Assessment of the Current Situation and Future Outlooks for the Pigeonpea Sub-sector in Malawi

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Abstract

Malawi is one of the major pigeonpea producing countries in Africa. This paper reviews the key opportunities and constraints in the pigeonpea sub-sector in this country in terms of the current situation in production, yield and area cultivated, seed delivery systems, marketing systems for produce, and examines the future outlooks by making projections for harvested area, production and total demand to the year 2020. Historical trends show a rise in harvested area, yield and production. Furthermore, the outlook analysis based on production and exports simulations shows that area, production as well as domestic demand will continue to rise.

Nonetheless, although future outlooks seem promising, there are a number of constraints that negatively impact on the development of the pigeonpea sub-sector. The findings reveal existing structural weaknesses in seed and technology delivery and grain marketing systems, which have an affect on the diffusion and adoption of improved technologies and consequently the on-farm productivity and profitability of pigeonpea.

Furthermore, while global demand for pigeonpea continues to rise, there is an increasing pressure on African farmers to benefit from these markets due to intense competition for export markets (mainly India) from Myanmar and other emerging producers, as well as the surging demand for other substitutes (e.g. yellow pea produced mainly in Canada and France). Unless productivity growth and market development help offset these threats, it can severely affect the overall competitiveness for pigeonpea farmers in Malawi and other similar regions in Africa. The findings suggest the need for faster productivity enhancement, strengthening seed delivery systems to reach farmers who continue to rely on low-yielding and disease-susceptible local varieties and development of existing value chains and alternative pigeonpea export markets.

1 Introduction

Pigeonpea (*Cajanus cajan)* is an important multi-use shrub legume of the tropics and subtropics. The crop originated from India and moved to Africa about 4,000 years ago. Unlike other grain legumes, pigeonpea production is concentrated in developing countries, particularly in a few South and Southeast Asia and Eastern and Southern African countries. It is the preferred pulse crop in dryland areas where it is intercropped or grown in mixed cropping systems with cereals or other short duration annuals (Joshi et al. 2001).

Pigeonpea has a wide range of products, including the dried seed, pods and immature seeds used as green vegetables, leaves and stems used for fodder and the dry stems as fuel. It also improves soil fertility through nitrogen fixation as well as from the leaf fall and recycling of the nutrients (Snapp et al., 2002; Mapfumes, 1993). It is an important pulse crop that performs well in poor soils and regions where moisture availability is unreliable or inadequate (Reddy et al., 1993 cited in Kimani, 2001). The crop can withstand low moisture condition and performs well in areas with less than 1000 mm of annual rainfall, depending on the distribution pattern. Pigeonpea can be incorporated with crops such as maize, sorghum or groundnuts without significantly reducing the yield of the main crop. Intercropping with maize and groundnuts is very common in Malawi. Its grain is of high nutritional value with high protein content that ranges from 21% to over 25%, making it very valuable for improving food security and nutrition for many poor families who can not afford dairy and meat-based diets.

The crop accounts for 5% and 5.3% of the total world's pulse production and total world pulse area, respectively. FAO statistics indicate that in 2007, the crop was grown on an area covering 4.6 million hectares[1] globally. About 90% of its production is from South Asia and Southeast Asia. India's pigeonpea production accounted for 73% of the global production in the year 2007. In Southeast Asia, Myanmar has emerged as a major

[1] The FAO database for pigeonpea is incomplete for some countries (e.g. Mozambique not reported).

producer contributing to about 15% of the global pigeonpea production in 2007. In Africa, Malawi, Kenya, Tanzania and Uganda are the major pigeonpea producing countries.

This paper examines the current situation and future outlooks for pigeonpea in Malawi in terms of the analysis of opportunities and constraints of production, productivity growth, harvested area, marketing and trade. The paper is based on a review of various studies conducted earlier as well as the analysis of secondary data. The future outlooks for pigeonpea are examined and projections made in terms of area cultivated, production, total domestic demand and net-trade to the year 2020. The paper provides plausible information that can be used by researchers and development experts to map out the key features, constraints, and potential solutions to address the problems that currently impede the development of the pigeonpea sub-sector in Malawi.

The rest of the paper is structured as follows: a brief outline of the methods used is presented in section 2, followed by the global situation of pigeonpea in terms of production and trade in section 3. The profile of the pigeonpea sub-sector including available technologies and seed systems for technology diffusion is discussed in section 4. In sections 5 and 6, we present pigeonpea marketing systems and future outlooks, respectively. The last section concludes highlighting the key findings and implications for policy.

2 Methods

This study is based on an analysis of existing literature - including published and unpublished materials - and secondary data obtained from national crop estimates statistics and FAOSTAT. The secondary data comprised of aggregate data on global and national production, export and import volumes of pigeonpea, global and national pigeonpea price trends over the years, and data related to access to seed for pigeonpea. The literature reviews are enhanced by field observations and consultations with several stakeholders.

A number of statistical tools were employed to analyze, summarize and present the data. Descriptive statistical methods were used to analyze the historical trends over the years and to estimate the growth rates over time. The projection of future outlooks for pigeonpea was done using two approaches. First, a regression model was used to estimate the precedent growth rate to project future pigeonpea outlooks. Under the regression model approach two scenarios were proposed and tested to project future production outlooks. The first scenario is based on the assumption that farmers will continue producing pigeonpea using existing/current farmer's technologies and methods of production. The second scenario is based on the assumption of technological change as a result of the adoption of improved varieties. Under this scenario, it is assumed that farmers will adopt improved pigeonpea varieties such as the high yielding long duration ICEAP 00040 and the ICP9145. The base year used for this analysis is 2008 and projections are made up to the year 2020.

The second approach used is a quantitative modeling methodology that projects plausible futures for pigeonpea area, production, demand and net-trade as part of a global partial equilibrium trade model. The global food projection modeling framework of IMPACT (the International Model for Policy Analysis of Agricultural Commodities and Trade) recently calibrated and adapted for policy analysis of dryland crops by IFPRI and ICRISAT is applied to examine the future situation for pigeonpea in Malawi. It uses the new and spatially disaggregated version of the model which allows supply, demand, and prices to be determined within each country and regional sub-models and linked at the global level through trade. Incorporating dryland crops such as pigeonpea into the IMPACT modeling framework however required extensive crop-specific data on area, production, supply, demand, trade and several associated parameters. For any specification of these underlying parameters, IMPACT generates projections for crop area, production, demand for food, feed and other uses, domestic and international prices and trade (import, export and net-trade). For details on the use of IMPACT model and projections for a wider range of crops, refer to Shiferaw *et al*. (2009).

3 Global Pigeonpea Production and Trade

3.1 Pigeonpea production

According to the FAO statistics, global pigeonpea cultivation increased at an annual rate of 1.3% from about 2.7 million hectares in 1961 to about 4.6 million hectares in 2007. India contributed to 63% of the area increase during this period (Table 1). In Africa, Kenya and Tanzania contributed significantly to world pigeonpea area expansion. Global pigeonpea production grew at an annual rate of 2.5% from about 2.2 million tons in 1961 to about 3.4 million tons in 2007 representing an increase of about 54%. The observed area and production annual growth rates were, however, characterized by high year to year variations as depicted in Fig. 1.

During the same period (1961-2007) pigeonpea yield grew at an annual rate of 1.1%. However, as depicted in Fig.2, the average global yield in 2007 remained lower (<1 t/ha) than the yield reported from on-farm trials of up to 4.6 t/ha (Kimani, 2001). The average yield was relatively higher in Latin America and the Caribbean, but pigeonpea remained small in this region. The lowest yields were registered in Africa. Low use of improved varieties and frequent occurrence of drought, pests (e.g. pod borers) and diseases (e.g. *Fusarium* wilt) are among the major factors affecting pigeonpea productivity.

In the 2007, India remained the largest grower and producer of pigeonpea (accounting for three quarters of the world's pigeonpea production), followed by Myanmar, whose production accounted for about 15% of the global production. Malawi's production accounted for 2.6% of the global total production, while Kenya, Uganda and Tanzania contributed up to 2.5%, 2% and 1.5%, of the world's pigeonpea production, respectively (FAOSTAT, 2008).

3.2 Pigeonpea in international markets

The international market for pigeonpea is very small compared to other agricultural commodities and is mainly limited to trade between the developing countries. Out of the average annual pigeonpea production of 2.4 million tons during the period 1961-2005,

only 0.6% (0.14 million tons) was traded globally. Average export and import shares for key countries for the period 1961-2005 are presented in Table 2. The major pigeonpea exporters are Malawi, Myanmar, Dominica Republic, and Nepal. Malawi's pigeonpea export share of the total world's export rose from 70% in the period 1961-1989 to 78% in the period 1990-2005. The growth in Malawi's export market share in the period 1991-2005 was less than 1% per year, a rate of growth that was slower than the neighboring countries. Nonetheless, the rate of growth in export volumes remained higher than 10% per year. Jones et al. (2000) attribute the slower growth in Malawi's pigeonpea export share in part to a poor grain quality with high pest damage.

The import data shows that during the period 1961-1989, India and Venezuela were the major importers. India's pigeonpea imports during this period accounted for about half of the world's total imports, while Venezuela's imports accounted for 36% of the world's total export. The other main pigeonpea importing countries for the period 1961-1989 were Nepal and Trindad. The two countries accounted for 8% and 5% of the world pigeonpea imports, respectively. India (87%)[2] and Mauritius (7%) emerged as major importers in the period 1990-2005.

3.3 Pigeonpea producer price trends

The pigeonpea producer price trends for selected countries are presented in Fig.3. The prices for selected countries with more reliable data (Kenya, Malawi, and India) show increasing trends. There are a number of factors that might explain this phenomenon. First, the price rise reflects the strong and growing demand for pigeonpea. Second, the surge in the pigeonpea nominal prices is also consistent with the general rise in nominal agricultural commodity prices in the same period resulting, in part, from the changes in the US dollar, a currency through which pigeonpea and other agricultural commodities are traded. Consistent with the growing pigeonpea global demand, Jones et al. (2002)

[2]These are average imports for India for the period 2001-2006 and based Shiferaw et al. (2008).

argue that this offers greater opportunity for increased pigeonpea production, which has to match the required quality grades and standards. The boost in producer prices is good for producers as they increase pigeonpea revenues. However, for farmers to exploit such an opportunity, institutional arrangements that strengthen the link between producers and markets through, for example, collective action groups such as cooperatives must be put in place. A major advantage with this form of arrangement is in its potential to reduce transactional costs and the provision of relevant, timely and reliable market information to producers.

The down side of higher producer prices is its negative effect on net buyers who have to pay more for the same quantity of pigeonpea. It also implies that pigeonpea importing countries will have to spend a higher share of their income on pigeonpea to sustain their current levels of pigeonpea consumption.

4 The Pigeonpea Sub-sector in Malawi

Pigeonpea is the most versatile grain legume grown by smallholder farmers in Malawi for both local consumption and export. Malawi remained one of the largest producers of pigeonpea in Africa in the period 1991-2006, producing about 78,000 metric tons per year, which accounted for about 28% of the continent's production (Table 3). In terms of pigeonpea harvested area, Malawi cultivated about 112,000 hectares per year in the same period (1991-2006) which accounted for 27% of the pigeonpea area in Africa and ranked second after Kenya.

Pigeonpea ranks as the third most important legume crop after groundnut and beans in the period of 1991-2006 in Malawi. The 78,000 tons of pigeonpea produced per year, accounted for 23% of Malawi's total legume production (Table 4). The 112 thousand hectares of pigeonpea cultivated per year (1991-2006) accounted for about 18% of the total legume land and about 5% of total cultivated land in the same period.

