cities.

Maize production is also crucial for small farmers in rural areas to secure subsistence food and obtain cash income by selling their crops. There are remarkable differences between rural households in maize production, self-sufficiency and sales. A sample survey conducted by Zulu et al. (2007) indicates that only 20% of rural households sell maize after satisfying their own needs. At the other end of the spectrum, 35% of them purchase maize to cover the deficit of their production. By income bracket, high-income rural households are generally sellers of maize, while low-income households are buyers of maize. Based on those facts, Zulu et al. (2007, p. v) conclude that the government's policies designed to raise the producer price of maize (including purchase above market prices and import duty) benefit wealthy farmers, to the detriment of the poor.

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Chapter III: Maize in Malawi

1. Production of Maize

1-1 Overview

As noted in Chapter II, it is said that maize (*Zea mays* L.), which originates from Latin America, was discovered by Columbus in 1492 on his voyage to find Americas and brought back to Europe. Reportedly, maize spread throughout Europe in only three or four decades due to its high yield. Those varieties of maize which spread via Europe are called Caribbean flint-type (i.e. flint varieties introduced in the old times from the Caribbean), and can be distinguished fairly clearly from the American dent-type (i.e. dent varieties introduced directly from America in modern times) in morphological factors such as plant form and grain texture.

Maize is said to have been introduced in East Africa in the 16th century, which means that it reached Malawi in matter of decades. As with Zambia, staple crops in Malawi at that time were sorghum (*Sorghum bicolor* (L.) Moench) and millet (*Eleusine coracana* Gartner), both indigenous to Africa, but it is considered that demand for maize increased progressively afterwards. Ever since, the production of sorghum and millet, the traditional subsistence crops which had supported the diet of Malawians for thousands of years, has experienced a steep decline. They now account for less than 10% of total planted area. In contrast, maize, as subsistence crop, has become for Malawi what rice is for Asia, taking up over 60% of the planted area.

Most traditional maize varieties in Malawi belong with Caribbean flint-type, but many of them have been mixed with introduced varieties. Thus, most of the varieties grown at present belong with flint-dent-type, i.e. crossbreds of traditional flint varieties and dent varieties. Pure flint-type can hardly be observed. Crossings with dent varieties introduced in modern times seem to be the primary reason. Incidentally, most of the traditional varieties in Japan belong with Caribbean flint-type. No crossing has occurred with dent varieties. Japanese maize is also different from Malawian maize for its wider variation in hull colour and grain texture, and includes popcorn and waxy varieties.

After its independence from the United Kingdom in 1964, Malawi experienced a dictatorship well into the 1990s. This period was characterized by policies in favour of large farmers, which mainly produced commercial crops such as tobacco, tea and sugar. Those crops accounted for as much as 80% of total exports. As staple crop, maize was placed under distribution and price control by the government, which also regulated the distribution of chemical fertilizer and improved seeds. Since the 1980s, when liberalization policies were introduced, private seed providers have entered the market to supply hybrids (F_1).

Frequent droughts since 1990 have seriously destabilized maize production, often failing to meet the minimum requirement of 2 million tonnes to satisfy the needs of the population. The famine caused every two or three years by this shortfall is currently the most pressing problem for staple crop production in Malawi. The unit yields of hybrids are higher than those of traditional varieties, but so is the cost to be incurred. For this reason, production area registers only a temporary increase when chemical fertilizer and improved seeds are provided free of charge. The input of fertilizer to compensate for the loss of soil fertility is an essential practice in agriculture, which is lacking in Malawi. The current practice of continued cultivation of maize, a heavyweight depriver of soil fertility, without fertilizer application, is not only unsustainable but also one of the factors behind the dehydration stress that is destabilizing yields.

The traditional species are late-maturing varieties planted during the rainy season (November-April). Many of the introduced species are early- or medium-maturing varieties, which are higher in yield but lower in biomass. The growth period of the latter is quite long, whereas the temperature in Malawi is considerably high, sometimes exceeding 37℃ in the rainy season. Although mainstream maize varieties in the modern world are mostly sensitive to temperature, traditional varieties in Malawi have a different environment-responsiveness, and thus represent invaluable genetic resources in stabilizing maize production (as staple crop and fuel source) under high temperatures. Nonetheless, the awareness of such genetic resources' values is lacking among researchers and government officials.

As in Zambia, most of the maize grown in Malawi is of flint-type varieties. Flint-type varieties are preferred because: they (1) have good keeping quality and hold off fungi; (2) do not crack in pre-processing (hulling) for wet milling, giving high process yields; and (3) taste better. Like Zambians, Malawians prefer white varieties, finding some important significance in the colour. Folkloric spiritual culture may have something to do with it, just as the Japanese prefer white rice. Milled white maize is mixed with boiling water until it thickens like dough to make a traditional specialty called *nsima*. This staple dish can be prepared quickly and is highly nutritious when made from whole grain meal. Individual Malawians have their own favourite taste and colour.

Although nutritional disorder due to vitamin A deficiency is very common, people do not eat yellow varieties because they are considered as feed. Red, purple or yellow coloured traditional varieties are not used as staple food but as raw material for alcoholic beverages after germination and drying. The traditional mindset of finding values in white-coloured grains also applies to sorghum. Thus, white sorghum varieties are largely preferred over others. Small amounts of yellow and white popcorn varieties are also cultivated in the country.

1-2 Production and Yields

1) Production and unit yield

According to the crop statistics published by the Department of Crops, Ministry of Agriculture and Food Security, maize production in Malawi amounted to 3,445,000 tonnes in 2007. The domestic production has fluctuated widely from one year to the next over the recent 16 years, with the average standing somewhere between 1 million and 2.5 million tonnes (Figure III-1-1). Any production below 1.5 million tonnes indicates a famine, which occurs every two or three years. In the 1990s, maize planting area and production stood at 1.2-1.3 million hectares and 1.2-1.8 million tonnes, respectively, which translated into a yield of 1-1.5t/ha. Although planting area has increased from 1.4 to 1.6 million hectares and the yield has improved slightly to 1-1.8t/ha since 2000, it still trails far behind the world average of 4.2t/ha (Figure III-1-2). This is largely because the Malawian agriculture lacks a “soil fertility replenishment” system to compensate for the loss of fertility after cultivation. Many farmers do not apply fertilizer as they can afford neither fertilizer nor new varieties.

