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Constraints and Opportunities to Expanding Legume Production: An Institutional and Economic Analysis Of the Legume Seed Sector in Malawi.

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Major professor

Date January 28, 1999

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CONSTRAINTS AND OPPORTUNITIES TO EXPANDING LEGUME PRODUCTION: AN INSTITUTIONAL AND ECONOMIC ANALYSIS OF THE LEGUME SEED SECTOR IN MALAWI

By

Patrick Sawasawa Kambewa

A DISSERTATION

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ABSTRACT

CONSTRAINTS AND OPPORTUNITIES TO EXPANDING LEGUME PRODUCTION: AN INSTITUTIONAL AND ECONOMIC ANALYSIS OF THE LEGUME SEED SECTOR IN MALAWI

By

Patrick Sawasawa Kambewa

Agricultural scientists in Malawi have identified a decline in soil fertility as a leading cause of decreasing smallholder productivity. Since most farmers can not afford to buy inorganic fertilizers, farmers are being encouraged to plant legumes in order to sustain agricultural productivity. Recent studies showed a lack of seed as a major constraint to increasing legume production. In order to redress the seed shortage, in the early 1990s several NGOs established smallholder seed multiplication schemes in Malawi. This study was conducted to analyze the smallholder seed multiplication schemes in Malawi.

An institutional analysis was conducted among seven smallholder seed schemes to determine their effectiveness in meeting farmers' seed needs. An economic analysis also was conducted to determine the profitability of producing both seed and grain from modern varieties, using the profitability of growing a traditional variety as a basis of comparison.

Two types of seed schemes were studied. Some schemes provided seed to farmers with an objective of alleviating seed insecurity. Others aimed at training farmers to become

seed producers and sellers. The former group involved many farmers (>2,000 farmers per scheme), who each received a small amount of seed (2 to 5 kg), the focus was on producing ordinary farmers' seed. The later group was composed of fewer farmers (<100 per scheme), who each receiving about 40 kg of seed and produced certified or quality-declared seed mainly for sale.

Most schemes were able to produce seed, few schemes assisted farmers in marketing their seed crop. Most participants, particularly farmers participating in the commercial schemes, regarded this as a major weakness of the schemes--especially the farmers who used more inputs to produce seed than they would have used to produce grain. All of the seed multiplication schemes were subsidized, which makes their long-term sustainability uncertain. Furthermore, most schemes worked in isolation. Competition among the schemes as well as duplication of efforts were noted. In some cases, NGOs worked independently of the Ministry of Agriculture and Irrigation, therefore did not benefit from the Ministry's expertise in seed production.

The economic analysis showed that it was profitable for farmers to produce both seed and grain from modern varieties, when planting in a monoculture and applying fertilizer. The break-even yield for modern varieties was higher than the observed yield of the traditional variety and the break-even price of seed and grain for modern variety was lower than the grain price for selling a traditional variety. These results suggest that it is more profitable for farmers to grow modern varieties than to grow traditional varieties. However, storing seed to sell three months later was not an economically attractive option.

DEDICATION

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I would like sincerely to thank my major advisor, Professor Richard Bernsten for his guidance designing this study and analyzing the data. I benefitted greatly from his experience in conducting research and from his insistence on carrying out quality work at every stage of the process. Also, I acknowledge the ideas and guidance of the other members of my committee--Professors Anne Ferguson, Eric Crawford, and Russell Freed-- who patiently but diligently guided me through this work in their respective areas of expertise. While writing this thesis, I benefitted from the assistance provided by my fellow students in the Department of Agricultural Economics, freely shared their computer and analytical skills, helped me with data analysis, and helped me to focus my research on the key issues. . Specifically, I would like to thank Dr. Mywish Maredia, Dr. Georges Dimithe, and Dr. Bernard Kupfuma (all former students in the Department of Agricultural Economics), Mr. Gerald Nyambane (currently a student in Agricultural Economics), and Dr. Peter Jeranyama (Department of Crops and Soil Science).

I would like to thank the Bean/Cowpea Collaborative Research Support Program (a USAID-funded project) fully supporting me with a scholarship during the time I was taking course work and for partially funding this research. Furthermore, I would like to thank Dr. Barnes-McConnell, Mrs. Suzanne Bengry, Mrs. M. Moryc from the Bean/Cowpea CRSP's Management Office for all the support they gave me during the period I was studying at Michigan State University. Their support especially logistic support was crucial to my finishing this program. I would like to thank the Rockefeller

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Foundation for funding the field work for this dissertation through the Rockefeller African Pre-dissertation Internship Fellowship. Conducting my fieldwork in Malawi was an extremely worthwhile experience and crucial to my intellectual development. Also, I would like to thank Mrs. Melba Lacey, from the Institute of International Agriculture and Mr. Barry Crassweller from the Office of Women in International Development Program for their assistance during the six years I was at Michigan State University. To my host-family, Anne and Merritt, I thank them for the many evenings and a few parties the hosted on my account. Watching football with the two was always fun with all its challenges.

In Malawi, I would like to acknowledge the assistance provided by the Bean/Cowpea CRSP at Bunda College in Malawi for logistical support and for providing some of the data I used for the economic analysis. Specifically, I would like to thank Dr. A. B. C. Mkandawire, the Director of the project, for facilitating much of my field support and advising me through his expertise in smallholder bean production in Malawi. In addition, I thank Miss Angela Nyirenda and Mr. Jonathan Chautsi for the help they gave me, especially in facilitating communication with my family via E-mail. Finally, I thank Dr. Richard Mkandawire, my mentor, for 'persuading' me to leave my previous job with Lever Brothers (Malawi) Limited to pursue a Ph.D. at Michigan State University. That two year break that I was supposed to take grew out of proportion to my delight.

I would also like to acknowledge the assistance provided by Mr. Chimwaza, of the Famine and Early Warning Systems (FEWS) Malawi office and the Ministry of Agriculture and

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Irrigation (Malawi Government), both of whom gave me data that I used in this study..

During the period I was carrying out this research, I benefitted much from the experience of several officials from the Ministry of Agriculture and Irrigation, including Dr. Jeffrey Luhanga, former Director of Chitedze Agricultural Research Station, Mr. Francis Maideni of Chitedze Agricultural Research Station, and Mr. Dan Kamputa from the Ministry of Agriculture and Irrigation Headquarters, who all contributed significantly toward my understanding of the history of smallholder seed multiplication schemes in Malawi. Also, I benefitted from the experience of officials from the NGOs included in the study. These included Messrs. Banda and Mapulanga from the Christian Service Committee, Dr. Elizabeth Sibale from the European Delegation office in Lilongwe, Messrs Banda and of Concern Universal, Messrs. Musopole, Ntonda and Mikana of ActionAid Seed Multiplication and Environmental Project, and Messrs. Mughogho, Chabwera and Mphyiphyira of ActionAid RDP at Dowa, Mr Mwage and Mr Malunga of Naming'azi Farm in Zomba. Their assistance and guidance made my work easier and more enjoyable in spite of the other challenges I faced. The National Bean Improvement Program at Chitedze allowed me to study their bean seed multiplication scheme and also gave me access to their data on smallholder seed farmers' survey. Therefore, I am grateful to Dr. Vas Aggarwal, Dr. Roland Chirwa and Mrs. Martha Maideni for their support.

I am indebted to the smallholder farmers I whom interviewed for this study. They were the ultimate producers of seed and therefore contributed greatly to my understanding.

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I would like to thank the University of Malawi for hosting me during the time I was conducting y field research and for allowing me to use the University facilities, especially E-mail. I appreciate the assistance that the Library officials at Bunda College of Agriculture gave me in this regard, as this enabled me constantly to keep in touch with my dissertation advisor, Dr. Bernsten. My host-country supervisor, Dr. Mataya accommodated me in his otherwise full schedule and was always helpful when I ran into logistical problems--I am most grateful for his efforts.

When I went to Malawi to carry out this study in march 1996, my family and I were in a serious auto-accident on April 14. I am thankful for the support we received from our family and friends, officials from the Lilongwe Central Hospital and the Garden City Clinic in South Africa during that period. I am especially thankful to my 'good Samaritan', Mr. Ngayaye who graciously gave us transport to the hospital when everybody at the site of accident refused to help. I acknowledge the assistance I received from the Rockefeller Foundation in meeting the medical evacuation costs to South Africa and Drs. Ferguson and Bernsten with the CRSP Management Office for deligently working hard towards my getting the best treatment. Without their hard work, I could not be able to hide my limping which is sometimes barely discernible.

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Finally, I would like to thank my wife, Beauty, who has had the sole burden of raising our four children in Malawi while I was pursuing studies at Michigan State University. I am thankful for her patience. To my children Eggrey Nabiyeni, Mpambira Baba, Patricia Phikinini, and Beauty 'Juniorate', I am grateful for the sacrifice they were forced to undergo while I was pursuing my studies. Lastly, I salute all friends who helped us during the past eight years when I left my family in pursuant of this dream. Specifically, I would like to mention the Kambewas of Lilongwe, Ambalis of Zomba and Blantyre, and the Kapitos of Blantyre. Their efforts contributed a lot towards my achieving this goal.

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CHAPTER ONE

INTRODUCTION

1.0 Problem Statement

Faced with widespread malnutrition, a rapidly growing population, and little or no available uncultivated land, Malawi needs to increase crop yields in order to supply the future food needs of its population. The declining soil fertility is widely recognized as an important limitation to increasing yields, and a major threat to the sustainability of the maize-based systems of Southern and Eastern Africa (Kumwenda *et al.*, 1995).

Many experts believe that expanded legume production can make a major contribution to Malawi's efforts to reduce malnutrition and achieve sustainable agricultural development. Not only do legumes contribute to soil fertility, but in addition they are a potentially lucrative cash crop for smallholder farmers, a relatively inexpensive source of protein, and a potential foreign exchange earner (as an export crop) for the nation.

However, many experts argue that a shortage of supply of legume seed and inadequate farmer access to available seed are significant constraints to expanding production and improving food security (Ferguson *et al.*, 1991; Cromwell, *et al.*, 1994). First, due to the seed shortage, smallholders' crop diversification options are reduced, which restricts the expansion of legume production. Second, lower production reduces the availability and increases price of legumes, an important source of dietary protein for low income of legumes

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Since the late 1980s, Malawi's Ministry of Agriculture and Irrigation and various Non-Governmental Organizations (NGO) have attempted to establish legume seed multiplication programs to increase the supply of legume seed. However, these schemes have experienced many problems and may not be economically sustainable in the long run. The purpose of this study is to identify technical, institutional, and economic factors that impact on the performance of small- and medium-size enterprises producing basic, certified, and artisanal-quality legume seed. More specifically, the study analyzes factors influencing the supply of and demand for legume seed, examines the economic sustainability of existing seed multiplication schemes run by the Ministry of Agriculture and Irrigation and various NGOs, and identifies institutional factors which currently constrain (or promote) the development of private sector seed enterprises in Malawi. Finally, the study recommends policies needed to insure an adequate supply of legume seed in the future.

1.1 Background

As Malawi moves into the 21st century, the country faces an uncertain future. With over 85 percent of Malawians living in rural areas and 90 percent of these households engaged in farming, most of the population is dependent on agriculture (World Bank, 1994). Despite progress in increasing maize production, the rate of population growth has exceeded th

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exceeded the rate of increase in agricultural production. For example, Sahn *et al.* (1990) report that per capita food production declined from 245 kg in 1976/77 to 193 kg in 1987/88. Recent studies indicate that malnutrition in Malawi is high, even by sub-Saharan standards. Stunting in children two to five years old is estimated at 61 percent, compared to an average of 39 percent for Sub-Saharan Africa; and stunting is higher in Malawi than in any country in Africa for which data are available, except Burkina Faso (World Bank, 1994).

Malawi has a limited capacity to increase agricultural production by expanding its cultivated area. With one of the highest population growth rates in sub-Saharan Africa (3.3 percent per year), the country's population density is increasing rapidly[1]. Average farm size has been declining at an average annual rate of 2 percent over the past decade (UNDP, 1991). Today, over one-half of the households (55 percent) have landholding of 1 hectare or less. Due to declining maize yields, smallholder households who cultivate between 0.50 to less than one hectare of traditional maize [2] are not able to produce enough grain to meet their food needs (World Bank, 1993).

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[1] While Malawi's population density averages 85 persons per square km of arable land (1995), about 50 percent of the population lives in southern Malawi.

[2]A staple food, maize mainly is produced by smallholder farmers (90%) on roughly 1.3 million hectares, 80 percent of the cultivated land in Malawi. The maize varieties planted are of local varieties (86%), composites (2%) and hybrids (12%).

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While Heisey *et al.* (1995) reported that improved maize technology has increased maize yield by 0.4 percent per annum over the past year, this rate of growth is insufficient to meet the expanding demand due to rapid population growth. Agriculture experts are increasingly concerned that the sustainability of Malawi's food production system is being threatened by intensive land use, with insufficient attention being paid to maintaining soil fertility (Kumwenda *et al.*, 1996)

1.1.1 Malawi's Fertilizer-Based Agricultural Intensification Strategy

Many countries, especially in Asia, have successfully increased food production by expanding their irrigated area, developing high-yielding varieties, and encouraging farmers to apply high rates of inorganic fertilizer. Historically, Malawi has also sought to increase maize yields by encouraging smallholder farmers to apply inorganic fertilizers.

Since most small farmers cannot afford to purchase fertilizer[3], the Government established the Smallholder Agricultural Credit Administration (SACA) in 1987/88 with funds provided by IDA and IFAD in an effort to expand access to credit. While loan repayment averaged 80 percent in the 1980s, SACA collapsed in the early 1990s for at least four reasons. First, transport costs increased following the closure of traditionally less expensive routes through Mozambique during the civil war. Second, following the 1991/92 drought, which reduced crop yields, the recovery rates fell to 13 percent. Third,

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[3]Since late 1970s, about 75 percent of fertilizer and hybrid seed sales to smallholder farmers were financed by credit (Malawi Government, 1992).

in 1992/93, some political activists told credit recipients that they need not repay their loans since the Government had not paid for the loan capital. Finally, following the implementation of structural adjustment program, the price of fertilizer increased substantially, first after banks increased interest rates to 40 percent after the floating of the Malawi currency and then again in 1994/95 when the Government removed fertilizer subsidies.

Thus, both the collapse of the Government's credit scheme and the increase in fertilizer prices have made it increasingly unprofitable for farmers to apply inorganic fertilizer. For instance, Conroy *et al.* (1995) estimated that the value-cost ratio averaged 1.8 for hybrid maize and 1.3 for local varieties[4]. Recognizing that most farmers, especially poor and female-headed households, could not afford to apply fertilizer, in the mid-1990s, policy makers began exploring alternative strategies for increasing, or at least sustaining staple food production in order to insure household food security.

1.1.2 The Role of Legumes and Cultural Practices in Maintaining Soil Fertility

Traditionally, Malawian farmers have maintained soil fertility through long fallows and crop rotations. However, with increased population pressure, farmers have gradually abandoned these methods, due to the need to continuously crop their land to supply

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[4]Prices alone may not fully capture important factors influencing the profitability of fertilizer use. For example, HIID (1994) reported that improvements in fertilizer use efficiency could make fertilizer more economically attractive to farmers than changes in fertilizer or maize prices *per se*.

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household food needs. Because inorganic fertilizer is too expensive for most Malawi smallholders, greater attention must be paid to utilizing biological processes to maintain fertility, processes that optimize nutrient recycling and thereby minimize the need for external inputs (Sachez (1995).

Legumes represent a promising route for increasing soil organic matter (Kumwenda *et al.*,1995) and sustaining tropical agriculture at moderate levels of output, often at double the rate those currently achieved (Giller, 1994). Kumwenda (1995) reported that a maize-pigeon peas intercrop yielded 42 kg N/ha and 1,181 kg/ha of dry matter. Mkandawire *et al.* (1989) report that intercropping legumes with cereals improved soil fertility, especially in soils with low nitrogen availability. Thus, legume-based agricultural systems offer an alternative for maintaining and possibly improving soil fertility. Farmers are typically encouraged to plant maize after legumes (in rotation), as experiments have shown a yield advantage to growing maize after legumes such as groundnuts and pigeon peas, although they have different nitrogen fixing potentials (Brown, 1962, MacColl, 1989). In many countries, smallholder farmers are increasingly being encouraged to practice agro-forestry in order to reduced soil erosion and soil fertility degradation. However, given that most farmers in Malawi have less than one hectare of land, the use of crop rotation and agro-forestry to maintain soil fertility are not feasible. Thus, intercropping systems (*i.e.*, maize/pigeon peas, maize/beans, maize/soybeans) represent a potentially attractive alternative for improving soil fertility.

1.1.3 The Role of Legumes in Household Food Security

Legumes widely grown in Malawi include groundnuts, beans, cowpeas, pigeon peas, and, in recent years, soybeans. These crops contribute to Malawi household food security in three ways. First, they are a relatively inexpensive source of protein, compared to animal and fish protein. Second, in some areas of Malawi, legumes, (especially beans, soybeans and groundnuts) are major cash crops, --which households sell to generate income needed to purchase food and non-food items (Ferguson *et al.*, 1991). Finally, legumes enable farmers to diversify their cropping system and thereby better utilize their available labor resources and spread risk.

1.1.4 Constraints to Expanding Legume Production

For smallholders, access to high potential and high quality seed is especially important since most make very little use of other inputs such as fertilizer and pesticides. Recent studies have documented the existence of a legume "seed shortage"[5] which in recent years has been aggravated by drought. For example, Ferguson (1995) reported that when ActionAid, an NGO, first entered Malawi as a drought relief organization, it imported seed because it could not buy locally enough groundnut, pigeon pea, cowpea, or bean seed to supply farmers participating in its seed multiplication programs[6]. The Ministry of Agriculture and Irrigation estimates that only 16 percent of the potential demand for

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[5]For beans, see Duku, 1986; Ferguson *et al.*, 1991. For other legumes, see Cromwell, 1992; Wright *et al.*, 1991; Mphande *et al.*, 1994.

[6]Personal communication.

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improved bean seed is being met (ActionAid, 1994). Cromwell *et al.* (1992) argued that limited availability of improved seed is the main constraint to increasing smallholder bean production in Malawi. Similarly, Wright *et al.* (1991) reported a "shortage" of sorghum, beans, groundnuts and vegetable seed. Recognizing seed availability as a problem for smallholder farmers, an increasing number of international donors, including the European Delegation and the Overseas Development Administration, have provided technical assistance and financial support to Malawi's efforts to strengthen its seed production system.

1.2 Research Questions and Objectives

While scientists and policy-makers often refer to a "seed shortage" as a constraint to increased legume production, the nature of and reasons for the problem are unclear. The problem may be due to interrelated supply and demand factors, as reflected in the following research questions.

The Supply Side: Constraints to Seed Availability

- Why do farmers lack sufficient seed to supply their future planting requirements? To what extent is this due to inadequate storage facilities, insufficient production to both meet food and seed needs, and/or the need to sell legume grain at harvest due to cash constraints?

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- Are farmers unable to purchase seed in the market because it is not physically available or because they perceive it to be too expensive?

- Is seed not physically available because potential suppliers perceive a lack of demand and, as a result, have no incentive to supply it (*i.e.*, no profitable market prospects)?

- Is the price of seed "high" due to high costs of production, storage, distribution and/or risk?

- Do barriers exist that limit private participation in seed production and marketing, such as regulations, a shortage of market information, or inadequate access to foundation seed?

- Are economies of scale in production and distribution of smallholder seed multiplication not being achieved because of low and uncertain demand and/or institutional factors?

The Demand Side: Constraints to Farmer Access

- Are farmers unable to buy seed because they lack cash or access to credit?

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- Do farmers feel that the seasonally high, pre-planting seed price is too high, given their expected return on their investment?

- Do the available seed varieties have the characteristics desired by farmers; including preferred grain quality characteristics such as seed color, size, cooking attributes as well as agronomic traits such as disease, insect, and drought tolerances, days to maturity, grain and dry matter yield?

The general objectives of this study are to investigate the constraints to increasing legume seed production and to expanding farmers' access to (and use of) legume seed. Based on insights gained, possible interventions to relax the identified constraint are proposed, including institutional innovations which would serve to expand legume seed production and insure greater farmer access to legume seed.

The specific objectives of this study are to:

At the National Level:

- Document the national and regional trends in legume area, production, and yields.

- Describe the spatial distribution of the major legume crops, with respect to the agro-climatic environments where they are grown.

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- Document agricultural policies that have an impact on legume production and marketing; and the availability of and access to legume seed.

At the Seed Multiplication Scheme Level:

- Document the historical evolution (including institutional arrangements) of past and current legume seed production schemes.

- Identify the key factors that have affected the performance of formal legume seed multiplication schemes[7].

- Analyze the economic and institutional performance of the existing legume seed distribution channels.

- Identify new policies, procedures, and institutional arrangements which would encourage the development of small- and medium-scale legume seed production and marketing enterprises.

At the Farm Level:

- Identify smallholders' goals and objectives in cultivating legumes (*i.e.*, food security, diversification, cash, soil fertility maintenance).

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[7]Formal seed multiplication schemes include schemes run by the Government, NGOs, and private seed firms.

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- Determine what factors influence farmers' willingness and ability to store legume seed.

- Assess farmers' perception of the seed "shortage" problem, with respect to it being a problem of physical availability or access.

1.3 Summary and Thesis Organization

The dissertation is organized in the following manner. After introducing the research problem in the first Chapter, Chapter Two presents background information about Malawi and the role of agriculture in the economy. Chapter Three presents the literature review and conceptual framework related to smallholder seed multiplication schemes. Further, the research methodology and data collection approach are presented.

Chapter Four describes Malawi's legume sub-sector. It analyzes the performance of the legume sub-sector at the national level, concentrating on spatial and historical production analysis, seasonally and historical price analysis of beans, groundnuts and soybeans. Finally, Government policies affecting the subsector, especially the seed law is discussed.

Chapter Five presents the institutional framework used in analyzing the smallholder schemes. This is followed by an institutional analysis of the seven schemes that were studied. T

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studied. The analysis examines the strengths, weaknesses, opportunities, and threats of the various schemes in multiplying seed among smallholder farmers.

Chapter Six presents an economic analysis of seed multiplication. Specifically, the profitability of seed multiplication of new varieties is compared with grain growing of the traditional varieties. Also, the profitability of grain growing between the new varieties and that of the traditional varieties is compared.

Chapter Seven provides a summary of the study and offers policy recommendations, limitations, and research issues for further investigation.

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CHAPTER TWO

MALAWI: AN OVERVIEW

2.0 Topography and Climate

Malawi, a small country with an area of 119,140 square kilometers, occupies the southern part of the Rift Valley in East Africa. Located between 9° and 17° south of the Equator, the country is the size of Pennsylvania, with 20 percent of its area covered by water. Malawi is a land-locked country, bordered by Mozambique in the southeast, south and southwest, Zambia in the northwest and Tanzania in the northeast. The country's topography ranges from the rift valley floor (50 to 200 meters above sea level) to 3,000 meter high mountains. Its climate, vegetation and associated economic activities are therefore widely variable (Malawi Government, 1994).

Malawi consists of four agro-ecological zones (World Bank, 1993):

- The Shire Valley, hot and semi-arid, lies at 30-40 m above sea level and has a mean annual rainfall of 500-700 mm.
- The lakeshore plains, at 450-600 m, are warm-to-hot and have a mean annual rainfall of 750-1,000 mm.
- The medium-altitude plateau, covering 75 percent of the country, has an elevation of 800-1,350 m, mild-to-warm temperatures, and a mean annual rainfall of 750-1,000 mm.

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- o The high altitude plateaus ranging from 1,350 m to 3,000 m, are characterized by rolling hills as well as steep terrain, mild-to-cool temperatures, and a mean annual rainfall of 1,000- 2,000 mm.

2.1 Demographic Characteristics

Malawi's population is estimated at 11 million people, with an annual growth rate of 3.3 percent. About 85 percent of the population is rural-based. Over 80 percent of the total work force is employed in the smallholder agricultural subsector and 11 percent in the estate subsector (World Bank, 1993).

Since independence in 1964 until recently, the performance of the smallholder agricultural sector has been weak. During the 1980/91 period, the annual GDP growth rate averaged about 1.5 percent in the smallholder sector, compared to 9.4 percent in the estate sector. However, in 1996 GDP grew at a rate of 9.5 percent, small-scale agriculture grew at 39.8 percent, compared to only 1.1 percent in the estate sector. This rapid growth in the smallholder sector was mainly due to the liberalization of burley tobacco production which enabled many smallholder farmers to grow this crop (Malawi Government, 1997).

Thus, during most of the 1980s and 1990s, the agricultural growth rate has been substantially below the population growth rate (World Bank, 1993), which has contributed to rural stagnation and declining incomes for many households.

2.2 The Macro-Economy

After an impressive economic growth in the 1960 and 1970s, Malawi's economy began a steady decline in the mid-1970s. Falling world prices for the country's exports (*i.e.*, tobacco, tea, coffee and cotton), rising oil prices, and the civil war in Mozambique[8] simultaneously contributed to this decline. Between 1978 and 1981, Malawi's terms of trade fell by 28 percent. The situation was exacerbated by the 1980/81 drought, maturation of external debt, and rising interest rates. Consequently, Malawi experienced negative GDP growth rates during 1980 and 1981 (World Bank, 1993).

In 1981, to restore macroeconomic stability and growth, the Malawi Government launched a structural adjustment program with assistance from the World Bank and the International Monetary Fund (IMF). The program sought to establish policies which would enhance economic efficiency, including market liberalization, import liberalization, currency devaluation, changing from a fixed to a floating exchange rate system, downsizing the public subsector, liberalizing pricing policies, and removing agricultural inputs and output subsidies (Sahn *et al.*, 1990). By adopting these policies, it was envisaged that resource allocation would improve, thereby increasing economic efficiency--a prerequisite for economic growth. Between 1982 and 1985, the economy showed signs of recovery. The GDP grew at a rate of 4.1 percent, the trade balance became positive, and both the current account and budget deficits declined.

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[8]The civil war disrupted access to transport routes to the coast through Mozambique.

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However, in 1986 Malawi faced a large influx of refugees fleeing the civil war in Mozambique. Reaching a record high of 1 million, Malawi's refugee population became equal to about 10 percent of its indigenous population (Sahn *et al.*, 1990). Also, since the war led to closure of the traditional transport routes to the sea, transportation costs for Malawi's exports and imports increased, leading to a deterioration in the terms of trade. As an exporter, higher transportation costs made the country's agricultural commodities less competitive on the world market. As an importer, Malawi had to pay higher transport costs than before. These events necessitated further macroeconomic policy changes, primarily successive currency devaluation.

During the 1990s, additional structural adjustment phases were implemented, including the removal of subsidies for agricultural input, *(i.e,* seed and fertilizer), deregulation of foreign currencies, and further market liberalization. Despite these measures, Malawi's economy did not substantially improve. While per capita GDP averaged US$ 240 (World Bank, 1993) in 1991, it has declined in recent years for two reasons. First, the droughts of 1992 and 1994 reduced agricultural output. Maize production fell from 1.6 million metric tones in 1990/91 to 0.7 million metric tones in 1991/92 (a 58 percent drop), leading to a decline in the GDP. Second, in 1992/93, foreign donors withheld non-humanitarian aid to Malawi, pending political changes. In the early 1990s about 80 percent of the smallholder households had incomes lower than MK 500 per adult equivalent per year (less than US$ 100 at 1993 exchange rates).

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In 1992 and 1993, although the value of imports still exceeded that of exports, the trade deficit improved from K786[9] million in 1992 to K539 million in 1993. However, this decline was not due to an increase in exports, but rather due to the scarcity of foreign exchange which reduced Malawi's capacity to import.

Despite devaluing its currency several times in the 1980s and 1990s, trade statistics indicate that the terms of trade have not improved. For example, in 1993, the unit value of imports rose by 15.3 percent while that of exports rose by 2.4 percent[10]. Using 1990 as the base year, the income terms of trade for 1993 was 78.8 percent. Thus, all things being equal, Malawi would have had to export more goods in 1993 to finance the same level of imports as in 1990.

Furthermore, Malawi's successive devaluations have contributed to high inflation. Using 1990 as the base year, the consumer price index rose to 520 percent in 1992, largely due to devaluation in 1992. In 1994 the exchange rate was changed from a fixed to a floating system. As a result, the currency value fell by 400 percent against the US dollar (*i.e.*, before devaluation, US$ 1 ≈ MK 3.5; after devaluation, US$ 1 ≈

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[9]Kwacha, Malawian currency.

[10]Tobacco, the country's main export commodity, accounted for 69.1 percent of export earnings in 1993. Other main exports were tea (11.5 percent), sugar (5.1 percent), coffee (2.6 percent), and other exports (10.6 percent) (Malawi Government, 1994). Because of the structure of exports, the economy is vulnerable mainly to shocks in the tobacco market.

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MK 15). Then, in 1995, the Malawi Government removed the subsidy on fertilizer (that averaged 15 percent of the selling price) and eliminated the consumer subsidy for maize. Although not yet documented, the removal of the maize subsidy will have a significant and negative impact on urban consumers and food deficit households. Similarly, the removal of the fertilizer subsidy will likely reduce input use, resulting in lower maize yields.

2.3 Contribution of Agriculture to the Economy

In 1996, agriculture accounted for 43 percent of Malawi's GDP and 86 percent of its export earnings (Malawi Government, 1997). Other major contributors were government services (13 percent), manufacturing (12 percent), and distribution (11 percent). Clearly, the general performance of the economy strongly depends on the performance of the agricultural sector. For example, whereas the 1992 drought caused the GDP growth rate to decline by 7.9 percent and good rains in 1993 caused the GDP to grow by 10.3 percent (Malawi Government, 1994). Overall, the agricultural sector has declined in recent years. For example, while the sector grew by 2 percent per annum in the 1980/90 period, it declined by 0.6 percent in the 1990/94 period.

2.4 Agriculture: Structure and Scope

Agriculture in Malawi is composed of an estate subsector and a smallholder subsector. While both subsectors are important, each makes a different contribution to the economy. The smallholder agriculture accounted for 79 percent of the agricultural

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GDP in 1993. In recent years, the estate subsector has accounted for 90 percent of agricultural exports (Malawi Government, 1994).

2.4.1 The Estate Subsector

The estate subsector, composed of 14,700 estates occupying 850,000 hectares, mainly grows export crops such as tobacco, tea, sugar, and coffee (Table 2.1)[11]. The estates are the primary producers of many cash crops and generate most of the country's foreign exchange. Unlike smallholders, estates sell their crops directly to international buyers at local auction markets. Until recently, smallholders were not allowed to grow certain estate crops, such as burley tobacco. Although smallholder farmers now can grow burley tobacco, in order to sell tobacco at the Auction Market, one needs to buy a quota in advance. This increases costs for most smallholder farmers. Therefore, most farmers prefer to sell their tobacco to intermediate buyers.

Estates acquire land through leasehold and freehold land tenure arrangements. Most are operated by local private companies such as the Press Farming and General Farming Companies, both subsidiaries of Press Corporation Limited. Press Farming Company grows burley tobacco while General Farming Company mainly grows flue-cured tobacco. Multinational companies also are involved in estate farming. The major ones are Dwangwa Sugar Corporation (sugar), the Sugar Corporation of Malawi

[11]Only one-third of land in this sector is under cultivation (Malawi Government/United Nations, 1992).

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(sugar), British Central African Limited (tea and coffee), and Lever Brothers Malawi Limited (tea). The sugar companies are owned by LONRHO Company which also manufactures sugar for local consumption and for export. In contrast, local estate owners mainly grow burley tobacco.

Table 2.1: Estate Crop Production, Malawi, 1982/83 through 1991/92.

Crop	Annual Production ('000 Mt)	
	1983	1984

Table 2.1: Estate Crop Production, Malawi, 1982/83 through 1991/92.

Crop	Annual Production ('000 Mt)										
	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	10-Year Average
Tobacco											
Flue	21,659	24,912	22,291	21,034	24,464	20,743	20,000	21,819	25,747	26,000[a]	22,866
Burley	41,537	29,979	30,372	30,190	36,789	45,544	61,212	64,019	75,013	118,000[a]	53,266
Sugar	175	150	144	164	166	174[a]	162[a]	189[a]	191[a]	244	176
Tea	32	37.5	39.9	39	31.9	40.1	39.5	38.9	40.5	[B]	38[c]

[a] Estimates; [B] Data not available; [C] 9-Year Average
Source: Malawi Government (1993), *Malawi Agricultural Statistics. 1993 Annual Bulletin'*. Pages 31, 33, 36.

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2.4.2 The Smallholder Subsector

The smallholder subsector is characterized by small farmers cultivating food crops under customary land tenure (Sahn *et al.*, 1990). Many smallholder farmers market part of their produce to meet their cash needs. They primarily grow maize, tobacco[12], cassava, and sweet potatoes (Table 2.2). Whereas there exist smallholder schemes for cash crops like flue-cured tobacco, sugar, tea and coffee[13], participation is highly location-specific. One major constraint facing smallholders is the size of their landholdings, which, according to a National Sample Survey of Agriculture, averaged 1.17 hectares per smallholder household in 1980/81 (Malawi Government, 1984) and is steadily declining. Also, land under permanent pasture declined from 35 percent of total area in 1980 to 20 percent of total area in 1993. This indicates that land pressure among smallholder farmers has caused some farmers to encroach on land previously reserved for pasture.

2.4.2.1 Farm Size Classes

The Malawi Government (1994) classifies smallholder farmers into three categories: the 35 percent with less than 0.7 hectares, who cannot satisfy their subsistence food requirements with existing technologies; the 40 percent with landholdings between 0.7

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[12]This includes three types of tobacco previously grown by smallholders; dark-fired tobacco, sun-air-cured tobacco and Turkish tobacco.

[13]Parastatal organizations organize these farmers in order to produce and market these export crops.

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and 1.5 hectares who, using modern technology, can normally satisfy their subsistence requirements as well as have a potential for modest crop sales in good rainfall years; and the remaining 25 percent who are relatively land-rich, with landholdings of 1.5 hectares or greater. This last group typically plants their fields to both food and cash crops.

Crops	Annual Production ('000 Mts)									
	1984	1985	1986	1987	1988	1989	1990	1991	1992[a]	10 Year Avera

Table 2.2: Smallholder Production of Cash Crops, Malawi, 1983/84 through 1991/92

Crops	Annual Production ('000 Mts)									
	1984	1985	1986	1987	1988	1989	1990	1991	1992[b]	10 Year Average
Cotton[a]	56	59	36	32	47	33	[d]	[d]	[d]	26
Tobacco										
Fire-cured	16,165[d]	18,680[d]	11,362[d]	10,056[d]	7,987[d]	4,715[d]	14,001[d]	15,735[d]	12,523[cd]	11,122
Sun-Air-cured	1,939[d]	1,870[d]	954[d]	981[d]	560[d]	372[d]	1,396[d]	2,023[d]	2,084[cd]	1,218
Turkish	334[d]	129[d]	121[d]	97[d]	161[d]	280[d]	168[d]	515[d]	515[cd]	232
Sugar	9	9	9	8	8	9	9	8	10	8
Tea	8	10	13	11	10	13	14	14[c]	14[c]	11

[a] Ginned bales; [b] Production was low this year because of the drought in the 1991/92 season; [c] Estimates; [d] Data not available
Source: Malawi Government (1993), *Malawi Agricultural Statistics Annual Bulletin*. Pages 29 to 30, 33 and 36.

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2.4.2.2 Food Crop Production

Maize, the staple food for more than 80 percent of Malawi's population, accounts for about 70 percent of the cultivated customary lands under smallholder agriculture. Approximately 90 percent of the country's maize is produced by smallholders and 10 percent by the estate subsector (World Bank, 1993). While hybrid maize has been grown in Malawi for many years, 86 percent of the maize crop is still planted to local varieties, 2 percent to composite varieties, and only 12 percent to improved hybrids (World Bank, 1993). To date, low adoption rates for improved hybrids are attributed to the poor storage and processing characteristics of the earlier dent hybrids (Conroy, 1993). Traditionally-grown flint varieties have endorsperms which contain a high proportion of 'hard starch', while dent varieties have mainly soft starch (Kydd, 1989). These characteristics give flint varieties better storage and pounding properties than dent varieties. However, the new semi-flint hybrids (MH 17 and MH 18), released in 1992, are expected to better match farmer preferences.

Cassava and sweet potatoes are the second and third most important food crops (by area) produced in Malawi. In some locations, specific crops are grown especially intensively. For example, farmers bordering Lake Malawi grow cassava and rice as their main food crops. Similarly, groundnuts are grown in the mid-to-upper altitude areas, although in recent years groundnut production has declined. Since food crops are grown entirely under rain-fed conditions, they are extremely vulnerable to the weather.

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2.4.2.3 Smallholder Input Use and Credit

The overwhelming majority of smallholders use little or no purchased inputs (*i.e.*, fertilizer, insecticide, herbicide, or improved seed). In 1989/90, smallholders applied an average of 23 kg of plant nutrients per hectare of arable land, compared to 48 kg/ha in Kenya and 60 kg/ha in Zimbabwe. Furthermore, within the smallholder sector, input use is highly skewed. Typically, larger farmers on customary land apply far more fertilizer than the smallholders who cultivate the smallest holdings (Conroy, 1993).

Finally, most smallholders either do not have access to credit or choose not to use it. In the late 1980s only about 25 percent-30 percent of the smallholder farmers participated in the Government's formal credit program that provided participants in-kind credit consisting of fertilizer, seeds and chemicals (Conroy, 1993). However, because the farmers did not repay their loan, the Smallholder Agricultural Credit Administration (SACA) collapsed in 1992. Although it has since been replaced by the Malawi Rural Finance Company, this company charges commercial interest rates for its loans and in some cases, it has not been willing to offer loans to farmers growing maize as it is regarded as a high risk activity. Since the majority of the farmers cannot afford to buy fertilizer, some scientists argue that greater use of legumes to help maintain soil fertility is an attractive option. The next section presents a history of the seed sector in Malawi with special emphasis on smallholder seed multiplication schemes.

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2.5 Malawi's Seed Sector[14]

Overview

In Malawi, the seed sector development has undergone three phases. First, from the early 1960s to the mid-1970s, the Government emphasized the development of the commercial seed production, second, in 1986, the Government introduced a smallholder seed multiplication scheme with the goal of providing seeds for self-pollinated crops such as groundnuts and beans which the commercial sector did not produce. Third, in the early 1990, recognizing that smallholders did not have sufficient access to seed, non-governmental organizations started playing an active role in seed multiplication and distribution among smallholder farmers.

2.5.1 The Formal Seed Sector in Malawi

Government production and distribution of seed started in 1959 with the release of the first local maize hybrid, LH7[15]. Subsequently, seeds of other crops such as groundnuts, rice, and cotton were multiplied and distributed by the extension service. Under these programs, seed was either given free of charge or in exchange for the farmers' seed. In 1968, a formal seed program for maize and groundnuts was initiated by government in Lilongwe and at Bvumbwe with plant breeders given responsibility for multiplying seed. Beginning in 1971, seed was sold at economic prices and in

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[14]This section is based on Cromwell *et al.*, (1993) unless otherwise indicated.

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1973, a proposal was drawn up to create a national seeds program which would integrate all activities related to seed multiplication and distribution. A parastatal, ADMARC[16] was given the responsibility for producing both certified maize and groundnuts seed, while smallholder farmers were recruited to multiply groundnuts to "approved" status[17].