With regards to utilization, Muwalo et al. (1999) report that an estimated 65% of the pigeonpea produced in Malawi is consumed on-farm by the farm households either as

cooked dry peas or as immature pods and green seeds cooked as vegetables. The consumption rate is similar to that of Kenya but substantially higher than the consumption rate of 35% reported for Tanzania. Lo Monaco (2003) attributes the low on-farm consumption rates in Tanzania to the high integration of producers in the market channels. An estimated 10% of Malawi's pigeonpea production is sold to the domestic market while 25% is exported.

4.1 Pigeonpea producing areas and production systems

Malawi is sub-divided into eight Agricultural Development Divisions (ADDs), each representing an agro-ecological zone. Table 5 indicates the area of pigeonpea cultivated for each of the eight ADDs. The bulk of pigeonpea production is concentrated in the southern region of Malawi where pigeonpea occupies a significant proportion of the farming system, contributing up to about 20% of farmers' income (Orr et al. 2000).

The Blantyre and Machinga ADDs accounted for about 90% of the total pigeonpea area cultivated during the 2005-2008 period. A summary map indicating the major pigeonpea growing areas of the country is presented in Appendix 2. Pigeonpea is widely grown as an intercrop with maize in southern Malawi, but it is mainly grown as a boundary marker in northern Malawi. Although known for its soil fertility enhancement attributes, Snapp et al. (2002) report that farmers are primarily interested in pigeonpea as a market crop and as a weed suppression agent and that soil fertility benefits are secondary.

4.2 Available technologies

A few improved varieties of long and short duration pigeonpea were released and made available to farmers by ICRISAT in collaboration with the ministry of agriculture. Two long duration (ICP 9145 and ICEAP 00040) and two short duration (ICPL 93027 and ICPL 87105) varieties were released for wider cultivation (Appendix 1). Each of the released varieties has economically important traits that make it attractive to smallholder farmers. ICP 9145 (released in 1987) and ICEAP 00040 (released in 2000) are resistant to *Fusarium* wilt and harbor high yield potential. For example, ICEAP 00040 has a yield

potential of 1.9 tons/ha. The short duration varieties are less tolerant to *Fusarium* wilt but have an added advantage in that they can be consumed as grain as well as a vegetable. Their capacity to mature early also makes them more suited for the semi-arid regions and provides an opportunity for double cropping in regions with long or bimodal rainfall seasons.

Although improved pigeonpea varieties were released as early as 1987, their dissemination and adoption by smallholder farmers remain low. Furthermore, Simtowe et al. (2009) report that only 10% of the sampled farmers grew improved pigeonpea varieties in 2007, although 40% of them could potentially adopt improved varieties of pigeonpea if they were exposed to the varieties and had access to seed. The main constraint to the adoption of improved pigeonpea varieties has been the lack of access by farmers to sufficient quantity of good quality seed. Consistent with this observation, Tripp (2000) reports that there is no commercial market for improved pigeonpea to enable seed purchases as farmers often save grain and recycle as seed or purchase grain from the local market to use as seed. As a consequence, this discourages private sector participation in seed production and marketing as it is less profitable. Aside from the seed constraint, Snapp et al. (2002) report the destruction of pigeonpea by goats and cattle as a primary constraint to the adoption of the crop in central Malawi. Protecting pigeonpea fields from these animals would require additional family labor and time. Several tradition pigeonpea varieties are also available to farmers, but *Mthawa juni* is the most popular, reportedly grown by most pigeonpea farmers in central and southern Malawi.

4.3 Harvested area, productivity and production trends

The trend in the size of land cultivated for pigeonpea in Malawi (1961-2006) is depicted in Fig.4. The size of land cultivated rose from 80,000 ha in 1961 to about 123,000 ha in 2006, representing an average annual growth rate of 1.1%. This growth rate is smaller than the 3% annual growth rate observed for the area allocated to groundnut during the same period. Nonetheless, this is a significant growth considering that pigeonpea

production in Malawi is concentrated in the south, a region characterized by high population density and high land pressure. A more sustainable strategy for improving production in this region would be the increased use of improved varieties, as opposed to the unsustainable area expansion.

The yield grew modestly at an annual growth rate of 1% between 1961 and 2006 (Fig.5). The average grain yield of pigeonpea for the period 2001-2006 was about 700 kg/ha. This yield is about half of the potential yield on station of about 1.3 t/ha for improved varieties. The observed yield gap suggests that there is scope for increasing pigeonpea productivity once farmers adopt improved varieties and if they follow recommended management practices. There are significant variations in the yield across the years. The increasing yield trend can in part be attributed to the adoption of improved varieties following the first release in the late 1980s. The long duration improved pigeonpea variety (ICP 9145) was the first to be released in 1987, followed by the release of the long duration ICEAP 00040 in 2000. Two more short duration pigeonpea varieties (ICPL 93027, and ICPL 87105) were released in 2003. Aside from the limited adoption of improved pigeonpea varieties, the low productivity can be attributed to other biotic and abiotic stresses such as drought as well as pests and diseases. It is hoped that the current on-going legume projects in Eastern and Southern African countries will contribute towards improving productivity of pigeonpea in Malawi.

Malawi's annual pigeonpea production rose from 52,000 tons in 1961 to 79,000 tons in 2006, representing an annual rate of growth of 1.8% (Fig. 4). The increase in production is attributed to productivity gains per unit area as well as area expansion. However, this increase is relatively small when one considers the growing global pigeonpea market. Furthermore, Malawi's world production share decreased from 3.3% in the 1961-1989 period to 2.6% in the period 1990-2007 (FAOSTAT, 2008), mainly because Kenya's and Myanmar's production share increased substantially during the same period (see for example Lo Monaco 2003).

4.4 Growth rates of production, yield, area and exports

In this section we estimate growth rates in the production, harvested area, yield and export volumes of pigeonpea and examine whether the patterns in the growth rates are associated with changes in agricultural policy orientation. Furthermore, it is interesting to understand how the changes in the rates of growth in the four parameters in Malawi compare with the world trend.

Historically, Malawi's agricultural development process can be said to have passed through three phases. The first phase spanning up to 15 years after independence (1961-1984) was characterized by active government involvement in the economy and agricultural sector (Chirwa, 2007). The main objective of policies during this period was to diversify the economy away from the agricultural sector through increased import-substitution industrialization, thereby generating sustainable employment opportunities (Chirwa, 2007).

The second phase, also known as the reform phase spanned for another 15 years from 1980 to 1994. The period was characterized by government's adoption of several structural adjustment policies proposed by the World Bank, including the liberalization of the marketing of agricultural inputs and produce. Government under the auspices of the World Bank liberalized prices of most crops in 1988 with the state marketing agency Agricultural Development and Marketing Cooperation (ADMARC), acting as a buyer of last resort at minimum guaranteed pan-territorial and pan-seasonal prices. Private traders were allowed to participate in marketing of agricultural produce such that by 1995 prices of all other crops, except for maize, were fully liberalized (Chirwa, 2000). This meant that private traders were free to determine their own prices for the purchase of crops from smallholder farmers.

The period from 1995 is regarded as the post-reform period, a period after major structural reforms under structural adjustment period were completed in most sectors of the economy. The phase is characterized by a formulation and adoption of a number of

development policy frameworks, including the Malawi Poverty Reduction Strategy (MPRS) of 2002 and the Malawi Economic Growth Strategy (MEGS) of 2004. This phase is also characterized by the reversal of many of the structural adjustment and marketing policies that were adopted during the reform phase. For example, the state marketing agency ADMARC has once again become an important player in the marketing of maize and other crops. The continued participation of ADMARC has partly been attributed to the sluggish response of the private sector taking up marketing activities following liberalization.

Presented in Table 6, results indicate that the annual growth rate in the world's total production (2.5%) was higher than the annual growth rate in Malawi's pigeonpea production (1.8%). Also, the first phase of the post reform period (1995-2000) registered the highest pigeonpea annual rates of growth in production (13%), yield (9.3%) and harvested area (5.4%). This is apparently because of a sharp rise in the yield and production between 1995 and 1996[3]. The rise in pigeonpea production in this period could also be a supply response resulting from the liberalization of the marketing of agricultural produce during the preceding reform phase. The second phase of the post-reform period (2000-2006) is characterized by a decline in the production (-1.8%) and a relatively lower export growth rate (12.2%) compared to the average annual export growth rate of 16% for the period 1961-2006. The apparent low export growth occurred following the consistently falling export prices in the preceding period (1995-2000) (Fig.9). This led to a loss in the competitiveness of Malawi's pigeonpea in the international markets. Consistent with this observation, Lo Monaco (2003) reports that falling pigeonpea prices pose serious challenges to the competitiveness of African exports. The reasons for the falling prices are unclear; however Lo Monaco (2003) suggests that the drop could be attributed to the surge of pigeonpea exports from Myanmar during the late 1990s. On the other hand, domestic and international prices spiked during the 2007/08 period and generally remained at high levels during the first half of 2009.

[3] It appears this coincided with the period when government was changing the methodology for estimation of harvested area, production and yield. Therefore the sharp rise in production may also be a result of changes in the methodology and not the changes in the absolute volumes of pigeonpea produced.

4.5 Pigeonpea seed systems

In this section we discuss the pigeonpea seed system in Malawi with regard to breeding, seed production and seed marketing. Malawi's seed sector is supported by both the public and the private sector. Public support for seed production is more relevant for the legume crops because of the high cost of exclusion (low excludability), a characteristic that discourages the private sector from investing in legume seed production. Farmers can recycle the seed for many seasons without experiencing significant yield reductions. Therefore, while the seed system for more profitable crops such as the hybrid maize is largely formal with the private and public funded institutions as major actors, legume seed production in Malawi is largely informal. Thus the informal sector (e.g. farmer seed production, exchanges and distribution by non-governmental organizations and the emergency programs) are an important component of the legume seed systems.

Malawi's seed production and marketing activities are conducted by the state, the private sector (e.g. seed companies), the international research organizations such as ICRISAT and farmers. With regard to regulations, Malawi has some procedure for officially releasing new varieties usually done by the varietal release committee. The committee is composed of members from the National Research Council, the private sector, the University of Malawi, the Department of Agricultural Research.

A Seed Traders Association of Malawi (STAM) was created in 2004 comprising several stakeholders in the seed industry to oversee activities in the industry. The goals of the association are to enhance communication between the seed sector and the Ministry of Agriculture, promoting their products, and ensuring that seeds sold to Malawian farmers are of good quality. The association also aims at lobbying for members' interests and to hold their members accountable for maintaining high standards in product and service delivery. The association has, for example, lobbied for inclusion in government and donor discussions of policies and programs that support their businesses (Ministry of Agriculture, 2007). The structure of the Malawi seed industry is depicted in Fig.6. The figure demonstrates the flow of seed from producers to farmers. Multinationals, regional companies and local companies as well as seed producer associations produce seed which

is then marketed to farmers through input distributors, formal chain stores, agro-dealers or through the state managed marketing outlets under ADMARC. However, as stated earlier pigeonpea seed production is largely done by farmers, ICRISAT (e.g. through contract farming) and sometimes distributed by NGOs and government (through the subsidy program). Below we provide detailed description of functions of the key actors in the seed industry.

4.5.1 Private companies

The private seed companies such as MONSANTO, and Seed Co. play a central role in the production of foundation seed as well as commercial seed for cereals; however they play a limited role in the supply of commercial as well as foundation seed for legumes. As depicted in Fig. 6, there are two categories of private companies operating in the seed industry. In the first category are multinationals operating in and outside Malawi. The second category includes regional companies that operate within the southern African region. The multinational companies mainly focus on hybrid maize production and marketing due to its high excludability and hence high profitability. Examples of multinational companies include MONSANTO and Pioneer. The regional seed companies include Seed Co., based in Zimbabwe, and Pannar of South Africa. Seed Co. has breeding programs for both hybrids and open pollinated varieties (OPVs) of maize, soybean, wheat and groundnuts. It also sells seeds of sorghum, cowpeas, millet, rice, beans and vegetables. Pannar produces and markets hybrids and OPVs of maize but does not supply legume seed.