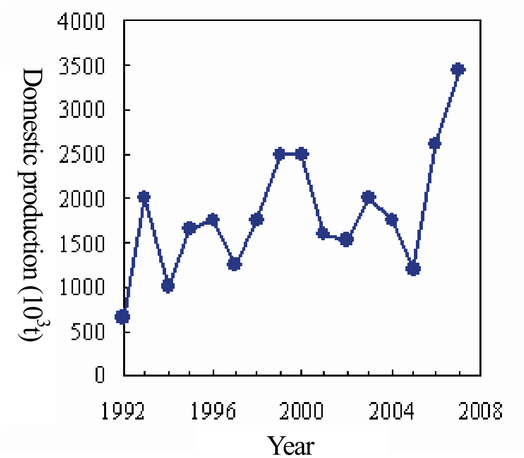

Figure III-1-1 Trend of domestic maize production

Sources: FAOSTAT; and Department of Crops, Ministry of Agriculture and Food Security, “Crop Statistics 2007.”

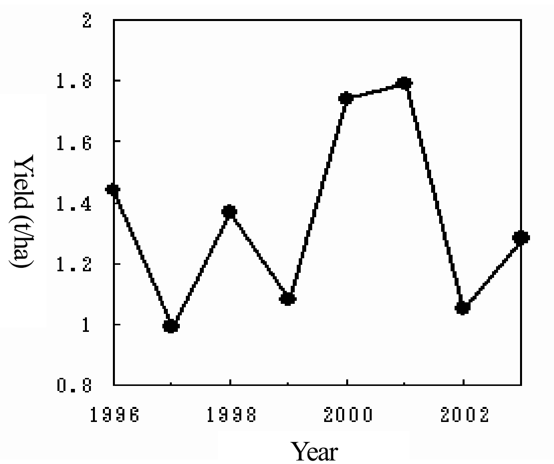

Figure III-1-2 Trend of maize yield per unit area in Malawi

Source: FAO, 2004.

2) Cultivated varieties

The maize varieties cultivated in Malawi may be classified into three types: traditional, hybrid and composite. The composite type includes varieties generated by natural crossings between traditional varieties, on the one hand, and commercially available hybrid and synthetic varieties developed by modern breeding methods, on the other. They are also known as OPVs (open pollinated varieties). OPVs are mostly provided by CIMMYT and controlled by the government. Traditional varieties are dominant in Malawi, and enjoy the lion's share in the total maize planting area (Figure III-1-3). Most of them are extremely late varieties grown in the hot rainy season.

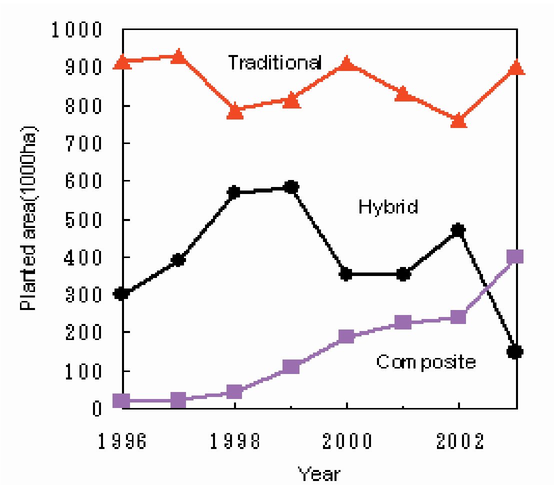

Figure III-1-3 Trend of planting area by type of variety

Source: Malawi Maize Sector Stakeholders Workshop Report, 2004.

This may be partly because the extremely late-maturing traditional varieties, containing large biomass, are important not only as staple food but also as fuel source. Another reason may be that farmers who live in areas where fertilizer is not available have opted for varieties that grow at a slower pace for a longer period of time, as maize will not grow very fast under such condition anyway.

Since strong lodging resistance is not required under the stormless climatic environment in Malawi, the selection of such extremely late-maturing varieties is considered to be reasonable. The rate maturation of those varieties despite the temperature exceeding 37ºC in low-lying areas in October and November may be explained by their photo sensitivity that reduces growth speed under long-day conditions. The growth period of some extremely late-maturing traditional varieties even extends to six or seven months (180-210 days).

Hybrids, on the other hand, have considerable seed yields but are only planted when the government introduces a support scheme, because of the high seed prices and the requirement of fertilizer. They show considerable productivity even in the dry season, provided that water and fertilizer are available. They are actually grown during the dry season in some irrigated areas.

Composites have been increasing in number in recent years, and the government has been working towards their diffusion. A significant difference exists among the three types of maize in terms of yield potential. The seed yield of hybrids per unit land area is more than twice that of traditional varieties (Figure III-1-4). They also show a relatively high productivity without fertilizer application. The character of composites is located in the middle of the spectrum. In Malawi, farmers in remote areas grow more traditional varieties while farmers living near the capital cultivate composite varieties more often (Table III-1-1). It is very common that farmers in the same village plant (1) hybrids, (2) composites and (3) traditional varieties at the same time. Seeds are renewed every year for hybrids and every two or three years for composite varieties. Seeds for traditional varieties are renewed by individual farmers. The varieties have no proper names. The grain texture of dent varieties has spread among traditional varieties and composites, making it difficult to tell the exact variety from the shape of seed. Apparently, crossings between traditional and introduced varieties have progressed over the years, as farmers do not separate varieties in planting maize.

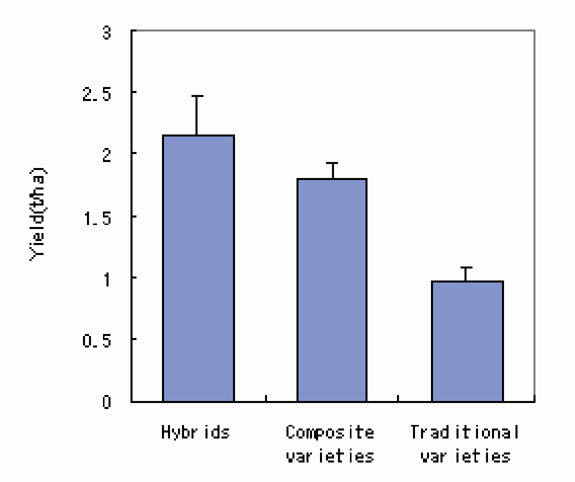

Figure III-1-4 Comparison of yields between maize varieties
Source: Data obtained in Mzuzu ADD over eight years from 1993 to 2001.

The governmental agency (ADMARC) has controlled the maize market by setting a uniform price after mixing hybrid, composite and traditional varieties bought from smallholders. However, few traditional varieties are marketed because most of them are consumed on-farm.