2.5.2 The National Seed Company of Malawi

In 1978, in addition to maize and groundnuts seed multiplication, ADMARC began multiplying certified seed for several crops, including beans, sunflower, grasses, pasture legumes, and tobacco. In the same year, the Ministry of Agriculture and Irrigation launched the National Rural Development Program (an integrated rural development program) which increased the demand for seed. To meet the increased demand, in 1979 the National Seed Company of Malawi (NSCM) was established as a seed production unit of ADMARC, responsible for producing maize and horticultural seed. While the Commonwealth Development Corporation had a controlling share in the company, other key players included the Department of Agricultural Research, supplying the breeder seed; the Variety Release Committee, responsible for releasing

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[16]ADMARC is an abbreviation for Agricultural Development and Marketing Corporation, a Government parastatal responsible for marketing agricultural produce and inputs.

[17]Approved seed also is known as "quality declared seed" or "artisan seed." While this seed is produced following all recommendations for seed growing it does not pass through the strict standards required for official seed certification.

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new varieties; the Seed Technology Unit (now called the Seed Services Unit), charged with the responsibility of inspecting seed crop and testing of seed; the NSCM, responsible for producing the seed and packaging; and ADMARC, responsible for seed distribution.

Maize Seed

The NSCM produced the foundation seed, which they later distributed for further multiplication to 60 contract growers under the supervision of the company's staff and government inspectors. The company cleaned, graded and treated the seed at its processing plant in Lilongwe.

In 1978, the Department of Agricultural Research developed a dent hybrid MH12[18] using inbred lines from SR52[19] from Zimbabwe. However, this hybrid had poor storage and pounding characteristics. In 1985, the Department of Agricultural Research released MH15 (dent variety) and MH16 (semi-dent variety), using inbred lines from South Africa and local materials. Also in the same year, two flint varieties Chitedze Composite C (CCC) and Chitedze Composite D (CCD) were released, using local materials and materials from CIMMYT, IITA and South Africa.

[18]MH is an abbreviation for Malawi hybrid.

[19]SR is an abbreviation for Southern Rhodesia.

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Starting in 1986, the Government changed its breeding strategy from developing dent hybrids to developing flints. As a result, the Government released MH17 and MH18 maize in 1990. As flints were more acceptable to farmers than dents, the area under hybrids increased from 7 percent in 1988 to 24 percent in 1992 (Smale, 1995). However, the NSCM failed to meet the demand for maize seed as it could not recruit enough contract farmers to grow maize seed. In most cases, because the maize seed crop competed with tobacco crop, most farmers tended to neglect their maize crop in favor of tobacco, leading to the disqualification of much of the crop.

Bean Seed

In 1981, the NSCM expanded its seed production activities to producing certified seed of released bean varieties (Nasaka and Kamzama) and Canadian Wonder for the export market. However, as new bean seed varieties became available the NSCM chose not to multiply them, arguing that the bean researchers at Bunda College of Agriculture did not provide enough parental material and there was no domestic demand for bean seed.

In 1988, Cargill bought a controlling share of the NSCM[20]. As a subsidiary of Cargill, NSCM was transformed from a seed producing unit of ADMARC to a profit-driven company and focused on producing maize, tobacco and vegetable seeds. Currently,

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[20]The name of the company changed from National Seed Company of Malawi (NSCM) to National Seed, Cotton and Milling (NSCM).

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Cargill's central maize breeding program is based in Zimbabwe and carries out adaptive research in Malawi.

2.5.3 Lever Brothers (Malawi) Limited

In 1991, Lever Brothers (Malawi) Limited started producing hybrid sunflower seed in order to encourage farmers to grow sunflowers which they could use as an alternative raw material for producing vegetable cooking oil. In 1992, Lever Brothers started producing hybrid maize seed to make their seed business more commercially viable. They produced hybrid maize seed (MH17 and MH18 varieties) under the brand name *Chokonoka*, which means poundable. Being an established multinational, Lever Brothers used its nationwide distribution network to sell its seed. Also, it linked with Plant Breeding Institute (PBI) Cambridge to acquire plant and equipment, germplasm and finance to establish a seed business in Malawi, and also established production and marketing agreements with Pannar-Saffola of South Africa to multiply and distribute the latter's proprietary brands in Malawi. Subsequently, Pannar Seed Company bought Lever Brothers' seed enterprise (hybrid maize seed and hybrid sunflower seed). Like the NSCM, Pannar uses contract farmers to multiply their seed and sells it through ADMARC, super stores, and other retail shops. However, unlike NSCM, Pannar has access to Lever Brothers national distribution network.

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2.6 Smallholder Seed Multiplication Schemes

Since the formal seed sector has largely ignored self-pollinated cereals and legumes, smallholders continue to obtain legume seed through informal channels *i.e.*, own stocks, relatives, neighbors and local market (Ferguson *et al.*, 1991.) Being informal, the organization of traditional seed distribution varies between locations and changes over time, causing uncertainty in the system (Cromwell *et al.*, 1993). Sperling *et. al.*, (1994) noted that traditional methods of seed diffusion are slow. Since farmers tend to plant new varieties on small pieces of land, widespread distribution is delayed. In addition, the circle of distribution is socially narrow, being restricted to friends, relatives and neighbors.

In 1986, the Ministry of Agriculture and Irrigation launched a Smallholder Seed Development Scheme (SSMS). The objective was to produce a low cost, high quality improved seed of self-pollinated crops for smallholder farmers, especially for crops which the commercial sector did not produce. The scheme was designed to decentralize seed production, and encourage each Agricultural Development Division (ADD[21]) to be self-sufficient in producing improved seeds of acceptable quality for farmers in the area. Under the SSMS, farmers have multiplied seeds for groundnuts,

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[21]Malawi is divided into eight Agricultural Development Divisions which are units of administration of Agricultural Extension and Training Services to smallholder farmers. In turn the ADDs are divided into Rural Development Projects (RDP) which are subdivided into Extension Planning Areas (EPA), the smallest unit of administration.

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The SSMS's groundnuts seed scheme was unsuccessful because the price Government offered farmers for their seed was low, compared to the grain price. For example, after market liberalization in the 1988/89 agricultural season, farmers in Mzuzu ADD sold their seed as grain to private traders who offered a higher price than the prices the schemes could pay. In addition, the schemes were late in buying the produce.

In 1987, as part of the SSMS, the National Bean Program at Bunda College started distributing bean seed to smallholder farmers for multiplication. Initially, seed multiplication was carried out in Mzuzu ADD, but in 1990/91, the effort was extended to Kasungu, Lilongwe, Shire Valley and Blantyre ADDs. All beans produced were sold to ADMARC to be distributed in the following year's seed multiplication program.

As noted previously, the SSMS's pricing policies encouraged farmers to sell their produce as grain rather than seed. Another weakness was farmers' low awareness of the scheme and of the varieties it multiplied. In addition, even where there was awareness, it was not financially attractive for farmers to buy the improved seed as their yield advantage over the traditional varieties was not obvious.

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Given these weaknesses, the SSMS model could not survive changes in the economic environment including market liberalization, price liberalization, and reduced funding for research and extension. As a result of reduced Government funding, SSMS's lacked funding to provide logistical support and purchase seed from farmers. Therefore, although SSMS has continued its activities in some ADDs, it has failed to expand its activities.

The most recent development in smallholder seed multiplication schemes in Malawi came as a result of the 1990/91 drought. Since the drought, the Government has permitted NGOs to participate in smallholder seed multiplication projects the commercial seed production. Initially, a few NGOs (*i.e.*, Christian Service Committee and ActionAid) provided seed as part of relief to the drought-stricken farming households. Another NGO, Concern Universal was initially providing relief to Mozambican refugees. After the return of the refugees, these NGO started relief operations to Malawians. Although these were supposed to be short-term programs, some NGOs have turned these relief operations into full-fledged seed multiplication programs. For example, in 1992, ActionAid bought maize from the local market and distributed it as seed to drought affected areas. After the 1994 drought, ActionAid again distributed seed to smallholder farmers. Criticized for distributing grain as seed, ActionAid launched a seed multiplication program under the Malawi Smallholder Seed Development Program, with funding from the Department of International Development (UK). More recently (1995/96), the European Delegation imported seed (maize, b

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(maize, beans, soybeans, sorghum, pigeon peas, cowpeas, and sunflower) from neighboring countries including Zambia, Zimbabwe and Mozambique. The seed was distributed to smallholder farmers through NGOs including ActionAid, Christian Service Committee and Concern Universal.

Today, large smallholder seed multiplication schemes in Malawi are organized by several international NGOs, including ActionAid (Malawi Smallholder Seed Development Project), Christian Service Committee, Concern Universal, Save the Children Federation (USA), World Vision International, International Eye Foundation and Self-Help Development International. Luhanga (1997) reported that in 1996, over 10 NGOs invested over US $5 million in seed programs in Malawi.

In an effort to establish smallholder seed production on a more commercial footing, in the 1996/97 growing season, the Ministry of Agriculture and Irrigation, in collaboration with the European Delegation started a program to train smallholder farmers as seed entrepreneurs.

2.7 Current Seed Policy Environment

In 1993, the Government formally introduced policy reforms to allow the licensing of new seed companies, removed seed subsidies, and provided tax credits for private sector investment in the seed sector. These reforms were intended to increase competition among the seed producers which would be to the advantage of the farmers.

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Also, the Government introduced plant breeders' rights and provision for royalties to be collected for Government-bred varieties and hybrids to help defray the costs of research. While seed certification is required for hybrid maize and tobacco, it is optional for the other crops. In 1995, the Ministry changed its variety release procedures to allow for the release of privately-tested hybrids and varieties, as required when Malawi applied for membership in UPOV[22] and OECD[23] (Rusike, 1995). In 1996, the Government amended the Seed Act, which among other things, stipulates that the Government will privatize seed-related services, (e.g., crop seed inspection and quality control) and has already deregulated seed imports and exports.

In this policy environment, the current seed multiplication schemes are run by the Department of Agricultural Research which is the source of foundation seed for new varieties to schemes, and the Seed Services Unit, which oversees quality control and seed certification services (where they are needed). In addition, the Department of Agricultural Extension and Training trains seed producers. The NGOs collaborate with these departments in implementing their seed multiplication programs.

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[22]UPOV is an abbreviation for International Union for the Protection of Plant Varieties which provides intellectual protection for plant varieties.

[23]OECD is an abbreviation for Organization for Economic Cooperation and Development.

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2.8 Summary

Malawi's economy is based primarily on agriculture, which accounts for 43 percent of the country's GDP and 86 percent of its export earnings. While the agricultural sector is composed of the smallholder and estate subsectors, the estate subsector is the main foreign exchange earner and the smallholder subsector provides the bulk of the country's food needs.

The smallholder sector is characterized by farmers who cultivate small landholdings, mainly growing food crops for their own consumption and selling their surpluses. Only a small proportion of smallholders use purchased inputs. Before the collapse of the Government's credit scheme, no more than 30 percent of smallholders participated in it. Smallholders grow mainly maize, cassava, potatoes and legumes. Beans are the most widely grown legume among smallholder farmers.

Most farmers plant their own seed, or obtain seed though the informal system. Malawi's formal seed sector has undergone major changes since the Government first became actively involved in seed multiplication in 1986. From initially having a sharehold in a monopoly seed company (NSCM), since 1978 it has opened the sector to competition, removed seed subsidies, expressed interest to privatize some quality control functions, and is now allowing the import of varieties from outside the country.

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The remainder of this study focuses on the legume seed subsector (beans, groundnuts and soybeans) in an attempt to identify ways to improve the performance of this subsector, and thereby increase the availability of protein to the population, especially the poor. However, primary focus will be given to beans because beans have been the major legume grown in Malawi since 1990. Also, the Bean/Cowpea CRSP[24] supported this study by co-sponsoring the field work and providing the author's scholarship for the Ph.D. Program.

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[24]CRSP, Collaborative Research Support Program is a USAID-funded research project between a U.S.A. institution and developing country institution with the aim of conducting research to improve agricultural productivity among smallholder farmers.

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CHAPTER THREE

LITERATURE REVIEW AND RESEARCH METHODS

3.0 Introduction

This chapter reviews literature relevant to analyzing the performance of smallholder seed multiplication schemes. The first section describes a stylized model of how a country's seed industry evolves as its agriculture develops. The second section reviews the experience of establishing seed in developing countries. The third section introduces the theory of induced innovation to illustrate how a country's state of development, including its seed industry, is a function of its resource endowment, cultural endowment, technology and institutions. The fourth section presents concepts which explain farmers' behavior, focusing on how transactions costs create both incentives and disincentives that affect the performance of the smallholder seed multiplication schemes. The final section discusses the factors affecting supply and demand of legume seed.

3.1 The Evolution of a Seed Industry

Douglas (1980) identifies four stages through which a country's seed industry evolves as its agriculture develops: the traditional stage, the emergence stage, the growth stage, and the maturity stage. In the early stage of agriculture development, farmers produce and save their own seed for the next season, and/or exchange seed with other farmers to gain access to desired varieties. As farmers become more market-oriented, the public research systems develop a capacity to generate foundation seed, and governments establish seed multipli

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multiplication schemes to produce improved varieties, the demand for improved varieties grows (*emergence stage)* and a few farmers begin to specialize in producing and marketing improved seed. As the demand for improved seed expands (*growth stage)*, private seed companies, who recognize the profit potential, invest in producing and marketing improved seed to supply the expanding demand. Finally, as demand for improved seed increases further (*mature stage)*, seed production and marketing evolves into a highly organized commercial system.

In analyzing the implications of this evolution, Douglas (1980) notes that as a country's seed system evolves from the *traditional* to the *mature stage*, transaction costs increase as farmers become increasingly dependent on modern transportation, information and storage systems in order to obtain seed. Therefore, as a country's seed system evolves, reducing transaction costs becomes increasingly important, if farmers are to have access to the seed at affordable prices. However, Douglas does not take into account the fact that with international trade, it is possible to obtain improved varieties by importing seed from another country, rather than establishing its own breeding program. Nonetheless, in such cases transaction costs will still arise, as farmers become increasingly dependent on transportation, information and storage systems.

While Douglas' model provides a useful description of the historical evolution of seed systems, he fails to note that farmers are far more dependent on the market to obtain seed for improved varieties of cross-pollinated crops (*e.g.*, hybrid maize) than for self-pollinated crops. While farmers must purchase hybrid seed annually, they can reuse improved seed of self-pollinating crops for several seasons before its quality deteriorates regarding contamination or seed-borne diseases.

3.2 Recent Experience in Seed Development in sub-Saharan Africa

To supply local demand for improved seed, the donor community has assisted many countries to establish large-scale parastatal seed corporations, technical laboratories, modern seed processing plants, and seed certification departments. FAO (1994) reports that about one-third of the countries in sub-Saharan Africa have established formal seed production and distribution facilities for major food crops. Despite these efforts, Almeikinders *et al.*, (1994) report that the formal seed sources account for no more than 10 percent of seed in developing countries. In most cases, these parastatal-run seed systems have proven to be inflexible, inefficient, and have neglected important crops (Srivastave and Jaffee, 1993). For example, in Rwanda (Sperling *et al.*, 1996), the seed programs produced varieties that did not reflect farmers' preferences. In addition, the seed programs typically failed to reach the majority of farmers who lived outside the high potential areas.

Faced with stagnating crop yields and mounting food deficits, Cromwell (1993) reports that many African countries have sought to restructure their seed sector, including The Gambia, Ghana, Mozambique, Nigeria, Tanzania, and Zambia. Groosman *et al.* (1988) report that in the period between 1972 and 1984, FAO supported Seed Improvement and

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Development Programs in 60 countries. In the 1980s, the World Bank funded 13 national seed projects and 100 seed-related projects. Similarly, during the past 30 years, the United States Agency for International Development (USAID) has supported seed projects in 57 countries. Typically, as a condition for receiving foreign aid, the donor community has required these countries to privatize their agricultural markets and national agricultural parastatals. In many countries, state-owned seed companies have been sold in order to increase efficiency and flexibility. For example, Rusike (1995) reports that in Malawi, Cargill bought a controlling share of the National Seed Company and similarly, Pioneer bought Zamseed in Zambia and Zimseed in Zimbabwe. While Malawi's state-owned company had previously been a monopoly, following privatization, the seed sector was opened to competition and, as a result, Lever Brothers started producing seed in 1991.

In addition, as the role of the state in providing agricultural services has declined, governments have allowed NGOs to assist in delivering agricultural services, including informal seed production and distribution. For the NGOs to succeed in exploiting the innovations in agricultural research, there was need for institutional innovation. The next section presents some theories and concepts which are important in explaining how institutional innovations can influence the transfer of technology, such as how seed multiplication schemes provide seed to smallholder farmers.

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3.3 Induced Innovation Theory

Hayami's and Ruttan's "induced technical and institutional innovation" model (1985) provides a theoretical framework for identifying key variables that affect the performance of the legume seed sector in Malawi. Their "induced innovation" model hypothesizes that at a given point in time, a country's state of development is determined by its resource endowment, cultural endowment, technology, and institutions. Because these four elements are interdependent, not only do changes in one element induce changes in the other, but also stagnation in one element can retard development in the other elements. Thus, not only do expanding economic opportunities such as rising grain prices, create demand for (induce) new technologies (*e.g.*, improved seed varieties), but expanded economic opportunities create demand for (induce) new institutions (*e.g.*, seed multiplication schemes).

In the case of Malawi's legume seed sector, increasing demand for legumes, as evidenced by rising real prices, can be expected to induce farmers to adopt new higher yielding varieties or expand their area in legume production. However, sufficient incentives must exist to encourage new or existing institutions (in this case seed multiplication schemes) to produce seed of these improved varieties and distribute it to farmers. Noting that institutions evolve in response to a country's unique characteristics, technological change may induce multiple paths of institutional change (Stevens ,1988). Thus, the challenge is to identify the type of seed multiplication schemes that are most sustainable, given Malawi's resource endowment, cultural endowment, technology and institutions.

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Facing increasing population pressure on its agricultural land resources, rising legume prices and a rapidly evolving macroeconomic policy environment due to structural adjustment, Malawi is ripe for institutional change. Previous efforts to increase seed of new legume varieties may have failed because the schemes were designed with little understanding of factors that affect the supply of and demand for legume seed. Thus, designing a viable and sustainable legume seed system will require a better understanding of both supply and demand factors, of which transaction costs are a key component.

The next section utilizes transaction costs theory to demonstrate why smallholder seed multiplication schemes, as presently organized, are unlikely to be sustainable.

3.3.1 Transaction Cost Theory

Seed multiplication requires the performance of numerous activities ranging from providing new basic seed to growers, regulating and certifying the quality of seed, to the marketing of seed. At each of these stages, transaction costs arise from the technologically separable phases in seed production process. North (1990) defined transaction costs as costs of measuring the valuable attributes of what is being exchanged as well as the costs of protecting rights, policing and enforcing agreements. Transaction costs analysis examines the comparative cost of planning, adapting, and monitoring task completion under alternative governance structures, focusing on how transactions differ in their nature and how different governance structures dissipate the transaction costs. Governance structures refer to a set of rules and regulations organizing a given activity with an o

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3.3.1.1 The Nature of Legume Seed

Transaction costs in a seed sector arise from several sources. The legume seed sector, especially in cases where farmers use their own seed, exhibits a failure on some fundamental features of a competitive market, *i.e.*, farmers tend not to rely on the market for seed therefore, it is not a "many sellers and many buyers' market." The market failure is more pronounced in self-pollinated crops such as legumes since genetic performance of a seed, *e.g.* yield potential does not deteriorate fast, compared to cross-pollinated crops such as hybrid maize, whose seed has to be replaced every year. Therefore, legume crop varieties exhibit some public good characteristics. This is the case because, after breeding a variety, farmers who did not pay for the full cost of breeding the variety can purchase the seed below cost price or use grain as seed without loss of genetic value (yield potential). Consequently, there is a tendency for farmers to free-ride. The major problem in this case will be that some farmers will not be willing to be first movers and pay the relative high cost of the initial seed.

Another source of transaction costs arises from the fact that when farmers buy seed, it is difficult for them to determine the quality of the seed, since the genetic quality of a seed is exhibited after the seed is planted. This is even more critical in cases where farmers are planting

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planting a new variety. Thus, unless farmers are convinced the seed is from a genetically high quality variety, they are reluctant to pay a premium price.

The total cost of a seed is the sum of production and transaction costs. *Production costs* depend on the type of technologies used, quantities and prices of inputs used, economies of scale, the level of capacity utilization, and the nature of the learning curve. The *transactions costs* as discussed above contribute to the actual cost of a seed and therefore partially determine whether or not farmers will buy new seed.

The sources and the levels of transaction costs determine whether or not economic agents will undertake an activity. In the case of seed multiplication, failure to have mechanisms that mitigate transaction costs will lead to less seed production than is socially beneficial. For instance, although farmers would be better off if they had access to new varieties with desirable market characteristics, the availability of seed will determine the extent to which farmers *actually* benefit.

In some cases, high transaction costs contribute to market failure and thus are a key factor in explaining the high costs of government and NGO-sponsored seed multiplication schemes. However, Arrow (1969) warns that market failure is seldom absolute. More frequently, high transaction costs impede or, in extreme cases, completely block the formation of markets.

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Institutions have the potential to reduce the transaction costs. Unlike competitive markets, seed multiplication schemes can be created to incorporate a variety of governance structures (exhibited by a variety of models of different seed multiplication schemes) uniquely designed to modify transactions costs so that more of a good or service is produced. In some cases, high transaction costs are needed for a good or service to be produced, while in other cases low transaction costs are required.

Transaction costs may arise due to information costs, asset specificity, and uncertainty of the market. The following section discusses how these different sources of transaction costs affect the sustainability of seed multiplication schemes.

3.3.1.2 Information Costs in a Seed Sector

When farmers plant their own saved seed, no cost is incurred to obtain information about the performance of the variety, since they have observed its performance in the field. However, when farmers obtain varieties from off-farm sources, the cost of obtaining information about the variety increases. In such cases, the farmers may not be aware of the performance of the seed, and moreover the seed sellers may misinform buyers about the attributes of the seed. Where buyers suspect that the seller is providing misleading information regarding the attributes of a variety, he may end up offering a lower price than the price demanded.

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Due to the resulting information asymmetry between the sellers and the buyers (*i.e.*, lack of perfect information between buyers and sellers), sellers may engage in opportunistic behavior. Seed producers and sellers can exhibit opportunistic behavior in the following ways. First, in cases where contracts exist between an organization and participating farmers, such as in a seed multiplication schemes, a *principal-agency* problem may arise. In this case, the seed producer (*i.e.*, agency) may produce substandard seed through shirking, as it is difficult for the manager of the seed multiplication scheme (*i.e.*, principal) to monitor all seed producers throughout the growing season. In some cases, farmers may breach their contract and sell seed to competitors or use the seed as grain contrary to the agreement[25]. In such cases, it is profitable for farmers to sell their produce as grain than sell it as seed. The relatively low seed price offered to farmers by ADMARC was largely responsible for failure of earlier seed multiplication schemes in Malawi. Second, one economic agent (*i.e.* seed sellers) may provide misleading information to seed users if they think they can get away with it, since seed users can not observe all attributes of a seed variety at the time of purchase. Third, where it is possible to enforce contracts, some economic agents (*e.g.* seed schemes) may negotiate long-term contracts, thereby limiting the opportunity for the other party (farmers) to exploit more lucrative markets. For instance, in cases where grain traders offer a higher price than the seed scheme, farmers

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[25]For instance, in some seed multiplication schemes in Malawi where farmers were required to sell the seed to a specific marketing agency, ADMARC, they sold their seed to private traders as grain (Cromwell *et. al.*, 1993). Also, Rusike and Kelly (1997) report that smallholder farmers contracted to multiply seed for AGRITEX often sell the seed to other buyers, contrary to the condition of their contract. In this case, there are no mechanisms to enforce the contracts.

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are better-off selling their produce as grain. Yet, by the time farmers have discovered the more lucrative markets, they are limited by contracts requiring them to sell their produce to the seed multiplication program.

3.3.1.3 Asset Specificity Problem in Seed Production

Compared to grain production, commercial seed production requires the use of specialized assets. These assets can be physical assets or human assets. As long as an asset cannot be redeployed and yield equal return in an alternative enterprise, there is an asset specificity problem. For example if a seed producer buys bagging equipment for packing seed or buys processing equipment, he will earn more revenue producing seed (versus grain) which he can sell at a relatively higher price than price of grain. Thus, switching to grain production will result in loss in revenue as his equipment has no alternative use, *ceteris paribus*. Additionally, farmers participating in seed multiplication schemes that produce certified seed, incur high costs arising from extra labor and skills needed for roguing (*i.e.*, removal of off-types to the variety of interest in the field) , processing, inspection and other seed-specific operations. Although most smallholder seed producers do not use specialized physical assets, an asset specificity problem still arises both because these farmers typically will use more resources (labor, management, monocropping etc.) to produce seed than they would if they were producing grain, and the seed they produce is a specialized product (Weleschuk and Kerr, 1994).

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As a seed industry evolves, from the traditional through the emergence and growth to the mature stage (Douglas' model), seed producers find it necessary to invest in increasingly specific assets associated with growing, packaging and distributing the seed. The specific assets can not easily be sold or converted into other use. This creates a strong dependency between the seed producers and seed users, since if the return to the specialized assets does not cover costs, the seed system will fail. To protect their investments, seed companies typically impose safeguards on their seed growers- these are devices that protect investments in transactions in which specific assets are placed at a risk. Safeguards can take several forms. For example, seed companies/schemes can introduce severance payments to discourage premature termination of contracts, encourage combined ownership of inputs and outputs to assure continuity seed multiplication schemes, and/or ensure a good seed price.

Williamson (1985) proposed the following contractual schema to illustrate how safeguards mitigate transaction costs arising from asset specificity (Figure 3.1).

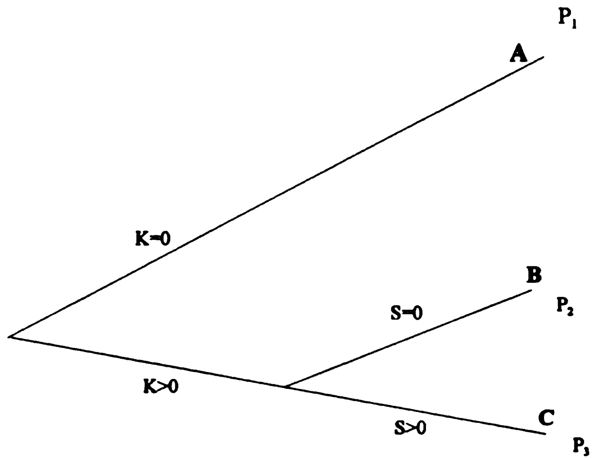

Figure 3.1: Contractual Scheme Involving Asset Specificity Problem

First, in cases where growers produce seed using general purpose assets (k=0), there is no need for a specialized governance structure, since a discrete market is sufficient and the consumers (*i.e.*, seed buyers) will pay price P_1 at node A. In cases where growers employ specialized assets (k>0), there is an increased dependency between growers and buyers, if production is to take place.

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This dependency insures the seed growers of a market and offers certainty to the seed buyers by insuring the availability of seed. In the course of transacting, safeguards can employed (s>0) or they can not be employed (s=0).

When seed farmers employ specialized assets without safeguards (s=0), the price, P_2 will prevail at node B. However, this is an unstable situation. Since seed producers have no protection on their assets, they must rely on the market to offer them a high price to cover the risk they face due to using specific assets. Therefore, transactions (sales) may occur at node A, where no specialized assets will be committed or transaction will occur at C where specialized assets are used but safeguards are provided.

Node C represents the ideal case, where seed is produced using specialized assets. These safeguards assure seed growers of a relatively higher price and assure seed buyers that seed will be available the following season at price, P_3 . In contrast, for farmers to use specialized assets to produce seed, without safeguards, they would require price P_2, to be greater than the price with safeguards, P_3.

In general, the prevailing seed prices, the level of asset specialization, and the safeguards required are interactive in nature. Seed schemes succeed only if producers have sufficient safeguards to ensure a profit, such as a ready market and attractive seed prices. If seed producers are unable to establish safeguards, then the price of the seed must be significantly higher than the price of grain in order to compensate the seed producers for the addit

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the additional risk. For example, before 1990, the Government of Malawi guaranteed farmers contracted to grow seed in its seed multiplication schemes at a price that was 20 percent higher than the official producer price of grain. However, although the official seed producer price was higher than the official grain producer price, the actual market price of grain was generally higher than the official seed producer price. Thus, the in its effort to set price at a significantly high level, the Government failed to encourage seed producers to sell their harvest to ADMARC, rather than sell as grain to private traders. Thus, failure to strike a good balance among the seed price, level of asset specialization, and safeguards can encourage farmers to engage in non-cooperative behavior, such as selling seed to traders in violation of their contracts.

3.3.1.4 Uncertainty in Seed Production

Koopmans (1975) describes two types of uncertainties, primary and secondary. Primary uncertainty comes from random acts of nature and unpredictable changes in consumer preferences. Secondary uncertainty arises from a lack of communication between one decision-maker who has no way of finding out the concurrent decisions and plans made by others. However, these two types of uncertainties do not adequately describe uncertainty caused by a *deliberate* human behavior. Williamson (1985) defines behavioral uncertainty as any uncertainty which arises when incomplete contracting and asset specificity are simultaneously present. In this case, institutions are required to regulate social behavior by specifying behavior in specific recurrent situations so that uncertainty is reduced. In such a situation, contracting decreases the principal-agency problem by reducing noncoop

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cooperative behavior in a system. Thus, in the case of seed multiplication schemes, contracting assures seed growers of a market and assures seed buyers of a source of seed.

3.3.2 The Effect of Transaction Costs on Seed Production

Clearly, efforts to design a sustainable legume seed system must be guided by an understanding of what induces farmers to participate in a seed multiplication activity and what are the key institutional deficiencies of existing seed multiplication schemes. With this information, it will be possible to design 'new' institutions needed to induce farmers to undertake the legume seed production and/or marketing activities. These questions will be explored from the perspective of the theory of transaction costs. In this study, institutions, as rules of the game, are taken as facilitating factors to an exchange.

Cromwell (1993, Figure 3.2) argues that smallholder seed multiplication schemes have failed due to transaction costs. As a result of this failure, the effective supply and demand curves shift to the left (*i.e.*, D to D-TC, S to S+TC). For seed suppliers, due to additional costs which they must incur from undertaking seed specialized activities, they will be willing to produce less seed for a given price. Similarly, for seed users, they will demand less seed as a result of the increase in the price of seed. This implies that for the same price of seed, less is demanded and less is produced. Also, the demand curve for seed is kinked (area above the price of grain is more elastic) because of limited number of seed users willing to pay more than a small premium for improved seed.

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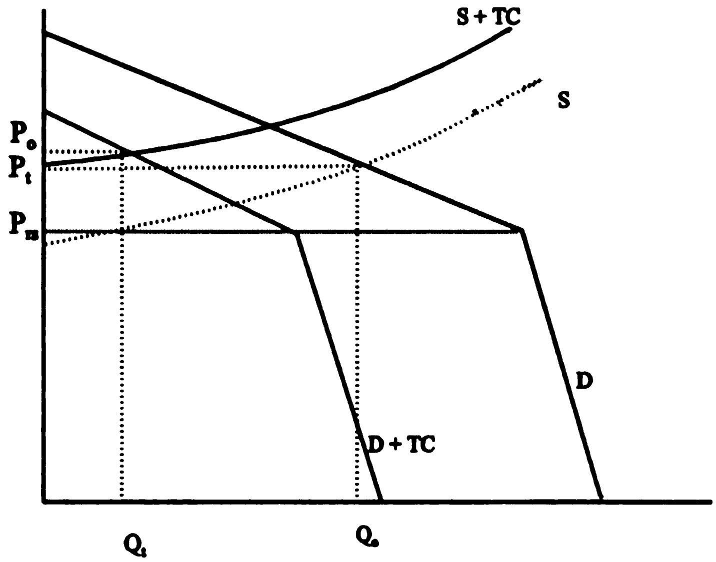

Figure 3.2: The Market for Modern Variety Seeds Among Smallholder Farmers in Developing Countries

Source: Wiggins, S.. And E. Cromwell, (1995).

Because of high transactions costs, as discussed above, the actual price, P_t and actual quantity of seed traded, Q_t is less than the socially optimal price, P_o, and socially optimal quantity, Q_o. This leads to loss in consumer surplus and producer surplus[26] and, in some cases, may lead to no production of new seed varieties. The price, P_m, is the opportunity cost of using own seed, which is equal to the price of grain. For this reason, new institutional arrangements are required to reduce some of the transaction costs (information costs, asset specificity and uncertainty) and therefore facilitate the production of seeds.

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[26]Producer surplus is the measure of the net gain to producers from operating in a given market which measures difference between what producers are willing to accept to produce a given quantity of goods and what they actually get. Similarly, consumer surplus if the net gain for consumers which measures the difference between what consumers are willing to pay and what they actually pay.

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As farmers become increasingly dependent on the formal seed industry, the governance structure of the seed industry will dictate the amount and types of transaction costs incurred and, therefore, the availability of seed to farmers. Institutions that lower transactions costs are essential as they contribute to the efficient provision of information about the attributes of the varieties, enforcement of regulations (seed production and marketing laws) and the specification of property rights of growers and buyers.

However, the design of institutions that effectively reduce transaction costs must take into account factors that affect farmers' demand for seed and seed growers willingness to supply seed. The next section presents some factors that affect supply and demand of legume seed.

3.3 Factors Affecting the Demand of Legume Seed

The amount of seed a farmer requires for planting is a function of area planted times the seed rate (Equation 3.1).

<u>Equation 3.1.</u> $$Q_d = A*S_r$$

Q_d is quantity required to plant an area

A is area to be planted

S_r is seed rate

Farmers who do not have enough retained seed must either purchase seed in the market or obtain it from an off-farm source. Thus, the quantity demanded from off-farm sources equals ;

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<u>Equation 3.2</u> $Q_{md} = (A * S_r) - Q_{rs}$

Where:

Q_{md} is quantity of seed demanded from off-farm sources

Q_{rs} is quantity of seed from retained seed

As shown in Equation 3.2, farmers' demand for seed from off-farm sources is a function of both the quantitative and qualitative characteristics of new varieties, relative to the quantitative and qualitative characteristics of the traditional varieties, plus the cost of adopting the new seed technology package, relative to the cost of planting the traditional varieties. Tripp (1997) notes four factors that lead farmers to demand seed from off-farm sources. First, farmers demand seed from off-farm sources because of poverty (*i.e.*, do not produce enough grain to save seed from the pervious harvest). Second, seed is demanded because of seed loss due to disaster such as drought. Third, farmers may demand seed because of farm level seed management (*e.g.*, hybrid seed, whereby farmers have to replace seed every year because of loss of hybrid vigor or in some crops because quality of seed goes down under high temperature and high humidity). Lastly, farmers will demand seed off-farm in order to gain access to new varieties. To obtain seed off-farm, farmers incur both monetary (*i.e.* purchasing seed and additional inputs) and transaction costs associated with adopting the new varieties (Equation 3.3).

<u>Equation 3.3.</u> $Q_{md} = F\{(Y^n - Y^t), (C^n - C^t)\}$

Where Q_{md} is quantity of seed demanded from off-farm/market sources

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Y^n are the qualitative factors associated with new varieties

Y^t are the qualitative factors associated with traditional varieties

C^n is the total cost associated with planting new varieties

C^t is the total cost associated with planting traditional varieties

As shown in equation 3.3, the total quantity of seed farmers demand from off-farm sources such as the market, Q_{md}, will equal the demand for traditional varieties, Q_{mt}, which the farmer is already familiar with plus the demand for new varieties, Q_{mn}. Farmers may prefer to plant a traditional variety because they know its qualities. On the other hand, they might wish to experiment with new varieties. Therefore, total quantity of seed for planting is represented in Equation 3.4.

Equation 3.4

$$Q = (A*S_r) = Q_{rs} + Q_{md}$$

$$\text{Where } Q_{md} = Q_{mt} + Q_{mn}$$

Where

Q_d is total quantity required for the field

Q_{mt} is quantity of seed of traditional varieties from off-farm sources

Q_{rs} is quantity of seed from retained seed

Q_{mn} is quantity demanded of new varieties

The level of farmer demand for seed from each source (retained seed, from the market both traditional varieties and new varieties) tends to vary by type of crop (*i.e.*, selfpollinate

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pollinated versus hybrids) and the stage of agricultural development. In developed countries, most farmers tend to rely on off-farm sources. In contrast, in developing countries, most farmers rely on their own seed or obtain seed from neighboring farmers. However, Tripp (1997) notes that especially for self-pollinated crops, farmers in developed countries also commonly rely on their own seed. Similarly, Pray *et al.* (1991) report that 50 percent of the cotton and barley, 60 percent of the oats, and 70 percent of the wheat planted in the US is planted with farm-saved seed. Ghijsen (1996) reports that in Europe, 50 percent of all seed in France and Germany, and 30 percent in the UK, is farm saved.

Farmers' income level also affects the price they are willing to pay for seed. For the same quality of seed, more affluent farmers are willing to pay more for seed than are poor farmers. The farmers' reasons for desiring seed from an off-farm source will determine whether the demand is effective and continuous. This has implications for the design of a country's seed multiplication program (Table 3.1).

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Table 3.1: Seed Production Response to Type of Demand for Seed

Source of Demand	Type of Demand		Supplier of Seed
	Effective	*Continuous*	
Chronic poverty	No	Yes	Not clear
Emergency	No	No	Government or voluntary programs
Seed management or hybrid use	Yes	Yes	Commercial seed provision
New variety	Yes	No	Not clear

Source: Adapted from Tripp, Robert (1997). The Institutional Conditions for Seed Enterprise Development. Overseas Development Institute, April, 1997.

For poor smallholder farmers, their demand for seed is mainly due to chronic poverty. While continuous, the seed demand is not backed up by effective purchasing power. Hence, the formal seed sector cannot solve their seed shortage problem. While voluntary organizations often attempt to supply the seed needs of this group, NGOs may not be able to permanently solve the problem due to the short time frame for most NGO projects. Similarly, the demand for seed resulting from emergencies such as from flooding or drought is neither effective nor continuous. In such cases, government and NGO-funded programs are best able to supply relief seed because of the short span of time involved. In contrast, in instances where farmers plant hybrids, the demand is both effective and conti

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continuous as farmers have to replace their seed each year because of quick loss in hybrid vigor in hybrids. Meeting the seed demand of these farmers is commercially attractive which explains why commercial seed companies have targeted this market. Lastly, farmers will buy seed from off-farm sources in order to get new varieties. While this demand may be effective, the demand is continuous for open-pollinated crops (hybrids) but not for self-pollinated crops.

3.4 Factors Affecting the Supply of Legume Seed

A farmer can obtain seed from several sources, as represented by equation 3.4. These sources include, seed retained from the previous harvest and seeds of new varieties from the formal seed system. Therefore a seed supply function is as follows:

<u>Equation 3.4.</u>

$$Q^s = Q^s_{rs} + Q^s_{nv}$$

Where Q^s is quantity supplied

Q^s_{rs} is seed retained from the previous harvest

Q^s_{nv} is quantity supplied of seed from new varieties

Each one of the independent variables is a function of several variables. For example, the farmer's ability to save seed is a function of the farmer's economic status and the biology of the seed (*i.e.*, self-pollinated versus open-pollinated). In some cases, relatively rich farmers

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farmers have relied on own seed more than poor farmers. Whereas farmers can continuously use their seed for self-pollinated crops such as legumes, they often replace seed for cross-pollinated maize hybrids. The supply of seed from other off-farm sources is dependent on other farmers' willingness to share seed, sell seed as grain, or store it to sell as seed. The supply of new seed varieties depends on the formal seed systems' ability to multiply and distribute seed to farmers, and also the farmers' willingness to adopt the new varieties.