Aside from the international and regional companies, national companies play a crucial role in the seed industry. For example, founded in 2004 in the southern region, Seed Tech is a company that produces the hybrid maize MH18. Another example is Funwe Farm Limited, founded in 2001 and produces and markets seed for a number of crops but they mainly focus on maize.

4.5.2 Outlets and retailers

Seed reaches farmers through outlets and retailers which stock seed produced by multiple companies. Such retailers include input seed distributors such as Rab processors and Nyiombo shops. Other formal chains including the Chipiku stores and the Agricultural Trading Company (ATC) and NASFAM have been stocking various seeds for sale to farmers. Agro-dealers are also playing an important role in the marketing of seed. The government through its state managed ADMARC sells seed for all crops. Currently, ADMARC has more than 300 marketing units where seeds for different crops are sold but it does not sell pigeonpea seed. Agro-dealers play an important role in the distribution of pigeonpea seed. For example, in a study conducted by ICRISAT in 2007, about 10% of the pigeonpea growers reported buying seed from local agro-dealers (Simtowe et al. 2009).

4.5.3 Farmer associations and individual seed producers

Farmer organizations play an important role in the production of commercial seed, mainly for hybrid maize and groundnuts. The Association of Smallholder Seed Marketing Action Group (ASSMAG) is a farmer-owned and controlled rural seed production and marketing organization and composed of affiliate organizations from the eight ADDs in Malawi that produce and market open pollinated varieties of maize and legumes seed, especially groundnuts. This system enables seed producers to sell seed at good prices while facilitating the supply of seed to different parts of the country. However, there has been some inefficiency due to the inability of the association to adequately market and buy seed from the producers. ASSMAG does not produce pigeonpea seed, probably because pigeonpea seed production is viewed as unviable considering that its production is concentrated in one part of the country (the southern region). However, the fact that ICRISAT's seed revolving fund[4] in which they also produce pigeonpea seed has proven viable in the past five years, suggesting that there is scope for ASSMAG to invest in pigeonpea seed production as well and to reap significant profits from it.

[4] ICRISAT has been implementing a seed revolving fund scheme for groundnuts and pigeonpea where by farmers are given initial seed on loan to multiply and then they are required to pay back the seed for redistribution to other farmers

The National Smallholder Farmers Association of Malawi (NASFAM) is now entering into certified seed production of sunflower, bean and soybean as well as other legumes. However, through its marketing of pigeonpea grain, NASFAM has in a way facilitated seed transfer as it provides seed to its members. NASFAM also collaborates with ICRISAT in several legume projects both in assisting farmers to market their produce as well as accessing seed and other inputs.

Individual farmers may also produce seed for sell to fellow farmers. In a survey conducted by ICRISAT in 2007, for example, about 40% of the pigeonpea farmers reported that they bought seed from local seed producers. However, more than 80% of the farmers still reported using seed from own saving from previous year's production. This shows the importance of local seed systems and the need to further develop them through investment in farmer training for seed production and seed selection.

4.5.4 Government and non-governmental organizations

Recognizing the failure of the public and private sector seed companies to meet farmers' needs for seed with high cost of excludability such as that for the self-pollinated crops, government and non governmental organizations (NGOs) operate a number of informal or emergency seed programs to meet the needs of the poor. The government of Malawi, through the Ministry of Agriculture, has been implementing several forms of input subsidy programs in the last decade and seed has been a major component of the programs.

Although such programs target maize, they have recently expanded to include legume crops such as groundnuts, beans, and pigeonpea. In 2008, for example, government bought about seven tons of ICEAP 00040 seed and eight tons of ICP9145 seed from ICRISAT for distribution to farmers through the subsidy program. The major problem with emergency programs and input subsidy programs implemented in Malawi has been

that of displacing the sales or supplies from the private sector, which distorts the commercial seed sector.

NGOs also buy certified seed from producers and distribute the seed to the farmers for further multiplication or for commercial grain legume production. They also have promoted a diversity of the varieties grown including a number of early maturing and high yielding varieties of pigeonpea released by research. In 2008, for example, NGOs purchased two tons of ICEAP 00040 and four and a half tons of ICP 9145 seed from ICRISAT for re-distribution to farmers. NGOs have also facilitated on-farm testing of new varieties, thereby enhancing demand for certain crop varieties. NGOs also facilitate the dissemination of seed for new varieties, through seed loan schemes, seed exchange or free distribution, especially when a disaster is declared. For example, Concern Universal in Dedza district of central Malawi has been facilitating research as well as the dissemination of improved pigeonpea varieties in collaboration with ICRISAT.

Action Aid has been involved in implementing a number of seed distribution projects including the Malawi Smallholder Seed Development Project, which was implemented in collaboration with the Ministry of Agriculture, to respond to the seed demand of farmers. Approximately 300 groups of 10-20 farmers were formed in order to multiply seed of new varieties. Groups could choose which seed crops they wished to grow. The farmers received training in seed production and loaned foundation seed (Tripp, 2000).

4.5.5 International research organizations

The International Research organizations, particularly, those belonging to the Consultative Group for International Agricultural Research (CGIAR) have been instrumental in producing breeder and foundation seed as well as facilitating the commercial production of seed. The international Crops Research Institute for the Semi-Arid Tropics (ICRISAT) has distributed pigeonpea and groundnut seed to farmers in Malawi for a number of years. For example, since 1999, supported by USAID, ICRISAT facilitated the production of certified and breeder seed for groundnuts and pigeonpea through a revolving fund scheme. Through the program, about 146 tons of certified seed

was produced; while 25 tons of breeder seed was also produced during the period 1999-2006 (see Table 7). The revolving seed scheme facilitated the adoption of improved varieties for groundnuts and pigeonpea while operating in a sustainable manner. The certified seed is distributed to farmers through various projects including several NGOs and the input subsidy program. This has made a major contribution to increasing the availability of quality of improved varieties and its use by farmers.

5 Pigeonpea Marketing Systems

5.1 Structure of pigeonpea markets

Following the partial liberalization of produce marketing in the late 1980's, grain legume marketing activities are conducted by private traders as well as the state controlled marketing body, the Agricultural Development and Marketing Cooperation (ADMARC). The actors in Malawi's pigeopea market include small and large scale producers, intermediate buyers, farmer associations, processors and consumers. Figure 7 depicts the structure of legume markets in Malawi showing the flow of pigeonpea from the producers to the consumers. The most prevalent grain legume marketing system involves individual farmers selling small quantities of grain legume products to intermediate buyers. Other prevalent marketing systems involve (i) individual farmers selling pigeonpea to local markets, (ii) farmers organizing themselves into groups which pool together their products, identify buyers (often a company) and sell at negotiated prices, and (iii) farmers selling their grain legumes to NGOs. There are several categories of buyers which includes, intermediate buyers, processing and packaging companies, and other consumers of grain legumes.

5.1.1 Private traders and informal intermediate buyers

Intermediate buyers are categorized into small-scale and large-scale assemblers. The small-scale intermediate buyers are often village based. Some have small shops in the village and buy the products directly from farmers through village shops. Others go round in the villages on bicycle or foot looking for products or colonize the local markets with

weighing scales (Msukwa 2005). They often accumulate products ranging from a few bags to about 1 – 2 metric tons and are more prevalent in the southern region of Malawi. They supply their products to large-scale intermediate buyers, and some of them have tenders in boarding schools and other institutions. Makoka (2009) reports that although intermediate buyers are common in all pigeonpea growing districts of Malawi, their presence is more prevalent in areas where NASFAM does not purchase the crop.

The large-scale intermediate buyers tend to cover a wider catchment area which could be several districts or an entire region or all pigeonpea growing areas. They often buy large quantities of products. They employ agents and place them in areas of high pigeonpea production.. They also may purchase pigeonpea from the small-scale intermediate buyers. Most of them deal in both seed and commercial grains and also supply export market channels. The large scale buyers may sometimes sell directly to processors or sell to the subsidiary of NASFAM, the National Smallholder Commodity Marketing and Exchange (NASCOMEX).

5.1.2 Producer associations

Producer associations belong to a set of institutional innovations that can play an important role in improving the competitiveness of Malawi's pigeonpea. NASFAM through its subsidiary, NASCOMEX, purchases grain legume from its members as well as non-members in a number of areas in the country. NASCOMEX then sells the grain to processors and exporters or exports it directly. Although, in some cases, NASCOMEX offers lower prices than prices offered by private traders, the absence of NASFAM leads to farmers obtaining less favorable prices as private traders are left without competitors. Until last year, NASFAM also used to purchase substantial quantities of pigeonpea from farmers for re-sell to exporters. However, following a marketing study that was conducted by NASFAM, pigeonpea trade was found to be unprofitable for them, hence NSAFAM withdrew from pigeonpea trading. Currently, NASFAM is mainly buying groundnuts and other high value crops such as tea from farmers.

5.1.3 Companies and processors

Aside from intermediate buyers, there are more than fourteen companies in Malawi that buy grain legumes and have the capacity to process, package, locally distribute and export different types of grain legume products (Msukwa 2005). For example, Muli Brothers Ltd, a Malawian local company is one of the companies involved in the marketing of pigeonpea. Malawi has the largest concentration of processing companies for pigeonpea. The majority of these companies depend on intermediate buyers for the supplies of their raw materials otherwise others send middlemen to buy products on their behalf. About 40% of the pigeonpea exports to India is processed, while 60% is exported in the form of raw pigeonpea grain. There are more than twelve pigeonpea millers in Malawi with a total milling capacity of 20,000 metric tons of dhal per annum. The companies processing pigeonpea include Transglobe Produce Exports, Rab Processors and Bharat Trading Company. Recently (April 2009), a processing plant was installed in Blantyre by Export Trading Company Ltd. This offers a good opportunity for farmers to market their commodity at better prices. However the extent to which farmers benefit from such opportunities will depend on the extent to which farmers produce market preferred large and white-seeded pigeonpea varieties. Although the companies have established market contacts in India where more than 90% of the processed pigeonpea is exported, export prices are largely dictated by the buyers in India, who also base their prices on supplies from other countries such as Myanmar, leaving Malawian exporters and farmers as price takers.

5.2 Pigeonpea exports markets, constraints and opportunities

Malawi dominated the world pigeonpea export market share until the late 1990s when its share declined. The export volumes increased from 3,059 metric tons in 1990 to about 22,000 metric tons in 1997. Pigeonpea exports started declining since 1998 despite the continued increasing trend in pigeonpea production. In 2000 and in 2001 Malawi did not export any pigeonpea (Fig.8). The declining export volumes appear to have been a lag effect of declining world pigeonpea prices prior to the year 1999. Nonetheless, the recent rise in pigeonpea export prices is likely to induce exports (Fig.9) as it offers a good

opportunity for Malawian farmers to increase their pigeonpea revenue through exports. Indeed while falling export prices in the late 1990's reached parity for Malawi (Lo Monaco, 2003) compromising Malawi's competitiveness, the recent trend (rising export prices) is good news. India remains the single major importer of Malawi's pigeonpea where about 25% of the pegeonpea produced is exported. About 40% of the pigeonpea is exported in a processed form of turdhal, while the rest is exported as dry grain (see Fig.7).