Table III-1-1 Maize cultivation in Malawi by type of variety

(2006)

	Outskirts of Lilongwe	Rural area (Nepeu)
Traditional varieties	15%	62%
Composites*	70%	23%
Hybrids	15%	15%

*Seeds produced by mixing various traditional and introduced species.

1-3 Cropping System, Cultivation Methods and Use

1) Cropping system

There is a clear distinction between the rainy and dry seasons in Malawi.

Maize is grown in the rainy season, which runs from November to April. It is also cultivated during the dry season where irrigation facilities are available. Vegetables are also planted on highlands in the dry season. In general, maize is planted on permanently cultivated land after burning bushes or fields towards the end of the dry season. The ash generated by the burn provides necessary soil fertility for continuous cropping. Beans such as black-eyed peas and soya are cultivated in some cases as intercrops. Since few crops, if any, are planted in the dry season, those fields are generally used for single maize cropping per year. The development of this cropping system may be explained by the transition from shifting to sedentary agriculture caused by demographic pressure. However, this transition has not been accompanied by a matching increase in the stock of farming assets, such as livestock, farm implements and fertilizer, resulting in an unsustainable cropping system with no means of maintaining and increasing the soil fertility of permanent fields.

2) Cultivation method

Rain-fed maize cultivation begins with intentional burn in October towards the end of the dry season (Photo III-1-1), followed by manual ploughing. Maize seeds are sown in November and December. The purpose of this practice is: (1) to incinerate organic matters for termite control; (2) to remove obstacles to ploughing; and (3) to utilize ash thus generated as fertilizer. However, little effect has been confirmed as regards the last item, i.e. fertilizer generation. Fertilizer application has not been generalized: chemical fertilizer has only been used when government support was available. Some farmers make compost from organic matters (Table III-1-2). Japanese *bokashi* (Semi-fermented organic fertilizer) is also known, but it is only used for vegetable garden near residences and unavailable in sufficient volumes for maize cultivation. Malawian farmers practice a unique composting technique called *chimoto*, which is designed to avoid the discontinuation of the fermenting process due to excessive aridity. It is also known as improved Chinese method (Photo III-1-2). Thus, many of the composting techniques were apparently introduced from Asia, attesting to the relative inexperience of Malawian farmers in working with permanent fields.

Photo III-1-1 Intentional burn in a Malawian maize field (Dezda, September 2007). Seen on the near side is a termite mound. The practice is primarily intended to incinerate the organic matters lest termites should feed on them.

Photo III-1-2 *Chimoto*, traditional composting method in Malawi (Dezda, September 2007). Compost materials are coated with pugged soil to retain moisture.

Table III-1-2 Composting methods in Malawian fields

Method	Description
Chimoto	Also known as improved Chinese method. Cover weed and other compost materials with pugged soil into a dome-like shape. Create a space beneath the materials using wood, for example. Bore a hole at the top of the dome to insert a stick to observe the temperature and humidity. Add water as necessary to facilitate fermentation (see Photo III-1-2).
Chinese method (*Changu*)	Make an enclosure and pile up the materials in layers. The practice originates from Taiwan and is traditionally known as "coffin" method in Japan.
Pit method	Composting in a pit.
Bokashi	A low-temperature, short-term semi-fermentation method introduced from Japan

Hoes are the only farm implements used for maize cultivation. Hilling comes after the intentional burn at the end of the dry season. The furrow is about 80-100 cm wide. The top part of the hill is trimmed off and put onto weed or ash to make a new hill. This work is mostly done by women. According to the traditional practice, 10-20 kg of seeds are sown per hectare with an inter-row and inter-stock spaces of some 90 cm each. The seeding rate is low, at 1-2 stocks/m^2, and a stock contains one or two plants. No thinning-out or weeding is practiced in most of the cases. Chemical fertilizer is not applied to traditional varieties with no top dressing. Other crops such as black-eyed peas, haricots, soya and chickpeas are often planted alongside maize after germination to serve as the source of nitrogen.

Harvesting is made by handpicking. During the dry season, harvested maize is stored in a silo made of a woven basket that measures 2-4 m in diameter and some 3 m in height (Photo III-1-3). It is during this period that maize may be damaged by maize weevils or fungi. Traditional flint varieties, which are more resistant than the hybrids of dent varieties bred by modern techniques, are preferred by Malawian farmers because of their better postharvest performance.

Photo III-1-3 Maize basket silo in Malawi

Photo III-1-4 Dried sprouted maize serves as a raw material for alcoholic beverages and soft drinks (public market in Lilongwe).

3) Use

Malawian maize is mostly used as food, although it is also used for brewing and animal consumption. As in Zambia, maize is milled and then boiled in hot water until it thickens like dough to prepare the staple dish.

This staple dish is called *nsima* in Chichewa, a Malawian language. Good-tasting *nsima* can be made in only about 20 minutes with the same simple recipe as that used in Zambia. White flint varieties are so overwhelmingly preferred in making *nsima* that the yellow varieties are almost excluded from the staple market. White varieties are preferred because they: (1) are better qualified as staple food in terms of colour and aroma; (2) taste better; and (3) have a higher milling process yield. *Nsima* is classified into two types according to the milling method used (Table III-1-3): *mgaiwa* excels in nutrition and taste but is inferior in colour, while *ufa* has a better colour and lower nutrition. *Ufa* is further divided into two subtypes according to the milling method: dry milling or wet milling. The latter technique was introduced in modern times from Europe. Coloured maize varieties are marketed after germination and drying as a raw material for soft drinks and alcoholic beverages (Photo III-1-4).

1-4 Breeding and Production Limiting Factors

1) Production limiting factors

The most significant environmental factors limiting maize production are: (1) the water stress induced by droughts; and (2) the lack of nutrients in soil. The Crop Department of the Malawian government recognizes three production limiting factors: (1) bad weather, (2) soil fertility and (3) improved varieties. Only 1.3 million tonnes of maize was supplied in 2004/2005, however, falling short of the national needs of 2 million tonnes. Against this backdrop, maize has now become a political crop on which depends the food security of the whole country. National policy measures have been taken to address those constraints. They include: (1) development and propagation of drought-resistant varieties; (2) composting of livestock manure by local PMEs or farmers; (3) development of postharvest facilities for exports using metal silos; and (4) diffusion of cultivation methods suited for improved varieties. The government introduced fertilizer and seed support schemes since 1998. A support programme for fertilizer and seed supply has been also implemented since 2004, financed by the EU.