3.5 Equilibrium Conditions for the Legume Seed Market

Given the factors affecting legume seed demand and factors affecting legume seed supply, at equilibrium the quantity demanded of seed should be equal to the quantity supplied of seed.

<u>Equation 3.5.</u> $$\mathbf{Q_{rs} + Q_{md} = Q^{s}_{rs} + Q^{s}_{ms}}$$

For new seeds, the seed users' willingness to pay for the seed should equal the cost at which the seed system is able to grow the seed (Figure 3.3).

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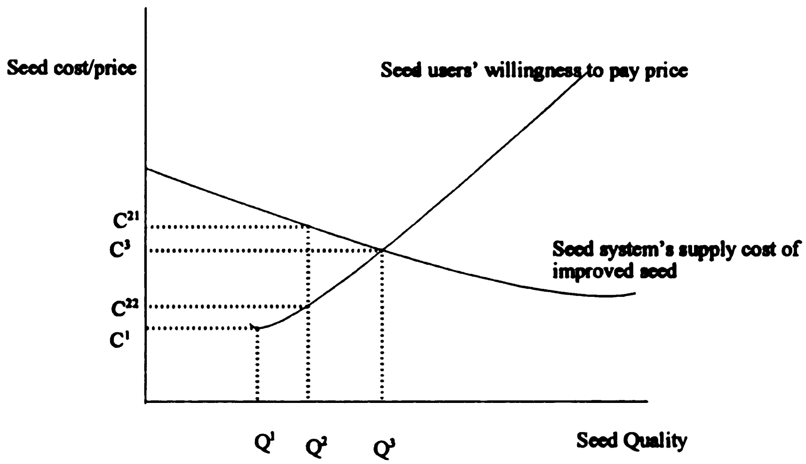

Figure 3.3: Seed Users' Willingness to Pay Price (Seed Demand) and Seed System's Supply Cost for Improved Seed in Relation to the Quality of Seed Supplied.

Seed is produced at a higher cost than the cost of producing grain. The sources of cost are research and development, seed multiplication, quality control, transportation and storage. Maredia *et al. (1997)* argue that the cost of supplying seed decreases with improvements in seed quality. At lower quality, the cost of supplying seed is higher than the farmers' willingness to pay for the seed. In this case, a market may not exist, as the price offered and the price demanded are not in equilibrium. As the quality of seed improves, seed users are willing to pay more for the seed.

Quality, Q^r and price, C^r denote the quality and price of using retained seed. As quality of seed increases from quality, Q^r to Q^n, the seed users' willingness to pay price, C^{nd} is lower than the cost of a seed system to produce seed C^{ns} therefore no transaction takes place since the seed users are willing to pay more as seed quality increases. As seed quality increases to Q*, the seed users' willingness to pay and seed systems cost of producing seed converge at price C*.

The seed users' willingness to pay for seed varies with their socioeconomic status. Cromwell (1993) identifies three categories of seed users. First, seed secure households are better resource endowed households who save the majority of the seed needed on-farm but may use off-farm sources in order to experiment with new varieties. Second, crisis-prone households are normally seed secure, but are less well resource-endowed. Third, chronically insecure households who are poor and in most seasons are unable to harvest sufficient crops to meet food and seed needs. The chronically seed insecure households rely heavily on the seed sources outside their farm. The paradox in this setting is that in general, farmers who are relatively better-off have a higher willingness to pay for seeds than poor farmers, but the rich are the ones who are more seed secure than the poor farmers (Figure 3.4).

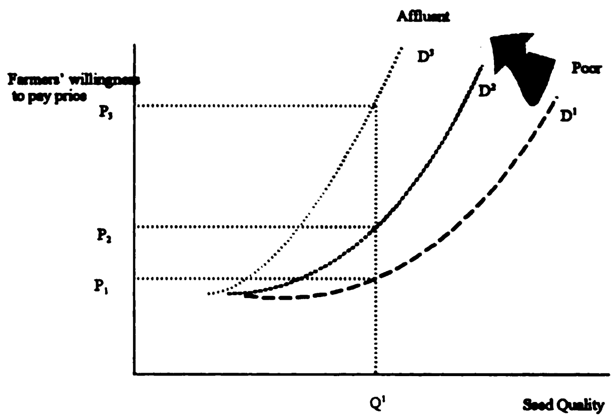

Figure 3.4: Farmers Willingness to Pay for Seed by Economic Status.

Synthesis

From the discussion above, it is evident that two factors are important in determining the success of a seed system. First, cross-pollinated varieties have a higher chance of succeeding than self-pollinated ones. Second, the socioeconomic characteristics of farmers have an effect their effective seed demand. Thus, a seed multiplication scheme should target a particular group of farmers and have specific governance structures to address the needs of these farmers.

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3.6 Research Methods, Data Collection and Data Analysis

Field work for this study was carried out between September, 1996 and June, 1997. Initial fieldwork focused on identifying the key players in the smallholder seed sector (September to October, 1996). Second, after establishing the major schemes, a rapid appraisal was conducted, including interviews with the smallholder seed multiplication scheme's managers (October). The main objective of these interviews was to identify the major activities in seed multiplication schemes. Subsequently, interviews were conducted with field officers of the schemes, as well as Government officials from the Ministry of Agriculture and Irrigation's Departments of Research, Extension and Training (November-December, 1996). Based on insights gained from these meetings, two questionnaires were developed and administered--one for smallholder farmers and another for the managers/field staff of the schemes (January-May, 1997). Details of the various stages of the research follow.

3.6.1 Background Research

The objective of the background research was to gain a general understanding of the status of smallholder seed multiplication schemes and to collect secondary data needed to document the role of beans, groundnuts and soybeans in the Malawi economy. To place the smallholder seed multiplication schemes within the larger context of seed sources in Malawi, research reports describing smallholder seed sources and smallholder seed multiplication schemes were collected from various organizations including ActionAid, Christian Service Committee, Concern Universal, the National Bean Program, Overseas

Development Institute, the Bean/Cowpea CRSP, the European Union/Ministry of Agriculture and Irrigation's Action Group Two and the World Bank. Some of these documents describe smallholder farmer's seed husbandry practices, while others documented efforts and failures of the past Government seed multiplication schemes. The documents collected from the various NGOs mainly reported on their current seed multiplication schemes. Also, secondary data were collected from the Famine Early Warning System[27] and analyzed to provide an overview of the legume subsector (*i.e.*, beans, groundnuts, and soybeans), including historical trends in legumes production the national and local level as well as producer price and consumer price trends.

Data generated by the two recent surveys conducted by the Bean/Cowpea CRSP and one survey carried out by the National Bean Program from 1995 to 1997 were collected and reviewed. The two CRSP surveys focused on seed handling, one related to seed-borne diseases at the farm-level, and the other on the bean market. The National Bean Program's baseline survey (1996) collected data from 355 respondents in Bembeke EPA (126), Kalira EPA (111) and South Vipya EPA (118). This study sought to identify the farmers' sources of seeds and seed handling practices. Insights gained from reviewing these helped to identify issues that needed to be addressed in this study. Finally, other studies documenting the experiences with smallholder seed multiplication schemes outside

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[27]Famine Early Warning System is a United States Agency for International Development's project within the Ministry of Agriculture and Irrigation. The project collects and interprets agricultural data for the country in order to provide advance warning of food.

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Malawi were reviewed to determine how smallholder schemes operated in other countries. After studying the various documents on smallholder seed multiplication schemes, managers of the various seed multiplication schemes were interviewed.

3.6.2 Rapid Appraisal

The rapid appraisal was conducted in two phases. During the first phase, visits were made to the head offices of six seed multiplication schemes: ActionAid, Christian Services Committee, Concern Universal, the European Union/Ministry of Agriculture and Irrigation's Smallholder Farmers' Development of Seed Multiplication as an Enterprise, Self-Help Development International and the National Bean Improvement Program's Community- Based Seed Multiplication Scheme (NBIP). The main objective of these visits was to learn about each schemes' crop priorities, regional focus, organization structure, size of operation (*i.e.*, number of farmers involved), and problems encountered.

Seven most important schemes were selected for further in-depth study: ActionAid's Seed Development Program in Dowa in Traditional Authority Msakambewa's area, 2) ActionAid's Smallholder Seed Multiplication Program, 3) Concern Universal's Seed Multiplication Program at Lobi Rural Growth Center, 4) Christian Services Committee's Smallholder Seed Multiplication Program in Mponela Development Area, 5) Christian Service Committee's Seed Multiplication at a Church Farm at Naming'azi C.C.A.P Church Farm near Zomba, 6) NBIP's community-based bean seed multiplication program at Zidyana EPA, and 7) the European Union/Ministry of Agriculture and Irrigation's

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Maize Productivity Task Force seed multiplication scheme. For each of the schemes, data were collected on the specific activities each scheme undertook and how they vertically coordinated seed acquisition, planting, farm management activities, extension, other support services, and seed marketing. The main objective was to identify problems encountered and how the schemes integrated the separate transformation activities from seed acquisition, packaging and selling.

A second round of visits was made during Dr. Richard Bernsten's visit to Malawi from November 10th to November 23rd, 1996 . The objective of the second visit was to verify information collected during earlier visits, including historical development of seed multiplication in Malawi, and the status of the current seed multiplication schemes and their *modus operandi* and the roles the Ministry of Agriculture and Irrigation plays in supporting the seed multiplication schemes. Persons contacted included officials from ActionAid and Concern Universal, and officials in the Ministry of Agriculture and Irrigation's Department of Research, Department of Agricultural Extension and Training, members of the Maize Productivity Task Force (especially those from the Action Group II responsible for seed production), the Seed Services Unit, the NBIP and the Malawi Director of Bean/Cowpea CRSP.

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3.6.3 Questionnaire Design and Formal Interviews with Officials from Seed Multiplication Schemes and Smallholder Farmers

Insights gained from the rapid appraisals were used to develop two questionnaires , one for the manager and one for the smallholder farmers participating in the seven selected seed multiplication schemes (Appendix 3.1 and Appendix 3.2). The aim of the formal interviews with managers was to systematically record data needed to compare the functioning of seven schemes.

After completing the interviews with the managers, the smallholder farmers' questionnaire was pre-tested on ten farmers from ActionAid's Seed Development Program before administering it to farmers from other schemes. The questionnaire was designed to collect information needed to better understand farmers: objectives in cultivating legumes (*i.e.*, food, cash, soil fertility management), 2) the criteria they used to determine the area planted to legumes, 3) their perceptions of preferred attributes of their legume crops and legume seed, 4) their seed sources, storage methods, and seed storage problems, and 5) their assessment of the nature of the "seed shortage" problem. The target sample size was 30 respondents from each scheme, with one-third of the farmers multiplying beans, one third multiplying groundnuts and the one third multiplying soybeans. However, for some schemes a proportionately higher number of farmers growing a particular crop were interviewed because farmers were not growing the other crops. Also, in some cases, farmers grew seed in groups, rather than as individuals. In such cases, five members per group were selected to spread the coverage across sites. Only the farmers participating in the A

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the Action Group II's program and the National Bean Programs seed multiplication program grew seed as individuals, while in the other schemes, farmers grew seed in groups

3.6.4 Data Analysis of Primary and Secondary Data

First, Government reports and documents were reviewed to identify the national policies that affected the legume subsector in general and the smallholder seed multiplication schemes in particular. This established the policy framework for the smallholder seed multiplication schemes.

Second, data on historical production and hectarage were analyzed to document the geographical distribution of the legumes in the country. Historical comparisons were made between the three legumes, in terms of their production, hectarage, prices, consumption patterns to identify changes in economic opportunities, as well as changes in the Government policies over time. QuatroPro was used to graphically analyze the bean and groundnut production, price and hectarage data although no such data were available for similar analysis of soybeans.

Third, data collected from the interviews with the field officers were tabulated to assess how the schemes differed in terms of the role of the various NGOs versus the farmers in carrying out the various activities, including seed acquisition, production, harvesting, selling, and repayment of credit. The working hypothesis was that differences among the schemes would affect the performance of each scheme.

Fourth, SPSS was used to analyze the survey data collected from smallholder farmers' to better understand their goals, preferences and constraints with respect to the cultivation of legumes and to document farmers' seed management practices.

Fifth, a model was developed to estimate both profitability of growing improved seed and the expected return to farmers who planted improved seed in order to simulate smallholder farmers' likely behavior, given various assumptions regarding the costs of seed, production and yields of improved seed. Comparisons were made among various scenarios. First, the profitability of seed multiplication of a modern variety is compared with the profitability of grain growing of the traditional varieties. Second, the profitability of growing grain between a modern variety is compared with the profitability of growing grain of a traditional variety.

By providing insights as to the farm-level constraints to increasing legume production, this analysis helps determine the extent to which a "seed shortage" is a limiting factor in increasing legume production and suggest policies needed to strengthen the performance of these smallholder seed production schemes.

The next chapter discusses the subsector of the legume sector in Malawi with emphasis on beans, groundnuts and soybeans.

CHAPTER FOUR

THE LEGUME SUBSECTOR IN MALAWI

4.0 Introduction

Beans and groundnuts are the mostly widely grown legumes in Malawi, although in recent years soybeans have gained popularity. This chapter analyzes recent trends in legume production, consumption, prices, trade, and Government policies affecting the legume sector.

4.1 Production Systems

In Malawi, agricultural production is maize-based. Apart from traditional cash crops such as tobacco and cotton, other crops such as legumes usually are grown in association with maize. However, the production systems under which these crops are grown vary, depending on the season in which the crop is grown and the landholding characteristics of the household. The following sections describe the production systems under which smallholder farmers grow beans, groundnuts, and soybeans in Malawi.

4.1.1 Bean Production Systems

There are three bean production systems in Malawi.

Rainy Season Bean Crop

Most farmers throughout the country plant beans during the rainy season (November to April). In this season, beans are most commonly planted as an intercrop with maize, although some farmers monocrop. Beans of climbing growth habit are grown in association with maize to take advantage of the structural support of maize stalks. Beans of bush growth habit may or may not be grown in association with maize. While some farmers plant beans as a monocrop, this is most common among households who have large landholding.

Relay Bean Crop

In some areas, beans are planted as a relay crop towards the end of the main rain season (March to June). Under this system, beans are planted just before harvesting the maize. This system is common in regions with prolonged rainfall, such as in the highlands of southern Malawi where a maritime wind called *Chiperoni* brings showers after the main rainy season.

Dimba Bean Crop

In the third system, beans are grown in lowlying areas called *dambos*[28] (June-August) where the bean crop grows on residual moisture. This production system is common in areas where *dimba* cultivation is common, such as in Dedza/Ntcheu.

In most parts of the country, farmers plant two bean crops either during the rainy season, followed by a relay crop, or in the rainy season followed by a *dimba* crop.

While some farmers plant beans in all three seasons, the rainy season and the relay bean production systems represent the major growing systems. This is because relatively large areas are available for planting beans in the rainy season and the relay crop. In contrast, the *dimba* is in a specialized land which is available in lowlying areas and is therefore scarce. Where farmers plant more than one crop, part of one season's harvest is usually used as the seed source for the next season. For example, part of the harvest from the *dimba* crop is used as seed for the rainy season or the rainy season harvest is used as a seed for the relay crop. Farmers make limited use of inputs such as fertilizer or pesticides in bean production. However, when intercropped with maize, beans take advantage of fertilizer applied to maize.

4.1.2 Groundnuts Production System

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Unlike beans, groundnuts are mainly grown during the rainy season as either a monocrop or intercropped with maize. As an intercrop, groundnuts compete with beans for land since both are intercropped with maize, the principal crop. Apart from the cases where groundnuts are intercropped with maize and are indirectly fertilized, smallholder farmers do not apply fertilizer to groundnuts directly.

4.1.3 Soybeans Production System

Soybeans are also grown in the rainy season. As beans and groundnuts, they are grown either as a monocrop or are intercropped with maize. Therefore, in most areas the three crops compete for land regardless of whether they are grown in monocrop or as an intercrop, as long as the environment is favorable to all these crops. However, unlike beans and groundnuts, because soybeans are more vegetative, they compete more vigorously with maize for resources such as light and water. Except in cases where soybean is intercropped with maize, smallholder farmers do not apply fertilizer directly to soybean. Although the Ministry of Agriculture and Irrigation recommends that farmers use an inoculant in order to promote soybeans to fix atmospheric nitrogen in their nodules, farmers seldom use this technology.

4.2 Area, Yield and Production

Until 1989, groundnut was the primary legume grown in Malawi. In 1990, beans became the most important legume in terms of production as well as area planted (Table 4.1 and Figures 4.1 and 4.2).

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4.2.1 Bean, Area, Yield and Production

During the past ten years, the area in beans almost doubled from 71,329 hectares in 1985/86 to 145,000 hectares (1995/96) (Table 4.1). Beans are mainly grown in mid-to-high altitude areas where temperatures are relatively cool (750 m to 1,500 m above sea level) (Kantiki, 1989). Initially, the National Bean Program identified ten Rural Development Projects (RDPs) of the country's 28 RDPs as the main bean growing areas[29]. However, analysis of data on bean production using geographical information systems, GIS analysis identified an additional important bean producing area, Thiwi-Lifidzi RDP (Kambewa, 1997). The RDPs with the largest areas planted to beans are Chitipa, Kasungu, Ntchisi, Dedza Hills, Ntcheu, Zomba, Salima and Blantyre/Shire

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[29]These are Thyolo/Mulanje RDP, Namwera RDP, Dedza RDP, Ntcheu RDP, Dowa West RDP, Ntchisi RDP, Salima RDP, Rumphi RDP, South Mzimba RDP, and Chitipa RDP (Tinsley, 1990).

Table 4.1: Production, Area and Yield of Bean, Groundnut and Soybean, Malawi, 1986 to 1996

Crop	Year										
	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
						Production (000' Mt)					

Table 4.1: Production, Area and Yield of Bean, Groundnut and Soybean, Malawi, 1986 to 1996

Crop	Year										
	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
						Production (000' Mt)					
Beans	23	29	28	28	28	38	30	45	81	82	80
G/nut	88	88	77	35	18	31	12	38	32	32	40
S/bean	*Na*	*Na*	0.3	0.8	3	13	11	14	8	15	42
						Area (000' Ha)					
Beans	71	87	91	94	97	116	127	133	146	147	145
G/nut	176	210	176	140	48	70	64	61	55	69	72
S/bean	*Na*	*Na*	0.7	2	6	16	22	16	18	23	53
						Yield (kg/ha)					
Bean	316	332	307	294	286	333	239	360	555	558	552
G/nut	501	420	437	249	358	444	187	622	557	462	563
S/bean	*Na*	*Na*	409	500	557	810	495	902	444	645	790

Source: Malawi Government, 1993, *Malawi Agricultural Statistics, 1993 Annual Bulletin* (pages 5-10) for 1986 to 1993 data and FAO Year Book for data from 1994 to 1996.

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Highlands. All of these ADDs are in the mid-to-high altitude areas, except for lower altitude Salima, where beans are grown during the dry season in the *dimbas*.

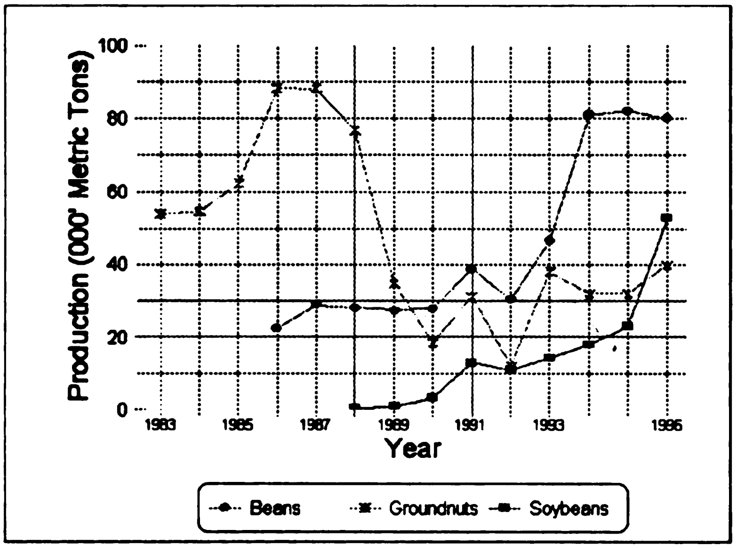

Figure 4.1: Historical Production of Beans, Groundnuts and Soybeans in Malawi, 1986 -1996.

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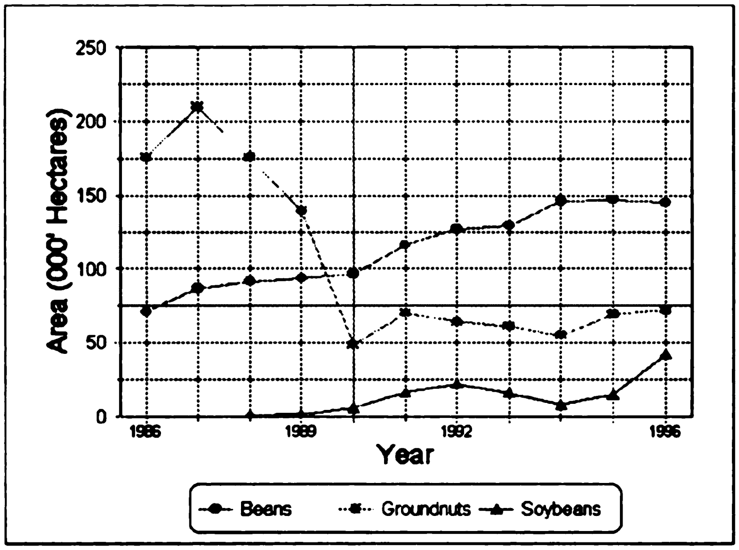

Figure 4.2: Historical Hectarage of Beans, Groundnuts, and Soybeans in Malawi, 1986 to 1996.

While area in beans doubled, total production almost quadrupled, from 22,545 mt (1985/86) to 80,000 mt (1995/96). This increase in production is a result of both a doubling of the bean area and increases in yield--while yield averaged 316 kg/ha in 1985/86, by 1995/96 yield had increased to 552 kg/ha.

Shift/share analysis was conducted on area, yield, and production data to determine the contribution of increase in area and yield to increase in the production. Over a period of 10 years (1985/86 to 1995/96), production increased at an average rate of 12 percent per year. Of this production increase, an annual increase in area (seven percent per year) contributed 56 percent of the increase in production while an annual increase in yield (five percent) contributed 44 percent to increase in production. These results show that increasing both area and yield can increase production of beans. Increase in yield likely resulted in farr

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However, yields are quite variable. In most cases, this is as a result of variability in rainfall. In addition to reducing bean yields, the variation in rainfall also reduces maize yields. As a result, in order to meet their immediate food needs, farmers end up eating Some of their seed and retain insufficient seed for planting in the following season.

4.2.2 Groundnuts Area, Yield and Production

Just as for beans, central Malawi is the main producing region for groundnuts. The Central Region, especially Lilongwe ADD and Kasungu ADD, produces more groundnuts than the other areas, in terms of the area planted to groundnuts as a percent of national average. In contrast to beans, groundnuts production declined from 88,297 mt in 1986 to 40,000 mt in 1996 (Table 4.1). While yield increased from 501 kg/ha to 563 kg/ha, area planted to groundnuts decreased from 175,607 hectares (1986) to 72,000 hectares (1996). Therefore, the decrease in production has largely been due to reduced area planted to groundnuts.

The results above concur with results from shift//share analysis, which showed that over a 10 year period (1985/86 to 1995/96) production decreased at an annual rate of seven percent. Similarly, area declined at eight percent per year, while yield increased at an annual

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annual rate of one percent. Thus, a decrease in area overwhelmingly reduced production of groundnuts.

One factor that contributed to the decline of groundnuts production was a lack of seed. Because Malawi faced a shortage of foreign exchange in the 1980s, manufacturing companies were allocated a fixed amount of foreign exchange with which to import their raw materials. As a result, in late 1980s, Lever Brothers and other groundnuts users aggressively bought groundnuts throughout the country for manufacturing cooking oil. Consequently, ADMARC was not able to buy enough groundnuts to resell to farmers as seed. Although eventually Lever Brothers sold the groundnuts to ADMARC, the scarcity of groundnuts seed among farmers continued.

4.2.3 Soybeans Area, Yield and Production

Soybeans are a relatively new crop in Malawi. Although farmers have been growing them since the early 1900s, it was only in the early 1990s that the Government started promoting soybeans as a substitute for beans in supplying protein, as well as a cash crop with export potential. In recent years, farmers have grown more soybean because they have commanded a higher price than either beans or groundnuts. However, compared to bean and groundnut, historically soybean is a smaller crop in terms of hectarage and tonnage although in 1996, soybean production was greater than groundnut production (Table 4.1).

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The production of soybean increased from 311 mt in 1986/87 to 42,000 mt in 1995/96[30]. The increase was both due to increase in area from 760 hectares to about 53,000 hectares and also increase in yield from 409 kg/ha to 790 kg/ha in the same period. The shift/share analysis showed that over a period of six years (*i.e,* 1990 to 1996), production increased by 55 percent per year. On the one hand, area increased at a rate of 44 percent per year contributing 82 percent of the increase in production and yield increased at a rate of 6 percent per year, contributing 12 percent of the increase in production increase. The annual increase in area suggests that in the early 1990s, there was at least doubling of area and production each year.

4.3 Utilization

Beans

Beans are mainly consumed as a relish. In addition, the green leaves are cooked as a vegetable, as are the green pods. Generally, the dry pods are boiled and mixed with tomato and onion to make a stew. Beans, being high in protein, are an important part of a diet in institutions such as boarding schools, hospitals and prisons. In the past, beans were promoted as a source of protein for *Likuni phala,* a baby food. However, in recent years, soybeans have replaced beans in this use.

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[30]Prior to 1990, the production of soybeans was below 1 ton. For shiftshare analysis, that period is not used.

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Groundnuts

Traditionally, people use groundnuts as a snack, as a vegetable, and as a flour additive in the preparation of other food items such as cooked vegetables. Until the late 1980s, Malawi's cooking oil industry used groundnuts as a raw material. Thereafter, sunflower replaced groundnuts as the primary raw material for oil manufacturing.

Soybean

Despite recommendations that households use soybeans as a weaning food and to supplement their protein needs, most farmers grow soybeans for sale. Most of the soybean produced in Malawi is used for manufacturing food products, such as baby weaning foods. In addition, soybean is an export crop. However, in the early 1990s the Ministry of Agriculture and Irrigation and some NGOs embarked on extension programs to educate the people on the various ways and technologies of soybean utilization.

4.4 Marketing

Beans

Prior to market liberalization, ADMARC was the primary buyer of beans. With market liberalization, beans are mainly marketed through private traders, who purchase beans from the producers and transport them to urban areas. Traders range from small scale itinerant traders to medium scale private traders. While some retailers act as their own middlemen, other retailers buy from middlemen, *i.e.* private traders buy beans which they sell to retailers in produce markets. Other private traders buy beans and sell directly to institu

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institutions, processing companies and export companies. The main form of processing for beans is packaging them in 500 grams or 1 kilogram bags which are sold in urban supermarkets. The major bean processor is Tambala Food Products, which packages beans in two brands, Kabula Beans and Tambala Beans. These brands are marketed by the country's two retail chain stores, Kandodo and PTC shops[31]. However, the bulk of beans are sold loose to consumers mostly by female market sellers.

Groundnuts

Just like beans, groundnuts are mainly sold loose to consumers in produce markets. However, Tambala Food Products is the major processor of groundnuts as a snack and flour additive and it uses the supermarkets which have a nationwide distribution network. In addition, there is a growing number of small processors serving their local markets.

Soybeans

Unlike beans and groundnuts, soybeans are not widely consumed in the country. Therefore, other than private traders buying soybeans from the producers, very little is directly sold for local consumption. Thus, almost all the soybean crop is either sold to food processors or exported.

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[31] All these companies (Tambala Food Products, PTC and Kandodo) are subsidiaries of Press Corporation Limited, a parastatal.

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4.5 Prices

Prior to the implementation of economic liberalization, the Government controlled the producer and consumer prices for all major crops. Therefore the relative prices among the crops reflected Government-deliberate policy rather than the market signals. The following sections present an analysis of relative prices, historical prices, and trends in the producer and consumer prices for beans, groundnuts, and soybeans, and seasonal price variations.

4.5.1 Relative Price Analysis

Over the years, changes in prices in groundnuts and soybeans relative to beans indicated the crops the Government favored. For instance, in 1983/84, the official producer price of groundnuts increased relative to the producer price of beans. Furthermore, the official producer price of soybeans increased relative to the official producer price of beans (Figure 4.3). As a result, under *ceteris paribus* conditions, these results suggest that growing soybeans was increasingly becoming more profitable than beans. However, during the period considered (1986-1991), there was little change in the relative prices of beans versus groundnuts.

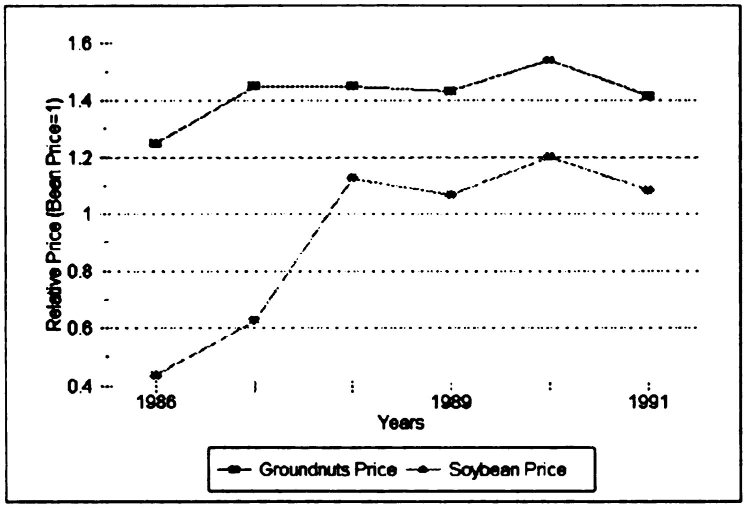

Figure 4.3: Official Groundnut and Soybean Prices Relative to Bean Price, Malawi, 1986 to 1991.

As part of the structural adjustment programs beginning in 1989, the Government no longer acted as a residual buyer of smallholder farmers' produce. Consequently, overproduction in one year depresses prices in the subsequent year. For instance, as an indicator of general trend in soybean price increase in the country, at Chimbiya market in 1994/95, the soybean price was twice (K10.41 per kg) over the previous year's price (K3.31 per kg). Consequently, farmers increased the area planted to soybeans from 23,000 hectares in 1995 to 53,000 hectares in 1996. The increased production in the following year (1995/96) led to the price decrease to K8.90 per kg and in 1997 the price declined to K5.30 per kg (FEWS, 1997). Thus, in the era of market liberalization, farmers will require access to marketing information and most importantly, price forecasting in order to guide their planting decisions.

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4.5.2 Producer Price versus Consumer Price Analysis of Beans

Although nominal producer and consumer prices of beans have increased, in real terms, producers have received almost the same price in the 1990s as they did in the 1980s. Similarly, consumers have paid almost same prices in the 1990s as they did in the 1980s (Table 4.2). Since the marketing margins (*i.e.*, difference between consumer price and producer price) have remained constant, these results suggest that there has not been any increase in marketing services in the bean sector such as storage and transportation. However, given that the Government was setting the producer and consumer price, the marketing margins represent a distortion from a deliberate Government policy. However, there has been no apparent increase in other services, like processing and packaging. Moreover, ADMARC's monopoly in marketing smallholder produce prior to 1987 ensured that Government policy was effected. In the early 1990s, the Government stopped setting the producer and consumer prices.

Table 4.2: Real Bean Producer and Consumer Prices, Malawi, 1983 to 1992

Price (t/kg)	Year									
	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992

Table 4.2: Real Bean Producer and Consumer Prices, Malawi, 1983 to 1992

Price (t/kg)	Year									
	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Producer	14.68	19.84	*Na*	21.06	17.4	13.25	12.49	14	14.6	14.05
Consumer	24.23	22.49	*Na*	25.06	20.65	*Na*	22.42	22.12	24.11	Na

Na Data not available.
Source: Malawi Government (1993), *Malawi Agricultural Statistics. Annual* Bulletin. Pages 39 to 42.

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4.5.3 Seasonal Price Variation

The price of legumes show some seasonal variation. These variations represent a production cycle as well product use (Figures 4.6)

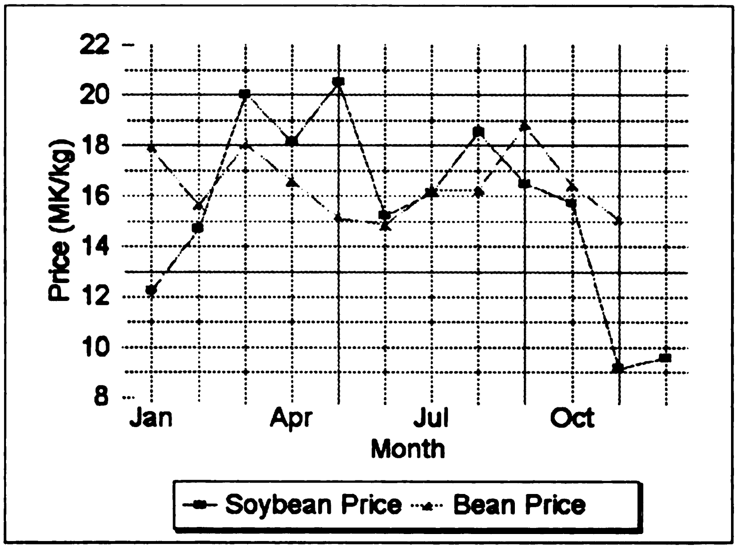

Figure 4.6: Monthly Price Variation of Beans and Soybeans, Malawi, 1997.

The two commodities are planted under different regimes. For instance, in Chimbiya area beans are grown twice in a year. After harvesting the first crop within three months, there is another harvest. Thus, the price of beans is not likely to increase as there is no scarcity within that period--February to August. In contrast, soybeans are grown once per year therefore, the price is driven by the single harvest. Furthermore, beans are consumed ordinarily unlike soybeans which are principally grown as a commodity crop (*i.e.* grown for sale rather than for home consumption). Therefore, the price of beans increases with time after h

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time after harvest as demand remains generally constant but supply declines. For soybeans, the private traders buy soybeans during the traditional marketing season (June-August) and thereafter, they are not likely to buy it. Therefore, demand for soybeans decline after the traditional marketing season leading to a price decline. The price of groundnuts will vary in a manner similar to bean price in the sense that the price increases after the harvest time, since groundnut is also a locally-consumed commodity.

4.6 Trade

The extent of trade between Malawi and other countries is poorly documented. Among the three legumes, groundnuts is the least exported crop, as Malawi does not produce enough to be self-sufficient. At the same time there is no evidence that Malawi imports groundnuts. The same applies to beans. On the other hand, a larger proportion of soybeans produced in the country are exported South Africa and Asia.

While evidence of formal trade is scarce, there is evidence of increasing informal cross border trade in beans, especially between Malawi and Mozambique. The area which produces much of the beans sold in the two major cities in Malawi, Blantyre and Lilongwe, lies on the border between the two countries. Interviews with sellers of beans at the market indicated that the majority of the sellers were from Mozambique and that the bulk of the beans at the market were from Mozambique (Kambewa, 1997). This may also apply to groundnuts and soybeans, as the markets on the Malawi side of the border offer better marke

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4.7 Government Policies

In Malawi, apart from cash crops such as tobacco and tea which have separate research programs which are funded directly by respective commodity organizations, the Ministry of Agriculture and Irrigation concentrated its research efforts on maize. In order to redress the situation, in 1983 commodity teams were set up to promote research for the other crops. Thus, a legume commodity team was set up to coordinate research among legume crops. While these operated as separate biological research programs, in the late 1980s efforts were initiated to coordinate on-farm research jointly.

With liberalization of the economy and the market, the Government no longer uses price as a policy tool to guide the legume sector. Thus, today the Government's main area of influence is through its support of biological and social research. Since 1986, the Government has used seed multiplication as a policy tool to increase seed availability among smallholder farmers. Beginning 1990, the Government allowed NGOs to participate in smallholder seed multiplication activities.

However, in addition, the Government is currently conducting training in soybean utilization among smallholder farmers. Since the use of soybean by Malawians either as a food for ac

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food for adults or children is low, the Government is trying to encourage more widespread use of soybeans to help reduce malnutrition.

4.7 Summary

Beans, groundnuts and soybeans compete for available land and labor resources. Farmers typically intercrop legumes with maize, in an effort to meet their food needs and use their land and labor most efficiently. Groundnuts and soybeans are mostly grown during the rain season. On the other hand, beans are grown in the rainy season, as a relay crop after the rain season, and are also grown in *dimbas* in the dry season.

In Malawi, the legume sector is dominated by beans and groundnuts, but soybeans are becoming an increasingly important crop. Since animal protein is scarce and legumes are an important inexpensive source of high quality protein, and they are an important source of protein in the people's diet. While grown throughout the country, the central region is the main producer of beans, groundnuts, and soybeans.

Apart from groundnuts, beans and soybeans have increased in production in recent years. Currently, beans are the largest legume grown in Malawi, in terms of production and area. In 1996, groundnut production fell to the 1986 production level. In all crops, the increase in production is mainly attributable to an increase in area planted to the crop, although yield contributed a significant amount.

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Whereas the Government used to intervene into the market by setting producer and consumer prices for the crops, with economic and marketing liberalization, the Government no longer undertakes this function. As a result, private traders now dominate bean, groundnut and soybean marketing. Unlike in the past when the Government set the prices and ADMARC was a guaranteed buyer, now farmers must decide what crops to plant based on demand forces.

The seasonal price variations among the crops were different. These pattern differ between crops that are locally consumed by farmers such as groundnuts and beans versus the crops grown mainly for sale such as soybeans. The consumer and producer prices have remained stable over the years although this was mainly because the Government was setting up prices other than that being a reflection of market forces. Although there is no well documented trade between Malawi and other countries in legumes, except for soybeans, there is increasing evidence of cross-border trade, especially with Mozambique. With the Government no longer setting the consumer and producer prices, the future performance of this sector heavily depends on the ability of the sector to provide information to the farmers.

The Ministry of Agriculture and Irrigation, in conjunction with outside organizations, carries out research in all three crops in order to increase the crops' productivity among smallholder farmers. In addition to funding crop research, in recent years, the main Government policy affecting the legume subsector its support to seed multiplication schemes. W

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schemes. While initially run by the Government (1986), since 1990, NGOs have been encouraged to participate. As the Government rationalized its budget, it is most likely that NGOs will play an increasing role in providing agricultural services to smallholder farmers. As NGOs set up seed multiplication system, the lessons learned from these schemes will be vital in the provision of agricultural service in future. The next chapter presents an institutional analysis of the seven schemes that were a focus of this study.

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CHAPTER FIVE

AN INSTITUTIONAL ANALYSIS OF THE SMALLHOLDER SEED MULTIPLICATION SCHEMES IN MALAWI

5.0 Introduction

This chapter presents an institutional analysis of the smallholder seed multiplication schemes in Malawi. First, the model used for the analysis is presented. Second, key characteristics of the three legumes in this study (*i.e.*, beans, groundnuts, and soybeans) are summarized. After describing the seven seed multiplication schemes, they are compared using the environment-behavior-performance model (E-B-P). Finally, insights are drawn regarding how environment and behavior affect the performance of the smallholder seed multiplication schemes.