5.2.1 Constraints and threats

Malawian exporters are faced with supply constraints in that there is an insufficient production of large and white-seeded pigeonpea preferred by the export market (Jones et al. 2002) due to the low adoption of white-seeded varieties such as ICEAP 00040 by farmers. Furthermore, there is a considerable threat to Malawi's pigeonpea export market, particularly to India resulting from increased pigeonpea supplies from other countries. The increasingly dominant position of Myanmar, for example, as the major pigeonpea supplier to India can not be ignored. Besides Myanmar's increasingly dominant position, Lo Monaco (2003) reports that the competitive pressure from imports of yellow pea from Canada and France pose serious threats to the competitiveness of Africa's pigeonpea exports to India. As also reported by Jones et al. (2002), Malawi as one of the landlocked countries, experiences higher transport costs as well as longer periods of shipment than other pigeonpea exporting countries which negatively affect its competitiveness. Jones et al. (2002) further report that the cost of exporting a 20-foot container of pigeonpea to Mumbai in India in 2002 was US$ 1800 for Malawi compared to US$ 800 – 1200 for Tanzania, and US$ 500 – 800 for Kenya. The cost disparities suggest that for Malawi's pigeonpea to be as competitive as pigeonpea from other countries, it has to be a better quality so that it can fetch better prices.

5.2.2 Opportunities

In spite of the foregoing discussion, there still are opportunities for pigeonpea exports to India due to the large and growing demand. Lo Monaco (2003) further reports that seasonal pigeonpea price variations in India offer a window of hope for African countries to export pigeonpea to India when prices are high. Lo Monaco reports that pigeonpea prices in India are lowest in March-April, and that they begin to rise from July. The prices are reported to be at the peak around November-December. In Malawi pigeonpea is harvested between July and August which coincides with a period of high prices in India. Malawi could, therefore, take advantage of this window to improve its pigeonpea competitiveness. Furthermore, the national food policy of India promotes the importation of legumes as a means to achieve food security, more especially, for the low income Indian consumers. The fact that India is the single major importer of Malawi's pigeonpea, suggests the urgent need to explore alternative markets for Malawi's pigeonpea, especially within Africa, in order to reduce the risk associated with over-dependency on one market. This would require a detailed analysis of the comparative advantages (eg. see, Diao et al. 2007) of pigeonpea among African countries. This would reveal the potential intra-regional demand among African countries. Consistent with this observation, Lo Monaco (2003) reports that market opportunities exist within Africa, where pigeonpea is widely (but often informally) traded between Mozambique and Malawi and between Tanzania and Kenya. An analysis on the competitiveness of Malawi's pigeonpea compared to pigeonpea from other countries would provide some insight on the potential of regional and other export markets both for whole grain and processed products (e.g. Asian communities in the United Kingdom require processed products such as dhal).

There are opportunities for increasing the production of the required grain quality for pigeonpea following the release of improved varieties such as ICEAP 00040 which is highly preferred by the market. In order to promote a wider adoption of this variety there is need for the dissemination of information to farmers about the variety and its relevance to export market. However, the fact that most of the pigeonpea is consumed locally might explain part of the non-adoption puzzle for the market preferred varieties.

5.3 Nominal and real retail price trends

Average nominal and real retail prices (2000-2006) for 41 markets in Malawi are depicted in Fig.10. They show an increasing trend, with a nominal annual price growth rate (24%) that is higher than the annual real price growth rate of 9%[5]. The average annual real price rose from MK24 per kg in 2000 to MK 69 per kg in 2006. The increasing trend is consistent with the trend in world market prices for pigeonpea and other agricultural prices in general and it is expected to benefit local farmers directly. The key question remains as to what extent these increases in consumer prices translate into a simultaneous increase in producer prices. In many cases marketing costs and risks tend to lower producer prices while increasing consumer prices. This is a good justification for investment in public goods for the development of grain markets (Shiferaw et al. 2009).

6 Future Outlooks

The overall outlook for Malawi's pigeonpea sub-sector is positive considering the potentials and investments in technology and market development that the private and public sectors have been undertaking. These investments such as the release of improved varieties are already having positive impacts on production. However, the future outlook will depend on a number of factors including the relative profitability, of pigeonpea compared to other competing crops. In this section we make future projections using two approaches. First, a regression based approach is applied under two scenarios to project future production outlooks. The first scenario is based on the assumption that farmers will continue producing pigeonpea using existing/current farmer' technologies and methods of production. We assume area expansion at the current annual growth rate of 1.07% and use of the same/current production technologies. In addition, we assume other things such as yield growth rate, own prices and cross prices (competing crops prices), insect pests infestation and diseases pressure will remain constant.

[5] The real prices were computed based on CPI obtained from Malawi's Central Bank statistics, with base year of 2000.

However, the assumption of continued area expansion is unrealistic in the long-run due to limited land availability resulting from population growth. Thus, in the second scenario we assume that any increase in pigeonpea production should come from productivity gains per unit area as a result of improved technologies. Under this scenario it is assumed that farmers will adopt improved pigeonpea varieties such as the high yielding long duration ICEAP 00040 and the ICP9145. The base year used for this analysis is 2007 and projections are made up to the year 2020. Currently the area covered by improved pigeonpea varieties is about 17% of the total pigeonpea area in the country (Source: ICRISAT Malawi baseline household survey, 2008).

Therefore, in the second scenario, we assume area covered by improved pigeonpea varieties will increase by 20%, 30% and 50% by 2010, 2015 and 2020, respectively, holding other factors constant. This implies that area covered by traditional varieties will be reduced by the same percentage.

Under scenario one, assuming a constant pigeonpea area growth rate of 1.07% per annum, pigeonpea area is forecasted to increase from 123 thousand ha in 2007 to 140 thousand ha in 2020. Assuming an average yield of 0.67 ton/ha, (average yield from 1982-2007), the production from forecasted area will increase from 79 thousand tons in 2007 to 94 thousand tons in the year 2020 (Table 8).

Under scenario two, assuming the average farm yields of improved and local varieties of 1.12 ton/ha and 0.67 ton/ha, respectively, and an increase in area allocated to improved varieties as stated earlier, the pigeonpea production in 2020 is estimated to be at 135 thousand tons compared to 79 thousand tons in 2007, an increase of 72% (Table 8).

The second projection approach involves the use of IMPACT model as described in the methods section. The IMPACT model projection assumes continued adoption of new existing varieties that improve yields over time using the current rates of productivity growth. In this sense, the IMPACT model scenario is similar to the second scenario presented using the regression methods above. In terms of the projected area and

production trends over the 20-year horizon for which the projections are made, the IMPACT model results suggests that pigeonpea area and production in Malawi will significantly grow.

The IMPACT model results for production projections are similar to the regression methods, but the area and production responses seem to be more elastic. This is can be attributed to differences in the methods employed and the base year considered for projection. The IMPACT model projections indicate that pigeonpea harvested area and production will increase by 67% and 184%, respectively, between the years 2000 and 2020 (Fig. 11). The harvested area is projected to rise from 122 thousand ha in the year 2000 to 204 thousand ha in the years2020. The production is projected to rise from 79 thousand tons in the year 2000 to 220 thousand tons in the year 2020. The implication is that if the new pigeonpea varieties are made available to farmers, the crop likely to see significant growth in its production. This would in turn generate significant marketable surplus for export.

The total domestic demand and net-trade (export minus import) projections for pigeonpea show considerable growth in the years to come, (Fig. 12). The total demand for pigeonpea in 2020 is estimated at 120 thousand tons, up from 75 thousand tons in 2008, representing an increase of 63% while the net-trade projection for 2020 is expected to be 100 thousand tons up from 3 thousand tons in 2008. This extremely high expected increase in net-trade for pigeonpea is a response to the high and growing demand for the crop in South Asia. However the substantial increase in exports will depend on productivity growth. So far, the productivity growth appears to be constrained by the low use of improved varieties. Production is also constrained by land scarcity as Benin et.al. (2008) report that Malawi is the third most densely populated country in mainland Sub-Saharan Africa, after Rwanda (3.8 people per ha) and Burundi (2.7 people per ha).

7 Conclusions

This paper examines the current situation and future outlooks for pigeonpea in Malawi, one of the country's major legume crops. We address questions that relate to the current production levels, available technologies, seed and grain marketing systems, export markets and then explore the potential for increasing production, domestic demand as well as exports in future. We find that currently, pigeonpea remains an important food and cash crop with high acceptability and wider use in Malawi. Pigeonpea accounts for about 22% of the total pulse production of the country, while its harvested area accounts for 5% of the total cultivated area for all crops in Malawi. With regards to utilization, available estimates indicate that 65% of the pigeonpea produced is consumed on-farm, 25% is exported, while 10% is traded on the domestic markets.

Historical trends show that over the past four decades, Malawi's pigeonpea harvested area, and yield grew at rates of at least 1% per annum while production grew at an annual rate of about 2%. Malawi's pigeonpea productivity remains low largely due to the continued use of low yielding and disease susceptible traditional varieties by smallholder producers. The low productivity is a major constraint to the expansion of pigeonpea trade, leading to high average costs of production and to a loss of economies of scale. Low yields and poor productivity of available varieties translate into inadequate production and unreliable supply which undermines commercialization and competitiveness. The low adoption of available new varieties is mainly attributed to the underdeveloped and inadequate seed systems, shortage of quality seed and lack of timely delivery, lack of awareness, and insufficient access to production credit to farmers, among others. There is a need to support and promote the use of improved varieties by farmers to improve productivity. This will require coordinated and collaborative efforts from the public as well as the private sector in improving seed availability, affordability and utilization.

Related to the low use of improved varieties, the review of Malawi's seed systems indicated that despite the existence of several seed companies, there are very few that

produce and market quality legume seeds in general and pigeonpea seeds in particular. Apparently, problems of exclusion for the pigeonpea seed implies low returns to private investments in the pigeonpea seed sector. Consequently, the private sector is likely to continue maintaining a low profile in the legume seed sector. One viable solution is the establishment of farmer seed multiplication groups that will produce commercial pigeonpea seed. Linkages between informal and formal sector to allow regulatory inspection in seed production would improve seed quality. Adoption of simpler standards like quality declared seed (QDS) for local diffusion of good quality seed through truthful labeling would enhance seed availability and adoption. Previous arrangements such as the establishment of the seed revolving fund scheme managed by ICRISAT in the period 1999-2008, were viable and should be expanded to cover different regions of the country. Financial support in the form of seed money to start revolving schemes will be required to promote the establishment of more viable programs.

Furthermore, existing community level and private seed producers and marketing institutions must be encouraged and empowered in a manner that enhances the creation of a stable and commercially viable seed sector that meets the seed needs of a diverse group of farmers. For sustainability of the legume seed industry, government and NGO supported input subsidy programs will have to be implemented in a manner that does not displace commercial sales. The development of a commercial seed sector should go in parallel with the development of a commercial grain market, which is poorly developed in most parts of the country. In the absence of a commercial grain market, it is unreasonable to expect a commercial seed market to emerge. Demand for formal seed sector will be simulated by opportunities to sell these crops, and by markets that reward grain quality and types. Agro-processing and other forms of value adding such as packaging would significantly increase the profitability of pigeonpea production.

The outlook in terms of production and exports is promising. Simulation results have shown that area, yield as well as total production will continue to increase for the next twenty years. The IMPACT model has shown that pigeonpea area and production will increase by 67% and 184%, respectively between the years 2000 and 2020. But this will

largely depend on the stability of the domestic and world demand for pigeonpea as well as market prices and adoption of new varieties. Despite the rising global demand for pigeonpea, there is an increasing pressure and competition in the pigeonpea export market. This has mainly resulted from the rising pigeonpea production from other countries such as Myanmar, as well as the surging yellow pea production from Canada and France, which is an important substitute to pigeonpea in consuming countries. Furthermore, the size of the European markets such as in the United Kingdom that offers better and stable prices is small, stagnant and saturated.

Nonetheless, the increasing competition for the export market need not constrain the growth in the Malawi's pigeonpea markets as there are signal pointing to other potential markets within the Africa region. The informal cross-boarder trade that has been going on between Malawi and other countries is an example, indicating the potential pigeonpea export market. However, a further analysis of the comparative advantages in trading with other African countries would be useful in order to provide more insight on the existing market opportunities within the region. The domestic market further offers some alternative for pigeonpea market especially if the value adding and agro-processing is promoted. Currently there are very few actors that participate on the domestic marketing as well in the export market for pigeonpea in Malawi. It is important to explore other innovations that increase the participation of private traders as well as innovations that improve farmer's access to domestic, regional and other export markets.