Hybrid varieties tend to be highly resistant to droughts, and are expected to produce a high yield (6 t/ha) with appropriate fertilizer application and watering, as well as weeding and pest/disease control. However, the costs of seeds and fertilizer application are prohibitive for smallholders. The traditional cultivation method keeps the distance of 90 cm between stocks, enabling nitrogen fixation

Table III-1-3 Major uses of maize as food in Malawi

Item		Process	Suited varieties	Description
Nsima	*Mgaiwa*	Mill whole grains of maize without sifting.	White flint	Good taste; nutritious; slightly yellowish.
	Ufa (ground meal)	Mill grains after removing bran.	Whit flint	Good quality; fine and smooth texture; white but low in nutrition.
	Ufa (white flour)	Mill and then dry grains soaked in water for three days (*mphale*) after hulling.	White fling	Wet milling; smooth and white but low in nutrition. Flint varieties do not crack and are better in quality than dent varieties.
Chibuku		Ferment for several days.		Crude locally-brewed beverage with low alcohol content.
Khachaso		Distilled alcoholic beverage (ferment for seven days).		Local gin with high alcohol content.
Chindonguwa		Soft drink (ferment for several days).		Beverage for women; drunk when it is hot.
Thobwa		Soft drink (ferment sprouted dried grains of coloured varieties for a short period).	Traditional coloured varieties	Sweet non-alcoholic beer for children to drink anytime.
Chikondamoyo		Whole-grain cake (bake bread adding baking powder and sugar).		Yellow bread.
Green corn		Boil to make sweet corn, a staple dish.	Sweet varieties	Marketed in the dry season when prices are high.
Mbuluuli		Heat and pop, sometimes with groundnuts.	Popcorn varieties	Small yellow or white grains.

through inter cropping with beans. This inter cropping is impossible when the space is 75 cm or shorter. Adoption of single-cropping to raise seed production per unit land area (pure community with a plant density of 30,000 stocks/ha) would reduce the space between stocks, effectively precluding beans cultivation and thus necessitating fertilizer application to preserve soil fertility. The viability of production would then be at stake.

Other production limiting factors include pests and diseases (Table III-1-4). The major diseases are maize streak virus (a *Geminiviridae* virus) and grey leaf spot (caused by fungi such as *Cercospora zeae-maydis*), which may result in a significant yield loss. Other diseases include rust caused by *Puccinia sorghi* and southern leaf blight caused by *Bipolaris maydis*. In response, agricultural research stations and private seed providers have been working towards the development of resistant varieties.

The most harmful pests are *Chilo partellus* and other stalk borers. Asiatic witchweed (*Striga asiatica*), a parasitic plant in the *Scrophulariaceae* family, is also a major factor limiting maize production. Although termites do not eat maize in growth, they will proliferate by feeding on plant residue. It is for this reason that permanent fields are burnt intentionally, effectively taking away organic matters that may serve as fertilizer. Thus, termite may be considered as an indirect pest.

Table III-1-4 Ecological Constraints on Maize Production in Malawi

Constraint	Affected area
Drought	Low elevation area
Striga asiatica	Lowlands and middle elevation area
Southern leaf blight (*Bipolaris maydis*)	Middle elevation area
Rust (*Puccinia sorghi*)	Middle elevation area
Maize streak virus (*Meminiviridae* family)	Low elevation area
Chilo partellus and other stalk borers	Middle elevation area
Maize weevil	Lowlands and middle elevation area
Lack of nutrients in soil	Lowlands to middle elevation area

Source: Gununga, R., Chitedze Agricultural Research Station (2004).

Moreover, highly acidic soil limits production in some areas. At Mzuzu in the Mzimba district, for example, the soil is strongly acidic and plants are put under substantial aluminium stress. Even aluminium-resistant hybrids such as DK8051 produce only about 30% of their potential yields (Nhlane, W. G., 2004).

2) Breeding

Breeding activities in Malawi are conducted by national laboratories and private seed providers. There is no active breeding programme directly involving farmers. The objectives of maize breeding concern (1) resistance to aridity stress, (2) yields under poor nutritional conditions, (3) resistance to acidity, (4) resistance to pests and diseases and (5) quality, among others.

Malawi has an agricultural research station in Chitedze, on the outskirts of Lilongwe, which conduct breeding activities with the support of CIMMYT in an area of 430 ha. The gene bank attached to the research station has collected 87 varieties of maize, in addition to 43 strains of millets and sorghum. However, the collection of local varieties has been insufficient so far. Most of the collected varieties are white flint types. The breeding activities are focused on hybrids, which are more resistant to drought and produce higher yields under poor nutritional conditions.

The research station does not develop any original inbred line, using strains introduced from CIMMYT as mother plants for hybridization after testing. Although traditional local varieties are known to have strong resistance to diseases, they are not used as mother plants largely due to their late maturation. Relative maturation objectives are 75 days for extremely early-maturing varieties, 90 days for early-maturing varieties and 120-150 days for medium- and late-maturing varieties. Promising hybrids have been developed recently, including CZP4, CZP5 and CZP8. CZP4 is a double-cross variety, while CZP5 is a triple-cross hybrid.

OPVs (open pollinated varieties) have also been introduced from CIMMYT after being tested for cultivation adaptability testing. Commonly used OPVs include ZDM421, ZDM521, ZDM621 and ZM623. Similar to the selected varieties and selected strains in Japan (Inoue, 1991), OPVs are developed by mixing high-performing individuals or strains to produce seeds. Apparently, OPVs are created from selected traditional and introduced varieties in Africa and other regions.

Other quality composites (OPVs) such as *masika* and *sundwe* have been extended through a Chinese maize project for yield improvement.

SEED-CO (SC), the largest private seed provider in the country located in Lilongwe, was established in 1941 and is currently based in Zimbabwe. The hybrids marketed by the company account for 56% of the agricultural seeds supplied to the domestic market. Maize is its primary source of profit. The company provides a wide range of maize hybrid seeds in terms of maturation (Table III-1-5), as well as medium-maturing OPVs.

SC uses inbred lines supplied by international organizations including CIMMYT as well as its proprietary lines as parent strains of hybrids. Hybrids whose parents are strains developed by SC or international organizations are tested for adaptability in its productivity testing farms located all over the country before marketing. Triple-cross or single-cross method is used for seed production. Triple-cross varieties take disparate shapes when cultivated on farm, showing a difference of some 50 cm in ear height. At present, SC627, a middle-maturing, high-yielding variety, is relatively well accepted for cultivation in the rainy season.