5.1 A Model for Analyzing the Smallholder Seed Multiplication Schemes--The Environment-Behavior-Performance Model

The rules stipulated in seed multiplication schemes define the responsibilities and determine cost-sharing among the various key players in a scheme. These players typically include the sponsors of the schemes, the organizations that provide seed, seed producers, and seed users. The justification for carrying out an institutional analysis rests on the premise that since institutions are required to mediate the different sources of transaction costs, a set of institutions which minimize the sum of the production cost and the transa

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transaction cost will increase profitability or performance of a scheme. Therefore, to design a more efficient seed multiplication scheme, aspects of schemes which create high transactions cost must be identified and mitigated wherever possible.

The E-B-P model focuses on identifying the basic relationships among 1) the environment within which a seed multiplication scheme exists, 2) the behavior of the key participants in a scheme (especially farmers and managers of the scheme), and 3) the resulting performance.

5.1.1. Environment

Environment encompasses the rules which govern, or at least influence, the behavior of participants in a seed multiplication scheme. The environment includes the target farmers, the cropping system, physical inputs, and repayment and marketing arrangements. The rules stipulated in a seed multiplication scheme's contracts define who does what, and how the benefits and costs in seed multiplication are shared in the production and distribution of the seed. Since the terms of each scheme differ, it is expected that each scheme's performance will also differ.

Two factors that may affect the environment in which a smallholder seed multiplication scheme operates are asset specificity and information. If a scheme requires farmers to employ resources with no alternative use and they are uncertain if they will be able to sell their seed, farmers will be unwilling to invest in seed production. Also, in some cases insufficient i

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insufficient information regarding the performance of the varieties being multiplied will reduce the demand for seed and thereby affect the performance of the scheme. The following sections discuss how asset specificity and limited information create uncertainty in a seed multiplication scheme.

a) Asset Specificity and Uncertainty

Seed scheme participants typically enter into contract with the organization sponsoring the scheme. The nature of the contract will determine the types of transaction costs arising from uncertainty. Uncertainty can arise from market uncertainty (*i.e.* reliable market) or price uncertainty (*i.e.* price of seed higher than price of grain), which motivates farmers to either sell their seed as grain rather than as seed, or to consume the seed instead of planting it.

For schemes that require farmers to employ specific assets, the extent to which the schemes provide safeguards to the growers will be examined. Safeguards may include a guaranteed market or a guaranteed price. Given the magnitude of asset specificity and the existence or non-existence of safeguards, it is possible to predict the performance of a scheme, *i.e.*, whether farmers will be more likely to grow seed and sell their crop as seed, or engage in *non-cooperative behavior* which may be in *breach* of a contract.

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b) Information Cost

Since seed schemes in Malawi multiply new varieties, information about the performance and characteristics of these varieties must be readily available to induce farmer demand for these new varieties. Hence, by facilitating the flow of information between the growers and breeders, and between growers and seed users, (*i.e.*, communication within the seed system matrix), the performance of a scheme can be enhanced. Each scheme will be evaluated to assess the existence or non-existence of an information problem.

Information problems can take several forms. First, *information asymmetry* results when there is a lack of information about the attributes of a seed variety. As a result one agent can exploit another agent by failing to disclose accurate information. For example, if the seed user does not have access to objective information about the quality of the available seed (the *market of lemons phenomenon*), she may have little confidence in the producer-declared seed quality and thus be unwilling to pay a premium price for the seed. When an information asymmetry problem exists, *rent extraction* is common. In such cases, growers may exploit seed buyers by failing to fully disclose information about the quality of their seed. On the other hand, lacking such information, seed users may undervalue the new seed and not be willing to pay a premium for it. This causes a divergence between the price that the buyer is willing to pay and the price the seller is willing to receive. Second, in certified seed schemes, a *principal-agency problem* may arise, if farmers producing certified seed and some principal (NGO or Ministry of Agriculture and Irrigation) inspects their crop for certification. In this case, the agency (seed producer) may not undertake son

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some activities required to ensure the quality standard set for certified seed. Yet, it is difficult for the principal (NGO or the Ministry of Agriculture and Irrigation) to observe or monitor non-performance.

Thus, information costs associated with *a market of lemons or a principal-agency problem* can lead to opportunistic behavior. Therefore, if an information problem is observed , it is likely that either farmers will not be willing to produce seed or seed users will not be willing to buy the seed because of high transaction costs. However, seed certification tends to reduce information problems by enforcing strict seed multiplication procedures and quality control tests. Nevertheless, in some cases, these procedures are poorly enforced, which results in the production of low quality seed. For example, farmers may mix seed with grain, a practice which may be difficult to detect.

5.1.2 Behavior

In discussing the effect of behavior on economic performance, Shaffer (1992) notes that institutions, as rules or regulations, have a strong influence on participant behavior and that the resulting behavior has a strong influence on economic performance. While institutions define opportunity sets for individuals, participation varies with available opportunity sets. Moreover, participants are dynamic and tend to learn by taking into account the consequences of previous responses *(i.e.* institutions affect the shape of the learning curve). Thus, given the nature of a contract in a seed multiplication scheme, individual farmers will behave differently, either by cooperating or by exhibiting noncoo

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cooperative behavior such as selling seed as grain, or producing sub-standard seed-- both of which constitute an explicit or implicit breach of contract.

Economic theory suggests that seed growers will behave so as to maximize some objective function. In the case of a seed scheme, growers' objectives can range from satisfying their seed security needs, sharing seed with friends/relatives, selling seed at a slightly higher price than the price of grain to gaining access to a new variety. Unless seed producers' objectives are similar to those of the scheme, producers are likely to engage in non-cooperative behavior.

5.1.3 Performance

Performance denotes outcomes, well-being, or consequences--given the existing economic environment, objectives, and the behavior of the participants in a given economic setting. Performance will be tested by comparing the objectives of a scheme against its performance. For instance, if a scheme is designed to produce certified seed, the extent to which a scheme does this is a measure of its performance. Similarly, if the objective is to increase seed security among smallholder farmers, the degree to which the scheme insures seeds security is an indicator of its performance.

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5.2 Major Legumes Grown Under Seed Multiplication Schemes in Malawi

Malawi's seed multiplication schemes primarily produce maize, beans, soybeans, groundnuts, and pigeon pea seed. This study focused on schemes that produced bean, soybeans, and groundnut because they are the major legumes grown in the country.

5.2.1 Beans

Two parallel programs conduct research on beans--the bean research program at Bunda College of Agriculture is supported in large part by the Bean/Cowpea CRSP and the National Bean Improvement Program (NBIP) based at Chitedze Agricultural Research Station, is supported in part by CIAT. Seed multiplication schemes established in the early 1990s tended to multiply bean varieties obtained from the Bean Program at Bunda College, while those established in the mid-1990s tend to grow bean varieties obtained from the NBIP.

The bean program at Bunda College released two varieties which have been multiplied in seed schemes. These are Nasaka, a variety which was selected from a local landrace in 1980; and Kalima, a cross which was obtained from CIAT and released in Malawi in 1993. The NBIP released six varieties in 1995--namely Napilira, Kambidzi, Maluwa, Nagaga, Sapatsika and Mkhalira--all crosses from CIAT headquarters in Colombia. The characteristics of these varieties are summarized in Table 5.1.

Table 5.1: ***Characteristics of the Bean Varieties Grown in Seed Multiplication Schemes, Malawi, 1996/97.***

Variety	Year of	Growth	Seed Size/Shape	Seed Color	Days to	Yield (kg/ha)	[illegible]

Table 5.1: Characteristics of the Bean Varieties Grown in Seed Multiplication Schemes, Malawi, 1996/97.

Variety	Year of Release	Growth Habit	Seed Size/Shape	Seed Color	Days to Maturity	Yield (kg/ha)[1]	Disease/Drought Characteristics[2]
Bunda Bean Program Release							
Nasaka	1980	Bush	Large kidney shaped	Khaki	75	1200	Resistant to ALS and BCMV
Kalima	1993	Bush	Large kidney shaped	Red-mottle over cream background	81	1800	Resistant to ALS and BCMV
NBIP Releases							
Napilira	1995	Bush	Medium (42/100 seeds)	Red-Speckled	90	2000	Resistant to PM and HB
Maluwa	1995	Bush	Medium (46/100 seeds)	Red-speckled	85	2000	Drought resistant
Nagaga	1995	Bush	Medium (46/100 seeds)	Khaki	86	2000	Resistant to CBMV
Sapatsika	1995	Bush	Medium (46/100 seeds)	Red	86	2000	No particular disease resisted
Mkhalira	1995	Bush	Small (24g/100 seed)	Tan	85	2500	Resistant to ALS, HB, does well in low fertility soils, and escapes drought
Kambidzi	1995	Bush	Small (22g/100 seeds)	Tan	87	2500	Resistant to ALS, HB, does well in low fertility soils, and escapes drought

[1]Potential yield under research conditions and favorable weather; [2]ALS=Angular leafspot, BCMV=Common Bean Mosaic Virus, HB=Halo Blight,

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All seven varieties being multiplied exhibit bush growth habit. The two varieties released by the Bunda Bean Program are large-seeded beans, while the varieties released from the NBIP were small to medium in size. Socioeconomic surveys conducted in the past revealed that overall, consumers prefer large-seeded beans (Ferguson *et. al.* 1991). While all varieties are resistant to common bean diseases such as Angular Leafspot and BCMV, two varieties from the NBIP, Mkhalira and Kambidzi have an I-gene which causes necrosis in presence of bean common mosaic virus . Under favorable conditions, the yield potential of varieties released by the NBIP was generally higher than of the varieties released by Bunda Program. However, these data cannot be used to compare the two groups because the varieties in the two groups were tested under different conditions.

Generally, beans from the Bunda Program had a shorter period to maturity (75 and 81 days), compared to the varieties released by the NBIP (85 to 90 days). A shorter growing period increases ability of a variety to escape drought or to produce acceptable yield under moisture-stress conditions. While most Malawian farmers intercrop beans with maize during the rainy season, over 50 percent of the bean crop is grown under a relay-cropping system or in the *dimbas* as a monocrop at the end of the rainy season during the winter months. Yields in *dimbas* can range from 1,000 kg to 1,500 kg per hectare as disease pressure is low and sowing rates are high. Under the rain-fed conditions, farmers can get yields of about 500 kg per hectare. Under dimba crop and the relay crop, early maturity is important because it reduces the crop's exposure to moisture stress.

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5.2.2 Groundnuts

The Department of Research of the Ministry of Agriculture and Irrigation has released seven groundnut varieties over the years: These varieties are Chalimbana, Manipintar, RG1, Mawanga, Malimba, Chitembana and CG7. The release of CG7 marked a new attempt by the Ministry and ICRISAT to revitalize groundnuts production. Currently, all major seed multiplication schemes in Malawi multiplying groundnuts use CG7, which was obtained from ICRISAT. CG7, a semi-bunch groundnut type, produces a confectionery groundnut and has a potential yield of 2,500 kg/ha.

5.2.3 Soybeans

Unlike the bean and groundnut research programs which released varieties to farmers in earlier years, the soybean research team officially first released five varieties in 1987: Davis, Bossier, Kudu, Impala, and Hardee. In 1993, seven additional varieties were released; Geduld, Duocrop, Santarosa, Ocepara-4, 427/5/7, 501.6.7 and 491/6/12.

Three seed multiplication schemes (MPTF, ActionAid-SD Scheme and Concern Universal) multiplied soybean varieties obtained from the Ministry of Agriculture and Irrigation. In contrast, the CSC schemes multiplied Magoye, a *promiscuous* soybean variety originally from Zambia. Unlike other varieties, Magoye does not require inoculation in order to fix atmospheric nitrogen. However, the Department of Research has not released this variety, arguing that it does not perform any better than the recommended varieties.

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Malawi's seed schemes tend to focus on multiplying new varieties rather than indigenous varieties. The only exception is Nasaka which is a recommended variety selected from farmers' germplasm. In contrast, in Zimbabwe the smallholder seed multiplication schemes multiply both local varieties and new varieties (Rusike *et al.*, 1997).

5.3 Description of the Seed Multiplication Schemes

This section describes the seven smallholder seed multiplication schemes studied, including their nation-wide distribution, the key players in each scheme (*i.e.* in terms of donors and seed producers), and the nature of the contract between the seed producers and the schemes. Together, these features describe the environment under which these schemes operate.

5.3.1 The Maize Productivity Task Force-Action Group Two's Seed Multiplication Scheme (MPTF)[32]

Following recurrent drought in the early 1990s, which forced the Government to import maize in some years, in 1995 the Ministry of Agriculture and Irrigation formed a Maize Productivity Task Force in conjunction with the donor community. Composed of officials from the Ministry of Agriculture and Irrigation and the major donor community (*e.g.* the European Delegation, Department for International Development, and the Rockefeller

[32]Information from this section came from interviews with officials from the MPTF, MOAI and farmers. Formal sources included the following documents: 1) Maize Productivity Task Force; Action Group Two-EC Food Security Programme (1996), 2) Task Force on Maize Productivity Activities of Action Group 2 (1996), 3) Luhanga, J. H. (1997) Local Seed Systems. SADC and GTZ .

Foundation), the Task Force was charged with the responsibility to develop and implement strategies to encourage farmers to use available agricultural technologies, which they had not yet adopted in order to increase food security.

The Task Force is composed of four action groups. Action Group I is responsible for examining problems of soil fertility, especially fertilizer application rates; Action Group II is responsible for promoting crop diversification through increased seed availability; Action Group III is responsible for addressing problems relating to the extension needs of resource poor farmers; and Action Group IV is responsible for identifying technologies to improve soil fertility through incorporation of organic matter and crop management.

Action Group II

In order to increase crop diversity through increasing seed availability, Action Group II-- with funding from the European Delegation-- established a seed multiplication scheme designed to teach farmers how to multiply seed as a business. Also, in the 1995/96 growing season, the program provided funds to the various commodity programs which they used to produce basic and certified seed. In the 1996/97 agriculture season, 73 farmers nation-wide participated in the seed multiplication scheme. Under the scheme, farmers multiplied groundnuts, beans, maize, soybeans, pigeon peas, and cowpeas. Of this total, 49 farmers multiplied groundnut, bean and soybean seed (Table 5.2).

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Table 5.2: Number of Farmers Participating in Seed Multiplication and Hectares of Legume Seed Crops Grown under the MPTF Seed Multiplication Scheme by ADD, 1996/97, Malawi.

ADD	Groundnuts		Beans		Soybeans		Total per ADD	
	No.	Area (ha)	No.	Area (ha)	No.	Area (ha)	No.	Area (ha)
Shire Valley	2	1	0	0	0	0	2	1
Blantyre	2	1	2	1	0	0	4	2
Machinga	1	0.5	1	[1]	1	[1]	3	0.52
Lilongwe	5	2.5	7	3.5	1	1	13	7
Salima	5	2.5	0	0	3	1.5	8	4
Kasungu	6	3	5	[1]	0	0	11	32
Mzuzu	6	3	3	1.5	1	[1]	10	4.52
Karonga	3	1.5	1	[1]	0	0	4	1.52
Total	24	15	19	6[2]	6	2.5[2]	49	23.5[2]

[1]No hectarage was reported; [2]The actual hectarage is more than the area reported since in some instances farm size was not recorded; Note: Forty-nine out of the 73 farmers participating in the scheme multiplied legumes.

Source: Kamputa D, (1996) "1996/97 Seed Inspection Report." Maize Productivity Task Force.

In past Government seed programs, farmers were guaranteed a market for their seed. In contrast, in this scheme, farmers were expected to market the seed by themselves. The project, which offered training in seed production, seed management, and business skills also paid the Seed Services Unit to inspect and certify the farmers' seed crop. At the end of the 1996/97 growing season, the scheme projected that the farmers would produce the following quantities of seed: groundnuts, 16 tons (shelled); beans, 5 tons; and soybeans 13 tons. Ho

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tons. However, rather than requiring the farmers to sell their seed, as initially planned, the project bought all the seed in order to distribute it to other farmers in the 1997/98 growing season, as will be discussed below.

In addition to training farmers, this program provided training to other stakeholders in seed production, including seeds officers from the ADDs, seed inspectors, and field extension personnel. Also, in 1996/97 the program set up about 700 demonstrations throughout the country in order to increase awareness of and demand for the new varieties among smallholder farmers (Kamputa, 1996)[33]. Furthermore, the scheme promoted its activities through radio announcements and by holding field days conducted on the farms of participating seed growers.

For the 1997/98 season, the program expected to enroll additional seed growers who would receive seed from the 1996/97 group of farmers. In 1997, the pioneer group of seed growers formed an association to further their interests such as lobbying the banks for input credit and identifying ways to increase their bargaining power in selling their seed.

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Nature of the Contract

Each participating farmer was asked to choose two crops to multiply. Farmers signed their contracts as individuals and were expected to repay the cost of the seed. To be eligible, a farmer had to agree to set aside land for seed multiplication and plant in monocrop. Each farmer received about 30 - 40 kg of seed and worked hand-in-hand with officials from the Ministry of Agriculture and Irrigation's Department of Research and the Seed Services Unit. Furthermore, as farmers were producing certified seed, their fields were inspected to insure that the crop was diseases-free and not contaminated by other varieties. After harvest, the seed was certified before farmers sold it back to the seed program.

5.3.2 The ActionAid Seed Multiplication Programs

ActionAid, with headquarters in the United Kingdom, receives its funding from private donors in the United Kingdom and Spain. In 1990, it started working in Malawi in two districts, Dowa and Mwanza, where it established integrated rural development projects designed to promote food security, health, and education.

In recent years, ActionAid established a Seed and Environment Office. The objective of this project was to first assist smallholder farmers to implement activities designed to address environment problems, such as carrying out afforestation projects. Second, the project assisted smallholder farmers to meet their seed needs through a seed multiplication scheme. While seed schemes under integrated rural development projects were aimed at adc

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addressing seed security needs, under the Seed and Environment Project, farmers were encouraged to produce seed for themselves as well as for sale to other farmers. More recently, ActionAid's Seed and Environmental Office established a Seed Development Scheme which encouraged participating farmers to distribute the seed to other farmers in their area.

5.3.2.1 ActionAid-Seed Multiplication Scheme--ActionAid-SM[34]

Established in Dowa District, the goal of the food security project was to reduce the food shortage from five months in 1990 to one month by the year 2001 through the provision of seed of new varieties, farm input credit (to groups), and by helping farmers to develop income-generating activities such as seed enterprises. Specifically, ActionAid targets its activities towards the poorest farmers.

This study focused on a scheme in Traditional Authority (TA)[35] Msakambewa in the 1996/97 growing season where average landholding per household in the target area was 0.7 hectares. The most important food crops were maize and beans. Important cash crops included tobacco (burley and dark-fired tobacco), and during the 1994 to 1996 period, soybeans were gaining prominence.

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[34]Sources for this section were mainly from interviews with officials from ActionAid, Dowa Office and trip reports from Bunda Bean Program.
[35]A Traditional Authority is an area within a district which has one chief. Usually, a district has more than one TA.

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The project area was divided into four ecological zones, and each zone had a supervisor who oversaw all development projects. At the grassroots level, extension workers, called Village Development Workers, helped to coordinate the activities, with one Development Worker being responsible for five to seven villages. Each village has a Village Development Committee which identifies activities the village wanted to undertake as well as the beneficiaries for each program.

At the onset, the seed project worked with existing village groups such as the Ministry of Agriculture and Irrigation's Farmers' Clubs. However, since these groups tended to leave out the poor farmers, in 1991 ActionAid started requiring the villages to set up Village Development Committees which would solely work in support of ActionAid's projects. ActionAid used participatory rural appraisal methods to ensure that the local people had an input in identifying and prioritizing the community needs and in identifying the beneficiaries (see Appendix 5.1 for a brief description of steps followed in undertaking a participatory rural appraisal).

Initially, the seed multiplication program only multiplied beans, but farmers were given the option of growing soybeans in 1992/93 and groundnuts in 1993/94. In 1995/96, farmers in one village group multiplied soybean, but all villages multiplied beans.

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Nature of Contract

ActionAid's seed multiplication schemes are community based. Each farmer in the program received 10 kg of seed and was expected to repay 12 kg of seed at the end of the season (*i.e.*, 20 percent more seed than was received). Farmers could request seed for more than one season, as long as they repaid the previous year's loan. Initially farmers repaid their loans to ActionAid, which in turn distributed the seed to other farmers in the following season. In recent years, repayments from farmers had been kept by the village development committees, which decided the recipient of seed the following season.

Because the objective of this program was to produce farmer seed rather than certified seed, ActionAid's requirements for producing seed were not as rigorous as those in other schemes such as the MPTF. Nevertheless, the field supervisors and the village development workers inspected farmers' fields to insure that the seed crop was adequately isolated from other fields growing the same crop, especially for open-pollinated crops. Although farmers were not required to plant legumes as a monocrop, they were encouraged to plant one variety per field and isolate the crop from fields in which other varieties of the same crop were grown.

The project head office was responsible for delivering seed to the participating farmers' households just before planting (October/November). Initially, bean seed was obtained from Bvumbwe Research Station and from local farmers in Mzimba District. In addition to training in agronomic skills in seed production, the farmers were trained in leadership skills and management of income-generating activities.

According to ActionAid field officers, the key problems that threaten the success of the project were drought, market unavailability, and the farmers' lack of appreciation of seed as seed *(i.e.* rather than being willing to pay more for seed most farmers preferred to plant grain). Field officers contended that in order to strengthen the program, there was a need to increase individual farmers' responsibility and improve their training. Failure by one individual to repay a loan could result in the whole group being penalized. Also, by increasing training, farmers would have less of a need to rely on external services such as the Ministry of Agriculture and Irrigation's Seed Services Unit for seed crop management advice in subsequent years. As the project was drawing to a close, as part of ActionAid's strategy to phase out the project, the farmers assumed more responsibilities after a mid-term review of 1995. For instance, after the review farmers were responsible for both identifying the needy farmers and were managing the returned seed.

5.3.2.2 ActionAid- Seed Development Project--ActionAid-SD[36]

The Malawi Smallholder Seed Development Project was managed by ActionAid's Seed and Environment Office in conjunction with the Ministry of Agriculture and Irrigation, with funding from the United Kingdom's Department for International Development. The project aimed at increasing the availability, accessibility, and affordability of seed of new

[36]Sources include 1) Luhanga, J. H. (1997); Mloza-Banda (1994).

open- and self-pollinated crops and planting materials to resource-poor farmers in order to improve food insecurity. It followed a community-based approach in managing seed multiplication and distribution. To strengthen these efforts, ActionAid provided training for extension workers, project staff, and the farmers in seed production and group dynamics. Also, the project helped strengthen the Ministry of Agriculture and Irrigation's Seed Service Unit by providing equipment and vehicles for its laboratories.

ActionAid launched this scheme in 1995, and in the year 2000 the Ministry of Agriculture and Irrigation will take it over. The scheme supports community group nurseries for multiplying cassava and sweet potato in all ADDs in the country. For other crops (maize, beans, groundnuts and soybeans) the scheme operated in four ADDs: Blantyre[37], Machinga[38], Kasungu[39] and Mzuzu[40] (see map in Appendix 5.2). The Program Managers from the four ADDs identified the projects (RDPs) with a seed shortage problem. In turn, the Project Officers in the RDPs identified the EPAs in their areas which were food deficient and had a high number of resource-poor households. Farmers were selected using participatory rural appraisal methods.

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[37]The RDPs with seed multiplication programs were Mulanje West, Blantyre/Shire Highlands, Phalombe, and Mwanza.

[38]The RDPs with seed multiplication schemes were Mangochi, Zomba, Namwera, Kawinga, and Balaka.

[39]The RDPs with seed multiplication schemes were Dowa East, Dowa West, Mchinji, Ntchisi, and Kasungu.

[40]The RDPs with seed multiplication schemes were Rumphi North and Mzimba Central.

ActionAid obtained its certified seed for distributing to farmers from the MOAI's Department of Agricultural Research and from the Bean Program at Bunda College of Agriculture. To ensure that it had an adequate supply of seed ActionAid sometimes contracted organizations to produce certified seed.

Nature of Contract

In each village, the project provided certified seed to community groups. These could multiply seed as a group or each farmer could multiply it individually. The initial seed is recycled for three years and thereafter it is replaced with new seed obtained from the research stations. Eligible farmers had to grow the seed under monoculture. ActionAid's field supervisors were responsible for crop and post-harvest inspection. Where farmers multiplied seed in a group, they shared part of the harvest and sold the rest at a grain price. The group repaid the credit with the cash from seed sales. The repayment was deposited into the group's bank account which was to be used as a revolving fund to purchase certified seed or other inputs on the next season crop. Where farmers grew the seed individually, they contributed a share of their seed to meet their loan requirements or contributed money to open a group account as a requirement of the scheme. ActionAid's supervisor was responsible for checking the progress of each group's bank account.

In 1995/96, ActionAid supplied 2.2 tones of basic and certified seed on credit to 45 groups. Of these, 21 were female groups and 24 were mixed groups. In all, 823 farmers participated in the scheme, the majority (653) of whom were female members and the rest (170) male (ActionAid, 1994).

During the first year (1995) the scheme faced several problems (ActionAid, 1997). First, since the supporting staff was not yet hired, there was little supervision of the farmers' activities. Second, some extension workers gave seed to individual farmers, rather than to groups. By September 1996 (two to three months before the next planting), only 10 percent of the farmers had repaid their credit. Of the 45 groups who received seed, only 13 had repaid their loan in full. Overall, farmers reported that credit rules and regulations were unclear. Third, as seed crop management was poor, the fields were weedy and some crops suffered from bird and aphid damage. While ActionAid stated that the scheme produced 9.6 tones of seed, some groups did not report their harvest.

ActionAid (1997) reported that in the second year (1996/97), 140 community groups participated in the program. Of these, 72 were female groups and 68 were of mixed gender. One-hundred and eight groups received two types of seed and the rest multiplied one crop. Participants totaled 2, 416 women and 706 men. By end of the 1996/97 growing season, 142 extension workers (30 female and 112 male) from 44 EPAs were expected to have received training in seed crop husbandry. Thus, although the majority of the participants were women, the majority of the extension workers trained in seed production were men because extension staff in the Ministry of Agriculture and Irrigation predominantly were men.

From the experiences of the first two years, Musopole (1997) noted three problems that the project faced. Overall, farmers tended to choose high cash value crops such as groundnuts, beans, soybeans, and sorghum while they had little interest in producing a crop like pearl millet. In fact, in 1996/97 over 69 percent of the farmers requested groundnuts. Thus, the project had insufficient seed to meet the demand of potential seed multipliers. Second, for the first year, the cash repayment rate was low as some farmers thought the seed was given free. Third, since farmers did not appreciate the genetic superiority of new varieties, they were unwilling to pay a premium for the seed produced by the scheme.

5.3.3 The Christian Service Committee

The Christian Service Committee (CSC)-- a local NGO sponsored by the Episcopal Conference of Malawi (Roman Catholic) and the Protestant Churches in Malawi-- managed health, education, and agricultural training and water supply projects. Most of the funding came from organizations based outside Malawi such as Christian Aid of the United Kingdom, Inter-Church Fund for International Development of Canada, ICCO of the Netherlands, and the United States Agency for International Development (USAID).

Formed in 1968, initially CSC only responded to specific requests to initiate projects in the agricultural sector. However, in 1990 CSC started to implement its own agricultural projects and in 1991/92 established seed exchange programs in 12 development areas (Nsanje, Mulanje, Namadzi, Namadidi, Chilema, Balaka, Monkey Bay, Ntcheu, Dedza, Mponela, Embangweni, and Ekwendeni). In each area, the project posted a development worker who coordinated the program with the local people. The development worker had a target of working with 50 church groups within a 20 to 25 kilometer-radius. To facilitate extension work, volunteers were recruited among the target group and first trained or provided new technologies to test before extending them to other farmers in the area. In 1994, 125 volunteer extension agents acted as demonstrators in their areas (Banda, 1994).

The objectives of the seed multiplication scheme were to: 1) to increase smallholder access to seeds of improved open-pollinated varieties of sorghum and pearl millet, and self-pollinated crops such as bean, pigeon pea, and other pulses; 2) create income-generating activities for the church organizations and interested individuals; 3) create sustainable linkages between church organizations and the Ministry of Agriculture and Irrigation, especially as they related to seed production; 4) educate farmers in simple seed selection and storage practices, along with the agronomic practices recommended by the Ministry of Agriculture and Irrigation, 5) and train the Ministry's extension workers in simple and appropriate techniques for the production of "approved" seed on church farms. Seed was either multiplied on church farms or directly by the smallholder farmers in the development areas (Christian Service Committee, 1996). In addition to seed multiplication, CSC also carried out on-farm testing of new varieties, especially bean varieties provided by the NBIP. The next two sections present an overview of CSC's two seed schemes.

5.3.3.1 The CSC-Smallholder Seed Exchange Program--CSC-SSEP[41]

Nature of the Contract

This study focused on the seed scheme in Mponela, one of the development areas. Mponela is in Dowa District, about 60 km north of Lilongwe City, and is situated on the main road connecting Lilongwe and Kasungu. Under this scheme, most farmers were given three kg of seed to multiply, but the amount of seed ranged from two kilograms to eight kilograms per farmer, depended on the availability of seed and the demand from farmers. The farmers were expected to repay twice this amount after harvest. While the program started as a seed exchanged program (*i.e.*, farmers were required to repay the loan in seed), beginning in 1994/95 the farmers were allowed to repay their loans in cash.

The local volunteer extensionist, also known as an extension multiplier, identified farmers who were interested in seed multiplication, and the selected farmers chose which crops they wanted to multiply. Although farmers formed groups, each farmer grew the seed crop individually, with no restrictions on who could participate in the program.

Christian Service Committee obtained the soybean seed from Zambia and bean seed from Chitedze Agricultural Research Station and Bunda College of Agriculture. The CSC has been multiplying Magoye soybean variety from Zambia since the beginning of the program in 1991. By 1996/97 season, over 4,000 farmers were multiplying Magoye under the CSC

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[41]Main source of information was through personal communication with the Agricultural Office from CSC and field officer at Mponela Development Area.

programs (Banda, 1996)[42]. Regarding logistics, the CSC head office transported seed to the development worker, who in turn delivered it to the extension multiplier who distributed it to the farmers.

Although CSC trains farmers in basic seed production techniques, under this scheme farmers were not required to follow any stringent seed production procedures. Usually, CSC obtained seed in July for planting in November/December. The development workers dressed the seed with actellic and stored it for five months. They encouraged farmers to plant a small amount of seed on sandy soil before the onset of rains in order to ascertain the viability of the seed (germination test). Farmers grew the seed crop during the rainy season.

Failure of a community group to repay its loan would lead to the group being excluded from participating in future CSC programs. In the past, repayment ranged from over 80 percent in good production years to 30-50 percent in bad years. The participating farmers were only supposed to multiply seed of a particular crop only once. However, most farmers multiplied seed for more than one season, as they believed seed from CSC was of a higher quality than the seed the farmers produced. Apart from seed, farmers participating in this program did not receive any other input. Most farmers sold their produce as grain to private traders.

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[42]Personal communication.

One key problem facing the program was its reliance on working with officials from the Ministry of Agriculture and Irrigation for seed, extension, and research. Changes in the Government regulations and bureaucracy affected the performance of the seed programs. Sometimes collaborating civil servants were transferred in the midst of the growing season and thereby disrupted the on-going program (Banda, 1997[43]).

5.3.3.2 Christian Service Committee-Church Farm's Seed Multiplication Scheme[44]

Seed multiplication at church farms started in the 1994/95 agriculture season. By the 1995/96 growing season, five church farms participated in this program, specifically Chididi African Evangelical Church, Naming'azi C.C.A.P[45] Church farm, Ntonda Zambezi Evangelical Church, Ngwira Prayer House (C.C.A.P), and Muruma Mission. However, in 1996/97 as funding was not available for seed multiplication, some church farms did not multiply seed.

Nature of Contract

For churches to participate, they had to have access to land on which to multiply seed. Each church signed a contract with CSC in which they promised to multiply seed to sell to surrounding churches and farmers (Appendix 5.3). Unlike its Smallholder Seed

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[43]Personal communication.

[44]Main sources are 1) Banda, 1997 and Luhanga, J. H. (1997).

[45]C.C.A.P., an abbreviation for Church for Central African Presbyterian.

Exchange Program (SSE Program), CSC provided the churches with basic seed on loan, as well as other inputs such as fertilizer and money for hiring labor.

After selling the seed, church farms were required to repay their loan, plus 35 percent of the amount borrowed. During the second year, the farms received a loan less the 35 percent they paid during the repayment of the loan. This allowed farms to repay their loan gradually over a period of three years. In 1994/95, the loan was worth K1, 400 per farm (approximately US$90).

Each scheme was closely supervised to ensure that the farm met the minimum requirements for seed production. The Ministry of Agriculture and Irrigation's Seed Services Unit were required to visit the farms before planting to verify that the seed fields were isolated by the minimum distance required. Unlike the CSC-SSE Program, the church farms were expected to practice monocropping. While some supervision was carried out by the Ministry of Agriculture and Irrigation's Seed Services Unit, the local extension workers were also trained to carry out inspection (*i.e.*, on roguing and post-harvest processing) and to advise the farm managers on appropriate seed crop production cultural practices. In addition to training in seed production, the farm managers were trained in book keeping and general business management. After the crop was established, Seed Services Unit staff made a second visit to confirm that the seed crop was disease-free and free of off-type varieties. After harvesting, the Seed Services Unit took samples to test the variety for purity.

The church farms were expected to produce "approved" (*i.e.*, quality declared) seed which they sold to the surrounding churches and farmers. However, in the past, CSC bought some seed from church farms in order to redistribute it to smallholder farmers participating in its SSE Program. Apart from multiplying the seed, the church farms also set up demonstration plots to promote the newly released varieties.

After three years, the church farms were expected to be independent. First, the links with the Ministry of Agriculture and Irrigation's Department of Research, Department of Extension and Training and the Seed Services Unit were expected to be sufficiently strong so that the farms would not need further mediation from CSC. Second, since the farm should be financially independent after three years, they could no longer rely on a loan from CSC. Third, through learning by doing, the farm managers should have acquired enough skill to be able to undertake seed multiplication with minimum supervision and advice.

Naming'azi Farm Training Center

The study focused on the Naming'azi Farm Training Center which is based in Zomba District. This farm belonged to the Church for Central African Presbyterian (C.C.A.P.). Located about 12 kilometers north of Zomba town on the Zomba-Lilongwe Road, the farm had 112 hectares, of which 20 hectares were developed. About five hectares of the land was a field used for bean production. The farm multiplied bean seed in 1994/95 and 1995/96. After the 1995/96 season, the farm manager recommended that the farm discontinue seed multiplication since the farm made a loss on seed production. Moreover, the Christian Service Committee did not have sufficient resources to fund the church farm scheme in the following year.

During the years CSC multiplied seed at Naming'azi Church Farm, the major problems that the farm faced included a lack of labor that led to late fertilizer application and poor weed control. Some cultural recommendations were not applicable, as they were perceived to be too labor intensive. For instance, ridge spacing was reduced from 90 cm to 50-60 cm (Naming'azi Farm Records, 1996). Also, the farms planted one row per ridge, rather than two rows per ridge, as recommended. Finally, the local extension worker did not make frequent visits, as expected, because he had other commitments[46].

Naming'azi Farm sold the seed it produced to farmers in the surrounding areas, just before planting time the following season. Most farmers learned about the availability of seed through field days and training sessions that the church farm conducted. However, since the seed was produced at a high cost (*i.e.*, the cost of labor was higher than budgeted for in the loan from CSC) but sold at the price of grain, the farm incurred a loss.

[46]Personal communication

5.3.4 The Concern Universal Seed Multiplication Scheme[47]

Introduction

Concern Universal is an international NGO working in two districts in Malawi-- Mwanza in southern Malawi and Dedza in central Malawi. Initially, it started as a relief organization to assist Mozambican refugees. After the refugees returned home, Concern Universal began to offer its services to Malawians who lived in areas surrounding the abandoned refugee camps. This study was conducted in Lobi in Dedza District where Concern Universal was working in three EPAs (Linthipe, Lobi and Kabwazi). The program had three main foci; first, its food security program supported seed multiplication and vegetable growing, and operated a grain/seed bank. Second, its water and sanitation program drilled bore holes in the villages. Third, its agro-forestry program supplied farmers with nitrogen-fixing trees such as *tealephrosia*, *leucaerna*, and *phiplebia.*

Nature of the Contract

Although Concern Universal started operating in the area in 1991, it did not establish its seed multiplication for crops other than vegetables until 1995/96. Therefore, at the time of the research, the project was in its second year for the non-vegetable crops. Funding for this program was provided by Caritus Neerandica, UNICEF (for vegetable growing), and the European Delegation (for seed multiplication). Participating farmers were selected using participatory rural appraisal methods (see Appendix 5.1). After multiplying

[47]Personal communication and Concern Universal (1997).

seed, farmers were expected to repay twice the amount they received at the beginning of the planting season.

Research Site

In Lobi, the main food crops grown were maize, cassava and beans. In the first year (1995) most of the seed given to the farmers for multiplication was locally-purchased grain and groundnuts which were bought from ADMARC. Farmers multiplied beans, soybeans, groundnuts, maize, finger millet, and cowpeas. Groundnuts were multiplied by the largest number of farmers (2,118), with soybeans being second (1,863) and beans third (1,724). For farmers growing crops in 1995/96, the average loan repayment rate was 74 percent, and those who defaulted were expected to repay following the 1996/97 harvest. However, since the seed that farmers repaid was of poor quality, the project had to hire labor to sort the seed. Groundnuts, millet and maize from the 1995/96 harvest were redistributed to other farmers in the 1996/97 season. The other crops were kept in a seed bank where there was physical and chemical pest control, but no temperature or humidity controls . This has implications for the quality of seed, especially soybeans which loses its viability when stored under high humidity and temperature conditions.

5.3.5 The National Bean Improvement Program's Community-Based Basic Seed Multiplication Scheme--NBIP[48]

Introduction

After releasing six bean varieties in 1995, the National Bean Improvement Program (NBIP) carried out several activities designed to multiply and disseminate the released varieties. First, in 1995/96, the NBIP produced breeder seed on Government and smallholder farms, planting approximately 19 hectare of land. Second, in conjunction with the Department of Agricultural Extension and Training and various NGOs, the program conducted 165 on-farm trials which also produced breeder seed[49]. Third, the program sold breeder seed to private farms, which in turn produced bean certified seed (Table 5.3).

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[48]Sources: Personal communication, EC Food Security Program (1996), and Luhanga, J. H. (1997)

[49] Including Livingstonia Primary Health Care in Rumphi District, ActionAid and Village Enterprise Zone Association (VEZA), Concern Universal and the Christian Service Committee.

Table 5.3: NBIP Certified Bean Seed Multipliers in 1995/96.

Farm/Farmer	Location	Variety	Quantity Planted (kg)	Estimated Area (ha.)
Mr Pyman	Changalume (Zomba)	Nasaka	300	5.0
	"	Nagaga	80	1.0
Mr Shumba	Chimbiya (Dedza)	Nasaka	30	0.5
Njewa Farm	Njewa (Lilongwe)	Kambidzi	45	1.5
	"	Mkhalira	30	1.0
Mr Kazeze	Chigwere (Mzuzu)	Nasaka	50	0.8
	"	Napilira	20	0.3
	"	Sapatsika	20	0.3
CSC	Various Church Farms	Nasaka	200	3.3
	"	Napilira	[a]	0.8
Total	All	All		

[a] Data not available

Source: Chirwa, R. in "Task Force on Maize Productivity Activities of Action Group 2" (April-June 1996).