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Tables

Table 1: Changes in the global area, yield, and production of pigeon pea, 1961-2007

Countries	19961-1989			1990-2007			Contribution to area change between the two periods (%)
	Area ('000 ha)	Yield (kg/ha)	Production (' 000 ts)	Area ('000 ha)	Yield (kg/ha)	Production (' 000 tons)	
South & southeast Asia	2827.2	695.0	1966.2	3826.2	705.0	2697.4	83.7
India	2741.1	701.0	1922.0	3492.1	689.0	2407.0	62.9
Myanmar	63.8	462.0	29.5	306.1	879.0	269.0	20.3
Nepal	14.5	633.0	9.2	23.0	808.0	18.6	0.7
Bangladesh	5.9	756.0	4.5	4.8	505.0	2.4	-0.1
Pakistan	1.8	546.0	1.0	0.0	630.0	0.1	0.0
Philippines	0.0	0.0	0.0	0.1	1805.0	0.3	0.0
Africa	229.9	567.0	130.4	421.3	655.0	276.1	16.0
Malawi	106.5	662.0	70.4	113.6	694.0	78.9	0.6
Uganda	75.2	409.0	30.8	73.9	933.0	69.0	-0.1
Tanzania	35.0	610.0	1.8	63.1	706.0	44.6	2.3
Congo, DR	5.7	626.0	21.4	8.0	620.0	4.9	0.2
Kenya	5.3	333.0	3.6	160.1	477.0	76.3	13.0
Burundi	2.2	1087.0	2.4	2.2	968.0	2.1	0.0
Comoros	0.0	0.0	0.0	0.4	710.0	0.3	0.0
Latin America and Caribbean	44.3	904.0	40.0	47.0	789.0	37.0	0.2
Dominican Republic	161.3	1270.0	20.5	25.9	925.0	24.0	0.8
Venezuela	899.4	516.0	4.6	5.7	611.0	3.5	0.0
Haiti	713.6	503.0	3.6	7.2	406.0	2.9	0.0
Puerto Rico	486.5	824.0	4.0	1.0	713.0	0.7	-0.3
Panama	223.1	764.0	1.7	4.3	458.0	2.0	0.2
Jamaica	234.6	789.0	1.9	1.3	1074.0	1.4	-0.1
Trinidad and Tobago	158.8	1561.0	2.5	0.8	2297.0	1.8	-0.1
Grenada	549.0	1287.0	0.7	0.5	1050.0	0.5	0.0
Bahamas	428.0	1268.0	0.5	0.2	854.0	0.2	0.0
World	3101.3	689.0	2136.5	4294.2	701.0	3010.3	100

Source: Computed based on FAOSTAT (2008)

Table 2: International trade, export and import volumes (tons) and shares (%) – 1961-2006

Countries	Export				Import			
	1961-1989		1990-2005		1961-1989		1990-2006	
	Average quantity (tons)	Share (%)	Average quantity (tons)	Share (%)	Average quantity (tons)	Share (%)	Average quantity (tons)	Share (%)
Malawi	12939.1	70.0	6220.6	78.0	0.0	0.0	0.0	0.0
Myanmar	4465.3	24.0	1260.4	16.0	0.0	0.0	0.0	0.0
Dominican Republic	555.1	3.0	421.4	5.3	0.0	0.0	0.0	
India	538.7	2.9	80.1	1.0	1345.5	50.5	101579.0	87.3a
Nepal	95.7	0.5	8.2	0.1	217.6	8.2	15.3	0.1
Mauritius	0.0	0.0	8.6	0.1	0.0	0.0	1713.0	7.4
Barbados	1.1	0.0	5.8	0.1	25.2	0.9	84.5	1.0
Trinidad and Tobago	0.2	0.0	2.7	0.0	121.3	4.5	367.0	3.6
Poland	0.0	0.0	2.8	0.0	0.0	0.0	13.0	0.5
Jamaica	1.1	0.0	0.0	0.0	20.5	0.8	2.6	0.1
Guyana	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0
Venezuela	0.0	0.0	0.0	0.0	936.0	35.1	26.6	0.6
Grenada	0.0	0.0	0.0	0.0	0.0	0.0	148.0	0.1

Source: Computed based on FAOSTAT (2008)

[a] The average imports for India are for the period 2001-2006 and based Shiferaw et al (2008)

Table 3: Malawi's pigeonpea annual area cultivated and production compared to other countries in Africa (1991-2006)

Country	Area cultivated		Production	
	Area ('000 ha)	Area share (%)	Production ('000 tons)	Production share (%)
Malawi	113.6	27	78	28
Uganda	73.9	18	69	25
Tanzania	63.1	15	44.6	16
Congo, DR	8	2	4.9	2
Kenya	160.1	38	76.3	28
Burundi	2.2	1	2.1	1
Comoros	0.4	0	0.3	0

Source: Computed based on FAOSTAT (2007)

Table 4: Malawi's pigeonpea annual area cultivated and production compared to other legumes (1991-2006)

Crop	Area ('000 ha)	Area share (%)	Production ('000 tons)	Production share (%)
Groundnuts	171.1	27.0	96.4	27.8
Beans	170.2	26.8	80.5	23.0
Lentils	1.1	0.2	0.8	0.2
Peas	12.5	2.0	6.3	1.8
Pigeonpeas	112.4	17.7	79	23
Chickpeas	88.9	14.0	34.3	9.9
Cowpeas	78.12	12.3	49.9	14.4

Source: Computed based on FAOSTAT (2008)

Table 5: Pigeonpea area cultivated by Agricultural Development Division (ADD), 2005-2008

Agricultural Development Division (ADD)	Pigeonpea area cultivated ('000 ha)[a]					Average area share (%), 2005-2008
	2005	2006	2007	2008	Average (2005-2008)	
Karonga	0.8	0.6	0.6	0.5	0.6	0.4
Mzuzu	0.4	0.2	0.2	0.2	0.3	0.2
Kasungu	0.2	0.1	0.1	0.2	0.2	0.2
Salima	0.0	0.1	0.1	0.1	0.1	0.1
Lilongwe	0.0	2.3	2.4	2.3	1.8	1.1
Machinga	45.7	44.4	45.5	46.8	45.6	29.0
Blantyre	103.1	96.7	103.2	108.3	102.8	64.0
Shire valley	5.8	5.7	9.4	9.4	7.6	5.0
Total	**156.0**	**150.2**	**161.5**	**167.8**	**158.9**	**100.0**

Source: Computed Malawi National Statistics Office (NSO), 2008

[a] The total area statistics are slightly higher than those reported by FAOSTAT.

Table 6: Growth rates of pigeonpea production, yield, harvested area and exports in Malawi by policy phase (annual averages %) compared to the world.

	Pre-Reform	Reform Period			Post-Reform		Total
	1961-79	1980-84	1985-89	1990-94	1995-2000	2001-06	
A. World							
Production growth rate	1.7	7.0	2.0	1.0	2.7	2.3	2.5
Yield growth rate	1.2	2.5	-0.6	0.4	2.0	0.8	1.1
Harvested area growth rate	0.6	4.1	2.4	0.6	0.3	1.7	1.3
Export volume growth rates	3.2	15.7	21.7	71.5	12.4	12.3	16.8
B. Malawi							
Production growth rate	2.2	-1.2	-1.3	-2.5	13.1[a]	-1.8	1.8
Yield growth rate	0.0	-0.4	0.1	-2.8	9.3	1.0	1.0
Harvested area growth rate	2.2	-0.3	-0.9	-3.4	5.7	-0.2	1.1
Export volume growth rates	17.2	12.0	26.4	15.1	15.2	12.2	16.5

Source: Computed based on FAOSTAT data (2008)

[a] There is a huge jump in the production, yield as well a harvested area for Malawi between 1995 and 1996. This might have occurred due to the change in the crop estimation methodology used by the Ministry of Agriculture during this period.

Table 7: Production of groundnut and pigeonpea seed through a revolving fund scheme managed by ICRISAT in Malawi - (1999-2008.)

	Groundnut seed quantity (tons)		Pigeonpea seed quantity (tons)	
Season	Certified Seed	Breeder Seed	Certified Seed	Breeder Seed
1999-2000	61	8	12	3.0
2000-2001	56	15	30	0.4
2001-2002	194	17	35	17.0
2002-2003	116	8	12	2.0
2003-2004	45	3	16	0.4
2004-2005	89	6	34	2.0
2005-2006	64	2	7	0.2
2007-2008	76		23	0.0
Total	**801**	**58**	**169**	**25**

Source: ICRISAT (2006)

Table 8: Pigeonpea area and production predictions under different scenarios using the regression approach

	Scenario 1		Scenario 2		
Year	Area (‘000 ha)	Production (‘000 tons)	Area under new varieties (%)	Production (‘000 ton)	Change in production (%) compared to 2006/07
2007	123	79	<18%	79	
2010	126	84	20	105	33
2015	132	89	30	117	48
2020	140	94	50	136	72

Source: Own computation

Figures

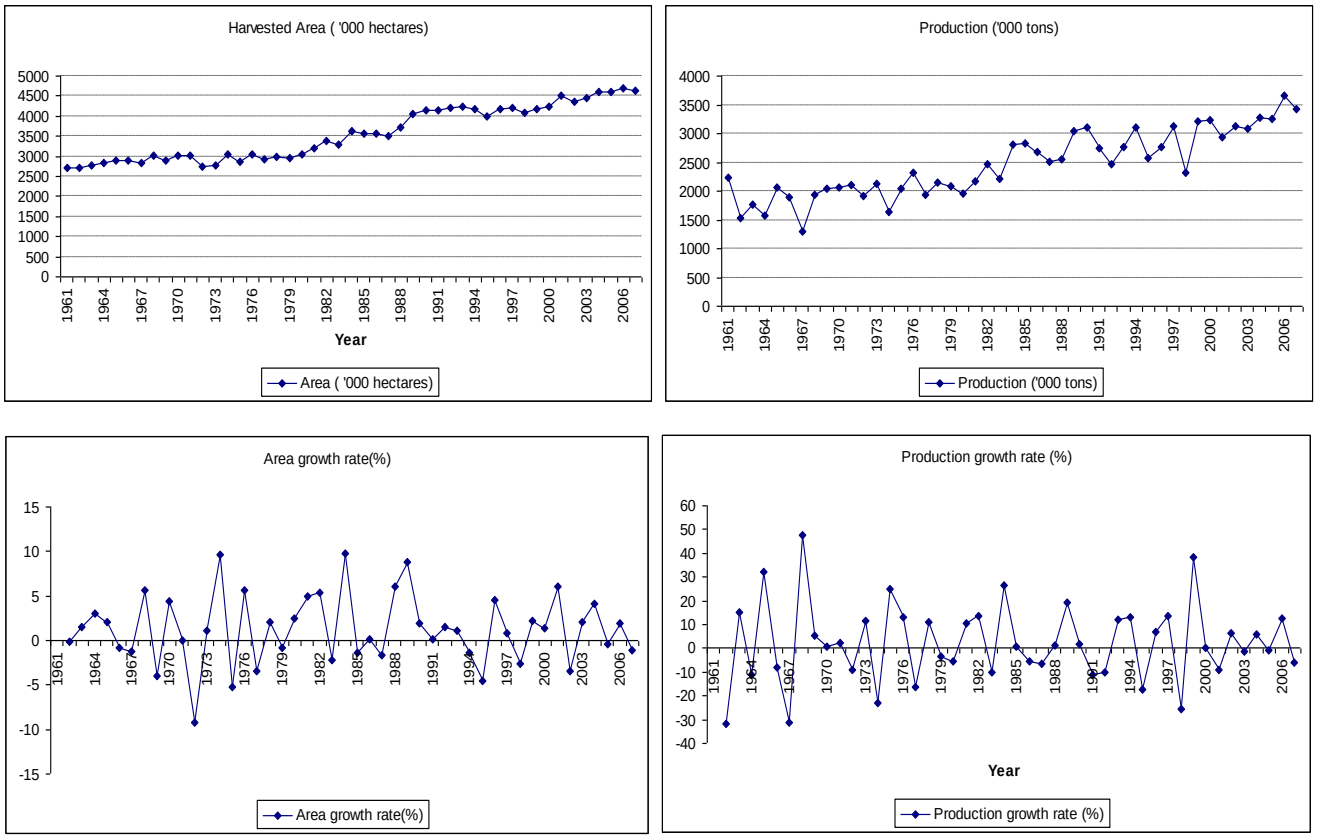


Figure 1: World pigeonpea area and production trends and growth rates (1961-2007)
Source: Computed based on FAOSTAT (2008)