Table III-1-5 Major varieties marketed by SEED-CO in Malawi

Variety	RM: relative maturation	Yield (t/ha)	Main features	Seed production method	Remarks
SC403	90-110 (early)	3-6	MSV, drought-resistance	Semi-flint	For cultivation in dry season with irrigation
SC407	90-100 (early)	3-7	GLS, MSV	(F×D)×F	For cultivation on highlands
SC513	115 (early to middle)	6-10	GLS, drought-resistance	(D×D)×F	
SC627	125-135 (middle)	7-10	GLS, MSV	(D×F)×F	High-yielding variety
SC709	130-150 (extremely late)	11	GLS	D×D	
SC715	130-150 (extremely late)	11	GLS, MSV	Single-cross using synthetic varieties	
SC717	130-150 (extremely late)	13	GLS	Triple-cross, semi-flint	Long-eared

Note: F = flint varieties, D = dent varieties, MSV = resistance to maize streak virus (*Geminiviridae* virus), GLS = resistance to grey leaf spot (caused by *Cercospora zeae-maydis* and other fungi).

Table III-1-6 Major DEKALB varieties marketed in Malawi

Variety	RM: relative maturation	Yield (t/ha)	Main features
DK8021	110-115 (early)	6-8	Strong GLS, high yield
DK8031	Same as above		
DK8033	115-130 (middle)	8-9	Two-eared, adaptable to wide areas, high yield
DK8051	130-135 (middle)	Slightly higher yield than MH18	Semi-flint variety, high milling suitability
DK8071	140-145 (extremely late)	9-11	Strong GLS, large-grain flint variety
DKC80-73	Same as above		

Note: GLS = resistance to grey leaf spot (caused by *Cercospora zeae-maydis* and other fungi).

Also marketed in Malawi are DK varieties imported from Monsanto South Africa. "DK" is the identification code given to hybrids developed by DEKALB (US). They include white semi-flint and flint varieties with excellent qualities (Table III-1-6). Their market has been expanding in recent years.

1-5 Future Outlooks

Government policies have been guided by the national strategy of attaining self-sufficiency by single-cropping of maize. This subsection considers the prospect of this production strategy from the viewpoints of: (1) sustainability and stability of maize production; (2) satisfaction of nutritional needs of the population; and (3) commercial values of products.

Maize production requires a substantial amount of water and is susceptible to drought. Varieties developed by modern breeding techniques are highly sensitive to the temperature. Their growth tends therefore to be unstable because it will be restrained in a warmer climate. Lack of balanced fertilizer application destabilizes the composition of nutrients and reduces the productivity of soil. For example, fertilizer application heavily dependent on urea will deprive specific minerals of the soil. Upland single-cropping of maize cannot achieve sustainable or stable agricultural production. This problem will not be solved simply by introducing high-yielding hybrids.

Nyctalopia caused by vitamin A deficiency and anemia due to iron deficiency is widely observed among the Malawian population (Table III-1-7). The suffering is directly related to the diet biased in favour of white maize. Eating yellow maize varieties would be effective in addressing this problem because they contain carotenoid, a precursor to vitamin A. Planting traditional varieties of sorghum and millet, which are highly resistant to water stress and sufficient contents of human nutrients is an option for alleviating environmental and health impacts.

Finally, white sorghum has a considerable potential as a commercial crop. It does not contain any pigment including carotenoid, and hence is valuable as animal feed to prevent colour development in fat. Millets include finger, common and foxtail millets is also valuable in terms of nutrition and function because it is rich in iron, zinc and vitamins. Nonetheless, finger millet is rarely traded in the world market, as attested by its high unit price in Japan. Thus, indigenous coarse cereals in Malawi have strong resistance to drought and valuable functions as food. Reintroducing those crops would help stabilize staple cereal production and increase income.

Table III-1-7 Vitamin and mineral deficiencies in Malawi*

Category	Vitamin A	Iron/anemia
Children under five	60%	80%
Children under three	-	60%
Women	57%	27%
Men and school children	38%	17%

* 2001 National Micronutrient Survey (MOHP, 2003).

Future prospects of Malawian maize should also be considered in terms of its value as a genetic resource. Traditional varieties in Malawi have strong photo sensitivity, with growth periods of up to seven months even in the hot rainy season. Some of them are said to inherit disease-resistant genes. In this light, they may be useful as breeding materials for stabilizing yields in the warming environment. Caribbean flint varieties are also valuable as mother plants for hybridization, as they are expected to be suitable for crossing with American dent varieties and remotely related varieties introduced from Americas. These genetic resources should be preserved for future development of high-yielding varieties. In the final analysis, it may be concluded that traditional Malawian maize varieties constitute promising genetic resources, which will contribute to the development of excellent inbred lines.

2. Marketing and Processing of Maize

2-1 Comparison with Other Staple Crops

Malawi needs to produce 2.2 million tonnes of maize per year if it is to attain self-sufficiency in staple food. This requirement was met in cropping years 2005/2006* and 2006/2007 thanks to good rainfalls. From a longer-term perspective, however, a high volatility is be observed in domestic production due to bad weather and other constraints as described above (Figure III-1-1). Recent trend indicates that maize production plummeted in 2000/2001, 2001/2002and 2004/2005 cropping seasons, resulting in serious food shortages.

Other staple crops produced in Malawi include rice, sorghum, millet, cassava, sweet potato and Irish potato. Table III-2-1 presents the production and growing area for each of the crops in recent years. The data point to an overwhelming share of maize in planted area, as the growing area of rice, sorghum, millet, cassava, sweet potato and Irish potato combined does not even reach 1/3 of that of maize. The fact attests to the predominance of maize among staple crops.

Table III-2-1 Production and planting area of staple crops in Malawi (2000-2007)

Production (t)

	2000	2001	2002	2003	2004	2005	2006	2007
Maize	2,501,311	1,713,064	1,556,975	1,983,440	1,733,125	1,225,234	2,471,125	3,444,655
Rice	71,633	93,150	92,097	88,184	49,722	41,270	82,757	113,166
Sorghum	36,799	36,606	39,155	45,438	40,905	18,175	51,130	63,898
Millet	19,508	20,414	20,900	24,615	17,349	15,970	26,597	32,251
Cassava	2,794,617	3,352,401	1,540,183	1,735,065	2,559,319	2,197,640	2,544,535	3,285,127
Sweet potato	1,918,489	2,586,878	1,061,411	1,535,137	1,784,749	1,081,463	1,494,112	2,307,354
Irish potato	160,264	323,306	324,904	399,376	420,590	404,420	521,843	594,003

Source: Ministry of Agriculture and Food Security.