Smallholder Seed Multiplication at Zidyana EPA

The study focused on the NBIP-sponsored scheme which contracted 45 smallholder farmers in Zidyana EPA (Nkhotakota District) to produce basic seed in the *dimbas* during the 1996 dry season. This is an area near Lake Malawi where farmers usually grow crops in *dimbas* during the dry season.

Nature of the Contract

The program provided the farmers with seed of five newly-released varieties: Nagaga (380 kg), Kambidzi (140 kg), Mkhalira (140 kg), Maluwa (80 kg), and Napilira (60 kg). Farmers multiplied the seed during the dry season because beans grown during this period are relatively disease-free, compared to when grown during the rain season. The participating farmers agreed to sell all of their produce to the NBIP at a price 10 percent higher than the prevailing market price for grain. The project bought about 9 tons of beans (Nagaga, 2,300 kg; Kambidzi, 2,890 kg; Napilira, 564 kg; Maluwa, 716 kg; and Mkhalira, 2,553 kg) at K20 per kg.

The project used the seed in three ways. First, the NBIP sold some seed to NGOs which distributed it to farmers participating in their respective smallholder seed multiplication schemes for the 1996/97 growing season. Second, in conjunction with the MPTF and the ADDs, the NBIP mounted countrywide demonstrations to promote the new bean varieties. Third, the NBIP packed the seed in 500 g bags for sale in grocery shops in

Blantyre/Shire Highlands RDP, Dedza Hills RDP, Ntchisi RDP and Mpompha Hills RDP.

From the description of the schemes above, it is apparent that there exist a wide range of schemes in terms of the crops of emphasis, nature of the contracts, and geographic distribution. The next section presents a comparative analysis of the environment of the schemes.

5.4 Comparative Analysis of the Environment of Seed Scheme

This section presents a comparison of the seed schemes studied--in terms of their sizes, nature of contracts, objectives, and type of seed produced. The main purpose is to assess how the differences in characteristics among the schemes contribute to the performance. First, a brief comparison of the results of a survey of farmers in the various schemes is presented.

5.4.1 The Respondents in the Survey

To collect data required to analyze these seed schemes, 163 respondents representing six seed multiplication schemes, were interviewed (Table 5.4). The respondents were from five ADDs: Mzuzu (7 %), Kasungu (52%), Lilongwe (13%), Salima (18%) and Blantyre (2%). A high proportion of respondents resided in Kasungu ADD because three of the six schemes[50] operated in this ADD (CSC-SSEP, ActionAid-SD and ActionAid-SM). The NBIP seed scheme was in Salima ADD while Concern Universal was in Lilongwe ADD. Respondents participating in the MPTF scheme farmed in all six of the ADDs.

[50]Smallholder survey was conducted on only six schemes as the seventh scheme involved a church farm.

Table 5.4: Proportion of Respondents by Smallholder Scheme and Area, Malawi, 1996/97. (N=163)

Scheme	Total Number	Kasungu ADD	Lilongwe ADD	Salima ADD	Blantyre ADD	Mzuzu ADD
		(Percent)				
Commercial Schemes						
NBIP	28	0	0	100	0	0
MPTF	30	17	30	7	10	37
Seed Security Schemes						
CSC-SE	30	100	0	0	0	0
ActionAid-SM	28	100	0	0	0	0
ActionAid-SD	21	100	0	0	0	0
Concern Universal	26	0	100	0	0	0
Total Number	163	84	35	40	3	11
Percent	100	51.6	21.5	18.4	1.8	6.7

Source: Data from Survey, Smallholder Seed Multiplication Schemes' Survey, Malawi, 1996/97

The spacial distribution of the schemes reflects the objectives of each scheme. For instance, the MPTF's seed scheme aims at training farmers throughout the country to produce and sell seed. Thus, seed production activities were implemented in all ADDs to enable farmers in each ADD have access to local suppliers of seed. ActionAid-SD, which targets the poorest farmers, started its seed programs in the four ADDs that it believed had the highest proportion of seed insecure households. Similarly, ActionAid-SM Schemes operated in areas which they initially believed needed integrated projects and planned to move the project to other areas after completing the project in the two initial areas.

Concern Universal's goal was to offer relief to Malawians formerly neighboring Mozambican refugee camps, so it targeted areas with the highest number of refugees. Finally, the NBIP Scheme, which was established to produce high quality basic seed, was sited at Zidyana EPA where availability of *dimbas* permitted dry season seed production.

5.4.1.1 Gender of Respondents

Overall, while the majority of the sampled respondents were women (62 percent), the gender mix varied across schemes. Schemes managed by the CSC-SSEP (90%), ActionAid-SM Scheme (67%), and Concern Universal (100%) primarily targeted women farmers. In contrast, ActionAid-SD Scheme (50%) and NBIP Scheme (57%) had almost equal representation of men and women. On the other hand, the MPTF Scheme had a higher representation of men (86%) than women.

The above scenario can be explained in part by examining the farming systems of the farmers in the areas. The majority of the respondents were from the central Malawi where tobacco is the main smallholder farmers' main cash crop. Hence, women are in most cases left with the responsibility to grow food crops as men grow the cash crop. That is why the proportion of men in seed multiplication increases where schemes were more commercial, for instance under NBIP (57%) and ActionAid-SD (50%). On the other extreme, the MPTF scheme was predominantly male dominated (86%).

From the scheme's gender composition, it appears that women are more likely to participate in seed security schemes that are targeted at the poor households. In contrast, schemes that have a more commercial focus, such as the MPTF Scheme, targeted men. For the MPTF Scheme, participation was based on the farmer's ability to demonstrate a willingness and a potential to participate in certified seed production. On the other hand, entry into some schemes depended on one's degree of poverty (ActionAid schemes, and Concern Universal) and entry into the CSC-SSE Program was self-selecting because of the small amount of seed involved.

5.4.1.2 Reasons for Respondents Joining a Seed Multiplication Scheme

Analysis of the respondent's objectives in joining a seed multiplication scheme indicates that some were motivated by a desire to ensure their seed security while others joined for broader financial reasons (Table 5.5)

Table 5.5: Reason for Respondents Joining the Seed Multiplication Scheme, Malawi, 1996/97. (N=163)

Scheme	(Number of Respondents)	Reason for Joining Scheme			
		Seed Security	Make Money	Learn Soya Utilization	Get New Variety
		-Percent-			
Commercial Schemes					
NBIP	(28)	0	100	0	0
MPTF	(30)	20	80	0	0
Seed Security Schemes					
CSC-SE	(30)	57	3	17	23
ActionAid-SM	(28)	96	8	0	0
ActionAid-SD	(21)	68	16	0	24
Concern Universal	(26)	81	10	7	14
Total Number	163	85	61	7	16
Percent	100	52	38	4	10

Note: Some farmers reported more than one reason for joining a particular scheme.
Source: Data from Survey, Smallholder Seed Multiplication Schemes' Survey, Malawi, 1996/97.

The majority of the respondents from ActionAid-SM (96%) and Concern Universal (81%) indicated that their main objective was to secure seed. However, in addition 17 percent of the CSC farmers joined the scheme in order to learn how to utilize soybeans and 14 percent of ActionAid-SM hoped to make money selling their seed. In sharp contrast, 100 percent of the respondents from the NBIP Scheme and 80 percent from the MPTF Scheme joined with the expectation of making money by selling their seed.

The above responses are consistent with the stated objectives of the respective schemes. Whereas one group of schemes was aimed at providing seed to seed insecure households, the other group was aimed at developing seed entrepreneurs and seed producers who would sell the seed to the NBIP or to other farmers (MPTF Scheme).

With the exception of Nasaka, all seed schemes multiplied new varieties. However, only about nine percent of the respondents specifically indicated that they joined the schemes to gain access to a new variety. While none of the respondents who participated in the NBIP Scheme and the MPTF Scheme mentioned receiving new varieties as a reason for joining, this might be because these farmers were recruited under the expectation that they would sell their seed. However, these results highlight the importance of differentiating the demand for new seeds as sources of new germplasm versus demand for seeds of any kind of germplasm. The low percentage of respondents mentioning obtaining a new variety as a reason for joining seed schemes suggests that farmers did not appreciate that the new varieties performed better than their traditional varieties.

5.4.1.4 Legume Crops that Respondents Multiplied

The emphasis on the type of crops being multiplied varied across the schemes. Programs managed by ActionAid (both programs), the MPTF, Concern Universal, and Christian Services Committee-SSEP all allowed farmers to select what crop they wanted to grow (*i.e.*, groundnuts, beans and soybeans). In contrast, the NBIP Scheme only multiplied beans. All others multiplied at least two crops (Table 5.6).

Table 5.6: The Proportion of Respondents Multiplying Legumes by Scheme, Malawi, 1996/97. (N=163)

Scheme	(Number of Respondents)	Crops		
		Beans	Groundnuts	Soybeans
			-Percent-	
Commercial Schemes				
NBIP	(28)	100	0	0
MPTF	(30)	40	37	23
Seed Security Schemes				
CSC-SSEP	(30)	27	0	77
ActionAid-SM	(28)	75	0	32
ActionAid-SD	(21)	62	24	36
Concern Universal	(26)	42	46	31
Total Number	(163)	93	28	54
Percent	100	57	17	33

Source: Data from Survey, Smallholder Seed Multiplication Schemes' Survey, Malawi, 1996/97

Interestingly, the bean varieties ActionAid distributed had become known locally as *ActionAid*.

5.4.1.4 Extension Support that Respondents Received in Smallholder Seed Schemes

The use and need for seed expertise varied by schemes, since some schemes produced certified seed while others produced good quality, but not necessarily certified seed. Thus, respondents in the MPTF Scheme had more contact with the seed experts from the Ministry of Agriculture and Irrigation's Department of Research who trained the participating farmers in seed crop management, and carried out seed crop inspection and certification. However, most farmers in all schemes, except Concern Universal, had access to extension support which was either provided by an extensionist employed by the scheme itself or employed by the Government (Table 5.7).

Table 5.7: The Type of Extension Support Respondents Received by Seed Multiplication Schemes, Malawi, 1996/97. (N=163)

Scheme	(Number of Respondents)	Type of Support		
		NGO Employee	Civil Servant	None
			-Percent-	
Commercial Schemes				
NBIP	(28)	4	96	0
MPTF	(30)	0	97	3
Seed Security Schemes				
CSC-SSEP	(30)	67	13	20
ActionAid-SM	(28)	68	0	32
ActionAid-SD	(21)	5	86	9
Concern Universal	(26)	12	0	88
Total Number	163	27	48	25
Percent	100	27	48	25

Source: Data from Survey, Smallholder Seed Multiplication Schemes' Survey, Malawi, 1996/97

Overall, the majority of the respondents indicated that they received support from the extension workers from the Ministry of Agriculture and Irrigation (48%). However, seed security schemes (*i.e.*, CSC-SSEP and ActionAid-SM Scheme) tended to rely more on their own extension workers (67% and 68% respectively) while the relatively more commercial schemes (*i.e.*, NBIP Scheme and the MPTF Scheme) and ActionAid-SD

Scheme relied more on extension workers from the Ministry of Agriculture and Irrigation. This is the case because the seed security focused schemes had resident extension workers living in the areas, whereas NBIP and the MPTF Schemes did not have similar personnel on the ground. However, ActionAid-SD extension personnel worked hand-in-hand with the extension staff from the MOAI because after the project phases out in the year 2000, it will be handed over to the Ministry would take over running the project[51].

Similarly, field inspection by seed experts varied by scheme. The inspection for CSC-Church Farms[52], ActionAid-SM and ActionAid-SD was carried out by NGO personnel. In contrast, the NBIP scheme's seed was inspected by the personnel managing the program while the MPTF scheme's seed production was inspected by the Ministry of Agriculture and Irrigation's Seed Services Unit. Among Concern Universal[53] farmers, none of the respondents reported having their field inspected while only 18 percent of ActionAid-SM reported field inspection.

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[51]For ActionAid-SD, the seed experts from the MOAI's Seed Services Unit train ActionAid's extension personnel and farmers in seed crop husbandry.

[52]The CSC-Church Farms relied on the MOAI's seed experts to train farm managers in seed crop husbandry, seed crop inspection and seed certification. For CSC-SSEP, the contact with the seed experts is through the Agricultural Supervisor, an agriculturalist by training and trained the extension staff.

[53]Concern Universal began involving seed experts to train extension personnel in 1997/98 season. Thus, during its first two years operation, neither the farmers nor the extension personnel were trained in seed multiplication.

Thus, these data suggest that schemes that had a more commercial orientation made an effort to insure seed quality, whereas the seed security-focused schemes did relatively little to monitor seed quality.

5.4.1.5 Year When Respondents Joined Seed Scheme

ActionAid-SM Scheme was established in 1991. About 15 percent of the respondents interviewed indicated that they had participated in seed multiplication since 1991 and over one-half (54%) reported participating since 1994. The remaining one-third of the respondents joined seed multiplication between 1991 and 1994, implying that most of the initial farmers had left the scheme and were replaced by new participants.

Similarly, the CSC started its smallholder seed multiplication scheme in 1991. A majority of the respondents started seed multiplication in 1993 (46%) and 1994 (35%). Although Concern Universal started working in Lobi in 1991, seed multiplication for legumes and other large-seeded grains did not begin until 1995. Thus, none of the farmers had participated for more than two years. ActionAid-SD Scheme started its operations in 1995 on a pilot basis. Finally, the NBIP and the MPTF schemes had operated for one year, so all farmers were recent farmers.

5.4.1.6 Approaches to Seed Multiplication

In most of the schemes, farmers multiplied seeds individually. Among the respondents, 88 percent indicated that they multiplied seed individually while 12 percent multiplied seed in a common field. While all respondents who multiplied in a group were associated with ActionAid-SD, within this scheme some farmers multiplied seed in individual gardens while maintaining group responsibility to repay their loan.

The information presented above indicates that seed production programs may be classified into three types of schemes. First, there are schemes such as the MPTF and the NBIP, under which farmers multiply seed individually and contract with the schemes on an individual basis. Second, schemes such as ActionAid-SM, CSC-SSE and Concern Universal have community groups which serve a coordinating role, while farmers still multiply seed individually. Lastly, under ActionAid-SDS, farmers multiply seed jointly as members of community group.

When asked about their preference, 80 percent said they preferred to multiply seed individually (Table 5.8).

Table 5.8: Respondents, Preference to Multiply Seed Individually or in a Group, Malawi, 1996/97. (N=163)

Scheme	Type	(Number of Respondents)	Respondent Preference	
			Individual Production	Group Production
			-Percent-	
Commercial Schemes				
NBIP	Individual	(28)	86	14
MPTF	Individual	(30)	60	40
Seed Security Schemes				
CSC-SSEP	Group	(30)	80	20
ActionAid-SM	Group	(28)	82	18
ActionAid-SD	Group	(21)	95	5
Concern Universal	Group	(26)	81	19
Total Number		163	130	33
Percent		100	80	20

Source: Data from Smallholder Seed Multiplication Schemes' Survey, Malawi, 1996/97

While farmers in all groups strongly preferred to multiply seed individually, it is noteworthy that 40 percent of the farmers in the MPTF Scheme (in which farmers were multiplying seed individually) preferred group production. However, the main reason for this choice was that it would enabled them to cooperate in activities other than growing the seed crop, such as obtaining a loan for inputs and marketing the produce (as is the case with the MPTF Scheme). In these instances, belonging to a group increases farmers bargaining power.

However, it is clear that individual responsibility is required to ensure the success of the scheme. For example, in repaying a seed loan, insuring seed quality was important in cases where seed is the form of repayment (ActionAid-SM, Concern Universal and CSC-SSEP) or where seed was bought by the scheme (NBIP and MPTF schemes). In this case, the quality of the seed produced by the scheme was the sum of all farmers' seed quality. Where farmers return seed individually, the cost of enforcing the seed quality (*i.e.* inspecting and rejecting substandard seed supplied by individual farmers) takes more time and labor than under the group production approaches, where the group is responsible for repaying in-kind loans.

5.4.1.7 Amount of Seed Farmers Receive from the Scheme

The amount of seed farmers received varied greatly by scheme, which has implication for the cost of operating the scheme and the total amount of seed produced. The MPTF, NBIP and ActionAid-SD Schemes provided farmers 10 to 18 times more seed than the other three schemes (Table 5.9)

Table 5.9: Respondents' Mean Seed and Mean Harvest by Scheme, Malawi, 1996/97.

	Commercial Scheme→		*Seed Security→*			
	MPTF	NBIP	ActionAid-SD	ActionAid-SM	CSC-SSEP	Concern Universal
			(Average Seed Received, Kg)			
Beans	a	18	a	6	2	a
S/beans	a	a	a	5	2	a
G/Nut	a	a	a	a	a	5
			(Average Harvest, Kg)			
Bean	a	182	a	75	30	a
S/bean	a	a	a	77	46	78
G/nut	a	a	a	a	a	a
			Harvest/Seed Ratio			
Bean	a	10	a	13	18	a
S/bean	a	a	a	14	23	16
G/nut	a	a	a	a	a	a

[a] Data not available
Source: Data from Smallholder Seed Multiplication Schemes' Survey, Malawi, 1996/97

Although the MPTF Scheme and ActionAid-SD Schemes (group) provided farmers almost the same amount of seed on a per capita basis, ActionAid-SD farmers received a similar amount of seed as Concern Universal, ActionAid-SM, CSC-SSEP Schemes' farmers. Also, while ActionAid-SM Scheme reported giving farmers 10 kg of seed, the respondents said they received only 5 kg of seed on average. This difference can be explained in terms of changes in the management of the seed multiplication scheme. As

ActionAid let groups assume more responsibilities, it appears the groups attempted to reach a larger number of farmers (*i.e.*, maximize equity concerns of a community) by providing each recipient with a smaller quantity of seed than ActionAid used to supply. The implication of these findings is that participants would not produce enough to provide for food and seed for the following season.

5.5 A Comparative Environment-Behavior Analysis of the Seed Multiplication Schemes

The seed multiplication schemes varied greatly in terms of their size (*i.e.*, number of farmers participating) and location where they work. While some of them operate nationwide, others focused on a few locations. Data in Table 5.10 summarize the key characteristics of the schemes, including the number of participating farmers, where they operated, crops targeted, and the amount of seed participants were supposed to receive.

Table 5.10 Characteristics of Seed Schemes, Malawi, 1996/97

Scheme Characteristics	*Commercial Schemes →*		*Seed Security Schemes →*				
	MPTF Scheme	NBIP Scheme	ActionAid-SM	ActionAid-SD	CSC-Church Farms	CSC-Seed Exchange	Concern Universal
Regional Focus	National	Zidyana EPA	Mwanza and Dowa Districts	Four out of eight ADDS in the country	Five Churches in Southern and Central Region	13 Development Areas around the country	Lobi, Mwanza
Number of Participants	73	45		>3,000	5 Churches	>4,000	>2,000
Year Established	1996	1996	1992	1995	1994	1992	1995
Crops Targeted[1]	Mz, B, G, SB, PP	B	Mz, B, G, SB, PP	Mz, B, G, SB, PP	Mz, B, G, SB, PP	Mz, B, G, SB, PP	Mz, B, G, SB, PP
Seed Source	MOAI[2]	MOAI	MOAI	MOAI	MOAI	MOAI	MOAI
Seed per Farmer	30-40 kg	30-40 kg	10 kg	30-40 kg	30-40 kg	3-8 kg	3 kg
Source of Seed Expertise	DOR[3]	DOR	Project extension personnel without seed training	DOR	DOR	Project extension personnel	Project extension personnel without training

[1]MZ = Maize, B = Beans, GN = Groundnuts, SB = Soybeans, PP = Pigeon peas; [2]MOAI = Ministry of Agriculture and Irrigation; [3]DOR = Department of Research
Source: Data from survey, Smallholder Seed Multiplication Scheme's Survey, Malawi, 1996/97.

5.5.1 Location and Size of Smallholder Seed Multiplication Schemes

Apart from the MPTF Scheme's nationwide program, the rest of the schemes were localized. Participants in the former scheme farmed in each ADD, although some ADDs had a higher number of participants than others. The scheme with second widest national distribution was ActionAid-SD which served farmers in four of the country's eight ADDs. Third was the CSC-SSEP, which covered 13 development areas (each about 50 square kilometers), followed by the CSC-Church Farm (five church farms). The ActionAid-SM and Concern Universal each served only two areas and the NBIP operated in one EPA.

The schemes also varied greatly in terms of the number of participants. Christian Services Committee's SSEP and ActionAid-SD Schemes involved the largest (3,000-4,000) numbers of farmers, followed by Concern Universal (2,000) and MPTF (73) and NBIP (45) and five CSC-church farms[54]. Since no records were available that documented the number of farmers involved in schemes, the extension workers' estimates were used for ActionAid-SM, Concern Universal, and CSC-SSEP.

Reviewing the relationship between the goals of the scheme and the number of participants suggests that schemes which were aimed at alleviating seed insecurity tended to involve a higher number of participants. On the other hand, schemes which were designed to produce seed for sale (MPTF and NBIP) had a smaller number of participants.

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[54]Personal interviews with officials from the schemes.

5.5.2 The Nature of Contracts Among the Seed Multiplication Schemes

Most seed multiplication schemes had contracts that defined the respective obligations of the farmers and the seed scheme. While in some cases farmers signed a contract and in other schemes the contract was implied. For instance, the ActionAid-SD Scheme, the NBIP Scheme and the CSC-Church Farms Scheme had explicit contracts. However, for the rest of the schemes, farmers were not required to sign a contract. Rather, through meetings between the farmers and the officials from the schemes, each party's obligations were stipulated. Concern Universal required each group to write a constitution before it was given a seed loan. The constitution had to indicate how the group would recover the seed loan. Data in Table 5.11 summarize the contractual agreements associated with each seed multiplication scheme.

Table 5.11 Contractual Arrangements on Smallholder Seed Multiplication Schemes

Item	*Commercial Schemes →*			*Seed Security Schemes →*			
	MPTF	NBIP	CSC-Church Farm	ActionAid-SM	ActionAid-SD	CSC-Seed Exchange	Concern Universal
Party to a contract	Individual	Individual	Individual churches	Group	Group	Group	Group
Repayment terms	Same amount	Same amount	120% of seed value	120% of seed provided	120% of seed value	200% of seed provided	200% of seed provided
Type of repayment	Seed	Seed	Cash	Seed	Cash	Seed/Cash	Seed
Time of repayment[1]	After seed sales	After seed sales	After selling	After harvest	After harvest	After harvest	After harvest
Quality of seed produced	Basic/certified seed	Basic/certifi ed seed	Quality declared seed	Farmer seed	Quality declared seed	Farmer seed	Farmer seed
Desired end use of seed	Sell to farmers[2]	Sell to NBIP used it as certified seed for other programs	To sell as seed to surrounding churches/farmers	For farmers to use both as seed and share/sell with neighbors	For farmers to use both as seed and share/sell with neighbors	For farmers to use both as seed and share/sell with neighbors	For farmers to use as seed and share/sell with neighbori ng farmers

[1]For programs, the repayment period was ambiguous, ranging from after harvesting to before the next planting season; [2]Although the goal was to turn these farmers into seed entrepreneurs, for the 196/97 season, the MPTF bought all the seed from the farmers.
Source: Data from Survey, Smallholder Seed Multiplication Schemes' Survey, Malawi, 1996/97

5.5.2.1 Parties to Contract in a Seed Scheme

In four schemes (ActionAid-SM, ActionAid-SD, CSC-SSEP and Concern Universal), contracts were negotiated between the organization and a group of farmers, and seed loans were both given and recovered through community groups. In contrast, the MPTF Scheme, NBIP Scheme and CSC-Church Farms contracted with individual farmers and farms.

Clearly, it is less costly for a scheme to deal with community groups rather than individuals--especially if the program targets a large number of farmers. These results may explain why schemes with a small number of participants tend to give individual contracts, whereas schemes involving a large number of participants use group contracts which reduce transaction costs (*i.e.*, transaction costs include the cost of negotiating a contract, monitoring for non-performance, and enforcing terms of a contract such as recovering a loan).

Whether farmers grew seed in a group or individually has transaction cost implications. While ActionAid encouraged farmers to produce seed as a group, some groups opted to produce seed individually because they feared that some farmers in the group would shirk in their responsibilities. In addition, seed quality may decline in groups as some farmers seek to free-ride on good quality seed that others produce. Thus, in schemes where farmers produce seed individually, but market it as a group, it could be difficult to maintain quality standards. In such cases, the final product, which is the sum of each farmer's quality, may not meet the required minimum standard.

In seed schemes where the goal was to produce high quality seed, the schemes tended to work with farmers individually. For instance, the MPTF Scheme, the NBIP Scheme and the CSC-Church Farms, which produced certified seed or quality-declared seed, required farmers to sign contracts as individuals which made success or failure an individual responsibility.

5.5.2.2 Seed Loan Terms

The seed schemes used different loan repayment options. The schemes' method of repayment reflect their objectives. First, ActionAid-SD[55] and CSC-Church Farms required farmers to repay using cash. In contrast, the rest of the schemes (*i.e.*, MPTF Scheme, NBIP Scheme, CSC-SSEP, Concern Universal Scheme and ActionAid-SM Scheme) required farmers to repay their loan in seed. These schemes planned to distribute seed to other farmers the following year. By requiring repayment in seed, they maximized the amount they had available for distribution the following year.

Community-based schemes (CSC-SSEP, Concern Universal Scheme and ActionAid-SM Scheme) that require repayment in seed followed two approaches. In ActionAid-SM and

[55]For example, ActionAid-SD required farmers to repay their loan using cash as a way of encouraging them to distribute the seed to other farmers through selling.

CSC-SSEP, the farmers repay the seed to a committee which stored it and then distributed the seed to farmers the following year. In contrast, Concern Universal farmers repay the seed to the scheme, which stored it in bulk before distributing it to farmers the following season.

Whether the seed is stored by the scheme or the farmers has implications for the quality of seed available for distribution to farmers the following season. Especially for crops such as soybean whose viability tends to deteriorate under poor storage conditions (high temperature and high humidity), proper storage is critical to maintaining seed viability. Clearly, it is easier to ensure storage quality standards if the scheme stores seed, rather than where farmers or farmer groups store the seed themselves. However, schemes attempt to reduce their transaction costs including storage costs, by requiring farmers to assume storage functions.

In all schemes, if farmers failed to repay their loan, they were required to repay it the following year. The terms of repayment for the loans varied across schemes. The CSC-SSEP and Concern Universal required the farmers to repay 200 percent of the amount of seed they received. Under ActionAid-SM, repayment was 120 percent of the initial amount the farmers received. ActionAid (SD) required the farmers to repay 120 percent of the value of seed they received.

5.5.2.3 A Comparison of Seed Production and Post-Harvest Requirements Among Seed Multiplication Schemes

The practice that seed farmers were required to follow reflected the quality of seed that the scheme sought to produce. Concern Universal, CSC-SSEP and ActionAid-SM did not intend to produce certified seed. Therefore, these schemes placed few restrictions on the farmers. While they were required to plant one variety per field, they were not required to isolate their field (e.g., since legumes are self-pollinated, observing isolation distance is not critical) and were allowed to grow the seed as an intercrop.

In contrast, schemes which sought to produce basic or certified seed imposed several restrictions. For example, the MPTF Scheme farmers had to observe isolation distance, plant one crop per field, and one variety per crop. Additionally, the Seed Services Unit inspected the fields before the crop was planted and during the time it was in the field. Following the harvest, the seed inspectors carried out seed certification tests. Similarly, CSC-church farms followed similar procedures, and NBIP farmers planted their crop with close supervision from the NBIP personnel and the extension personnel from the Ministry of Agriculture and Irrigation. While ActionAid-SD Scheme did not monitor their farmers' seed crop with the same level of scrutiny, the farmers were expected to plant one crop and one variety per field.

Both the MPTF and the NBIP required farmers to carry out several post-harvest activities (*i.e.*, cleaning, sorting and grading). This was the case because, first, the seed had to be certified before the farmers were permitted to sell it. Second, whereas the NBIP Scheme did not certify the seed its farmers produced, farmers knew that the seed had to be clean or the NBIP would not buy it. For other schemes, while farmers were encouraged to clean and sort their seed, there was no mechanisms to enforce compliance. Finally, none of the schemes had requirements for packaging, since they all sold in bulk to the schemes or sold loose to other smallholder farmers. While the NBIP packed seed in 500 g packs for direct sale to smallholder farmers, the packaging was done by the NBIP rather than the scheme farmers. Data in Table 5.12 show a list of seed production and post-harvest activities by schemes.

Table 5.12 Smallholder Seed Production and Post-Harvest Requirement Among the Schemes, Malawi, 1996/97.

Production Requirement	*Commercial Schemes →*			*Seed Security Schemes →*			
	MPTF	NBIP	CSC-Church Farms	ActionAid-SM	ActionAid-SD	CSC-SSE	Concern Universal
Monocrop required	Yes	Yes	Yes	No	Yes	No	No
One variety per field	Yes	Yes	Yes	No	No	No	No
Isolation required	Yes	Yes	Yes	No	Yes	No	No
Field inspection before planting	Yes	Yes	Yes	No	Yes		
Field inspection as the crop is in the field	Yes	Yes	Yes	No	Yes	No	No
Post harvest inspection	Yes	Yes	Yes	No	Yes	No	No
Certification	Yes	No	No	No	No	No	No
Cleaning of harvest	Yes	Yes	Yes	No	No	No	No
Sorting and grading	Yes	Yes	Yes	No	No	No	No
Packaging	No	No	No	No	No	No	No
Total Number of Required Activities	9	8	8	0	5	0	0

Note: Yes (encouraged) is not counted; Source: Data from Survey, Smallholder Seed Multiplication Schemes' Survey, Malawi, 1996/97

These results suggest that while all of the seven schemes produced seed, the production was under several different levels of supervision. Assigning a value of 1 for each required activity and summing these values for each scheme generates scores that range from 9 (MPTF) to 0 (CSC-SSEP and Concern Universal). Farmers in schemes with high scores were expected to carry out more activities than they would if they were producing grain.

In addition to increasing transaction costs (*i.e.*, negotiating, monitoring, inspection), these requirements increase the cost of production. Table 5.13 shows the additional resources that respondents indicated they used compared to grain production.

Table 5.13: Percent of Respondents Using Additional Resources in Seed Production, Compared to Grain Production, Malawi, 1996/97. (N=163)

Scheme	(Number of Respondents)	Additional Resources Used			
		Cash/Capital	Land	Labor	None
		-Percent-			
Commercial Schemes					
NBIP	(28)	0	10	30	68
MPTF	(30)	53	10	30	10
Seed Security Schemes					
CSC-SE	(30)	30	0	15	62
ActionAid-SM	(28)	1	18	0	75
ActionAid-SD	(26)	43	0	17	43
Concern Universal	(21)	7	0	6	92
Total Number	163	36	9	23	95
Percent	100	22	6	14	58

Note: There were multiple responses
Source: Data from Survey, Smallholder Seed Multiplication Schemes' Survey, Malawi, 1996/97

Among all schemes, respondents participating in the MPTF scheme most frequently (90 percent) reported using more resources in seed production than for grain production. Of these farmers, 53 percent reported using more cash, and 30 percent said they used more labor. As farmers in this scheme were required to produce certified seed, officials from the Ministry of Agriculture and Irrigation (Department of Research, Seed Services Unit and Department of Extension and Training) frequently visited these farmers to give advice, inspect and evaluate the crop. Therefore, farmers took activities such as roguing and sorting more seriously than farmers in the other schemes who were not required to do these activities or where enforcement was lacking.

The only other scheme reporting using more resources for seed production were farmers in the ActionAid-SD Scheme. Among these respondents, 43 percent indicated using more cash than they would for grain production. In most cases, respondents mentioned the membership fee which was required by some groups. The amount, which was determined by the group, varied from K20 to K30 per farmer per season.

With the exception of farmers from ActionAid-SM, farmers from the other seed security schemes did not indicate using more land for seed production than they would if they were producing grain. This is the case because, in many cases, farmers grew their seed crop intercropped with maize.

Implications of the Production System on Farmers' Expected Seed Price

In general, farmers who produced certified seed (NBIP, MPTF and CSC-Church Farms) used more resources than farmers from seed security schemes (CSC-SSEP, ActionAid-SM, ActionAid-SD and Concern Universal). Since ActionAid-SM and CSC-SSEP farmers did not use more resources, they did not require a higher price for their seed. On the other hand, farmers in the MPTF Scheme needed a premium price, if they were expected to continue to produce seed in the future.

Farmers' price expectations had implications for the sustainability of the seed multiplication schemes. If the scheme's requirements increased farmers costs, they will be reluctant to participate, unless they are confident of receiving a premium price for their seed. Furthermore, seed users' willingness to pay that expected price was critical in meeting the farmers' expected price. Therefore, a divergence between seed producers' willingness to receive price and the seed users' willingness to pay price can dampen efforts of producing and distributing new seeds.

5.6 Performance of Seed Multiplication Schemes

As noted previously, the intended end-use of the seed varied across the schemes. For some schemes (*e.g.*, CSC-SSEP, Concern Universal and ActionAid-SM), the objective was to simply multiply seed in order to ensure seed security for participating farmers. On the other hand, ActionAid-SD's objective was to both satisfy farmers' seed security requirements, and provide these farmers with a new income generating activity. For the NBIP, the farmers produced seed to supply for the organization, which would in turn distribute it to other seed multiplication schemes. Finally, MPTF Scheme farmers produced seed for sale to other farmers--under the assumption that farmers were willing to pay a premium for high quality seed of new varieties.

Although the underlying objective of all schemes was to multiply seed, one group of schemes was more commercially-oriented than the other which focused on alleviating smallholder farmers' seed security needs. Therefore, in assessing performance, the extent to which a scheme achieved its objectives was used as the performance criteria. Finally, the constraints that contributed to poor performance of a given scheme are presented, focusing on how each schemes' design contributed to its performance.

5.6.1 The Performance of CSC-Smallholder Seed Exchange Scheme

Approximately 4,000 farmers in 13 development areas participated in this program in 1996/97. From the results of the smallholder farmers' survey, women represented the largest proportion of participants.

Although there were no restrictions on who participated in the program, the small amount of seed farmers received (averaging 3 kg per farmer) self-targeted the scheme towards poorer farmers. While the seed supplied provided farmers with part of their seed needs for one year (*i.e.* enough seed to plant 0.06 hectares if intercropped with maize), this amount is insufficient to solve the farmers' long term seed needs. This is especially true, given that the legume crops have a high sowing rate[56] and a low multiplication rate[57]. Therefore, under optimal growing conditions, 3 kg of groundnuts would produce 30 kg of seed and 3 kg of beans would produce 150 kg of seed. From this harvest, farmers would

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[56]Under monocropping, beans have a sowing rate of 100 kg/ha and groundnuts have a sowing rate of 125 kg/ha. Both are ranked as crops with high sowing rates compared to others such as maize, sorghum and millet. Sowing rate is the amount of seed required to plant one hectare of land.

[57]Beans have a medium multiplication rate of 50 and groundnuts have low multiplication rate of less than 10 compared to maize which has a multiplication rate of 100.

likely eat, sell and save some seed for the following season, and probably share it with other farmers. In order to address seed security in the long term, farmers needed a larger amount of seed than they received. The amount they received was good only for the short term. In most cases, the NGOs did not have enough seed to meet for the seed demand. There were conflicting interests between achieving efficiency levels (*i.e. the* amount of seed that would make an individual farmer achieve long-term seed security) and achieving equity (*i.e.* providing seed to as many farmers as possible).

5.6.2 Performance of CSC-Church Farm Program

The Church Program was conducted for two years as there was no funding for the third year. From the perspective of producing quality-declared seed, the scheme operated successfully in the 1995/96 season. While the Ministry of Agriculture and Irrigation's Seed Services Unit did not visit some church farms before the farms planted, when visits were made the Seed Services Unit noted a few problems at some farms. Seed grown in fields that failed to observe the isolation distance, where the seed was planted with other crops and where poor crop husbandry was practiced (*i.e.* weedy fields, no roguing and shading from nearby trees) was rejected because of these violations (Naming'azi Farm records, 1996).

As for Naming'azi Farm, the production of the seed was satisfactory, *i.e.* no seed crop was rejected. In 1995/96, the farm produced 89 kg of beans and 180 kg of pigeon peas. However, this amount of seed was sufficient to supply only a small number of farmers.

For example, assuming farmers were allowed to buy 3 kg of seed each, only 30 farmers would be able to buy bean seed and 60 farmers would be able to buy pigeon pea seed. Thus, for the farm to have a significant impact on meeting farmers' seed needs, it would have to produce far more seed than it did in 1996. In terms of profitability, production costs were higher than the revenues the farm realized after selling the seed as grain. The farm manager reported that the cost of labor exceeded expectations, and records showed that instead of engaging labor for four months as the CSC contract stipulated, the farm employed labor for eight months (July to February). Therefore, the objective of producing seed at a profit was not achieved (Naming'azi Farm Records, 1995/96).

Because of poor documentation, there were no records to indicate how many farmers bought the seed or if they used it as seed. Nevertheless, being a well-established farm, those who bought seed might have used it as seed believing the quality to be higher than the farmers' own seed. Although the scheme was designed to sell seed to smaller churches that have fields, the scheme never established these links. However, in terms of creating awareness, the Church Farm hosted training sessions for surrounding farmers, so farmers attending these courses were exposed to the seed crop.

Christian Service Committee sought to increase the links between the MOAI and the Church Farms. However, since the Department of Training and Extension and the Seed Services Unit are service departments, *(i.e.* they charges for their services), without funding from the Christian Service Committee, the Church Farm was not willing or able to contract for these services. Therefore, the objective of strengthening links with other stakeholders such the MOAI was not achieved.

5.6.3 Performance of Concern Universal Program

The Concern Universal scheme produced seed and established a seed bank from storing the repaid 1995/96 crop. However, because the stored seed varied greatly in quality, Concern Universal had to re-grade the seed before it could be distributed to farmers. Cost-benefit analysis of storing seed in a seed bank indicated that the seed bank was operating at a profit, *i.e.* selling the seed would recover the cost of storage (Concern Universal, 1997) .

In terms of achieving its seed security objective, the scheme was relatively successful. In 1996, Concern Universal distributed seed to a large number of farmers: 1,724 received beans, 1,863 received soybeans, 2,118 received groundnuts (Concern Universal, 1997).

Similar to the CSC-SSEP, however, the amount of seed each farmer received was too small to solve the farmers' long term seed security needs (1.5 kg beans, 4.5 kg soybean, and 2 kg groundnuts). This was evident from the proportion of farmers who indicated having participated in seed multiplication in both years. This suggests that farmers were not saving seeds, but relied on returning to Concern Universal for seed every year. From the repayment of seed in 1996 which was stored in the seed bank, the following number of farmers would benefit from the seed assuming they received the same amount of seed as in the previous year: beans, 5,217 households; soybeans, 4,000 households and groundnuts 1,663 households (Concern Universal, 1997) . Instead of solving the farmers' seed security problem, the NGO acted as a seed reserve for farmers every year.

5.6.4 Performance of ActionAid-SM Program

Under this program which had been operating since 1990/91, farmers assumed some of the seed distribution functions such as seed loan recovery, seed storage, and seed distribution. Participating farmers received an average of 5-10 kg of seed from ActionAid--enough seed for a farmer to produce no more than 250 kg of beans under optimum conditions. In this way the size of the seed multiplying operation was similar to that of Concern Universal and CSC-SSEP. However, most farmers said that in previous years they sold most of their produce as grain to private traders. Moreover, in the 1996/97 season, some farmers indicated that they were expecting a poor bean harvest because of disease problems. Thus, because the bean harvest was likely to be less than normal, it is unlikely that participating farmers met their seed security needs in 1996/97. The future success of the scheme rests on the ability of farmers to maintain good quality seed in storage, the ability to recover the seed from farmers and having disease resistant varieties.