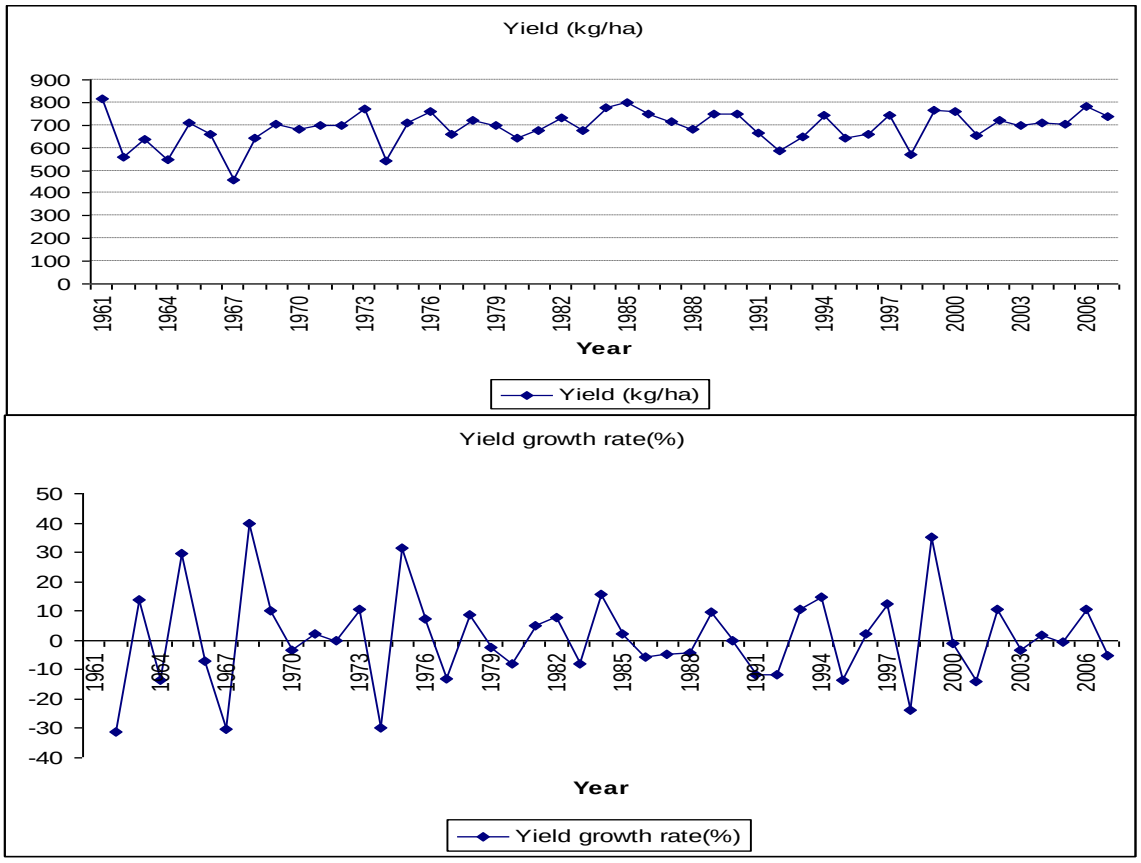


Figure 2: World pigeonpea yield trends and yield growth rate (1961-2007)
Source: Computed based on FAOSTAT (2008)

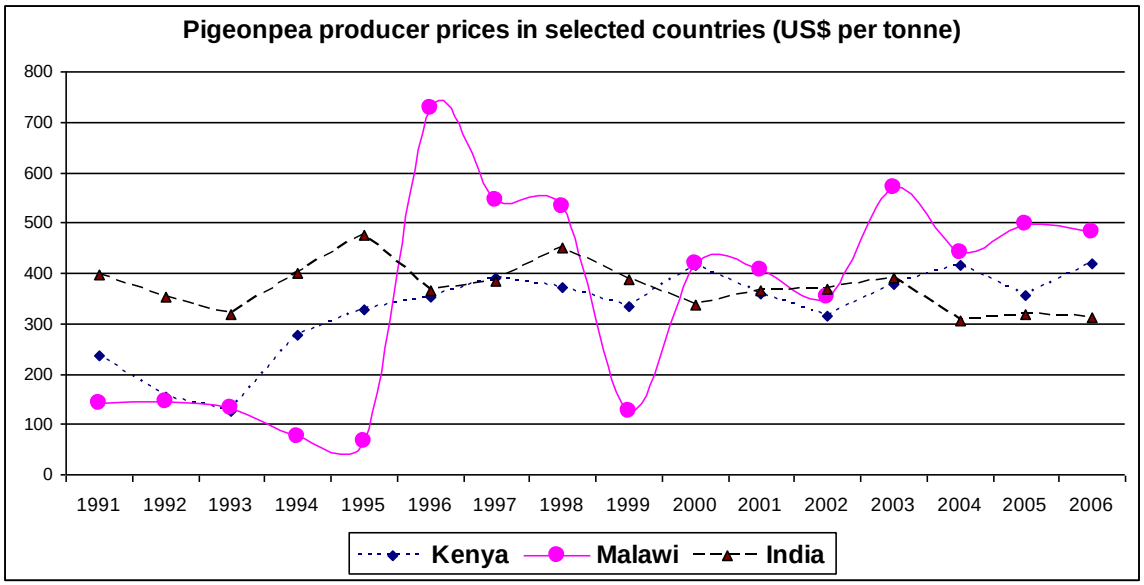


Figure 3: Pigeonpea nominal producer prices in selected countries (US$/t), 1991-2006
Source: Computed based on FAOSTAT (2008)

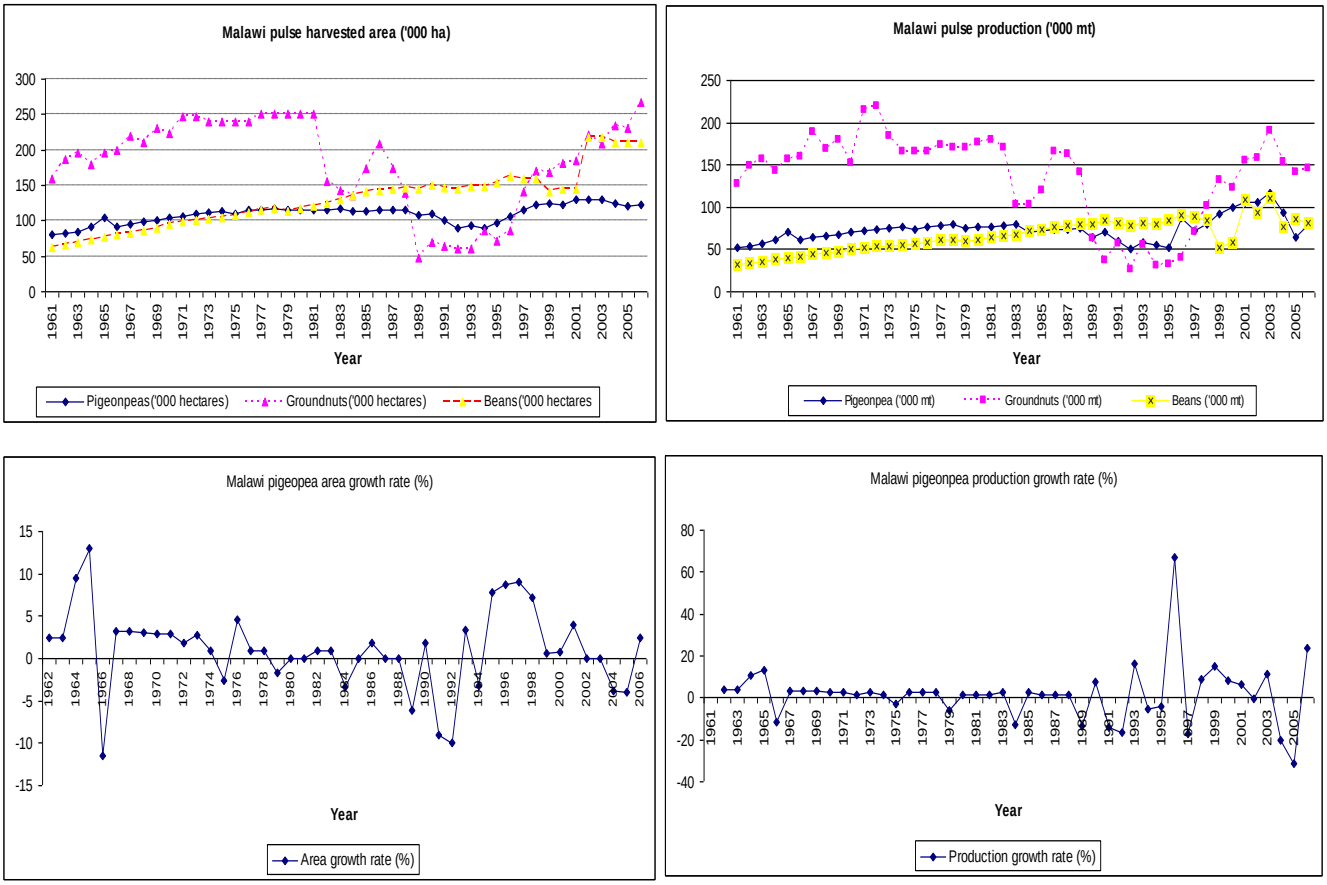


Figure 4: Trend in harvested area and production for pigeonpea and major pulses in Malawi (1961-2006)
Source: Computed based on FAOSTAT and Malawi's National Statistics Office (various reports: 1961-2006)