* A cropping year runs from October to September.

Planting area (ha)

	2000	2001	2002	2003	2004	2005	2006	2007
Maize	1,507,088	1,506,528	1,488,449	1,568,975	1,537,651	1,513,929	1,600,506	1,686,442
Rice	43,542	50,146	56,029	54,407	42,568	49,154	53,631	57,371
Sorghum	55,030	54,098	54,404	59,627	63,459	68,419	68,931	74,131
Millet	34,257	34,169	34,234	38,758	37,368	41,192	40,081	44,878
Cassava	183,486	202,338	102,929	112,071	156,645	153,687	151,623	174,932
Sweet potato	167,118	192,457	87,675	115,679	149,478	128,982	118,577	150,592
Irish potato	14,312	22,794	25,789	30,398	33,053	35,439	39,109	40,202

Source: Ministry of Agriculture and Food Security.

Rice is produced mainly in northern Malawi to be consumed in urban areas and along the coast of Lake Malawi, or exported via northern border to Tanzania. Cassava is mostly produced and consumed along the coast of Lake Malawi. By virtue of its stronger drought-resistance, cassava draws attention of the government and aid agencies as alternative staple crop in times of bad maize harvest. As described in the previous chapter on Zambia, cassava takes longer time before harvest and hence competes with maize in land use. The issue is all the more serious in Malawian villages because of the already substantial population pressure on land. Sorghum and millet are just as drought-resistant as cassava, but their production is far below that of maize. Often cropped along with maize, they are also used as alternative crops when maize cropping fails due to insufficient rainfall.

2-2 Processing Industry

Maize meal used by urban consumers for preparing *nsima* is processed and marketed by milling factories. Commercial maize meal is classified into three types - super cream of maize, cream of maize and whole maize meal – in accordance with its quality and milling method (i.e. hulled or unhulled). The first two types of maize meal are white-coloured, being hulled before milling. The former is better than the latter in quality. The third type is off-white whole grain meal. Maize thus processed by milling factories is estimated to account for some 10% of total domestic maize production (RATES Centre, 2003). Many consumers buy maize grains and have them processed into meal at small milling stations.

Milling in rural areas proceeds as follows.First, leave the ripened maize in the field well into the dry season to dehydrate the grains sufficiently before harvesting (roughly from April to July). Store maize thus harvested in an outdoor silo without removing the cob or hull (Photo III-2-1). Then, shed grains in the necessary amount and prepare nsima after milling. Any maize harvested during the rainy season, however, is often stored indoors in gunnysacks after shedding until the end of the dry season, instead of drying outdoors. Shed grains are milled directly or after being hulled with mortar and pestle (Photo III-2-2). Hulling the grains reduces the volume of output but produces pure white meal to make good-looking and good-tasting nsima. Milling the whole grains produces off-white meal, which is greater in volume and nutritional value than the pure white meal. The hull removed in the milling process is used as a raw material for animal feed and beverages (see the previous chapter on Zambia).

Photo III-2-1 Outdoor storage of maize.

Photo III-2-2 Maize grains are hulled by crushing.

Photo III-2-3 A woman brewing the local alcoholic beverage in a drum.

As in Zambia, beverages made from maize are classified into two types: non-alcoholic and alcoholic. In particular, a cheap alcoholic beverage made primarily from maize – which has the same brand name as in Zambia (*Chibuku*)

– is produced in factories in large volumes mainly for consumption by the general public. In addition, *Chibuku*-like alcoholic beverages* are widely produced from maize, millet or sorghum. Furthermore, a distilled beverage with a higher alcoholic proof (*kachaso*) is often produced and sold in rural areas. In most cases, the brewing and selling activities are undertaken by rural women, for whom home-made beverages represent a crucial income source (Photo III-2-3).

2-3 Marketing of Products and Inputs

From the independence to the mid-1990s, crops produced by smallholders including maize were all bought by Agricultural Development and Marketing Corporation (ADMARC) at fixed prices. In addition to purchasing crops, ADMARC also served as exclusive supplier of chemical fertilizer for smallholders at subsidized prices.

General economic deregulation measures taken since the 1980s, when the structural adjustment programme was introduced, have been accompanied by the liberalization of agricultural product distribution. Some of those reforms introduced in the framework of structural adjustment concerned maize, the predominant staple crop. In the first place, maize distribution was liberalized progressively so that private operators may directly purchase harvested maize. Private buyers were allowed in 1987 to engage in the distribution of agricultural products under a license system. In 1988, 15% (125) of the ADMARC branches that had been buying maize from farmers throughout the country were closed, followed by further progressive cutbacks. The license system for the trading of agricultural products was abolished in 1996, allowing private merchants further latitude to deal in them. The prices of maize traded between private merchants and companies were also liberalized in 2000.

Secondly, the markets of inputs required for maize production have been transformed. Reform measures related to inputs include the abolition of subsidy for improved seeds (1994), withdrawal of subsidy programmes for chemical fertilizer (1995), downscaling of the function of ADMARC, which had controlled the distribution of improved seeds and chemical fertilizer, and

* These alcoholic beverages are known as *masese*, for example.

participation of private operators in input markets. Those reforms led to steep increases in chemical fertilizer and seed prices.

The third reform concerns the credit market for smallholders. Until the early 1990s, farmers were able to finance the purchase of seeds and chemical fertilizer by securing low-interest loans from the SACA (Smallholder Agricultural Credit Administration), a financing institution for smallholders run by the government. Under this distribution and financing systems, farmers at that time obtained seeds and chemical fertilizer from ADMARC on credit, and paid their prices plus interest when selling harvested maize to the corporation. However, the SACA went bankrupt in 1994 due to low credit repayment rate. MRFC (Malawi Rural Financial Company), which replaced it as agricultural credit institution, provided loans at market interest rates. Following this reform, many smallholders lost access to the credit market, for informal agricultural credit is hardly available in Malawi. As a result, farmers had to face a double challenge of rising seed and fertilizer prices, on the one hand, and the loss of access to the agricultural credit market, on the other.