5.6.5 Performance of ActionAid-SD Program

This program was in its second year. In the first year, since most farmers neglected their crops and some thought the seed was given free of charge, credit repayment was low.

This was a result of inadequate supervision, as most of the NGO's extension personnel were not yet employed.

In the year the survey was conducted, there was adequate supervision by the NGO's extension personnel. Thus, the objective of producing seed was likely achieved. However, the condition that farmers repay their loan in cash[58] had mixed implications. While this stipulation was intended to force farmers to distribute seed through selling their produce, the timing of loan recovery is critical to achieving the objective of the scheme. If for instance farmers were expected to repay their seed loan before the end of October, then most would be forced to sell their produce as grain, since generally the majority of the farmers start obtaining their seed only in November (Scott *et. al.* 1998). Selling seed before this period would force farmers to sell seed at a lower price than if they sold it later. Most would also sell the seed as grain since demand for seed in September/October was low[59]. Farmers would prefer to repay the loan later when price was higher since there was no extra charge for paying the loan later.

5.6.6 The Performance of National Bean Improvement Program

Under this program, about 9 tons of seed was produced and sold to the NBIP in 1996. The scheme had the single objective of producing seed for the NBI Program. Since the

[58]Bank account

[59]Since ActionAid reported quarterly on the progress of the seed multiplication scheme, the NGO's interest in reporting early repayment of the seed loan conflicted with farmers' interest in selling their produce when the price was higher.

farmers produced and sold the seed to the NBIP, that objective was achieved. However, farmers surveyed complained that they were forced to sell all their produce to the NBIP, and were not allowed to keep any seed for themselves to use as they wished. However, it was likely that farmers kept some produce for themselves as it is difficult to check non-compliance. Since farmers were producing certified seed which the NBIP distributed to other NGOs for use in their respective seed multiplication programs, the NBIP sought to recover all of the seed produced under the scheme.

In an effort to increase awareness of the new varieties, the NBIP cooperated with the MPTF in setting up demonstrations throughout the country for the new varieties. Also, NBIP worked with respective NGOs to set up on-farm trials in locations where the NGOs were carrying out seed multiplication.

To further increase distribution of the varieties, some of the produce from the farmers was packed in 500 grams and sold to smallholder farmers through shops in four ADDs. Furthermore, the program also advertised the availability of these varieties on the national radio.

5.6.7 Performance of MPTF Program

The main objective of this scheme was to train farmers to undertake seed multiplication as a business. The participating farmers successfully produced certified seed with the supervision from the scientists from the Department of Agricultural Research. As originally envisaged, farmers were expected to take full responsibility for marketing their seed crop. However, as the harvest approached, the farmers pressured the scheme to purchase their crop fearing farmers were not likely to pay a higher price for the seed. Therefore, despite the business training that farmers received, the scheme failed to achieve its objective that the farmers market or test-market their produce.

5.7 Factors Affecting Performance of Smallholder Seed Multiplication Schemes

The failure of a scheme to achieve an objective was in most cases related to some aspects in the design of the scheme. This ranged from the scheme not being able to carry out certain functions or farmers not being cooperative in carrying out some functions. This section summarizes reasons why some schemes failed to achieve their objectives.

5.7.1 Timing of Seed Delivery and Seed Quality

All respondents reported that they received the seed in good time before their planting date. However, seed quality was a problem in two schemes. In the scheme run by Concern Universal, the managers mentioned seed quality as a major problem. ActionAid-SM in Dowa reported similar experiences. In the 1995/96 season, both schemes used imported seed, obtained from the MPTF Program, some of which did not germinate. In the 1996/97 season, soybean seed did not germinate. Apparently, when the MPTF Program imported seed, it distributed it to various NGOs without contracting with the MOAI's Seed Services Unit to verify its viability. As a result, farmers in some parts of the country were supplied seed which would not germinate.

In principle, the Ministry of Agriculture and Irrigation's Seed Service Unit was supposed to check the quality of seed before it was distributed to farmers. In practice, most schemes did not do this since they used seed supplied by researchers--most of whom were professionals, compared to seed specialists who were technicians. Among the NGOs, only ActionAid-SD formally contracted seed producers who would supply certified seed.

After harvesting the crop, seed quality was a function of storage conditions. Storage conditions are critical, especially for soybeans as viability deteriorates under humid and hot temperature sometimes reducing germination by as much as 50 percent. Schemes such as ActionAid-SM, CSC-SSEP, and Concern Universal recycled seed for three years before getting fresh stocks from the researchers. On the one hand, under the ActionAid-SM scheme and CSC-SSEP, farmers stored the seed. Therefore quality of seed was a function of how well they maintained the seed storage structures and conditions. On the other hand, Concern Universal stored the seed in a seed bank (*i.e.* group storage managed by Concern Universal). Other than chemicals applied to control pest damage and storing the seed in hessian bags, there were no temperature or humidity control facilities.

Before planting, scientists recommend that soybean seed be inoculated with a *Rhizobium* bacteria to enhance the capacity of the plant to fix atmospheric nitrogen in the roots. In Malawi, the *Rhizobia* 'SOY' is recommended. The MOAI recommended that the inoculant be kept below 28 ^{0} C to maintain its effectiveness (Soko, 1996). None of the respondents who planted soybean inoculated their seed, nor had they ever heard of the technology. Thus, farmers' soybean yields were likely to be lower than their potential. In contrast, the *promiscuous* soybean variety Magoye is able to fix nitrogen without an inoculant. However, the MOAI had not officially released it. Thus, to enable farmers benefit from the nitrogen-fixing capacity of soybean, the schemes needed to educate and train farmers about this technology and set up the logistics required to make making the *Rhizobium* available to them just before planting.

5.7.2 Farmer Training, Crop Supervision and Inspection

In some schemes, farmers received more training in seed multiplication than in other schemes. Schemes that provided extensive training included MPTF, ActionAid-SD and NBIP. The training went hand in hand with the supervision of the seed fields. In the year of the survey, the Seed Services Unit inspected on time the seed crop produced under the MPTF scheme. In contrasts, in the CSC-Church Farms in 1995/96, some fields were rejected because when the inspectors went to visit them, the farmers had already planted the crop without following required regulations. Therefore, timeliness in inspection was crucial in the certification process. One probable reason for the delay in visiting the field was because of CSC's late release of funds to the Seed Services Unit.

5.7.3 Sale of Modern Seed

While MPTF bought seed to increase its seed stock for the following season, farmers' unwillingness to sell seed on their own raised doubts about the existence of an effective demand among the farmers for modern seed. Informal interviews with seed producers revealed that they pressured the scheme to buy their first year's seed crop, and then they planned to sell seed on their own in the second year. As noted in earlier sections, farmers in the MPTF used more resources than if they had produced grain. Therefore, their expected price was likely to be higher than the price of grain. Furthermore, they might have expected that the prospective buyers would not be willing to pay such a price.

The analysis above contrasts with the situation under the NBIP whereby farmers were promised a market and price. For the other schemes, farmers generally did not use more resources producing seed than they would if they were producing grain. Therefore, across the schemes there was a spectrum of production systems similar to Williamson's contractual schema as follows:

Scenario One

Schemes in which farmers produced a specialized commodity, seed, without using fixed assets (K=0) would sell their product at competitive prices, e.g. sell at grain prices, P_g (CSC-SSEP, Concern Universal, ActionAid-SD, ActionAid-SM)

Scenario Two

Schemes in which farmers produced a specialized product using more specialized assets--human assets and additional inputs such as labor and cash (K>0)--and where safeguards are provided (S>0). Safeguards could be in the form of a guaranteed market or a guaranteed price or both. Under the NBIP, the farmers were offered a safeguard--price ($P_s > P_g$) and market.

Scenario Three

Schemes in which farmers produced a specialized product using more specialized assets--human assets and additional inputs such as labor and cash (K>0)--but were never offered any safeguards (S=0). In this case the price of seed needed to be higher than the price of grain ($P_s \gg P_g$) in order to offer farmers an incentive to produce seed in the future. Under MPTF scheme, the fact that farmers resisted selling to sell the seed themselves, suggests that they were uncertain of effective demand.

These scenarios highlight the importance of designing a scheme so that the inputs and procedures adopted match with the expected end-use of a product. Otherwise, a scheme might succeed in producing high quality seed as planned, but then the seed producers might find that farmers were not willing to pay the higher cost of producing the modern seed.

5.7.4 Sustainability of the Seed Multiplication Schemes

In most cases, the schemes subsidized seed production by paying for administrative costs required to support the schemes. Data in Table 5.14 show the administrative costs covered by each and the implications for the real cost of the seed produced.

Table 5.14: Sources of Cost in Seed Production Among Smallholder Seed Multiplication Schemes

Sources of Cost	*Commercial Schemes →*			*Seed Security → Schemes*			
	MPTF Scheme	NBIP Scheme	CSC-Church Farm	ActionAid-SM	ActionAid-SD	CSC-SSEP	Concern Universal
Certified Seed	Farmer	Farmer	Farmer	Farmer	Farmer, for the first year recycle for three years	Farmer, for the first year recycle for three years	Farmer, for the first year recycle for three years
Transport to the farmgate	Scheme, yearly	Scheme, yearly	Scheme, yearly	Scheme, once every four years	Scheme, once every four years	Scheme, once every four years	Scheme, once every four years
Extension Services	Scheme	Scheme	Scheme	Scheme	Scheme	Scheme	Scheme
Demonstration	Scheme	None	None	None	None	None	None
Inspection/ Certification Service	Scheme	Scheme	Scheme	None	None	None	None
Storage/ Marketing	Scheme	Scheme	Scheme/Farm	None	None	None	None

Source: Data from Survey, Smallholder Seed Multiplication Schemes' Survey, Malawi, 1996/97

Taking seed multiplication as a value adding activity, the amount of value increased from the seed security scheme such as CSC-SSEP and Concern Universal to the more commercial-oriented schemes such as NBIP and MPTF. For the schemes to be sustainable, there was need to analyze the costs that schemes cover and determine whether in their absence farmers would be willing and able to pay. These are discussed from the seed-acquisition stage to the marketing point.

5.7.5 Cost of Certified Seed

All schemes obtained their seed from the researchers or some farms contracted to produce certified seed. While commercial schemes used new stock of seed every year--MPTF, NBIP and CSC-Church Farms--the seed security schemes recycled the seed for at least three years--CSC-SSEP, Concern Universal, ActionAid-SD and ActionAid-SM. This implies that seed from the former group of schemes was bound to be more expensive than from the later group of schemes. Thus, in the long run, the seed security schemes had a lower cost of seed than the other group as they bought certified seed once every four years. However, there is a trade-off between the cost of seed and the quality of seed. When farmers recycled the seed, the quality of the seed is bound to decline than when they get seed every year from researchers, especially if it is certified.

5.7.6 Transportation of Seed to Farm-gate

In all schemes, the schemes provided transportation of seed to the farmers' homes. Thus, the schemes that distributed seed every year incurred this cost every year contrasted with schemes that received seed once every three years.

5.7.7 Training, Extension Service and Demonstration Plots

While all schemes had training and extension services, the intensity of these varied. The MPTF had more training components in its scheme than the other schemes. In most cases, they involved meeting all farmers at one location. Since farmers were from all over the country, a central location for meetings or training was a less expensive option. The NBIP dealt with farmers from one EPA; therefore meeting with farmers was not as expensive. Also, ActionAid-SD had meetings at one location with farmers in the four ADDs. Concern Universal, CSC-SSEP and ActionAid-SM all met with the extension workers in their respective areas. For CSC-Church Farms, the meeting involved both their respective farms and training at one location.

Although the providers of extension services varied, *i.e,* in some cases it was the MOAI and in other cases it was the scheme, in all cases, the scheme paid for the cost. Schemes producing certified seed, such as MPTF and CSC-Church Farm, also the Seed Services Unit added to the cost its service. This was an additional cost to the seed.

The MPTF set out about 700 demonstration plots throughout the country while the other schemes did not sponsor separate plots. The demonstration plots were operated by the MOAI.

5.7.8 Packaging/Storage and Marketing

Apart from Concern Universal, none of the seed security schemes assumed any storage function. Concern Universal stored seed returned to them. The other schemes let the farmers assume the storage function. In the commercial schemes, the NBIP assumed the packaging and storage functions. The MPTF was not supposed to assume the storage, and marketing functions but ended up performing them. The CSC-Church Farms sold the seed apart from cases where the CSC bought seed from the Church Farms to distribute among the smallholder farmers under CSC-SSEP.

5.7.9 Implications of Seed Production Requirements for Seed Cost

Assuming the requirements above as real costs of the seed, it is evident that seed from the commercial schemes was produced at a higher cost than seed from the seed security schemes. Dividing the total cost of producing seed into fixed costs and variable costs, revealed that some costs such as training have a high initial cost (*i.e.* in the succeeding years, the cost of training goes down assuming the same farmers continue multiplying seed). The same is applicable for extension services, advertising and the cost of conducting demonstration plots--there is a learning curve. Costs of certified seed, of inspection, storage and marketing costs are variable as they were performed every year seed was produced and they increased with the scale of production.

Where the goal was to produce seed of high quality, the investment was higher than in cases where the aim was to produce farmer seed, for example in the seed security schemes. By recycling seed, the schemes were cutting the cost of getting new seed every year--transport, cost of seed, storage and handling. Furthermore, it was not necessary to get a new stock of seed for self-pollinated crops. However, for the commercial schemes, getting new seed each year ensured that farmers receive good quality seed.

From the farmers' perspective, the performance of the schemes was assessed differently. Respondents were asked what changes they would suggest for the schemes (Table 5.15).

Table 5.15: Respondents' Preferred Changes to Seed Multiplication Schemes, Malawi, 1996/97. (N=163)

Scheme	(Number of Respondents)	Preferred Changes							
		None	Provide Credit	Provide High Yielding Varieties	Let Farmers Keep Some Seed	Increase Amount of Seed	Farmers to Have more Say	Increase Training Sessions	Seed
		(Percent)							
Commercial Schemes									
NBIP	(28)	0	0	0	82	4	7	7	0
MPTF	(30)	17	27	0	0	0	43	10	3
Seed Security Scheme									
CSC-SSEP	(30)	48	0	9	0	10	4	14	17
ActionAid-SM	(28)	46	39	4	0	0	0	7	4
ActionAid-SD	(26)	50	15	5	0	0	0	18	15
Concern Universal	(21)	12	50	8	8	4	0	4	15
Total Number	(163)	48	35	7	27	5	16	16	14
Percent	100	29	21	4	17	3	10	10	9

Note: Some respondents gave multiple replies.
Source: Data from Survey, Smallholder Seed Multiplication Schemes' Survey, Malawi, 1996/97

About one-half of the respondents in CSC-SSEP (48%), ActionAid-SM (46%) and ActionAid-SD (50%) said they were satisfied with the schemes, and suggested no changes to the schemes. Only 12 percent of farmers from Concern Universal were satisfied. In general, respondents from the commercial seed schemes tended to be less satisfied with their schemes than respondents from the seed security schemes. All respondents from NBIP suggested something which they thought would improve the scheme compared to only ten percent from the MPTF.

The improvements many respondents suggested ranged from availability of credit, increases in training and letting the farmers keep some seed. On the issue of credit, respondents from Concern Universal (50%), ActionAid-SM (39%) and MPTF (27%) suggested that their schemes could be improved if the farmers were offered credit on inputs other than just seed. Specifically, these farmers were interested in getting fertilizer on credit. Interviews with the management of these scheme revealed that the schemes did not intend to provide the other inputs. However, the MPTF encouraged the participants to form an association through which the scheme could provide a loan guarantee to the commercial banks in the following season.

The majority of respondents from the NBIP (82%) said they would like the scheme to let the farmers to keep some of the seed rather than the current arrangement whereby farmers were expected to sell all their seed to NBIP. Thus, although the farmers got a premium price on their seed (10% over the price of grain), they wanted flexibility on how much they could sell. Moreover, farmers had no choice regarding what month to sell the seed, which was a problem in cases where some of them wanted to store seed for sale later in the year when price was high. However, this practice conflicted with the interest of the scheme which was to provide seed to NGOs in good time so that they could, in turn, distribute it to their seed multiplication schemes.

Finally, 43 percent of the respondents from the MPTF mentioned that they would like to have a greater say in how the scheme operated. Ironically, farmers in this scheme met with the scheme's managers for training and to discuss its progress and logistics more often than was the case in other schemes. These results suggest that probably the scheme managers were not accommodating the farmers' suggestions. At the time interviews were conducted, the farmers had just harvested and were asking the scheme to buy the seed, rather than selling the seed on their own as originally planned. As the scheme was initially reluctant to buy seed, the farmers may have felt that their concerns were not being considered.

5.8 Summary

This chapter presented an institutional analysis of smallholder seed multiplication schemes in Malawi focusing on how the rules and regulations in a seed scheme affected its performance, *i.e.* what rules enable the schemes achieve their stated objectives. Thus, the goal was to identify which aspects of schemes needed to be changed in order to achieve their desired goal.

These seed schemes maybe classified in two categories: schemes that were designed to increase farmers' seed security needs and schemes aiming to make seed multiplication an income-generating activity. The four seed security-oriented schemes were managed by the CSC-SSEP, ActionAid-SM, ActionAid-SD, and Concern Universal. The three commercially-oriented seed schemes were managed by NBIP, MPTF and CSC-Church Farms.

The seed security schemes involved a larger number of farmers, with each farmer receiving a smaller amount of seed (3-5 kg each), compared to the more commercial schemes which reached relatively fewer farmers with each receiving a larger amount of seed (30-40 kg each). Also, the commercial seed schemes produced a higher quality certified seed, which was inspected by the Ministry of Agriculture and Irrigation. In contrast, the seed security schemes produced farmer seed which was not inspected for quality.

As performance of the schemes must be evaluated against their goals, the primary goal of the seed security schemes was to make small quantities of seed available to a larger number of farmers. Clearly, the farmers' harvest from their initial planting was not sufficient for them to retain seed for themselves, sell or share it with other farmers, and provide beans for family consumption. However, these schemes provided a large number of farmers with initial access to new varieties, some of which they retained for planting in the next year.

On the other hand, the more commercial schemes (NBIP and MPTF schemes) produced a large amount of seed (*e.g.* 200 kg). However, the MPTF scheme was less successful in achieving its marketing objective. While it was supposed to train seed entrepreneurs, it failed to get the farmers to sell their produce on their own. Therefore, although the NBIP was successful in marketing improved seed in 500 g packs, farmer demand for improved seed remains uncertain.

Finally, all of these schemes were subsidized. While most required farmers to repay the cost of seed, schemes provided numerous support services (transport, storage, extension). Without these subsidized services, it is unlikely that the seed security schemes would continue to operate. Similarly, although commercial schemes were designed to make farmers smallholder seed multipliers, it is unclear how the support costs (include transport of seed from the primary seed producers such research programs or farms, inspection services from the Seed Services Unit, and marketing) which the schemes were paying would be paid for in future. These are real costs which eventually will determine whether or not the schemes survive. Furthermore, the seed security schemes tended to make farmers dependent on them for seed every year, rather than encouraging them become self-sufficiency after the first year of participation. Hence, the success of the seed security schemes is intertwined with the development of seed entrepreneurs. Farmers are unlikely to buy seed from local seed producers if they can continually obtain new seed from the seed security schemes. Finally, in one district four of the seven schemes operated simultaneously. Since there was little coordination among them, most likely there was duplication and conflict of interest among the schemes. For instance, a farmer participating in the commercial MPTF scheme would likely find it difficult to sell seed in an area where the ActionAid scheme was operating *i.e.*, farmers would prefer to get seed from ActionAid rather than buy from a seed producer.

CHAPTER SIX

ECONOMIC ANALYSIS OF SMALLHOLDER SEED PRODUCTION AND USE OF SEED OF MODERN VARIETIES

6.0 Introduction

This chapter analyzes the profitability of seed production and farmer adoption of modern bean varieties (MVs). The purpose of the analysis is to assess the relative profitability of growing MVs versus traditional bean varieties (TVs) both as seed and as grain. First, yield comparisons were made between a widely-grown traditional variety, Nasaka, and advanced lines of MVs in order to estimate the yield advantage of MVs. Second, to assess the financial attractiveness of growing improved bean varieties, the profitability of producing grain using MVs was compared to the profitability of producing grain using a TV (control). Third, to assess the attractiveness of establishing a seed-growing enterprise, the profitability of producing seed of MVs was compared to the profitability of producing grain when planting a TV. Finally, several scenarios were considered to assess the sensitivity of the results by varying assumptions regarding factors that affect costs and benefits. In all cases, the profitability of producing seed or grain was compared using the Net Present Value (NPV).

6.1 The Legume Seed Demand Model-Profitability of Producing Grain from MVs versus Producing Grain from TVs

Seed Costs and Revenue

Bean farmers may either plant retained seed of their TVs, or purchase a MV. Assuming the TVs and MVs are similar in terms of growing and quality characteristics and MVs are available, farmers will only grow MVs if they are more profitable than a TV. A budget was developed to estimate the net benefit of producing grain from MVs, compared to producing grain from traditional varieties. Given that the opportunity cost of using retained seed of a TV is the grain price, P_g per kg, and the cost of purchased (MVs) seed is P_s per kg, (assume equal sowing rate, S_r kg per hectare) the total cost of planting a TV is $P_g S_r$ per hectare and the total cost of planting a MV is $P_s S_r$ per hectare. The yield obtained from planting a TV is Y^t and the yield from planting a MV is Y^m per hectare. Hence, revenue from the two enterprises are $P_g Y^t$ for the TV and $P_g Y^m$ for the MV.

6.1.1 The Price Premium for MVs

In the 1997/98 rainy season, the Bean Program at Bunda College charged NGOs K35 per kilogram for improved seed. In contrast, TV sold for K25 per kilogram. Thus, as an incentive, a premium of K10 per kilogram was assumed for farmers growing MVs as seed, over the price of grain (K25 per kilogram).

6.1.2 The Yield Advantage of MVs Over TV

The underlying justification of seed multiplication projects is that the MVs produced by seed programs are higher yielding than the farmers' traditional varieties. To determine the yield advantage of MVs over the TV, data from the Advanced Variety Trials (AVT) conducted by the Bean Program at Bunda College were analyzed to identify top performing varieties and their yields. The Program conducts three types of trials. First, its Preliminary Trials (PT) screen varieties for subsequent testing in AVT. The most promising AVT entries are then evaluated in the National Variety Trials (NVT) before being recommended for release. Therefore, the AVT yield data used in this study represented trials of varieties that were about to be tested nationwide. The data used in this analysis were obtained from AVT trials that were conducted at three research sites: (Bunda College research farm, Dedza research site and Champhira research site) over three rainy seasons (1993/94, 1994/95 and 1995/96). These locations represent the major agro-ecological areas in Malawi where most of the country's beans are grown, *i.e.*, mid-altitude areas (Bunda and Champhira) and high altitude area (Dedza).

The research trials were laid out in a randomized complete block design, involving 25 entries which included one recommended traditional variety (Nasaka), one newly-released variety (Kalima, released in 1993), and twenty-three unreleased lines (Appendices 6.1, 6.2, and 6.3). Each variety had three replicates per year per site (N=9). Plot (7.2 m^2) yields were calculated on a per hectare basis. A Bartlett-Box test was conducted to check for homogeneity. This procedure is necessary before one can conduct any test to compare yields among varieties. Therefore, the homogeneity test was conducted for all 25 varieties for each site (Table 6.1)

Table 6.1: Results of a Homogeneity Test on Yield Data from Variety Trials at Bunda, Champhira and Dedza Sites.

Variety	Bunda Site	Champhira Site	Dedza Site
		(Bartlett-Box's p-value)[1]	
A 197	NA	0.33	0.55
Sugar 56	0.41	0.34	0.05
AND 660	0.26	0.63	0.77
14N/2	0.62	0.10	0.46
2-10	0.03	0.13	0.09
Sugar 47	0.49	0.94	0.43
PC 293-C11	0.27	0.01	0.03
BAT 477	0.33	0.07	0.19
Enseleni	NA	0.58	0.24
BAT 336	0.40	0.15	0.20
Nasaka	0.67	0.42	0.10
AFR 248	0.87	0.53	0.54
17K/2	0.27	0.39	0.05 *
G 05434	0.11	0.35	0.74
(2) A344/4	0.07 *	0.07 *	0.44
Sugar 46	0.79	0.22	0.00 *
A 286	0.29	0.00 *	0.62
Umvoti	0.25	0.05 *	0.41
PVA 508	0.79	0.21	0.55
PVBZ 1589	0.10	0.04 *	0.15
V8025	0.51	0.74	0.16
Kalima	0.85	0.55	0.27
Sugar 57	0.13	0.40	0.08
16-6	0.04 *	0.68	0.60

25-2	0.43	0.07 *	0.07 *

[1]when the p-value is less than 10 percent, reject null hypothesis and conclude that there is no homogeneity. Therefore, can not compare yield of the variety with that of others.

*Varieties whose yield does not conform to homogeneity condition at 10 percent level of significance

NA: Could not calculate p-value because one cell had zero variance

Varieties which failed a homogeneity test can not be compared with Nasaka, a traditional variety. A T-test was conducted to determine whether the yield of the improved varieties were significantly higher than the yield of Nasaka at 5 percent, 10 percent and 15 percent levels of significance, and also the least squares difference (LSD) test was used at 5 percent level of significance. Furthermore, a yield index was developed with Nasaka as a standard, (*i.e.*, Nasaka =100%). These results are presented in Table 6.2.

Table 6.2: Three Year Mean Yields and Yield Index for Advanced Yield Trials at Bunda, Champhira and Dedza Sites, Malawi, (1993/94-1996/97)

Variety	Bunda Site			Champhira Site			Dedza Site		
	Average Yield	CV (%)	Yield Index (%)	Average Yield	CV (%)	Yield Index (%)	Average Yield	CV (%)	Yield Index (%)
A 197	906	56	112	512	49	57	1,174	55	139**
Sugar 56	1,104	69	137***	719	85	81	1,109	40	132
AND 660	853	64	106	762	61	85	1,040	58	123**
14N/2	784	49	97	807	56	90	1,352	50	160***
2-10	781	79	97	823	54	92	1,100	76	130 *NS
Sugar 47	877	66	109	853	54	96	1,633**	34	193***
PC 293-C11	769	51	95	866	81	97	823	95	101
BAT 477	903	42	112	868	50	97	1,135	84	136
Enseleni	803	61	99	878	56	98	929	100	110
BAT 336	855	61	106	887	57	99	1,113	67	136*
Nasaka	**807**	**89**	**100**	**892**	**66**	**100**	**844**	**60**	**100**
AFR 248	1,023	47	127**	903	57	101	1,457	48	173***
17K/2	772	65	96	909	61	102	806	119	90
G 05434	960	62	119 *NS	930	69	104	913	82	108
(2) A344/4	853	76	106	950	81	107	1,145	70	136**
Sugar 46	790	55	98	969	66	109	768	127	84
A 286	704	82	88	974	70	110	1,097	74	130**
Umvoti	872	65	108	985	79	110	1,104	56	131**
PVA 508	866	52	107	995	59	112	1,625**	50	193***
PVBZ 1589	853	44	105	999	51	112	1,384	60	177***
V8025	903	74	112	1,030	57	115	1,094	69	130**
Kalima	884	62	110	1,032	48	116	1,247	53	148***
Sugar 57	1,009	61	125 *NS	1,051	51	118	1,272	72	151 *NS
16-6	1,024	60	127	1,079	69	121	1,165	62	138*
25-2	958	59	119	1,159	66	130 *NS	1,048	124	114
Mean	876			913			1,135		
LSD $_{0.05}$	511			542			737		

CV	63	64	69

1. Yield index is based on Nasaka = 100%; on yield index, * ** , ** , * denote that MV's yield is significantly higher than the yield of Nasaka at α = 0.05, 0.10, and 0.15. In bold is Nasaka , the TV, *NS denote results not valid because the variable failed to pass a homogeneity test

The analysis of pooled data for three years presented in Table 6.2 indicates that none of the MVs grown at Champhira site produced a yield higher than Nasaka's at a 5 percent level of significance. Only one variety at Bunda, Sugar 56, had a higher yield than Nasaka's yield at the significance level of 5 percent. In contrast, at the Dedza location, six MVs had yields which were significantly higher than the yield of Nasaka at a significance level of 5 percent. Two varieties at Bunda had significantly higher yields than Nasaka but failed to meet a homogeneity requirement therefore the results were discarded. One variety at Champhira, 25-2, failed to meet the homogeneity requirement while Dedza had two varieties. Moreover, each variety performed differently at each site, *i.e.* the highest yielding variety at one location was not highest yielding at the other locations. For instance, the highest yielding variety at Bunda, Sugar 56, ranked 24th at Champhira (had a yield index of 81% of Nasaka) and it ranked 13th at Dedza (25 varieties were evaluated at each site). Similarly, the highest yielding variety at Dedza, Sugar 47, ranked 20th at Champhira and 11th at Bunda site. Finally, the highest yielding variety at Champhira, 25-2, ranked 18th at Dedza and 6th at Bunda. These findings suggest a strong interaction between variety and location. Thus, when making recommendations, the performance of varieties at specific locations needs to be considered.

Also, the performance of varieties varied by year. At each site, the overall highest yielding variety did not yield highest in all three years. For instance, at Bunda, the highest yielding variety, Sugar 56, had the highest yield in the second year, but ranked 13th in the first year and ranked 2nd in the third year. Likewise, at Champhira, the highest yielding variety, 25-2 had the highest yield in the first year, ranked 5th in the second year and ranked 8th in the third year. The implications of these results are that when making recommendations, there is need to use yield data for more seasons to avoid basing recommendations on extra-ordinarily good season (outlier).

The locations, the average trial yield varied by year. For instance, although the Dedza location had the overall highest average yield, its average yield was highest in the first and third years while Bunda had the highest average yield in the second year. However, analysis of the pooled data (three years) showed that at Bunda, the highest yielding entry, Sugar 56 averaged 137 percent of the yield of Nasaka. At Dedza, the highest yielding entry, Sugar 47, averaged 193 percent of the yield of Nasaka. At Champhira, the highest yielding variety, 25-2, averaged 130 percent of Nasaka.

Several conclusions can be drawn from the results presented above. First, these trials confirm that the Bean Research Program at Bunda had varieties that substantially out-yield the traditional variety. Therefore, if released and adopted, these highest yielding bean entries would substantially increase farmers' bean harvest. However, the performance of these varieties was quite variable from season-to-season and varied greatly by location.

The MVs had a higher yield at Dedza than at the other two locations and more varieties at Dedza yielded higher than Nasaka (21 of 25 varieties) than at the other location. At all sites, the coefficient of variation (CV) of yields for each year was almost half of the CVs for the three year period. This suggests that within a year, the variation in yields of the varieties is lower than the yield variation of the varieties over the three years. The high coefficient of variation for the pooled data is due to relatively large year-to-year variation in average yields at these sites.

For subsequent economic analysis, only data from two locations, Bunda and Champhira were used. Results from these sites were selected because yield data from these locations were consistent with research yield in other parts of the country. In contrast, yields at Dedza were judged to be exceptionally high. Thus, for Bunda, the average yield of Nasaka was compared to the mean yields of Sugar 56 and at the Champhira site, the average yield of Nasaka was compared to the average yield of 25-2.

Data in Table 6.3 show the yield comparison of the three highest yielding varieties and the respective yields of Nasaka for the two sites.

Table 6.3: Yield Comparison of Three Highest Yielding Modern Varieties and the Traditional Variety at Bunda and Champhira Sites, Malawi, 1994 to 1997

Variety	Average Yield[1] (Kg/Ha)	Coefficient of Variation	Level of α, $\hat{Y}^{MV} > \hat{Y}^{TV}$
Bunda Site			
Sugar 56	1104^{A}	69	0.02
16-6	1030^{AB}	60	0.09
AFR 248	1023^{AB}	47	0.09
Nasaka	807^{B}	89	-
Champhira Site			
25-2	1159^{C}	66	0.14
16-6	1079^{C}	69	0.29
Sugar 57	1052^{C}	51	0.37
Nasaka	892^{C}	66	-

[1]Varieties having the same letter are not significantly different at a 5 percent level of significance. For Bunda the Least Significant Difference yield was 250 kg/ha and for Champhira it was 358 kg/ha.

Source: Mkandawire, A. B. C. (1998) Advanced Bean Trial Results from Bunda College Research Site and Champhira Research Site.

The results in Table 6.3 show that at Bunda the yield of the top performing variety (Sugar 56) was significantly higher than Nasaka at the two percent level. In contrast, at Champhira, the yield of the top performing variety (25-2) was only significantly higher than Nasaka at 14 percent levels of significance[60].

[60]At Bunda, Sugar 56 yielded 297 kg/ha above Nasaka. To be significantly higher than Nasaka at the 5 percent level, only a yield difference of 250 kg/ha was required.

6.1.3. The Grain Production Budget

Budget analysis was used to determine the incremental profitability of producing grain when planting MV compared to growing TV. The items included in the budget were: 1) inputs used to produce the grain (seed, fertilizer, and bags for storage), 2) labor used to produce and market the crop (clearing the land, planting, weeding, fertilizer application, harvesting and marketing) and 3) gross benefits (Table 6.3).

For grain production, the inputs used to produce both the MVs and the TV are similar, except for the inputs that varied with yield (*i.e.*, the number of bags needed for storing produce, and labor required for harvesting, cleaning, bagging and marketing).

Since the data were from experimental plots, the yields were adjusted to 90 percent of the trial yields to more realistically represent the yield farmers would likely obtain. CYMMIT uses a 90 percent factor to adjust experimental yield to farmers' expected yield. The main reason for the difference between farmers' and experimental yields is that experimental stations carry out their cultural operations at optimal times and use more labor and capital. Nevertheless, experimental yields should be compared with farmers using similar cultural practices. Therefore, the results reported in the following sections would be applicable to small commercial farmers who apply fertilizer and plant beans in monoculture. Evidence suggests that there is no such group of farmers. Farmers would rather use fertilizer on crops such as maize and tobacco than on beans. Furthermore, for seed production, the effective yield was discounted by a factor of 20 percent, since seed production yield is lower than for grain production due to losses associated with cleaning shriveled and unhealthy seed and any off-types from the harvested seed crop.

Table 6.4: **Seed Multiplication and Grain Production Budget, Bunda Bean Research Data and Champhira Research Site Data, Malawi, 1996/97.**

Item	Location					
	Bunda Site			Champhira Site		
	TV-Grain	MV-Seed	MV-Grain	TV-Grain	MV-Seed	MV-Grain
Adjusted Yield (kg/ha)[a]	623	757	852	688	795	894
Price (K/kg)	28	39	28	28	39	28
Total Revenue (K)	17,436	29,532	23,853	19,264	31,005	25,032
Inputs (K)						
Labor	908	1,143	1,200	940	1,166	1,226
Seed[b]	1,000	1,400	1,400	1,000	1,400	1,400
Fertilizer	50	50	50	50	50	50
Insecticides	60	60	60	60	60	60
Total Cost (K)	2,093	2,759	2,829	2,133	2,787	2,861
Gross Revenue (K)	15,351	26,764	21,027	17,131	28,218	22,171

The budget is based on TV-grain, MV-seed and MV-grain when the produce is sold after three months and a farmer is facing a 50 percent discount rate; [a]Yield of MV-grain and TV-grain were adjusted to 90 percent to adjust for the experimental factor and at reduced by 5 percent per month to adjust for storage losses; [B]Cost of seed for MV-seed and MV-grain is based on the cost Bunda Bean program charged NGOs for seed and the cost of seed for TV-grain is based on market price; Cost for fertilizer and insecticides were standard irrespective of the enterprise. While unit costs of labor was the same, an enterprise's activities determined the total cost *e.g.* Some costs were based on the amount of beans harvested and some were based on final product *e.g.* seed production was more labor intensive

The level of inputs used in the budgets were set at levels that the Bean Program at Bunda College used in its bean variety trials during the 1996/97 cropping season. Therefore, the budgets associated with the MV represented the input use of a more commercial farmer, rather than a typical smallholder farmer. The results above indicate that the gross revenue of a MV-seed is clearly higher than the gross revenue for MV-grain and TV-grain.

6.1.4 Analytical Framework

Net Benefits of Producing Grain from Modern Varieties

The cost of the inputs and labor used each month were summed to generate the cost of production per month. These total monthly costs were then discounted, using two alternative discount rates (50 percent and 120 percent). Each month was discounted separately (4 percent and 10 percent, respectively) and a net present cost was calculated for a MV and a TV planted at each of the two. When sold at three months, the price of K28 per kilogram was used to value both the TV and the MVs, if sold as grain and seed was valued at K39 per kilogram. Total benefits (total revenue) for the MV and the TV were also discounted. Finally, the net present value were calculated (Table 6.5) as indicators of the profitability for each enterprise.

Sensitivity Analysis.

Sensitivity analysis was carried out using yield, interest rate, and time of selling the produce as discussed below.

1. Yield

The base case compares the mean yield of the bean variety that gave the highest yield at Bunda and Champhira research sites with the respective yields of Nasaka. Second, the base yield was then reduced by 10 percent to assess the sensitivity of the results to the yield assumption used in the base case scenario.

2. *Discount/Interest Rate*

By engaging in bean production, farmers were foregoing an alternative activity. First, the farmer had a choice of lending money used to finance her/his bean enterprise to borrowers and charging an interest rate ranging from 50 to 200 percent (Chipeta, 1981). Second, the farmer could have borrowed money to undertake bean production. Malawi Rural Finance Company, a bank that targets its loans at farmers, charges an interest rate of 46 percent. Therefore, for this budget analysis, two different interest rates were used--50 percent representing the case where a farmer borrows from a Malawi Rural Finance Company and 120 percent, representing the case where a farmer had an alternative of borrowing money from neighbors.

3. *Time of Sale of Seed/Grain*

Two periods were assumed for selling the farmers' bean crop. First, at harvest time and second, three months later at planting time. This was reflected on the price of grain which was K28 per kilogram when grain was sold at three months compared to the price of K25 per kilogram when grain was sold at harvest. Similarly, the price of seed was K35 per kilogram at harvest and it was K39 per kilogram when sold at 3 months after harvesting.

6.2 The Legume Seed Supply Model-Profitability of Producing Seed from a MV versus Producing Grain from a TV

For seed production, the objective of the analysis was to determine how profitable it would be for a farmer to multiply seed of a MV, compared to producing grain of a TV. It would appear that producing seed (using MV) would be more profitable than producing grain (using TV) because the MVs are higher yielding and it was assumed that seed growers would receive a premium price for their seed crop. However, seed production is more labor intensive than grain production because of the need to rogue off-types growing in the bean field and clean the seed prior to sale. Also, due to cleaning losses, seed producers can only sell part of their crop as seed. Thus, the relative profitability of producing seed from MVs versus a TV grain production is an empirical question.

The seed versus grain production analysis incorporated two scenarios. Aside from yield, the other important factor determining the seed producer's net income is the price at which the seed is sold. In the sensitivity analysis, first, the sale price of the MV which gave benefits (NPV) equal to the NPV of a TV was determined. Second, two prices were used as the seed could either be sold at harvest or at planting time just prior to the next season.