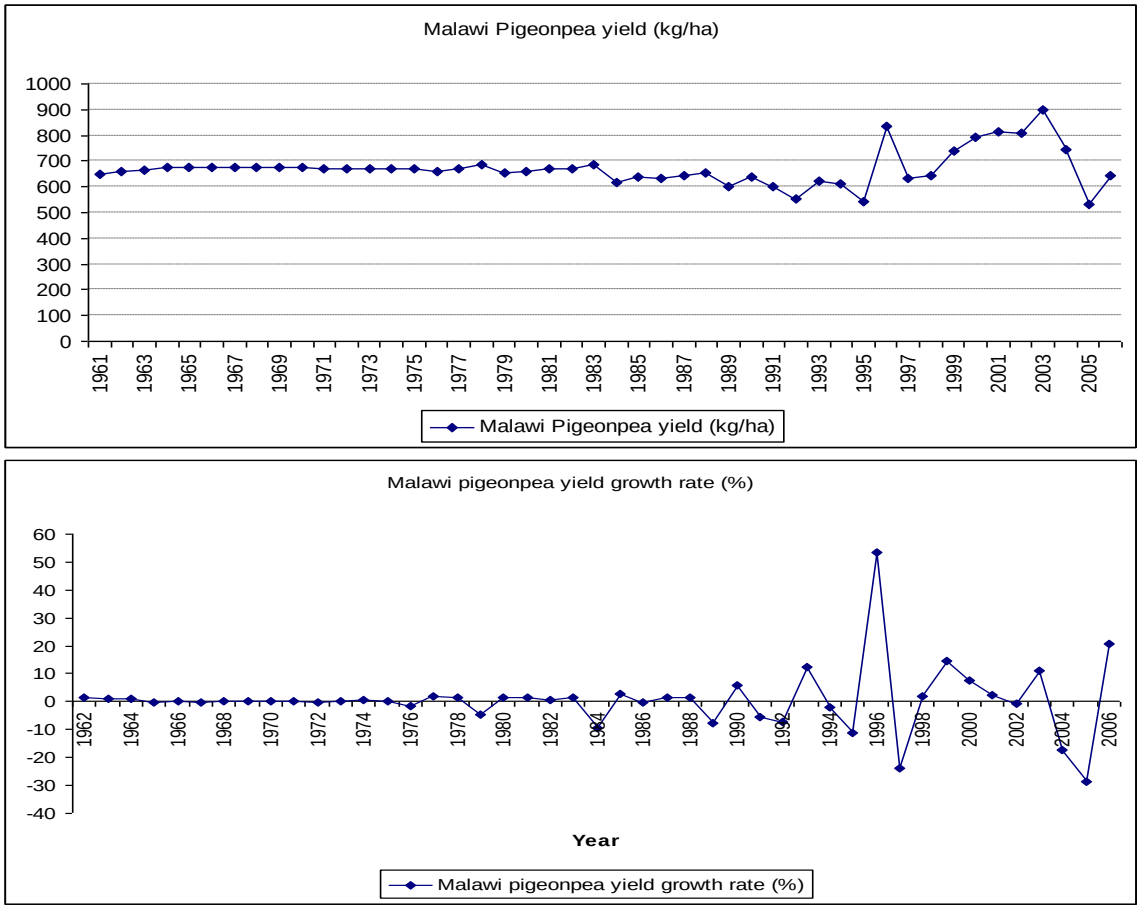


Figure 5: Malawi's pigeonpea yield trends (kg/ha) and yield growth rates (%) 1961-2006
Source: Computed based on FAOSTAT (2008) and Malawi's National Statistics Office reports

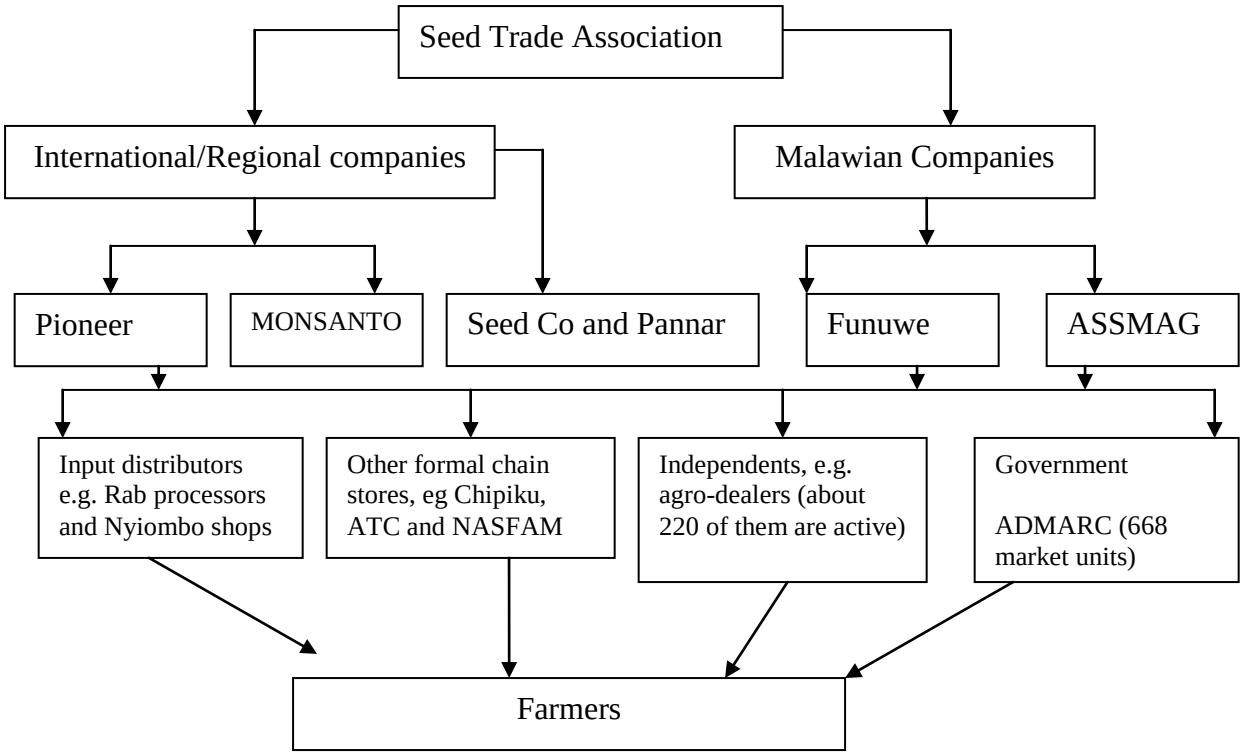


Figure 6: Structure of the Malawi' seed industry and seed distribution system

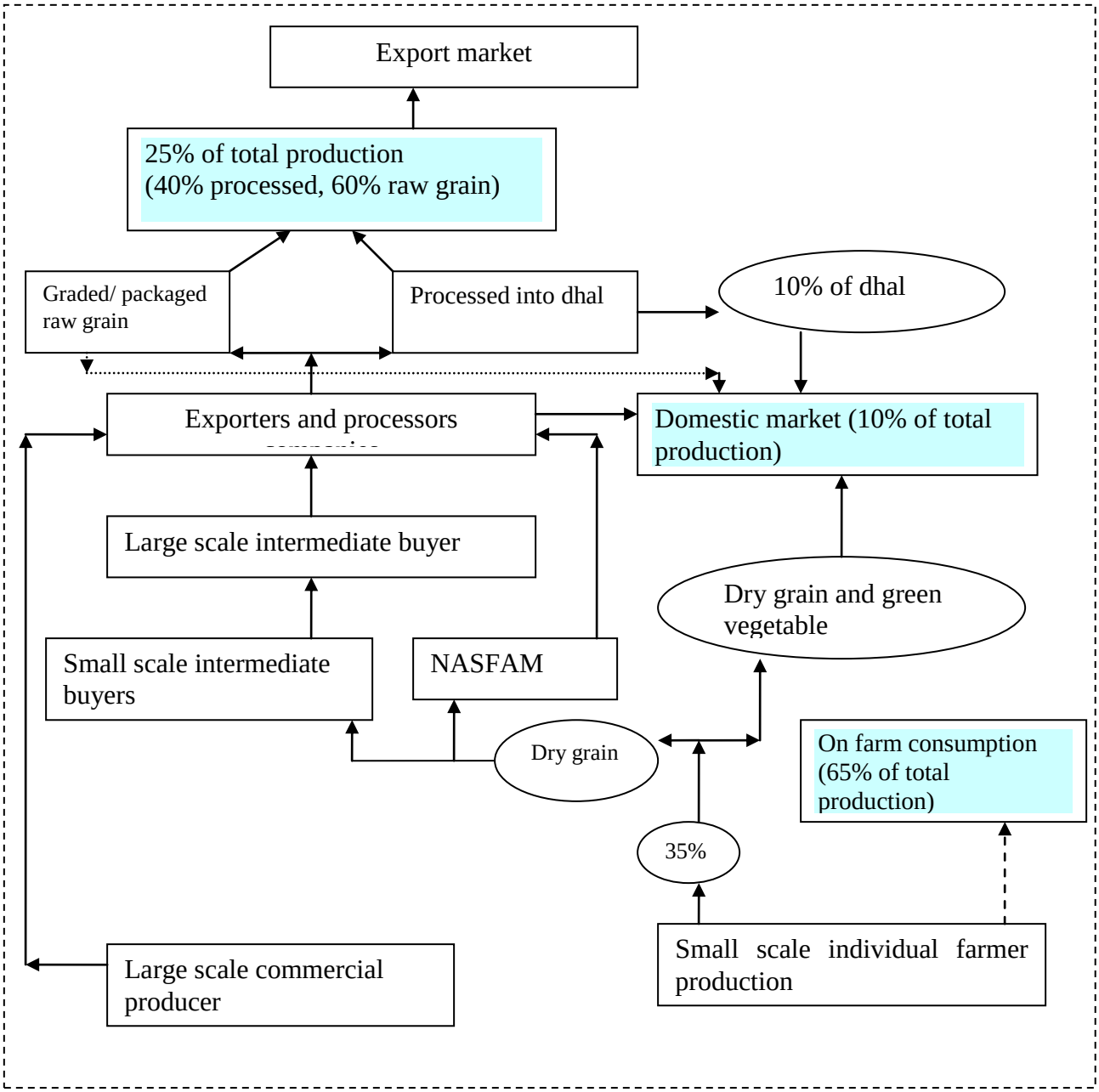
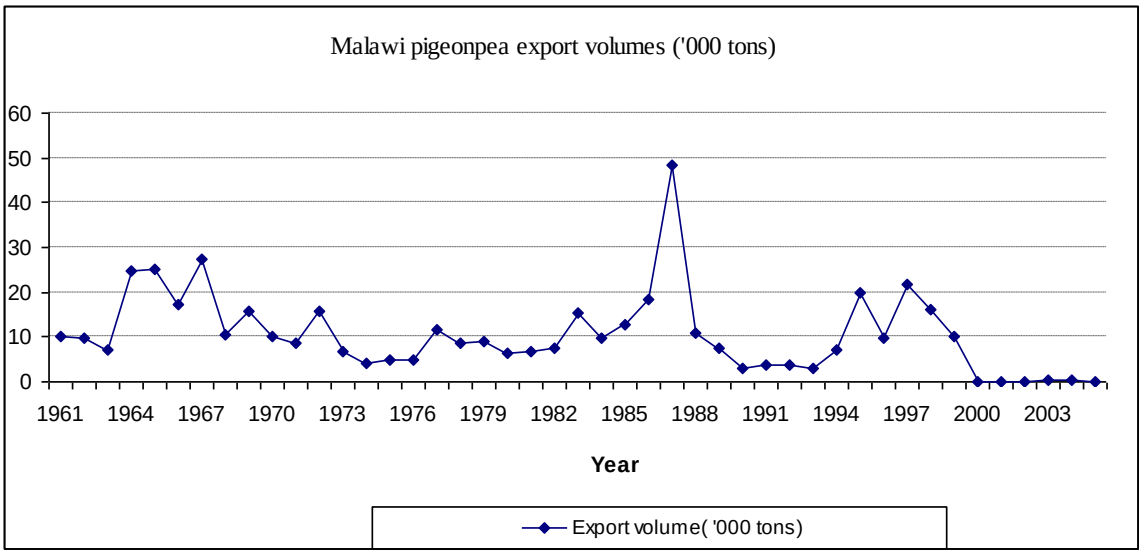


Figure 7: Pigeonpea marketing structure in Malawi.