As chemical fertilizer and improved seeds became elusive for smallholders, the Malawian government launched in the late 1990s a Starter Pack Programme to distribute large amounts of free inputs to smallholders. The pack distributed by the programme from 1998 to 2004 contained improved maize seeds, chemical fertilizer and bean seeds necessary for cultivating an area of about 0.1 ha. The number of packs distributed in the first two years of the programme roughly amounted to 2.8 million, which corresponds to the total number of smallholder households in the country. This number was subsequently reduced to 1.5 million in 2000 and 0.9 million in 2001, with the coverage limited to poor households. As food shortage in Malawi became serious in early 2002, however, the distribution was scaled up again to 2.7 million packs in 2002, followed by further distribution of 1.7 million and 2.0 million sacks in 2003 and 2004, respectively. It is not certain how much the implementation of the Starter Pack Programme has contributed to the national food security. Even in the programme implementation period, however, maize production fluctuated widely due to bad weather, thus causing a serious food shortage every few years. The government wound up this free input distribution programme in 2005, and replaced it with a Fertilizer

Subsidy Programme to distribute vouchers to poor farmers so that they may purchase chemical fertilizer at subsidized prices. Using those vouchers, smallholders may purchase chemical fertilizer and improved seeds at 30-50% of the market prices.* Within the framework of this programme, the government provided 137,000 tonnes of subsidized fertilizer through the SFFRFM (Smallholder Farmers Fertilizer Revolving Fund) and ADMARC (Chinsinga, 2007). 37% of the Malawian households benefited from this voucher programme (National Statistical Office 2007, p.67). The programme continued in 2006, selling 176,000 tonnes of fertilizer to smallholders at a quarter of the market prices (EIU Country Report July 2007). In 2007, further 170,000 tonnes of fertilizer was supplied at one fifth of the market prices (FEWS NET, November 2007). However, some question if the vouchers have really been distributed to poor smallholders.

Maize distribution channels are as shown in Figure III-2-1.

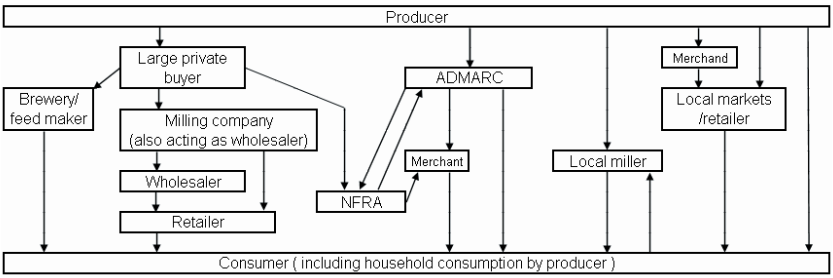

Figure III-2-1 Maize distribution channels in Malawi.

Note: ADMARC stands for Agricultural Development and Marketing Cooperation.

NFRA stands for the National Food Reserve Agency.

Source: RATES Centre (2003), etc.

* A voucher may be used for purchasing a bag of urea and a bag of NPK (23:31:0+4S) (950 kwacha each; a bag contains 50 kg of fertilizer). A tobacco producer may also purchase two bags of D-compound and a bag of CAN (1,400 kwacha per bag).

At present, ADMARC and private merchants/companies concurrently buy maize from smallholders for sale. The purchase price by ADMARC for marketing year 2007 was initially fixed at 17 kwacha (roughly $0.12) per kilogramme but raised to 20 kwacha in September. The buying prices by private operators (as of July 2007) ranged from 10 to 25 kwacha according to geographical location (FEWSNET August 2007, November 2007).

In addition to the distribution activities by private operators and ADMARC, the National Food Reserve Agency (NFRA) was established in 1999 to stockpile a certain amount of maize in preparation for any food shortage in the country. The NFRA buys maize from private operators or ADMARC for stockpiling and exports any excess amount when sufficient supply is available in the domestic market. When maize is in short supply, on the other hand, the NFRA ensures the required level of stockpile by importing maize, and supplies some of those imports to the domestic market as necessary.

In order to ensure Malawi's food security, the government controls maize export in accordance with the volume of production and the level of the stockpile. For example, the government banned maize export in 2005, following a steep decline in production due to bad weather, only to lift the ban progressively since February 2007 in light of good harvests for two consecutive years. Indeed, maize has been exported to Zimbabwe and Swaziland. However, it is only those companies licensed by the government that may export maize. In contrast, anyone may import maize without restriction and duty-free (except that import tariffs of 10-30% are placed on maize meal).

2-4 Socio-cultural dimensions of production and consumption

Maize is a staple crop in Malawi, and *nsima*, made from maize meal, is an essential dish for the population's diet in both urban and rural areas. It is reported that Malawi tops the world in per-capita consumption of maize (Smale 1995, p.820). As attested by the typically Malawian expression "Maize is our life" (Peters and Herrera 1994, p.314), the importance of maize is overwhelming in the diet of the population.

The significance of maize in Malawi is also clearly shown by the fact that most of the small subsistence farmers produce maize. After conducting a survey in six Malawian villages in 2004 and 2005, Takane (2007) reported that the 186 households covered by the survey planted maize without exception. A large-scale sample survey conducted by the Malawian government (covering 11,280 households in 2004-2005) also found that 97% of the subsistence farming households planted maize. No difference was observed among the households according to their attributes (location, consumption level, gender of the householder, etc.). Those data reveal that Malawi is a strongly maize-oriented society, in terms of both consumption and production.

TableIII-2-2 Percentage of maize producers in total farming households (2005)

		% of maize producers	% of traditional variety growers	% of composite growers	% of hybrid growers
Total		97.0	54.5	5.3	54.5
Headed by	Man	97.0	51.6	5.6	56.5
	Woman	96.8	63.6	4.1	47.9
Consumption level (see Note)	Level 1	95.2	55.4	6.6	47.4
	2	96.7	57.4	4.9	52.1
	3	98.1	54.3	5.5	56.2
	4	97.3	55.5	5.8	55.6
	5	96.9	45.5	4.8	60.3
Region	Northern	93.6	36.4	3.6	63.4
	Central	97.1	54.9	5.4	51.6
	Southern	97.9	59.9	5.7	54.0

Note: Classification of farming households on a scale of 1 to 5 according to the level of annual consumption per capita.
Level 1 represents the poorest 20%, while Level 5 represents the richest 20%.
Source: Government of Malawi (2005), p.96.