Scenario One: Sell Seed at Harvest

If farmers sell their seed at harvest, the difference between the price they receive for seed versus grain is the premium of seed over grain (*i.e.*, K10/kg). In this case, costs arising from storage or risk of storage are minimal.

Scenario Two: Sell Seed at Planting Time

Most smallholder farmers in Malawi prefer to purchase seed just prior to the beginning of the planting season. Thus, there is a time lag between the time farmers harvest their seed and when they are be able to sell it as seed. The price at which farmers will expect to sell their seed is affected by two factors. First, the seed producer will expect to sell seed at a higher price than grain, regardless of the point in time when the sale is made (*e.g.* at time, T_o) because seed production requires more inputs than grain production. Secondly, seasonal price variation affects the price a farmer can expect to receive for seed (and grain) *e.g.* at time, T_t (Figure 6.1).

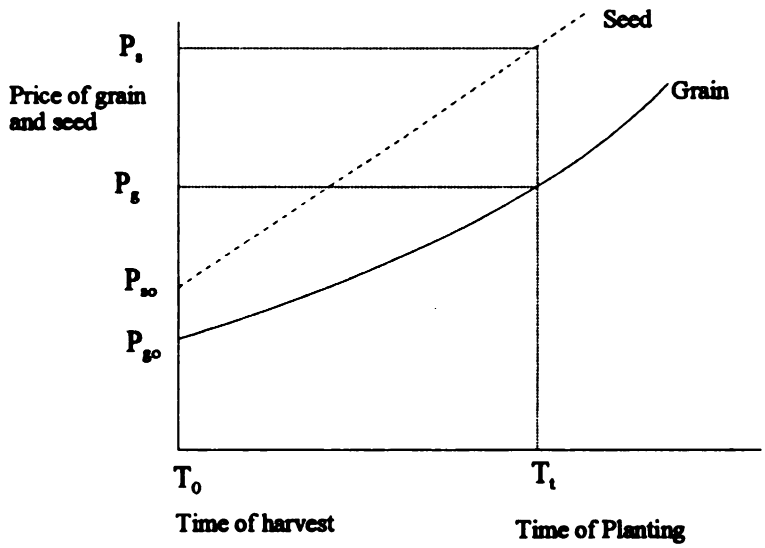

Figure 6.1: Theoretical Seasonal Variation of Seed Price and Grain Price

Data on monthly bean prices for 1997 show that after the harvest period (April), the price of beans (grain) is twice the harvest price level (Appendix 6.5 and Appendix 6.6). Thus, by storing the seed for pre-planting sale, the farmer can expect to receive a significantly higher price for the seed crop. However, a farmer who chooses this strategy will incur storage losses. In this study, a loss of 5 percent per month was assumed. This takes into account losses due to spillage, as well as the cost of any pest control a farmer uses.

For this analysis, the bean price at planting was assumed to be 10 percent higher than that at harvest[61]. This takes into account the fact that farmers sometimes will plant beans in the

[61] After three months, a price of grain/seed was 10 percent higher than the price at harvesting because it was assumed that seed would be planted in dimbas or in relay other than during the main growing season.

dry season in dimbas or in relay cropping. The produce from this crop is used as seed for the main rainy season.

Seed producers will have to decide whether to sell their produce at price, P_{so}, at harvest time, T_o, or sell their produce three months later at price, P_s at the time of planting, T_1. As most farmers begin to look for seed just before planting[62], the seed producing farmers' time of sale decision is guided by whether they expect P_s to be sufficiently greater than P_{so} for them to incur both storage costs due to pests, spillage, and the opportunity cost of postponing sales until later in the year. This analysis was done using two discount rates (50 percent per year and 120 percent per year, as a proxy for the opportunity cost of capital, *i.e.*, farmers' discount rate).

6.3 The Framework of Analysis

The profitability of producing seed/grain from a MV was compared with the profitability of producing grain from a TV. The three types of analysis were carried out. First, the absolute profitability of each enterprise was calculated. Second, the incremental benefits associated with producing seed/grain from MV over grain from a TV were calculated, under two scenarios--seed sold at harvest and seed sold after storing for three months. Third, break-even analysis was conducted to determine the yield and price at which seed/grain from MV production was no more profitable than grain production from a TV.

[62]In a study conducted by NBIP in 1995, over 75% of the farmers indicate that they start searching for seed to plant in November, just prior to the planting season (Scott *et. al.*, 1998). Therefore, price P_{so} may not be observable.

6.4 Results: The Profitability of Producing Seed/Grain from MV versus Producing Grain from TV

The profitability of producing seed and grain from a MV, compared to TV, was assessed comparing the NPVs of producing grain from MV over the NPV of producing a grain from TV. The results reported in Table 6.5 show the profitability of each.

Discussion of the various scenarios follows. First, the results are presented by the time of selling produce *(i.e.* selling seed/grain at harvest versus selling seed/grain three months after harvesting). Second, two levels of discount rates were used (50 percent and 120 percent).

Table 6.5: **Absolute Benefits of Producing Seed/Grain from MV versus Producing Grain from TV.**

		Location							
		Bunda Site				Champhira Site			
		r=50%		r=120%		r=50%		r=120%	
		Nasaka[1]	MV 1	Nasaka	MV 1	Nasaka	MV 2	Nasaka	MV 2
NPV (MK)									
Sell as Grain	At Harvest	12,842	17,622	9,486	13,043	14,366	18,601	10,645	13,788
	After 3 Months	10,634	14,597	6,363	8,770	11,925	15,425	7,193	9,302
Sell as Seed	At Harvest	12,842	22,639	9,486	16,866	14,366	23,868	10,645	17,804
	After 3 Months	10,634	18,757	6,363	11,470	11,925	19,793	7,193	12,136

Assumptions: Price of grain (MV and TV) at harvest is K25/kg. Price of grain (TV and MV) three months after harvest is K28/kg. Price of seed (MV) at harvest, K35/kg; and price of seed (MV) after 3 months, K38/kg.
[1]Nasaka was only sold as grain (used as a base). MV 1 is Sugar 56 and MV 2 is 25-2.

6.4.1 The Profitability of Selling Grain/Seed at Harvest

Absolute Profitability of Grain Production

Results from the two locations indicated that while growing beans (Nasaka and MVs) for sale at harvest as grain was highly profitable at both sites, it was more profitable at Champhira than at Bunda. For example, at a 50 percent rate of discount, the NPV for producing grain from Nasaka was K14,366 at Champhira, compared to K12,842 at Bunda (Table 6.5). Similarly, at a discount rate of 120 percent, the NPV at Champhira was higher (K10,645) than at Bunda (K9,486).

At the higher discount rate of 120 percent, the NPV was typically only about 60 percent of the NPV found when using a discount rate of 50 percent. This implies that even at the high discount rate, it would still be highly profitable for farmers to produce Nasaka for sale at harvest as grain.

Absolute Profitability of Seed Production

Similarly, producing seed of a MV for sale as seed at harvest was highly profitable at both sites. At a 50 percent discount rate, farmers at Champhira would earn a slightly higher NPV (K18,601), compared to farmers at Bunda (K17,622). However, at 120 percent discount rate, the difference in NPV between sites (Champhira site, NPV=K13,788, Bunda site, NPV=K13,043) falls to only K745.

Despite the higher costs associated with growing a MV as seed, at both sites and both discount rates, the NPV for the grain from MV was 37 percent (at Bunda) and 30 percent (at Champhira) greater than the NPV associated with growing the TV[63]. This difference was due to both the higher yield and price associated with the MV production. However, the relative profitability of growing a MV was greater at the lower discount rate (50 percent) compared to a high discount rate of 120 percent.

These results suggest that if farmers at both sites were to sell their produce as seed at a premium price assumed in the analysis, they would make about K10,000 above what they

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[63]These results are for grain production from MV sold at harvest.

would make by producing grain from Nasaka. Furthermore, farmers who sold an MV as seed would earn K5,000 above what they would make selling a MV as grain.

Incremental Benefits: The Profitability of Growing MVs Compared to a TV

An analysis of incremental benefits illustrate clearly the results from the absolute benefits. At both locations, there were higher incremental benefits from growing grain/seed from MV than producing grain from MV (Table 6.5). Although the differences were not large, the incremental benefits from producing grain from the MVs was higher at Bunda (K4,779 and K3,557 at 50 percent and 120 percent respectively) than at Champhira (K4,235 and K3,143). The difference arise from the higher yield of Nasaka at Champhira (892 kg/ha) compared to the yield of Nasaka at Bunda (807 kg/ha).

6.4.2 The Profitability of Selling Grain/Seed Three Months after Harvesting

Selling Grain after Three Months

Since the price of beans rises after harvest, it would appear that farmers should store their harvest for future sale. However, selling of both TVS and MVs grain after three months drastically reduced the NPV, compared to the NPV of selling grain/seed at harvest. Storing a TV reduced the NPV by 18 percent (at 50 percent discount rate) to 21 percent at 120 percent discount rate. In contrast, MVs' NPV was reduced by 25 percent to 44 percent.

In general, the reduction in NPV was greater under a 120 percent discount rate than at 50 percent discount rate. Also, the reduction in NPV was greater for the MV than for the TV. These results suggest it would be more profitable for farmers growing both MVs and TVS to sell their produce at harvest.

Selling Seed Three Months after Harvesting

Similarly, it is more profitable for farmers to sell seed of MVs at harvest rather than three months after harvest. Selling seed three months after harvest reduced the NPV to 83 percent of the NPV of selling seed at harvest, (under 50 percent discount rate) and to 68 percent (under 120 percent discount rate) (Figure 6.2).

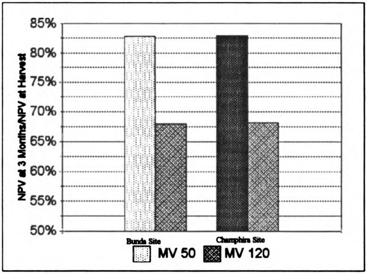


Figure 6.2: The Relative Profitability of Storing MV Seed versus Selling Seed at Harvest

Note: Relative profitability is calculated by dividing the NPV at three months by the NPV at harvest.

These results suggest that if farmers face a high discount rate, they are less likely to keep their seed to sell later at planting time. Moreover, since there is no market for legume seed, the price of the MV at three months is the price seed growers should expect to get.

Implications to MV Bean Grain/Seed Production

The results have the following implications. First, the MVs have higher yields than the TV at both locations therefore they offer a potential to increase bean production in the country. Second, irrespective of the discount rates used, it was profitable to grow MVs at both location. Third, it was more profitable to sell grain/seed at harvest than three months after harvesting. Figure 6.3 show the relative attractiveness of growing MV under different enterprises, *i.e.*, seed or as grain with storage and no storage as options.

Overall, growing seed for sale at harvest was the most profitable enterprise. This is followed by growing seed to be sold three months after harvest and growing a MV as grain to be sold at harvest. The least profitable enterprise was growing MV as grain to be sold three months after harvesting. These results therefore imply that even if farmers who grew MV for seed ended up selling their produce as grain at harvest, they would be better off than growing a TV. However, storing their seed would be profitable if seed users would be willing to pay a higher price for seed than for grain. Moreover, at planting time, most farmers have less cash to spend even for seed.

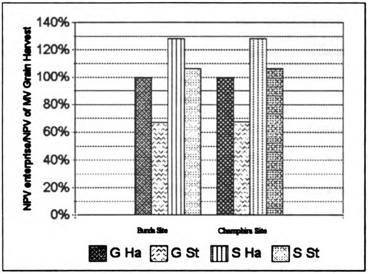


Figure 6.3: Relative Profitability of Seed/Grain Enterprise with Grain sold at Harvest as Base

Note: Measure of relative profitability is a proportion of an enterprises' NPV as a Proportion of NPV of grain sold at harvest. The calculations are based on a discount rate of 50%.

6.5 Sensitivity Analysis to the Profitability of Producing Seed from MV versus Producing Grain from TV

An analysis was conducted to determine the effect of a 10 percent reduction in yield on profitability (using the same analytical framework as above, *i.e.* calculating the net benefits and the incremental net benefits where the yield of MV was reduced by a ten percent and the TV's yield was constant). Complete results are presented in Appendices 6.5 and 6.6. Data in Table 6.6 summarizes the effect of yield reduction on incremental benefits.

Table 6.6: **The Effect of a Ten Percent Yield Reduction on Incremental Benefits of Growing Beans as Seed and as Grain at Bunda and Champhira Sites**

		Location			
		Bunda		Champhira	
		-Discount Rate-			
		50%	120%	50%	120%
NPV (MK)		*-Percent Decrease in Incremental NPV-*[1]			
Sell as Grain	At Harvest	41	42	49	50
	After 3 Months	42	44	50	53
Sell as Seed	At Harvest	25	25	27	28
	After 3 Months	26	26	28	29

A 10 percent yield reduction affected the profitability of enterprises (seed, grain and sell at harvest and sell at three months) differently. When yield was reduced by a ten percent an incremental profitability of grain production of MVs decreased from 41 percent to 50 percent. On the other hand, the 10 percent yield reduction reduced incremental benefits of seed production by 25 to 29 percent. This implies that a 10 percent reduction in yield reduces the profitability of grain production more than the profitability of seed production. These results indicate a price difference used in the analysis whereby seed had at least a 40 percent price premium (K35/kg) over the price of grain (K25/kg). On the other hand, the time of sale significantly did not affect the profitability of enterprises, *i.e.* a ten percent decrease in yield had the same percent decrease in the incremental benefits in seed sold at harvest or sold three months after harvesting (about 25 percent). Similarly, a reduction in incremental benefits in MVs grain production was almost the same irrespective of the time the produce was sold (42-45 percent).

6.6 Break-even Analysis

Break-even Yield Analysis

A break-even analysis was conducted to determine the yield that farmers planting a MV would have to get to make seed enterprise's NPV equal to the NPV of the TV given the price assumed. Data in Table 6.7 presents the break-even yield of MV which would give same NPV as the TV.

Table 6.7 Break-even Yield of MV at Bunda and Champhira Sites, Malawi

		Location							
		Bunda				Champhira			
		r=50%		r=120%		r=50%		r=120%	
		Yield (kg/ha)	% of Base Yield [a]	Yield (kg/ha)	% of Base Yield [a]	Yield (kg/ha)	% of Base Yield [a]	Yield (kg/ha)	% of Base Yield [a]
Sold as Grain	At harvest	836	76	841	76	921	79	957	80
	After 3 Months	841	76	852	72	927	80	940	81
Sold as Seed	At harvest	666	60	670	61	734	63	738	64
	After 3 Months	673	61	682	62	741	64	751	65

[a]Break-even yield as a percent of original yield, 1104 kg/ha for Bunda and 1159 kg/ha for Champhira.

The yield at which the MV was as profitable as growing grain from a TV, depended on whether the MV was sold as seed or as grain. The break-even yield (yield of MV at which NPV for MV would equal NPV for TV) for seed was generally lower than the yield of grain.

If sold as grain, the MV's break-even yield was 72-81 percent of the base yield, depending on the time of sale and discount rate. If sold as seed, the break-even yield was 60-65 percent of the base yield, depending on the time of sale and discount rate. This difference can be attributed to the difference in prices between the two products. The MVs and TV sold for the same price as grain, but when sold as seed, the MVs sold at a higher price than the TV grain. Thus, when sold as seed, a lower MV yield produced a revenue equal to the TV's NPV.

Regardless of the discount rates or time of sale, at Bunda the MVs' break-even yield was about 4 percent higher than at Champhira because the TV's yield at Champhira was higher than at Bunda. Thus, a higher MV yield was needed at Champhira in order for the MV's NPV to equal the TV's NPV.

Break-even Price Analysis

A break-even analysis was conducted to determine the break-even price of grain and seed at which selling the MV would be equally as profitable as growing the TV (Table 6.8).

Table 6.8 Break-even Yield of MV at Bunda and Champhira Sites, Malawi

		Location							
		Bunda				Champhira			
		Price (K/kg)	% of Base Price[a]	Price (K/kg)	% of Base Price[a]	Price (K/kg)	% of Base Price[a]	Price (K/kg)	% of Base Price[a]
Sold as Grain	At harvest	19	76	19	76	20	80	20	80
	After 3 Months	21	75	22	79	23	82	23	82
Sold as Seed	At harvest	21	60	25	71	22	63	23	66
	After 3 Months	24	62	26	67	25	64	26	67

[a]Break-even price as a percent of original prices, 1104 kg/ha for Bunda and 1159 kg/ha for Champhira. Price of grain sold at harvest is K25/kg, price of grain sold 3 months after harvest is K28/kg, price of seed sold at harvest is K35/kg and price of seed sold three months after harvest is K39/kg. These prices were calculated with the price of grain for Nasaka fixed at K25/kg

When grain of the MV is sold at harvest, the farmers discount rate did not affect the break-even price. This could be the case because the price of grain from the MV and the price of grain from the TV were the same and also there was little time over which to discount the revenue. Therefore, time did not have a large impact on discounted revenue regardless of the discount rate.

However, when grain is sold three months after harvesting, the break-even price was K1/kg lower than the break-even price at harvest. The small difference arises from the fact that the period over which the revenue was discounted was not long period enough to make the interest rate affect the revenue.

For seed producers who sold seed at harvest to earn the same NPV that they would get if they were growing TV as grain, the price of seed had to range from K21/kg at Bunda to K22/kg at Champhira under a 50 percent rate of discount, and from K25/kg at Bunda to K23/kg at Champhira, under a 120 percent discount rate.

Implications of Break-even Prices

Although the break-even price for seed of MVs at which the NPV would equal the NPV of grain from a TV was higher than the break-even price of grain, two factors stand out. First, the difference in price between the MVs and TV (*i.e.*, K19/kg and K21/kg at Bunda) was very small. Second, the break-even prices for seed were lower than the actual price of grain for the TV, which was K25/kg when sold at harvest and K28/kg when sold three months after harvest. This implies that for the yields observed, the seed producer could have sold the MVs at a price of grain and still be better off than they would if they grew a TV. Therefore, any price above the price of grain would make the growing a MV more attractive financially.

Furthermore, even with a 10 percent yield reduction, the break-even prices did not significantly increase. Data in Table 6.9 show the break-even prices with a ten percent yield reduction.

Table 6.9: **Break-even Prices at Ten Percent Yield Reduction Where MV NPV Equals TV NPV.**

		Location							
		Bunda				Champhira			
		Price at r=50%	% Base Price	Price at r=120 %	% Base Price	Price at r=50%	% Base Price	Price at r=120 %	% Base Price
Sold as Grain	At Harvest	21	84	21	84	22	88	22	88
	After 3 Months	24	86	24	86	25	89	25	89
Sold as Seed	At Harvest	24	69	24	69	25	71	25	71
	After 3 Months	27	69	27	69	28	72	28	72

Price of grain sold at harvest is K25/kg, price of grain sold 3 months after harvest is K28/kg, price of seed sold at harvest is K35/kg and price of seed sold three months after harvest is K39/kg. These prices were calculated with the price of grain for Nasaka fixed at K25/kg

6.7 Summary and Conclusion

The results in this chapter suggest that there were advantages to growing MVs. First, a number of the varieties had yields which were higher than the TVS at 5 percent, 10 percent and 15 percent levels of significance. Economic analysis showed that the NPVs from the MV were higher than the NPVs from the TV. These results were true for both locations. Furthermore, growing MV as seed was more profitable than growing MV as grain. However, the levels of profitability were affected by the time of sale of produce. In general (irrespective of whether it was seed or grain), the NPV from selling produce at harvest was higher than the NPV from selling after three months. Also, the results suggest that farmers facing a higher discount rates would be more profitable if they sold their produce earlier than store to sell later.

A 10 percent reduction in yield reduced the incremental benefits of grain from MVs more than it reduced the incremental benefits of seed production. Break-even yield analysis indicated that a farmer would break-even if when he got about 75 percent of the original yield of the MVs when producing grain and if he got around 60 percent of original yield of the MVs. Break-even price analysis suggests that even if farmers sold their produce (grain or seed from MVs) at the price of grain used in the analysis, they would break-even.

The economic analysis therefore indicated that farmers are likely to benefit from growing MVs whether they are growing MVs as seed or as grain. Regarding seed production, if seed users are willing to pay a higher price for seed at planting time, it is worthwhile for seed growers to store seed, otherwise, the analysis suggests that farmers are better-off selling their produce as grain at harvest time.

CHAPTER SEVEN

SUMMARY CONCLUSIONS AND POLICY RECOMMENDATIONS

7.0 Study Objectives

This study first documents trends in legume production and the evolution of seed multiplication schemes in Malawi. Second, it examines the institutional and economic factors affecting the performance of existing smallholder seed multiplication schemes, focusing on constraints to seed availability--including both supply side factors (constraints to farmer access to seed), and seed demand factors. Finally, it presents recommendations for improving the performance of smallholder seed schemes

7.1 Summary

Malawi's economy is based on agriculture, with about 85 percent of the population living in rural areas and most of the rural population relies on agriculture for their livelihood. In 1996, agriculture accounted for 43 percent of Malawi's GDP and 86 percent of its export earnings. While the estate subsector contributes the bulk of export earnings, the smallholder subsector contributes about 90 percent of the country's food needs. Maize is the staple food for more than 80 percent of the population and accounts for 70 percent of the cultivated customary land under agriculture. While maize dominates Malawi's agriculture, legumes-especially beans-play a key role in the agricultural economy. Beans are the second most important source of vegetable protein (following maize), are a cash crop for many small farmers, and contribute to maintaining soil fertility.

With a high population growth rate estimated at 3.3 percent per annum, Malawi is one of the most densely populated countries in sub-Saharan Africa. Therefore, there is limited capacity to increasing agricultural production by expanding the cultivated area. Traditional soil fertility enhancing technology such as crop rotation and fallowing are no longer being practiced by many of the country's farmers. As a result, most farmers continuously crop their land, which has led to a decline in soil fertility and agricultural productivity in recent years.

Since gaining independence in 1964, Malawi has adopted policies to encourage smallholder farmers to apply inorganic fertilizers to increase agricultural productivity. However, efforts to expand inorganic fertilizers have been unsuccessful. While the Government established an input credit program to enable farmers to purchase fertilizer, in recent years, only 30 percent of Malawi's smallholder farmers have had access to fertilizer loans, and most of these loans have gone to relatively well-to-do farmers. Additionally, due to the removal of subsidies in the early 1990s fertilizer has become more expensive. As a result, smallholders have reduced their fertilizer application, which has contributed to declining maize yields. Finally, in 1992, the smallholder agricultural credit administration collapsed due to non-repayment of the loans. Thus, today smallholder have limited access to credit for purchasing yield-increasing inputs such as fertilizer and improved seed.

Because of the increasingly high cost of fertilizer and limited availability of credit, scientists and policy makers have increasingly identified legumes as an option for sustaining soil fertility and increasing agricultural productivity, especially among smallholder farmers. Legumes not only provide organic matter, but are also both an important source of protein and an important cash crops in some areas. In spite of these benefits, studies have suggested that a lack of seed is a major bottleneck to increasing legume production. To redress the seed scarcity, in 1986, the Malawi Government embarked on developing smallholder seed multiplication schemes.

7.1.1 Legumes in Malawi

Today, Malawi's major legumes crops are beans (145, 000 hectares), groundnuts (72, 000 hectares) and soybeans (53, 000 hectares)[64]. Groundnut was the most widely grown legume crop until in the late 1980s, but thereafter, beans became the most important legume. In recent years (early 1990s), soybeans have grown in popularity, although they count for only a small share of the legume area. While most smallholders grow legumes primarily for home consumption, many smallholders also grow legumes as a cash crop--especially soybeans which they sell to processing companies.

7.1.2 Trends in Legume Seed Production

Historically, Malawi's seed sector has evolved through three phases. First, during the 1960s to the mid-1970s, the Government focused on developing a commercial seed subsector. In the 1960s, the Government provided farmers with new varieties through an exchange program and in 1972, it established the National Seed Company of Malawi

[64] 1996 hectarage.

(NSCM), a parastatal, as the sole supplier of the country's seed needs. However, the NSCM mainly focused on maize and tobacco, crops considered to be more profitable than legumes. Thus, increase access to seeds of smallholder crops such as legumes, in 1986 the Government established a smallholder seed multiplication scheme. However, facing a budget crisis in the late 1980s, the Government reduced its funding for agricultural support services (research and extension), which resulted in reduced funding for the seed multiplication schemes.

Second, in the early 1990s, the Government amended the seed law. The resulting deregulation of the seed industry opened up seed production and marketing to private sector. Currently, Cargill is the controlling shareholder in the NSCM. Although a second seed company, Pannar, was established in 1992, it only produced maize because it did not consider legume seed production to be a profitable activity.

The third phase of Malawi's seed history started in the early 1990s, when NGOs were allowed to establish smallholder seed multiplication schemes. The main participants in Malawi's smallholder seed multiplication schemes have been the Christian Service Committee, ActionAid, Concern Universal, and the European Delegation. In 1996, more than 10 NGOs invested over US $10 million in seed programs in Malawi. These seed multiplication schemes have focused primarily on beans, groundnuts and soybeans, which Malawian farmers generally grow either as monocrops or intercropped with maize. Thus, they compete with each other for land, capital and labor.

7.1.3 Economic and Institutional Analysis

Several theories and concepts explain the underlying economic and institutional forces that determine the performance of seed multiplication schemes. The first set of theories highlights the role that institutions play at different stages of agricultural development. As a country's agriculture develops from the traditional to the emergence stage, farmers become increasingly dependent on off-farm seed sources. In Malawi, Government originally funded programs to develop improved varieties of cross-pollinated crops, especially hybrid maize. When Government terminated its seed production monopoly, private firms launched hybrid maize seed production and marketing initiatives. Since farmers must buy hybrid seed each year, these firms were assured of a continued demand for their varieties.

Seed development for self-pollinated crops such as legumes followed a different pattern. Since farmers growing self-pollinated crops do not have to replace their seed every year, the demand for improved seed of such crops is weaker, compared to hybrid maize. Thus, private companies have shown little interest in developing improved legume varieties. While the public research system developed several improved varieties of self-pollinated crops, the absence of a mechanism for multiplying seed limited farmers adoption. Thus, for these innovations to benefit farmers, there was a need an institutional innovation. Seed multiplication schemes represent an institutional innovation aimed at insuring that improved legume varieties are produced and distributed to smallholder farmers.

In seed multiplication schemes, the organization managing the scheme obtains improved seed from research institutions and distributes it to participating farmers. In addition, seed schemes often carry out complementary activities such as regulating and certifying the quality of seed, providing training and extension, support services, and marketing the farmer-produced seed. Activities carried out at each of these different stages lead to transaction costs. Institutional analysis examines the comparative costs of planning, adapting and monitoring task completion to determine both how different schemes organize these activities and how the schemes' organization affects their performance.

7.1.4 Strengths and Weaknesses of the Seed Schemes

Data used to carry out an institutional analysis of the seed multiplication schemes were first collected through a rapid appraisal , during which officials of several NGOs involved in seed multiplication and officials from the Ministry of Agriculture and Irrigation. Then, seven seed multiplication schemes were selected for in-depth analysis (case studies): Christian Service Committee's smallholder seed exchange program, Christian Service Committee's Church Farm Scheme, ActionAid Smallholder Seed Development Program, ActionAid Seed Multiplication Program, Concern Universal, Maize Productivity Task Force, and NBIP Bean Seed Multiplication Schemes. These programs were chosen because they were relatively large or were long-established schemes. The officials from these programs were interviewed using a questionnaire to identify important characteristics of each seed multiplication scheme and to determine how each program was organized. Subsequently, 163 farmers participating in these smallholder seed multiplication schemes were interviewed to collect data regarding their experiences as participants in the schemes. These data were entered in SPSS for analysis.

The schemes studied fall into two distinct categories--commercial seed schemes and seed security schemes. The commercial schemes included the NBIP, MPTF and CSC-Church Farms, whose objective was to train seed producers who would sell seed to other farmers or farms. In contrast, the seed security schemes--CSC-SSEP, ActionAid-SM, ActionAid-SD and Concern Universal--aimed primarily at alleviating the farmers' seed security needs and sometimes had income generation as a secondary objective. Female farmers growing seed in groups tended to dominate the seed security schemes, while male farmers growing seed individually dominated the commercial schemes. While the commercial schemes mainly produced certified seed, the seed security schemes produced farmer seed.

Commercial scheme farmers received a relatively large amount of seed (30-40 kg), compared to the seed security schemes (3-8 kg). Consequently, the seed security schemes reached many more farmers than the commercial schemes. However, seed security scheme farmers reported that the amount of seed (3-8 kg) that they received was insufficient to alleviate their seed needs in the subsequent years. Facing a food shortage, rather than saving seed for the next planting season, many scheme participants relied on the schemes to meet their seed needs year after year. On the other hand, in the commercial schemes, the main problem farmers faced was a lack of a market for their seed. For example, under the Christian Service Committee Scheme, Naming'azi Church Farm ended up selling its produce as grain to local farmers. In another case, farmers participating in the MPTF project pressured the project to buy their seed when they doubted that fellow farmers would not pay a higher price for seed than they would pay for grain. Only the NBIP farmers, who had firm contracts with the National Bean Program, actually sold all their bean harvest as seed.

In the long run, these schemes are not sustainable because they are subsidized. While participating farmers paid for the seed they received, the schemes provided transportation, storage and extension services--all important services for ensuring the success of the schemes. In addition, in some instances both seed security schemes and commercial schemes operated in the same area, thereby creating competition among the schemes. In such cases, the seed security schemes may have undermined the viability of the seed entrepreneurs (such as the MPTF farmers), since farmers preferred obtaining seed on credit from a seed security scheme rather than purchasing it from farmers in commercial schemes.

7.1.5 The Role of the Private Sector in Seed Distribution

Currently, all seed multiplication schemes are managed by NGOs or the Government. Private firms have shown no interest in producing legume seed because, unlike hybrid maize seed, farmers do not have to replace their seed every year. In Malawi, this market failure (i.e. absence of an assured market) was initially solved by the Government, which established seed multiplication schemes in 1986. However, because of budgetary constraints, the Government reduced funding for its seed scheme development. Subsequently, the Government invited NGOs to establish seed schemes to meet the seed needs (especially legumes) of smallholders.

As the NGOs expand their role in smallholder seed multiplication, some scientists and policy makers argue that while NGO-managed smallholder seed multiplication schemes help to meet the immediate seed needs of smallholders, they discourage the development of private sector legume seed production and distribution.

7.1.6 Profitability of Growing Improved Bean Varieties

An economic analysis was conducted to determine the financial profitability (net present value, NPV) of producing seed and grain from modern varieties (MVs), using the production of grain from a traditional variety (TV) as a basis of comparison. Data used for this analysis were obtained from the Advanced Variety Trials conducted by Bunda College's Bean Program[65]. Analysis of the profitability of producing grain and seed from MVs involved examining several scenarios to determine how alternative assumptions affected profitability including the discount rates (50 percent vs 120 percent) for valuing the cost of borrowing capital; the time of selling seed/grain (at harvest vs three months later at a higher price); and third, a 10 percent yield reduction. Furthermore, break-even yields and break-even prices were calculated to determine yields and prices that would

[65]Data used in this analysis were obtained from trials conducted over three seasons (1994/95 to 1996/97) at two locations (Bunda and Champhira).

make producing seed and grain from MVs as profitable as growing a TV as grain. Separate analyses were carried out for each of the two research sites.

The economic analysis show that the Bean Program at Bunda had available MVs whose yields (at both research locations) were significantly higher[66] than the widely grown TV (Nasaka). Therefore, farmer adoption of these bean varieties would substantially increase smallholders' profits. Furthermore, at both locations growing seed of a MV for sale at harvest was the most profitable enterprise, followed by growing a MV for sale as seed three months after harvest--which was similar to the profitability of growing a MV for grain to be sold at harvest. Overall, storing seed or grain for sale three months later lowered the expected NPV, especially at the higher (120 percent) discount rate. This implies that farmers are extremely unlikely to keep their seed for sale later. A ten percent reduction in the yield of the MV reduced benefits (*i.e.*, absolute benefits) of growing a MV for grain (40 percent) more than the incremental benefits associated with growing a MV for sale as seed (25 percent). This means that a ten percent decrease in the MV's yield reduced the profitability of MVs sold as grain more than it reduced the profitability of seed production.

The break-even yield analysis showed that at the price of seed used in this analysis (K35), farmers would break-even (earn the same NPV as TV growers), even if the yield of the

[66]At Champhira, the highest yielding variety had 30% more yield above the traditional variety, the difference was not significantly because the data failed to pass the Bartlett's test for homogeneity of the variance.

MV decreased by 40 percent for a seed crop and by 25 percent for a grain crop. Similarly, the break-even price analysis indicated that MV growers who sold their crop as grain would break-even, even if the price of grain decreased by 25 percent. Similarly, MV growers who sold their crop as seed would break-even, even if the price of seed decreased by 40 percent. This suggests that the yield from MV was high enough to enable farmers to sell their produce at the price of grain and be better off than if they had grown a TV.

7.2 Conclusions and Policy Recommendations

The seed multiplication schemes have increased smallholder farmers' access to seed of new varieties. Most of the farmers reported that as a result of participating in the seed scheme, they were planting legumes on larger areas than they previously did. This implies that scheme farmers now have more produce to use as food, for sale, or for seed. However, there are changes that the seed schemes could make to improve their effectiveness. This section presents key policy recommendations arising from this study.

Recommendations for Strengthening the Seed Schemes

1. The main constraint to commercial seed multiplication is that the demand for legume seed is weak. The experience from the MPTF seed scheme suggests that farmers are not willing to pay more for seed of MVs than they are willing to pay for grain. This could be the case because farmers do not perceive the benefits of

paying more for seed of MVs, which are more expensive than seed of TVS (grain price). Yet, in this study, the economic analysis indicated that the MVs were both higher yielding and more profitable than Nasaka. This suggests that farmers lack information about the benefits (profitability) of the MVs. To reverse this, there is a need to create greater awareness of the benefits of new varieties. Information on new varieties can be provided in several ways. First, greater effort should be made to provide farmers more information regarding the added benefits of the new varieties--including their genetic superiority (higher yielding potential) and the value of growing disease-free seed (*e.g.*, the fact that the seed is certified or quality-declared). Since information has public good characteristics, the government and NGOs should help in disseminating this information through demonstration plots, radio adverts and field days.

2. Even if farmers are convinced of the advantages of the MVs, they will be unwilling to pay a higher price for this seed, unless they are assured that the seed they purchase meets the promised quality standard. Thus, packaging and labeling the seed is needed, which will add value to the seed by insuring farmers that the seed in the package is variety-specific and disease-free.

3. Apart from the NBIP, the other schemes did not guarantee the participants a market for their produce. For example, the MPTF farmers were encouraged to sell their produce without support from the scheme. Rather than expecting farmers to

market their own seed, it is recommended that schemes assist the farmers in developing demand for the seed. To their credit, some schemes grew demonstration blocks to create awareness of the new varieties grown in the schemes and held field days so farmers who planted the new varieties could tell their neighbors about the performance. The liberalization of the economy has created mixed signals. First, while it is now easy to enter and exit the seed market, farmers also have the option of selling their seed as grain to the highest bidder. On the other hand, the schemes are not obliged to buy seed from the farmers. This creates both supply and demand uncertainties in the subsector-- the seed growers are not sure whether they can sell their produce at a premium price and potential buyers are unsure whether the seed will be available. Thus, there is a need for the schemes to help reduce uncertainty by assisting farmers to identify the potential buyers of the grain which will in turn increase demand for seed. Although this will initially raise overhead costs of running the scheme, once farmers start buying the seed, the schemes will no longer need to perform this service.

4. Most schemes provided only seed to the participating farmers. In cases where seed growers produced high quality seed (such as certified seed in MPTF and NBIP), farmers indicated that they used more inputs (mainly labor) than they required for producing grain. No seed grower reported having ever applied fertilizer to produce seed, as most of them use fertilizer on other major crops such as maize or other cash crops. However, the model used in the economic analysis

included fertilizer as part of the inputs package and the results showed that the operation was profitable. Thus, by offering credit for inputs, the schemes would encourage farmers to apply fertilizer, which would increase their yield and profits, and thereby increase seed available to neighboring farmers.

5. The seed schemes should develop stronger linkages with the Government extension system, and input distribution channels (*i.e.*, fertilizer, insecticides) in order to identify opportunities for distributing seed through existing public and private distribution channels. Also, to promote long term sustainability, stronger linkages should be developed among the various actors in seed multiplication. For instance, most farmers did not know the source of the seed they were multiplying. Rather, the scheme provided the link between the farmers and the research institution which produced the seed. Failure to create a direct linkage between the farmers and the sources of seed has created a situation in which if the scheme collapsed, farmers would have no mechanism to gain access to improved seed. The linkages among the actors in the seed multiplication matrix can be improved by encouraging the schemes to work within the existing structure of the Ministry of Agriculture and Irrigation's extension system. This will ensure that when the projects phase out, the farmers still have access to the new varieties.

6. Most farmers indicated that they preferred the varieties that the seed schemes were providing and will likely find acceptable the new MVs which are similar in quality. To date, the main problem has been providing enough seed to meet the participating farmers' demand, *i.e.* in some schemes, farmers were given their third choice crop, some of which was not an important crop in the area. Therefore, the seed schemes need to more carefully assess farmers' crop/seed requirements to make sure there are adequate amounts of seed of the preferred crops at the onset of the season.

7. The seed schemes should make a greater effort to reduce farmers' dependency on the scheme. Among the schemes which had been operating for more than one year, there was evidence that some farmers had received seed of the same crop in previous years. Instead of giving the seed to the same farmers, new farmers should be selected to receive the seed. This would encourage farmers to start managing their harvest to meet not only their food and cash needs, but also their seed needs.

8. Most seed scheme farmers did not keep records for their seed multiplication enterprise. For example in ActionAid's scheme, only the extension workers kept up-to-date records on how much seed farmers planted. Similarly, although the MPTF was one of the best schemes in terms of farmers' training, the farmers did not keep records. Training farmers to keep 'basic' enterprise records would

enable both the scheme and farmers to determine the amount of inputs used in producing seed, as well as estimate the cost of producing seed.

9. Some schemes operated independently of the Government extension system. While this has freed the schemes from the Government bureaucracy, the schemes were also deprived of access to the existing agricultural infrastructure. In contrast other schemes such as the ActionAid-SSDP and MPTF which worked in close cooperation with the MOAI's extension staff, benefitted from this cooperation. Furthermore, apart from ActionAid-SSMP, there was no evidence that the schemes were making plans to phase out their seed projects. However, NGOs normally have a specific time frame for their projects. With ActionAid-SSMP, farmers had started assuming more responsibilities such as distributing and collecting seed, identifying recipients of seed and storing the seed for distribution in the following year. All schemes should implement similar strategies. Although most of the schemes had farmer training component, some schemes did not have extension workers trained in seed production for their first two years of operation, these schemes provided minimal training to farmers in seed production. Thus, there is a clear need for greater collaboration between the schemes and Government extension service.

10. The schemes in the study focused on working with either poor farmers (seed security schemes) or better-off farmers (commercial schemes). Most used a group approach in assisting the poor farmers and an individual approach in implementing the commercial schemes. Schemes should explore ways to increase the level of interaction between farmers in two groups. For example, the better-off farmers could be the primary producers of improved seed, which they would sell to the poor farmers to grow as grain. Thus, the schemes could utilize the better-off farmers to multiply seed for other farmers. The schemes operated by the Concern Universal project and Christian Service Committee's Smallholder Seed Exchange project were, in fact, seed consumer schemes, rather than seed multiplication schemes. On the other hand, ActionAid and MTPF were designed to multiply seed for distribution/sale to other farmers. Thus, instead of involving only one type of farmer, the schemes should identify a few more highly killed farmers who could save as primary seed producers in a community and would produce seed for sale to neighboring farmers.