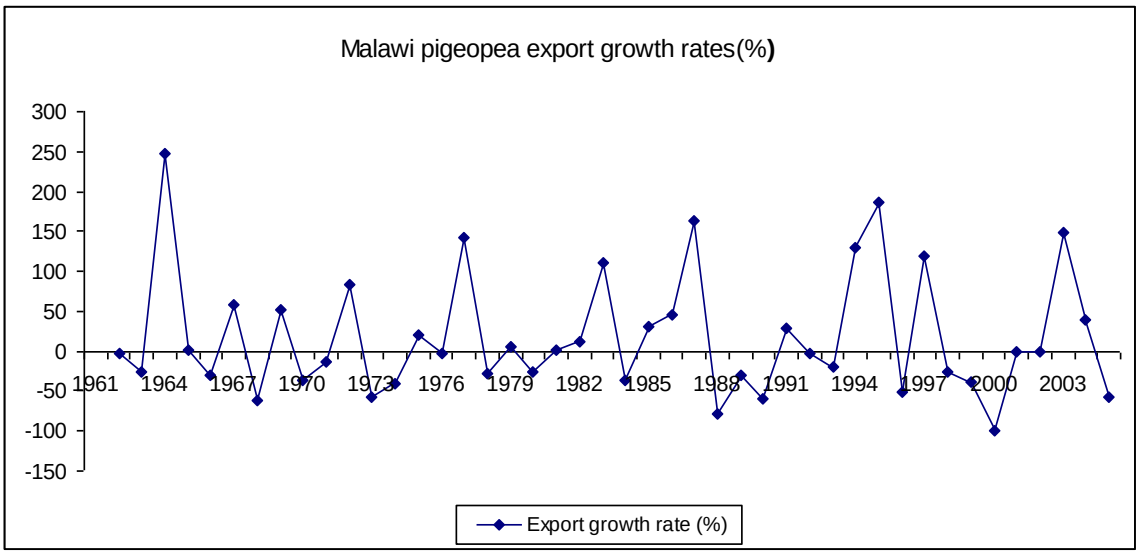


Figure 8: Pigeonpea exports in Malawi (‘000 tons) and export growth rate (%), 1961-2005
Source: Computed based on FAOSTAT (2008)

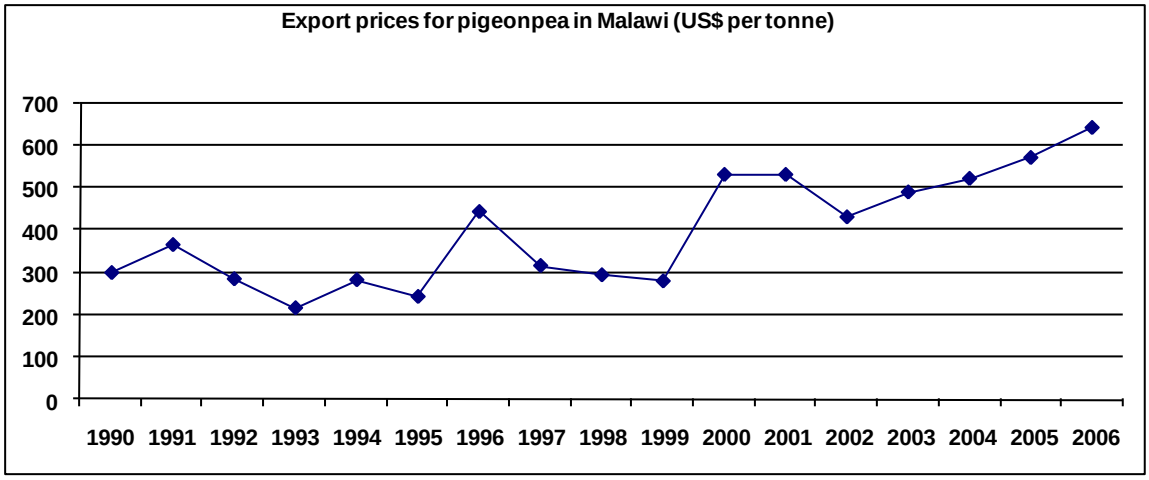


Figure 9: Malawi's pigeonpea export prices (US $/ton) 1990-2006
Source: Computed based on FAOSTAT (2008)

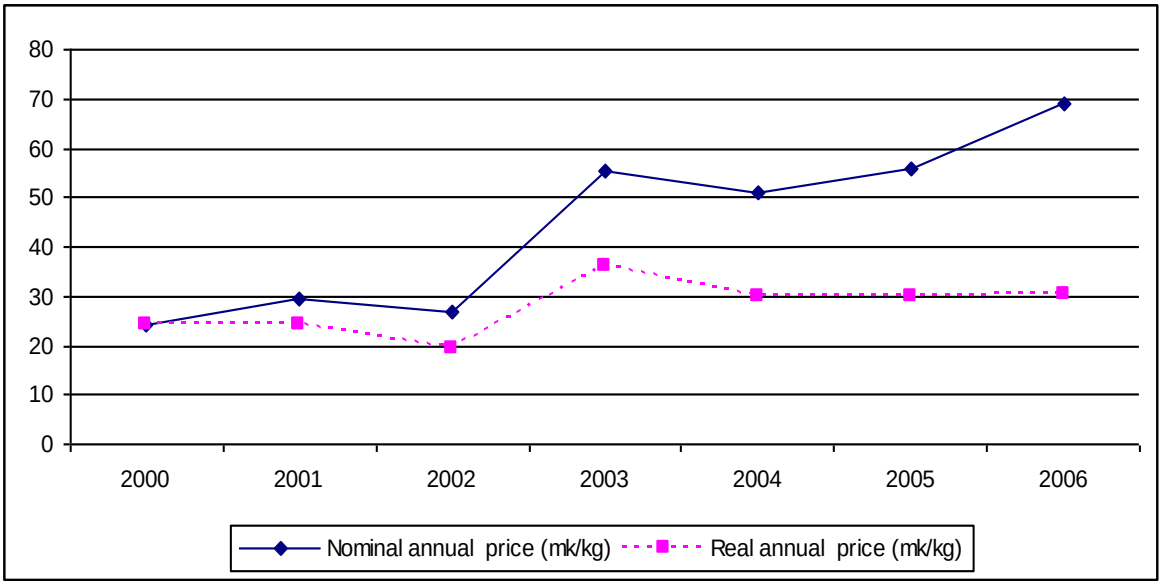


Figure 10: Malawi's pigeonpea annual average nominal and real retail prices in local markets (MK/ kg)
Source: Computed from Malawi National Statistics office

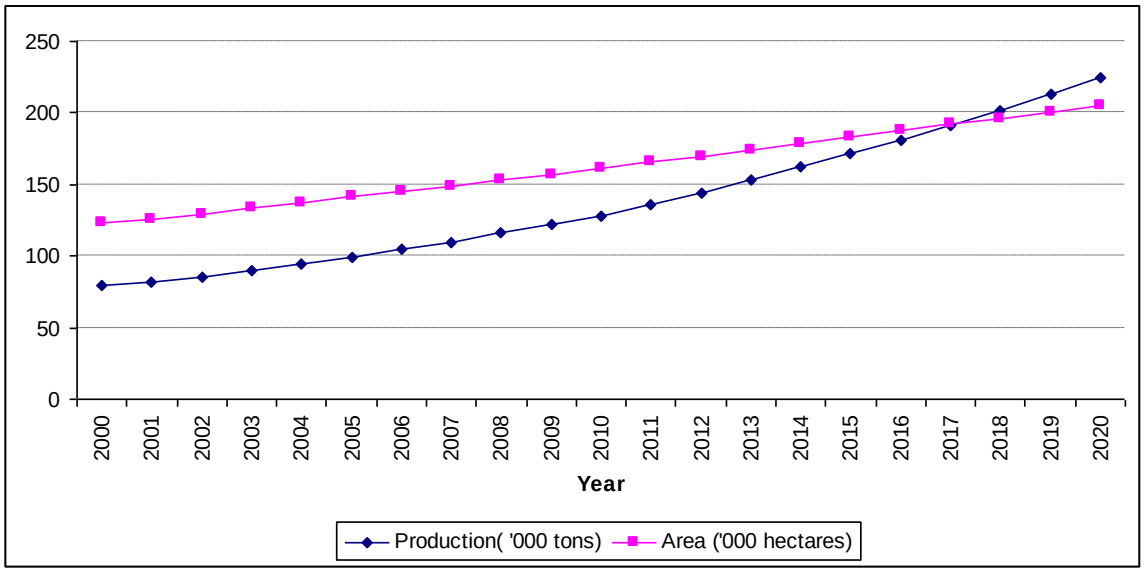


Figure 11: Pigeonpea area and production projections (from IMPACT model) for Malawi (2000-2020)

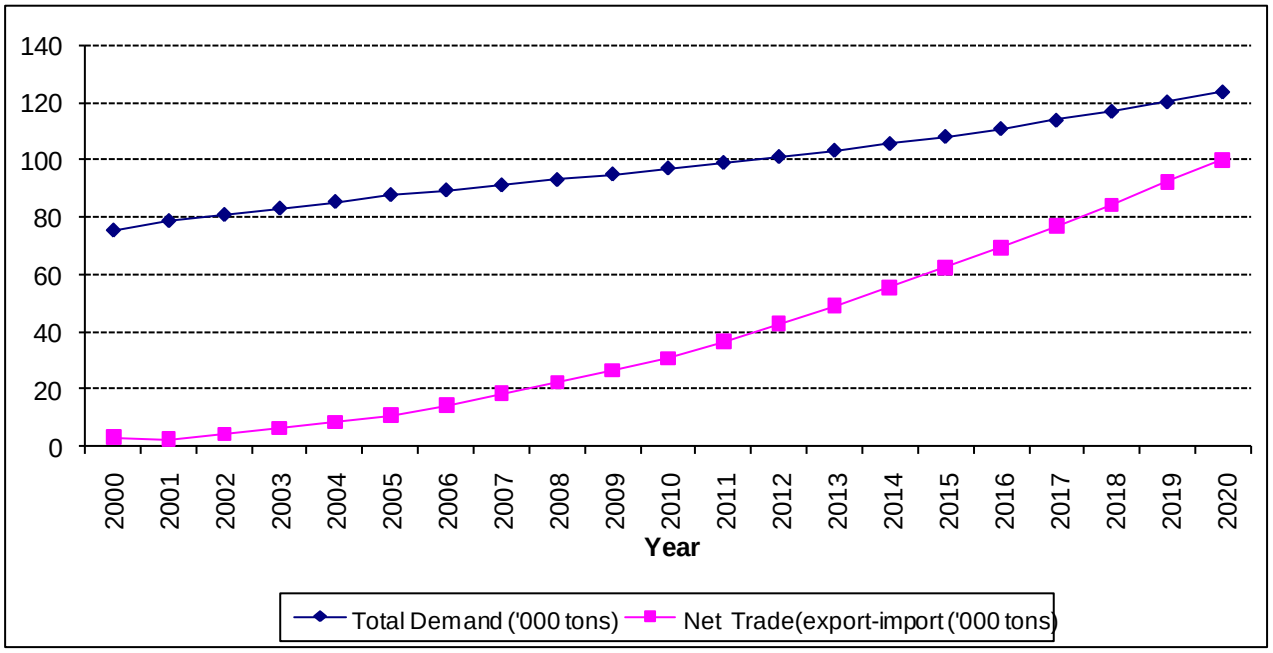


Figure 12: Pigeonpea demand and net-trade projections (from IMPACT model) for Malawi (2000-2020)

Appendix

Appendix 1: .Improved pigeonpea varieties released in Malawi

Year of release	Variety name	Yield potential (t/ha) – sole cropping		Type	Economically important traits			Agronomic traits		
					Color	Seed mass (g)	Grain Size in mm	duration	Pest resistance	Disease resistance
		On-station	On-farm							
1987	ICP 9145	2.0	1.0	Grain type	Cream speckled brown	16.3	7	Long duration	Moderate	Wilt resistant
2000	ICEAP 00040	3.2	1.3	Grain type	Cream	20.5	8	Long duration	Tolerant	Wilt resistant
2003	ICPL 93027	2.0	1	Grain & Vegetable type	Cream speckled brown	13.1	6	Short duration	Susceptible	Susceptible to wilt
2003	ICPL 87105	2.0	1	Grain & Vegetable type	Brown	12.0	5	Short duration	susceptible	Tolerant to wilt

Source: ICRISAT

Appendix 2: Distribution of area under pigeonpea production in Malawi.