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Conclusion

The goal of the ongoing aid program is the improvement of livelihood of people in Zambia and Malawi. Furthermore, it is hoped for that these countries shall be developed to become equal partners’ vis-à-vis industrialized economies, where no more aids are necessary. The staple diet in these countries is maize. While the principal objective of the entire report is to contribute to the improvement of productivity of maize, reporter devotes this section to describe the aspect of the commodity looked at from the viewpoint of more effective utilization of the product. There is no doubt that the cereal crops including maize are important commodities as staple food. The relative importance of cereals among staple foodstuff is higher particularly in areas that are menaced by starvation. However, once the supply reaches the level sufficient to meet the demand, the producers have to face the risks inherent in commodity markets. It is true that the raise of productivity contributes to a certain extent to the solution of starvation problem, and that there are still a large number of regions in the world where this issue has a top priority. But once the production has reached a certain level sufficiently high to solve starvation problem, it would be difficult to raise the economic status of local people unless the products are utilized effectively to enhance their income, since, as historically demonstrated, the abundant harvest inevitably leads to falling prices.

Before taking up the subject, reporter wishes to briefly comment on the recent rise of prices of cereals on world markets. From 1995 to 1996, the grain market rose sharply as a result of the publicized food crisis. After the brief period of rise, the grain prices resumed a phase of stagnation again that lasted until 2006. In the fall of 2006, in spite of a bumper harvest in the USA, world top grain producer, grain prices rose again due to the drought in Australia and the demand of burgeoning market of biomass energy.

What should be noted of the trend is that the high price level has been maintained since the fall of 2006 essentially by the factors on the demand side. Traditionally, the grain prices have been determined principally by the supply side factors. Apart from a certain exception, grain crops can be harvested only once a year in each locality and moreover the harvest depends essentially on

Figure: The Chicago maize quotation

climatic factors. Because of the variation in climatic factors among different growing regions, the fluctuation of production, therefore that of prices is adjusted by the grain trade.

Multinational "grain majors" are in the position to promote internal as well as external grain trade. As such, it can be said that they have been playing an important role in regulating the equilibrium of supply and demand on a worldwide scale by having established global distribution networks through optimized allocation of resources. Most of cereals except for rice are not consumed directly by humans. They have to undergo industrial processes before taking the form of food ready for human consumption. The most familiar case is that of wheat that is firstly milled to make flour before being prepared as bread or noodles. Likewise marketed maize grains are transformed into formula feed or starch for ultimate consumption. Grain crops grown under natural conditions are influenced by environmental factors such as weather and soil properties not only in the volume of their production but also in their quality. In order to commercialize them in international markets, they have to have qualities suitable for industrial processes. For that purpose, it is needed to standardize the parameters of product quality. To put it in more concrete terms, it is necessary to quantify such properties as moisture content, impurities, damaged kernels, which are outside the scope of the present subject and, therefore, reporter does not elaborate on but presents simply as proposition for further examination.

Reporter wishes also to point out another issue of the steep rise of ocean freight. With a view to achieving food security in terms of grain supply in a particular country, a hypothetical solution might envisage a situation that by acquiring a capacity to earn foreign exchange, the country would be able to purchase required commodities from abroad, instead of increasing domestic production. However, it should be noted that, due to the inflated ocean freight in recent years, the grain supply dependent on the mode of a long haul from a production country to a consuming one will entail substantially elevated total costs of the commodity, and that, therefore, it would be a more practical solution to adhere to the principle that a country should produce on its own soil what it consumes.

In Zambia and Malawi, people consume maize of varieties with white and hard kernels. However, these characteristics are not suited for the use as an ingredient for preparing formula feed in Japan. Compared to yellow-kernelled maize, white-kernelled maize has characters of a lower protein content and hard grain consistency which cause fragmentation when it is processed by grinding or forming flakes. On the other hand, white corn is characteristically preferred as raw material of corn starch especially of that for adhesive. If these countries are capable of supplying a sufficient quantity of exportable surplus grain on a constant basis, they might have a certain market not only in Japan but also in Europe. The qualifying term, “on a constant basis”, may be considered to state a simple requirement, but in reality, it signifies a very strict condition, for the position of a processing factory is not that which allows it to accept the surplus only when such surplus is created, but that which necessitates it to have a constant influx of grain to keep on running its production lines, irrespective of whether growers have surplus or not. As long as the producers maintain the posture that they export the products only when they have the surplus, they remain forever to be vulnerable to the abuse of buying power.

Regarding the subject grain of the present report, maize, the agriculture dependent on a single commodity is an extremely risky undertaking in the sub-Saharan Africa, including the two countries of our study, where unstable climates, infertile soils and undeveloped production infrastructure constitute the difficult production environment.

Since maize is a crop plant susceptible to drought, it would be needed to reexamine the role of other small grain crops which are resistant to drought such as sorghum and pearl millet. Regarding sorghum, in particular, it used to be characteristically cultivated in the Corn Belt of the USA for the very reason that it was resistant to drought, whenever the planting of major crops, maize and soybean, was delayed and had to be abandoned due to unfavorable climatic conditions. Incidentally, sorghum used to be given a secondary place vis-à-vis maize with a lower market value and considered only as a bulking ingredient in feedstuff. However, the sorghum production has decreased as a result of the augmentation of the area planted to maize and soybean owing to the improvement of varieties and cultural techniques of these crops. Consequently, the price of sorghum that used to be relatively lower is presently higher than that of maize. Moreover, since the harvest of sorghum is more reliable than maize when maize has suffered from drought, it can function as the Savior whenever the price of maize rises due to drought.

Generally speaking, in major maize growing areas, maize is planted as a component in a rotational cropping system. One of the predominant components in the system is soybean. In addition to the fact that maize and soybean share preferences for the same climatic conditions, in agronomic terms, they hold a complementary function to each other. While soybean is not suited to continuous cropping, it can assimilate and add to the cropping system the nitrogen, fertilizer element which maize needs in a great quantity. However, soybean has a character that it is more oriented for selling than for consumption as food to meet the need of self sufficiency. Moreover, it is normally not taken directly as food. Therefore, reporter would like to propose a more flexible approach in formulating the cropping systems to be practiced in Zambia and Malawi, by incorporating other leguminous crop species such as cowpea, common beans, etc., that are suited to the taste of people there.

The agricultural system to be realized ultimately would be the one in which a practicable cropping system will have been established by choosing maize as the core commodity and incorporating sorghum and leguminous crops as complementary components, in order to achieve the self-sufficiency of staple food as well as to produce surplus for export to provide cash income. For that end, it is needed not only to introduce techniques to raise the crop yield per unit area but also to make efforts to enlighten and motivate the farming community for higher production. The approach will also engender an effect to widen the scope of choices of food for local inhabitants.

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