11. Regarding the quality of seed, there are several areas that needed improvement. First, while most schemes distributed seed that was of good quality, in 1996 some schemes provided farmers with seed that failed to germinate. For example, the European Delegation imported seed from neighboring countries and distributed it without first testing its viability, despite the requirement that imported seed must be tested before it is distributed. Such failures can easily lead to farmers losing

trust in the quality of seed and also in the scheme distributing the seed. Furthermore, providing seed of poor quality has public good characteristics, *i.e.*, if one scheme provides poor quality seed, the reputation of other schemes can also be affected. Therefore, Government must develop and enforce clear guidelines to ensure that farmers receive good quality seed. Similarly, where farmers return seed to the scheme, farmers should be aware of the quality requirements and these requirements should be enforced by the scheme. Finally, in schemes where farmers keep their seed for distribution in the following year, the schemes should train the farmers on how to maintain good quality seed.

12. For beans and soybeans, different schemes provided different varieties for farmers to multiply. In the case of beans, long-established schemes such as CSC and ActionAid-SSMP and ActionAid-SSDS obtained their seed (Nasaka) from the Bean Program at Bunda College. The beans from the Ministry's Department of Research were provided to newly-established commercial schemes (MPTF and NBIP). In the case of soybeans, CSC-SSMS provided farmers with Magoye soybean variety--a variety from Zambia--while the rest of the schemes got their soybean varieties from the Ministry of Agriculture and Irrigation. Thus, farmers were denied full access to the available varieties despite their other good characteristics such as self-nodulating in the case of soybeans (Magoye) and consumer acceptance in the case of beans (Nasaka). Therefore, it is recommended

that the schemes include more if not all improved varieties in their schemes and allow farmers to choose which one they wish to grow.

13. Farmers in commercial schemes were required to undertake more activities than the farmers participating in the seed security schemes. In addition to agronomic requirements such as monocropping, observing isolation distance, and inspection, the commercial scheme farmers were required to clean, sort and grade which increased the cost of seed production. Unless measures are taken to increase the demand for improved seed of high quality and farmers' willingness to pay a premium for this seed, commercial scheme farmers will have no incentive to follow the practices recommended for quality seed production.

Since the NGOs do not have technical expertise in the field of breeding, they can assist the public sector in identifying the smallholder farmers' needs through conducting socio-economic studies to identify attributes of a crop that farmers desire. Also, the NGOs can assist in identifying the attributes that other end-users of a crop desire. In addition, NGOs are in the position of providing valuable feedback to scientists regarding the performance of improved varieties under farmers' management. Currently, there exists minimal data to assess the performance of improved varieties under farmers' management and across the country's varying agro-climatic conditions. By training scheme farmers in basic record keeping and working with farmers to analyze these data, NGOs could provide valuable feedback to scientists as to how the improved varieties performed across the country.

Recommendations to the Department of Agricultural Research

1. Since the private seed companies are not interested in legumes, public research institutions must play an active key role in developing new varieties. To this end, the public research organization should tap the international research centers such as ICRISAT (for groundnuts), CIAT and Bean/Cowpea CRSP (for beans) for expertise and germplasm in order to increase the number of varieties available to farmers. Where several research organizations are involved in varietal development, the Government must establish clear guidelines that will not favor one institution's varieties over the others and thereby avoid limiting farmers' accessibility to some of the new varieties.

2. To have a practical application to smallholder farmers' situation, there is a need to have research design that will closely replicate the smallholder farmers' environment (management). Also, instead of recommending one variety for the whole country, there is need to have a better agro-ecological targeting for specific areas in order to optimize overall bean yield in the country.

3. The public sector should play an active role in providing basic seed for the varieties farmers will multiply. In the current schemes, the public sector, *i.e.*, Department

of Agricultural Research, was primarily responsible for multiplying basic seed to foundation seed. However, farmers such as those participating in the MPTF scheme, NBIP scheme or commercial farmers could possibly be contracted to multiply basic seed into foundation seed or certified seed, which NGOs can use in their respective schemes. This will enable the Department of Agricultural Research (and Bunda College) concentrate its efforts on conducting research and monitor or regulate seed production other than multiplying seed.

7.3 Limitations and Future Research

The economic analysis is based on a production system which is not typical of Malawian farmers. First, apart from the MPTF and NBIP, farmers in the other schemes never planted seed crop in monoculture. Second, none farmers in the schemes applied fertilizer to their seed crop. Furthermore, the coefficient of variation from the data were high (about 30 percent) therefore make the results less precise. Therefore, the results have less direct applicability under Malawi situation.

Given the fact that the research was not conducted for the entire growing season, it is recommended that future research should be conducted through an entire growing season. This will assist in understanding the activities involved in seed multiplication. The majority of the seed schemes focused on seed multiplication with little emphasis on distribution. Research should be conducted to determine the possibility of using private input traders as distributors of seed.

APPENDIX 3

Appendix 3.1

Seed Development & Multiplication Schemes Survey Key Informant Survey

FIELD OFFICE

CONSENT STATEMENT (read to the respondent)

This study is being carried out by Patrick Kambewa, a Ph. D. Candidate in agricultural economics at Michigan State University, as part of my degree program. This study is funded by the Rockefeller Foundation's *African Dissertation Fellowship Program*. The purpose of the study is to provide abetter understanding of the nature of the seed programs being implemented in Malawi and propose suggestions for strengthening these programs. You are free to not answer any of the questions I will ask you, or you may choose to not being interviewed--without any penalty or consequence. If you agree to be interviewed, the information you provide will be confidential. Are you willing to be interviewed?

Yes| **No** (Circle one)

. **IDENTIFICATION**

1.1 Name of NGO/Organization . . . .

Representative interviewed . . . .

Address:

Phone/Fax . . . .

1.2. Malawi headquarters Address . . . .

1.3 Status of organization (i.e., local NGO, foreign NGO, government) . . . .

II. Overview of Organization/Programs

2.1 In what <u>year</u> did your organization start working at this site? . . . .

2.2. What was the <u>original focus</u> of your organization's program at this site?

. . . .

. . . .

. . . .

. . . .

2.3 At this site, what are your organization's current <u>programs</u> and their <u>general objectives?</u>

<u>Program Name</u> <u>General Objectives</u>

. . . .

. . . .

. . . .

2.4 At this site, how has your program (or objectives) changed in recent years?

<u>Program</u> <u>General Objectives</u>

. . . .

. . . .

. . . .

2.5 At this site, <u>how</u> has your program (or objectives) <u>changed</u> in recent years?

<u>Year</u> <u>Nature of Change</u>

. . . .

. . . .

. . . .

2.6 Why did your organization make these programmatic <u>changes</u>?

. . . .

. . . .

. . . .

2.6 What <u>specific activities</u> are associated with <u>each</u> of your program (i.e., agricultural, health, environment, food security)?

<u>Program</u> <u>Activities</u>

. . . .

. . . .

. . . .

2.7 What are the main sources of funding for your organization?

Program Funding Source

. . . .

2.8 In what locations does your organization implement each of its programs?

Program Locations (EPAs)

. . . .

. . . .

. . . .

2.9 Briefly describe the different types of seed multiplication schemes your organization supports

. . . .

. . . .

. . . .

2.10 What is the main difference between or among these seed schemes?

. . . .

. . . .

. . . .

2.11 How have these seed schemes changed in recent years?

. . . .

. . . .

. . . .

III. Characteristics of this location *Not Applicable since this is a head office*

3.1 What are the most important crops farmers grow in this site?

Food crops . . . .

Cash crop . . . .

3.2 How much land (has) does the average farmer household cultivate in this site? . . .

3.3 In what month do the rains usually begin? . . . .

3.4 When did the rains begin this year? . . . .

3.5 In what month do rains usually end? . . . .

3.6 Do farmers usually plant a relay crop?

Explain . . . .

IV. Seed Related Program Activities at this Location (1996-97)

4.1 What are the specific objectives of your organization's seed program?

. . . .

. . . .

. . . .

4.2 What class/type of seed does your program produce i.e., certified, approved, farmer, etc..)

. . . .

4.3 Does your organization carry out on-farm trials with the Agricultural Research Department? . . . . Y----N

Explain . . . .

Village Selection

4.4 How/why did you select the participating villages (explain?

. . . .

. . . .

4.5 What is the involvement of the local farmers in farmer selection? . . . .

. . . .

. . . .

. . . .

4.6 Does your program deal with farmers as individuals or in groups? Explain why . .

. . . .

. . . .

Seed Crop Selection

4.7 For which crops do you supply seed and why has your organization targeted these crops?

<u>Crop</u> <u>Reason</u> <u>Year first</u> <u>Supplied</u>

Crop	Reason	Year first Supplied
Maize	. . . .	Year_______
Beans	. . . .	Year_______
Soybeans	. . . .	Year_______
Cowpea	. . . .	Year_______

S. Potatoes . . . . Year________

Cassava, Sorghum, Pigeon peas . . . . Year________

4.7 Did your organization carry out an initial seeds identification aimed at identifying seeds in less supply in the area you work? . . . . Y----N

Explain

. . . .

. . . .

4.8 Are farmers involved in selecting the crop for which they produce seed? . Y----N

If no, why not . . . .

. . . .

Farmer Selection

4.9 What specific criteria do you use for selecting farmer participants?

. . . .

. . . .

. . . .

. . . .

4.10 **What specific method do you use to select farmer participants?**

. . . .

. . . .

. . . .

. . . .

4.11 **In what month did you select the farmers who will participate in your 1996-97 seed program?** . . . .

4.12 Overview of Seed Program Scope, 1995-96

Crop	Varieties	Seed Sources	Why this source	Churches Involved (No.)	Farmers Involved (No.)	Total seed Distributed (mts)
Pigeon peas						
Beans						
Soybeans						
Cowpeas						
S. Potatoes						
Sorghum						

Cassava						

4.13 **What is <u>required</u> (special conditions) of farmers for them <u>to participate</u> in your seed program? (Describe the conditions)**

. . . .

. . . .

. . . .

. . . .

4.14 **<u>List</u> and <u>describe</u> activities farmers undertake from the time they are selected to the time they plant the seed**

. . . .

. . . .

. . . .

. . . .

Seed Procurement and Storage

4.15 **<u>How</u> is the seed bought to this <u>site</u> (main office) and by <u>whom?</u>**

. . . .

. . . .

. . . .

. . . .

. . . .

4.16 **Is seed bought centrally or at site?** . . . .

4.17 **How is the seed distributed to the farmers and by whom?**

. . . .

. . . .

. . . .

. . . .

4.18 **How does your organization ensure that farmers participating in your program produce seeds which are true to type and healthy?** . . . . **Y—N**

. . . .

4.19 **Were you satisfied with the quality of seed you received in 1995-96?** . . . . **Y—N**

(Explain any quality problem)

Crop____________Problem . . . .

Crop____________Problem . . . .

Crop____________Problem . . . .

Crop____________Problem . . . .

Crop____________Problem . . . .

4.20 **Have seed sources changed over the years?** . . . . **Y—N**

(Explain) . . . .

. . . .

4.21 Was the seed treated in any way before arriving at the site? . . . . Y---N

Crop__________Treatment . . . .

Crop__________Treatment . . . .

Crop__________Treatment . . . .

Crop__________Treatment . . . .

After receiving the seed at this site:

4.22 How long did you store it before distributing the seed to the farmers? . . . . . . Months

. . . .

. . . .

. . . .

4.23 Where and under what conditions do you store new seed?

. . . .

. . . .

. . . .

. . . .

. . . .

4.24 Do you treat the seed during storage (circle) . . . . Y/N

(explain) . . . .

. . . .

. . . .

4.25 Do you pack/repack the seed before taking it to the farmers? . . . . Y/N

<u>If yes</u>

Specify the amount of seed per bag or lot ______

4.26 Do you carry out any tests to determine its quality (circle) . . . . Y---N

<u>If yes,</u>

Describe the tests

4.27 Do you treat the seed in any way prior to distribution (circle) . . . . Y---N

<u>If yes,</u>

Describe the treatment . . . .

. . . .

Seed Distribution/Repayment

4.28 When do you expect farmers to plant the crop seed

1. **During the main growing season *Yes***
2. **In *dimba* (end of main growing season)**
3. **In relay cropping**
4. **Other (specify...**

4.29 How many weeks before the planting period do farmers get the seed . . . . weeks____

Seed Provided

430 How much seed do program participants receive?

<u>**If seed provided to individuals**</u>:

Kgs of seed given: Maize: ________ Legumes______

Comments: ....

<u>**If seed provided to groups**</u>:

Kgs of seed given: Maize: ________ Legumes:________

Typical size of groups: ________

Comments: ....

Seed Repayment

4.31 How do farmers repay the seed?

<u>**If repayment is in-kind**</u>:

Amount of seed returned for each kg received: ___________

Month repayment due: _________________

<u>**If repayment is in cash**</u>:

Amount of cash per kg received: ____________

Month repayment due: _________________

4.32 Do participants sign any type of a written contract?

<u>**If yes**</u>

Explain

4.33 **What is required (conditions) of farmers for them to participate in your seed programs (explain)?**

. . . .

. . . .

. . . .

4.34 **Are there any penalties if a participant decides to drop out of the program? Y----N**

If yes, describe the penalties

. . . .

. . . .

. . . .

4.35 **How does your organization insure payment?**

. . . .

. . . .

. . . .

. . . .

. . . .

4.36 **Are there any circumstances under which you will not require repayment?** . . . . . **Y----N**

. . . .

. . . .

. . . .

4.37 In the past years, how successful was your program in having farmers repay their seed loans?

....

....

....

....

4.38 Can farmers receive seed for more than one year? .... Y---N

If yes, under what conditions?

....

....

....

....

Support Services Provided

4.39 Does your seed program provide any training to participating farmers? .... Y---N

If yes:

Describe the type of training

Agronomic ....

Commercial, ...

Marketing. ....

....

4.40 **Who actually provides this training? (Indicate where outsiders are involved)**

. . . .

. . . .

4.41 **Does your organization provide training for the extension workers involved in the program?** . . . .

If yes, explain the type of training

. . . .

. . . .

. . . .

4.42 **Does your organization have staff/extension agents in the participating villages? . Y---N**

<u>If yes</u>

Number of villages per supervisor

Number of villages per extension worker

What do these people do?

. . . .

. . . .

4.43 **Does your organization or any other organization provide any credit to participating farmers for inputs, or other than seed?** . . . . **Y---N**

If yes

Who provides credit, for what inputs? (Indicate the number of farmers benefitting and size of package)

. . . .

. . . .

. . . .

4.44 **Does anyone inspect the farmers' fields before farmers plant the seed?** *Yes* . . . . Y---N

If yes

Who does this?____________________________

What do they inspect for?

4.45 **Does anyone inspect the farmers fields during the growing season?** . . . . Y---N

If yes

Who does this? ____________________________

What do they inspect for? ____________________________

4.46 **After harvesting, are there any tasks farmers are expected to perform?**

Cleaning . . . .

Sorting . . . .

Treating seed . . . .

Storing . . . .

Packaging . . . .

4.47 **Does anyone supervise/inspect any of these activities inspected?** . . . . Y---N

If yes.

Which activities? . . . .

4.48 **Does the organization cooperate with other organizations (i.e., NGOs, government offices, ADMARC) in carrying out the seed multiplication exercise?**

Agency **Type of Collaboration**

Agency	Type of Collaboration
____________	____
____________	____
____________	____

Farmer Decision Making

4.49 **Can farmers choose what crop to grow?** . . . . **Y---N**

4.50 **Can farmers choose the variety to grow?** . . . . **Y---N**

4.51 **How many different crops can farmers choose to multiply?** . . . .

. . . .

. . . .

. . . .

4.52 **Does your program require farmers to:**

Crop	Monocrop:	Plant only one variety/field	Isolate the crop
Maize	Y---N	Y---N	Y---N
Beans	Y---N	Y---N	Y---N
Groundnuts	Y---N	Y---N	Y---N

Soybeans Y---*N* *Y*---N *Y*---N

4.53 Is there any specific date farmers are expected to harvest their crop? . . . . Y----N

Marketing

4.54 Did your organization buy seed from seed producers? . . . . Y---N

If yes, explain

. . . .

4.55 How was farmers' seed from past programs handled (i.e., given to other farmers,)?

. . . .

. . . .

. . . .

. . . .

4.56 When are farmers expected to sell their seed?

(i.e., at harvest, prior to next planting season)

Explain:

. . . .

. . . .

. . . .

4.57 To whom/how are farmers expected to sell their seed?

(i.e., seed bank, other farmers, MOAI, NGO, traders)

Explain:

. . . .

. . . .

. . . .

4.58 **Where (location) does your program expect farmers expect to sell their seed?**

. . . .

. . . .

4.59 **How does your program expect farmers to find a market for their seed?**

. . . .

. . . .

4.60 **Will your program assist farmers find a market for their seed?** . . . . **Y----N**

If yes, how?

. . . .

. . . .

4.61 **Will your organization provide any information to assist farmers in marketing their seed?**

. . . . **Y----N**

4.62 **At what price do you think farmers should sell their seed compared to the grain price prevailing in the market when they sell their seed?**

Crop	**Grain Price**	**Expected Price of Grain**

Maize	________	________________________
Bean	________	________________________
Soybean	________	________________________
Groundnuts	________	________________________

4.63 Does your program guarantee a specific selling price for farmers' seed? . . . . Y—N

If yes, explain/what price.

. . . .

. . . .

. . . .

. . . .

4.64 Will your program assist farmers with the following (tick where applicable and explain and specify who will pay for these)?

Packaging . . . .

Advertising . . . .

Transportation of produce . . . .

Storage of produce . . . .

V. Evaluation

5.1 What criteria will your organization use to assess the success of its seed program?

. . . .

. . . .

5.2 **Do you believe farmers will store their seed for sale as seed for the next season? . . Y---N**

Explain why/why not

<u>Crop</u>	<u>Grain Price</u>	<u>Explanation</u>
Maize	________	______________________________
Bean	________	______________________________
Soybean	________	______________________________
Groundnuts	________	______________________________

5.3 **Do you believe farmers have a good (certain) market for their seed crop? . . . . Y----N**

Explain why/why not

<u>Crop</u>	<u>Grain Price</u>	<u>Explanation</u>
Maize	________	______________________________
Bean	________	
Soybean	________	______________________________
Groundnuts	________	______________________________

5.4 **In this area, what farming activity do farmers give up in order to participate in seed multiplication (opportunity cost)?**

. . . .

. . . .

5.5 **Does participation in your organizations' seed program require farmers to use any additional resources (capital/cash, labor) compared to when they plant the crop as grain?**

. . . .

. . . .

5.6 **What do you feel are the key factors that contribute to the success of your organization's program?**

. . . .

. . . .

5.7 **What are the key problems that threaten to the success of your organization's program?**

. . . .

. . . .

5.8 **What changes are needed to strengthen you organization's seed program?**

. . . .

. . . .

5.9 **For how many years are you going to carry out this program in this area?**

5.10 **Are you going to phase the program before it ends to ensure sustainability?** . . . . . Y----N

Explain your answer . . . .

. . . .

. . . .

5.11 **Describe the records that you keep on farming activities to do with seed production** . . . . .

. . . .

. . . .

5.12 **Does your organization use any of the existing local institutions in your seed multiplication programs** . . . . **Y—N**

Explain . . . .

. . . .

Historical Seed Production

Year	Seed Received	Seed Sold

Area	Number farmers	Amount of seed	Hectarage planted

Many thanks for your time.

Appendix 3.2

Seed Development and Multiplication Schemes Survey Smallholder Survey

CONSENT STATEMENT (read to the respondent)

This study is being carried out by Patrick Kambewa, a Ph.. D. Candidate in agricultural economics at Michigan State University, as part of a degree program. This study funded by the Rockefeller Foundation's *African Dissertation Fellowship Program*. The purpose of the study is to provide a better understanding of the nature of the seed programs being implemented in Malawi and propose suggestions for strengthening these programs. You are free to not answer any of the questions I will ask you, or you may choose to not being interviewed--without any penalty or consequence. If you agree to be interviewed, the information you will provide will be confidential.

Are you willing to be interviewed? . . . . (0=no, 1=yes) **Circle one**

I. IDENTIFICATION

1.1 Name of respondent . . . .

1.2 Date . . . .

1.3 Village...EPA......................................RDP. . . . .

ADD...District..................................Region . . . . . .

1.4 Respondent's Information:

Gender..................Age....................Marital Status.......................Level of education (years in school).............

1.5 How many household[67] members live in the compound throughout the past year?

Adult males (>15years) . . . .

Adult females (>15 years) . . . .

Children (<15years) . . . .

1.6 How many household members lived away from home during the past year?

Adult males (>15years) . . . .

Adult females (>15 years) . . . .

Children (<15years) . . . .

1.7 In addition to farming, what other work does the household do to earn income?

<u>Household member</u>	<u>Activity</u>
....	....

1.8 Wealth ranking of a household (*I propose we use the extension workers in the area to do this ranking for us other than our using some indicators from the board).*___

(**CODES** 1=poor, 2=average, 3=rich)

II. BASIC AGRO-ECONOMIC INFORMATION

[67]Interest is on household labor. Hence, a household is the smallest economic decision-making-unit after the individual.

2.1 In the 1996/97 how many hectares do you:

Own .... (has)__

Borrow .... (has)__

Rent .... (has)__

2.2 Crops grown information

Parcel 1 Area (has)_______

Rainy season '96/97	Name	Area (has)	Sole/ Intercrop (circle one)	Fertilizer (type/kg)	Relay (no/yes)	Harvest (Kg)
Crop 1						
Crop 2						
Crop 3						
Relay crop '96						
Crop 1						
Crop 2						
Crop 3						
Dimba/dambo crop '96						
Crop 1						
Crop 2						
Crop 3						

Parcel 2 Area (has)_______

Rainy season 1996/97	Name	Area (has)	Sole/ Intercrop (circle one)	Fertilizer (type/kg)	Relay (no/yes)	Harvest (Kg)
Crop 1						
Crop 2						
Crop 3						
Relay crop '96						
Crop 1						
Crop 2						
Crop 3						
Dimba/dambo crop '96						
Crop 1						
Crop 2						
Crop 3						

Parcel 3 Area (has)_______

Rainy season	Name	Area (has)	Sole/ Intercrop (circle one)	Fertilizer (type/kg)	Relay (no/yes)	Harvest (Kg)
Crop 1						
Crop 2						
Crop 3						
Relay crop '96						
Crop 1						
Crop 2						
Crop 3						
Dimba/dambo crop '96						
Crop 1						
Crop 2						
Crop 3						

2.3 Of the crops you grow in the rainy season, from which do you get:

a. the most of your food ....

b. the second most of your food ....

c. the third most of your food ....

2.4 Of the crops you grow in the relay season, from which do you earn:

a. the most of your food ....

b. the second most of your food ....

c. the third most of your food ....

2.5 Of the crops you grow in the *dimba* or *dambo*, from which do you earn:

a. the most of your food . . . .

b. the second most of your food . . . .

c. the third most of your food . . . .

2.6 Of the crops you grow in the rainy season, from which do you earn:

a. the most money . . . .

b. the second most money . . . .

c. the third most income . . . .

2.7 Of the crops you grow in the relay season, from which do you earn:

a. the most money . . . .

b. the second most money . . . .

c. the third most income . . . .

2.8 Of the crops you grow in the dimba or dambo, from which do you earn:

a. the most money . . . .

b. the second most money . . . .

c. the third most income . . . .

2.9 Of the legumes you grow indicated in the table above, what are the objectives of each?

(Prioritize in terms order of decreasing hectarage)

Legume	Objectives
First legume	1.
	2.
	3.
Second legume	1.
	2.
	3.
Third legume	1.
	2.
	3.
Fourth legume	1.
	2.

2.10 What are the desired characteristic of each legume? (Prioritize in order of decreasing hectarage)

Legume	Desired characteristics
Legume 1	1.
	2.
	3.
Legume 2	1.
	2.

	3.
Legume 3	1.
	2.
	3.
Legume 4	1.
	2.
	3.

2.11. Of the following statements about legumes ask the farmer whether they (0=strongly disagree, 1=disagree, 2=strongly agree, 4=don't know).

2.11.1 Legumes are an important source of food .... __

2.11.2 Legumes are an important source of income .... __

2.11.3 Legumes improve soil fertility .... __

2.12 How do you harvest your legumes? (Prioritize in order of decreasing hectarage)

{Codes: 1=pluck pods in the field; 2=pluck the whole plant to the homestead where pods are plucked off the plant; 3=other (specify)}

Legume	Method of harvest
Legume 1	1.
	2.
	3.
Legume 2	1.

	2.
	3.
Legume 3	1.
	2.
	3.
Legume 4	1.
	2.
	3.

2.12.1 If the whole plant is taken home, what do you do with the residue? . . . . __

(1=burn, 2=feed to livestock, 3=manure, 4=others

(specify)....................................

2.12.2 If the plant is left in the field, what do you do with it? . . . . __

(1=burn, 2=feed to livestock, 3=manure, 4=others

(specify)....................................

2.13 Compared to the past 2-3 years, during this cropping season did you plant more area to any legume? . . . . (0=no, 1=yes)___

If yes:

What legume and why?

Legume name Reason

....

....

....

2.14 **Compared to the past 2-3 years, during this cropping season did you plant <u>less area</u> to any legume?** . . . . **(0=no, 1=yes)___**

<u>If yes:</u>

What legume and why?

<u>Legume name</u>	**<u>Reason</u>**
....	. . . .
....	. . . .
....	. . . .

Seed Issues

2.15 **Before you joined the seed multiplication program, did you store sufficient seed for future planting requirements of the legume you are now multiplying?**

. . . . **(0=no, 1=yes)___**

<u>If no:</u>

Explain . . . .

2.16 **Before you joined the program, from where did you get your seed?** . . . . ___

{1=from the field, 2=bought from the market, 3=from other farmers,

4=others (Specify)}

2.16.1 Did you get enough seed from these sources? . . . . (0=no, 1=yes)___

If no:

How did you supplement the seed . . . .

2.17 How do you store your seed? . . . .

2.18 Do you buy seed from other sources? . . . . (0=no, 1=yes)__)

Explain your answer: . . . .

If yes:

What is the frequency for buying seed? . . . . ___

{**CODES** 1=every planting season, 2=once every two years

3=occasionally, 4=others(Specify)}

2.19 Are there some farmers or traders who sell seed in your area? (Separate seed from grain, i.e., you might be buying seed when the seller is selling grain. We are interested in what is sold and bought as seed) (0=no, 1=yes, 2=don't know)___

<u>If no:</u>

Explain ....

....

2.20 After the onset of the rains, do prices of seed change? Explain ....

....

III. Overview of Seed Multiplication Program

3.1 What organization runs the seed multiplication program in this area? ....

....

3.2 In what year did the organization start working in this area? ....

3.3 What was the aim of the program? ....

3.4 What crop(s) is the program multiplying in the area? And why?

<u>Crop</u> <u>Reason</u>

....

3.5 Why did you join the program? i.e. what did you hope to achieve by joining the program? ....

. . . .

3.6 **How were farmers selected to participate in this program?** . . . .

3.7 **In what year and season did you start participating in seed multiplication programs**

Year/Season	Crop name	Variety	Reason for choosing the crop

3.8 **Do you multiply seed s an individual or in a group? (1=individual, 2=group)** . . __

Explain why? . . . .

. . . .

3.9 **Do you prefer to multiply seed individually or in a group? (1=individual, 2=group__**

Explain why? . . . .

. . . .

IV. Seed Procurement and Storage

4.1 Between the time you were selected to the time of planting, describe the activities that (s)he undertook or that the organization undertook. (In case of other organizations, specify the name)

Activity	Done by (circle one)
Training of farmers in seed production	....
Selection of field	....
Verification of appropriate field	....
Getting of basic seed from original sources	....
The buying of other inputs such as fertilizer & chemicals	
Storage of seed from the initial producers	....
Laying out of the field	....

4.2 How many weeks before planting did you get the seed this year? (Weeks before planting)

.... ___

4.3 How was the seed brought to you this year? .... ___

{**CODES**: 1=NGO brought it to farmer's homestead, 2=farmer went to get the seed from the NGOs office, 3=Original supplier brought it to the farmer's homestead, 4=Farmer went to get seed from original supplier, 5=Other (Specify)}

4.4 Who distributed the seed to you this year? . . . . ___

{CODES 1=NGO, 2=Government extension worker, 3=Village committee, 4=Other(Specify)}

4.5 Did you receive treated seed this year? . . . . (0=no, 1=yes, 2=don't know)___

If Yes

What was it treated with? . . . . ___

(CODES: 1=actellic, 2=ashes, 3=tobacco leaves, 4=others (specify)................................)

4.6 What is the source of the seed you multiply year? . . . . ___

{CODES 1=Chitedze, 2=Bunda, 3=others (Specify)}

4.7 How did you store the seed before planting this year? . . . . ___

{CODES 1=Stored in a sack, 2=Stored in pots, 3=Don't store, 4=Others(Specify)}

4.8 Do you treat the seed during storage before planting this year? . . . . ___

(0=no, 1=yes, 2=don't know)

If Yes,

explain how . . . .

. . . .

For Soybean Farmers Only! For non-soybean farmers proceed to Question 4.9

4.81 Did you inoculate your seed at planting? ..... (0=no, 1=yes, 2=don't know)___

If yes:

From where did you get the inoculant? ....

If no:

Why not? .... __

{**CODES:** 1=never heard of the technology, 2=inoculant not available,

3=other (specify)...}

Proceed with all farmers

4.9 How much seed did you get this year? .... ___

4.10 How are you expected to repay the seed this year? .... ___

{**CODES** 1=in cash, 2=in seed, 3=other (Specify)}

4.11 How much are you expected to repay this year? ____

{**CODES** 1=same amount/value received, 2=Plus interest (Specify rate of interest), 3=Other (Specify)}

4.12 Do you get inputs from other sources other than the organization running the program this year? .... (0=no, 1=yes)___

If yes

Explain

Type of input	Source	Amount
Fertilizer	...	....
Insecticides		....
Packaging materials (Specify)		....
Others (Specify)		....

Indicate whether the farmer is multiplying seed individually or in a group ...... __

(0=individual, 1=group)

Decision making process

4.13 During seed multiplication this year, indicate how the following decisions are made or who makes them

4.13.1 What crop to multiply? .... ___

{Use these codes from question 4.12.1 to 4.12.6 **CODES** 1=farmer, 2= group, 3=organization, 4=other (Specify)}

4.13.2 When to plant? ....

....

4.13.3 When to weed? ....

4.13.4 When to harvest? ....

4.13.5 When to sell? ....

4.13.6 How to sell i.e., grain or seed? ....

....

4.14 How many are there in the group? ....

4.15 What are the benefits distributed among the group members? ....

....

4.16 How are benefits distributed among group members? ....

....

4.17 How are labor requirements met? ....

....

....

4.18 Who stores the produce? ....

Support Services Provided

4.19 Did you get any training related to seed production? .... (0=no, 1=yes)___

If yes, describe the topics covered (circle if yes)

Type of Training	Description of training and who provided it
Land selection	. . . .
Seed selection	. . . .
Land preparation	. . . .
Planting	. . . .
Weeding	. . . .
Spraying	. . . .
Seed chemical treatment	. . . .
Seed storage	. . . .

4.20 Is there any extension worker in the area helping you in seed production this year?

. . . . (0=no, 1=yes)___

If yes:

What does he/she do	Who is he/she employed by
....	. . . .

4.21 Apart from seed, does the organization or other organizations provide other inputs on credit? . . . . (0=no, 1=yes)___

If yes,

Input type	Name of organization
....	. . . .

4.22 Did anyone inspect your field before planting the seed? . . . . . . (0=no, 1=yes)___

If yes,

Who inspected? . . . .

For what did they inspect? . . . .

4.23 Has anyone inspected your field since planting ? . . . . (0=no, 1=yes)___

If yes;

Who inspected . . . .

For what did inspect . . . .

4.24 After harvesting, are you expected to perform the following tasks?

(Circle where applicable and if yes, describe in detail

Cleaning . . . .

Sorting . . . .

Treating seed . . . .

Storing . . . .

Packaging . . . .

4.25 Does anyone supervise/inspect any of these post-harvest activities?

<u>Activity</u> <u>Who inspects or supervises</u>

Cleaning . . . .

Sorting . . . .

Treating seed . . . .

Storing . . . .

Packaging . . . .

4.26 Are there other organizations which assist the farmers or get involved in seed multiplication? . . . . (0=no, 1=yes)___

If yes;

<u>Organization</u> <u>Type of involvement</u>

....

Farmer Decision Making

4.27 How many different varieties can farmers choose to multiply per season? . . . . ___

4.28 Does the program require you to: (circle for each crop you multiply)

<u>Crop</u>	<u>Monocrop</u>	<u>One variety/field</u>	<u>Isolate the crop</u>
Maize	Y-----N	Y----N	Y----N
Beans	Y-----N	Y----N	Y----N

Groundnuts Y-----N Y----N

Y----N Soybeans Y-----N Y----N

Y----N

4.29 **Is there any specific date farmers are expected to harvest their crop?** . . . .

. . . . **(0=no, 1=yes, 2=don't know)___**

If yes,

explain . . . .

4.30 **List activities that you do to seed crop that's <u>different</u> from a normal crop?**

. . . .

Marketing

4.31 **Do you expect the organization that provided the seed to buy it back from you/your group?** . . . . **(0=no, 1=yes, 2=don't know)___**

<u>If yes:</u>

Explain . . . .

. . . .

4.32 **Did the organization providing seed guarantee a specific selling price for your seed?** . . . .

. . . . **(0=no, 1=yes, 2=don't know)___**

If yes,

explain ....

4.33 **Will the organization providing seed assist you with the following?** ....

Activity

4.33.1 **Packaging** .... (0=no, 1=yes, 2=don't know)___

If yes:

Explain type of assistance ....

....

Who will pay for this? .... (1=farmer, 2=NGO, 3=others (Specify)___

4.33.2 **Advertizing** .... (0=no, 1=yes, 2=don't know)___

If yes:

Explain type of assistance ....

....

Who will pay for this? .... (1=farmer, 2=NGO, 3=others (Specify)___

4.33.3 **Transporting of produce** .... (0=no, 1=yes, 2=don't know)___

If yes:

Explain type of assistance ....

....

Who will pay for this? .... (1=farmer, 2=NGO, 3=others (Specify)___

4.33.4 **Storage of produce** . . . . (0=no, 1=yes, 2=don't know)___

If yes:

Explain type of assistance . . . .

. . . .

Who will pay for this? . . . . (1=farmer, 2=NGO, 3=others (Specify)___

This section applies to farmers who multiplied seed in 1995/96 season, others go to question 4.38

4.34 Were you involved seed multiplication last year? . . . . (0=no, 1=yes)___

If yes:

4.34.1 What crop did you grow? . . . .

. . . . (1=maize, 2=gnuts, 3=soybeans, 4=beans, 5=others(Specify)___

How much seed did you plant? . . . . (Kgs)___

How much seed did you harvest? . . . . (Kgs)___

4.34.2 How much (kgs) of the crop did you:

(a) Eat . . . . (Kgs)___

(b) Sell as grain . . . . (Kgs)___

Sell as seed . . . . (Kgs)___

c Give to other farmers . . . . (Kgs)___

4.35 When did you start selling your produce as grain? . . . . (Month)___

(January=1....December=12, Not applicable=99)

4.36 When did you start selling your produce as seed? . . . . (Month)___

(January=1....December=12, Not applicable=99)

4.37 At what price did you sell the grain?

Buyer	Month	Amount sold	Price sold	Local market Price at sale time
Private traders	....	....	....	....
Farmers	....	....	....	....
NGO	....	....	....	....

ADMARC ....

....

Other (Specify)....... ....

....

Ask all respondents

4.38 Are you willing to hold the seed you harvest this year until the planting season of next year? . . . . (0=no, 1=yes)___

Explain why/why not . . . .

. . . .

. . . .

4.39 Do you think you have a certain market for your seed crop this year? . . . .

. . . . (0=no, 1=yes, 2=don't know)___

Explain why or why not . . . .

. . . .

. . . .

V. EVALUATION

5.1 Do you think your program will succeed this year? (0=no, 1=yes, 2=don't know)___

5.2 What criteria will you use to assess the success of this program? **Explain** . . . . . .

. . . .

. . . .

. . . .

5.3 **What farming activity did you give up in order to participate in seed multiplication (opportunity cost)?**

Explain . . . .

. . . .

5.4 **Does participating in seed programs require you to use any additional resources (capital, cash, land and labor) compared to when you plant the crop as grain?** . . .

. . . . **(0=no, 1=yes, 2 don't know)___**

Explain . . . .

. . . .

. . . .

5.5 **What do you think are the strengths of the program?** . . . .

. . . .

5.6 **Are there any problems that threaten to the success of the seed program?** . . . .

. . . . **(0=no, 1=yes, 2=don't know)___**

If yes,

Explain . . . .

5.7 **What changes are needed to strengthen the seed program?**

Explain . . . .

5.8 For how many years can you participate in the seed multiplication program? . ___

5.9 For how many years are you going to participate in seed multiplication? . . . . . ___

5.10 What records did you keep on your seed multiplication activities?

Explain . . . .

5.11 Are there any local institutions in the area? . . . . (0=no, 1=yes, 2=don't know)___

Explain . . . .

5.12 Do you belong to any local institution that facilitates the seed multiplication exercise? . . . .

. . . . (0=no, 1=yes)___

<u>If yes:</u>

Explain . . . .

. . . .

5.13 What are the strengths of the variety you are multiplying compared to the standard variety? *Indicate the farmer's standard variety.*

Crop **New Variety** **Standard variety**

. . . . ___

5.14 **What are the weaknesses of the variety that you are multiplying compared to the standard variety?**

Crop **New Variety** **Standard variety**

. . . . ___

5.15 **Does the variety you are multiplying have any special characteristics you desire?** .

. . . . **(0=no, 1=yes, 2=don't know)**___

If yes:

Describe the characteristics . . . .

. . . .

5.16 **How does the variety you are multiplying in seed multiplication compare with your standard variety? (i.e., if the farmer had unlimited amount of both varieties how would he change his planting pattern? Would he plant more of the new variety or more of the standard variety?)** . . . .

Characteristics	**No difference/better/worse/don't know (0.1.2.3)**
Yield	. . . .
Taste	. . . .

Pest resistance . . . .

Drought tolerance . . . .

Market price . . . .

Other (Specify) . . . .

5.17 How did you first learn about the variety you are is multiplying? . . . . ____

1. It is a common variety in the area
2. Through the seed multiplication program
3. Through the Agriculture Research people
4. Other (specify)____________________

5.18 Given the performance of the legume whose seed that you are now multiplying, would you be willing to buy this seed variety from another farmer if you were not multiplying it? . . . . (0=no, 1=yes, 2=don't know)___

<u>**If no:**</u>

Explain why . . . .

5.19 At planting time, how much more would you be willing to pay for the seed over the price of grain in the market? . . . .

. . . .

5.20 Do you think the other farmers in the area will buy your seed? . . . .

. . . . (0=no, 1=yes, 2 don't know)___

Explain why or why not . . . .

5.21 **If you were buying seed, what month would you buy seed**: . . . . ___

(1=January,................12=December)

Many thanks for your time.

APPENDIX 5

Appendix 5.1

Steps in Carrying out the Participatory Rural Appraisal for Rural Resource Management

1. Site Selection

The sites are picked by either the community or an extension officer or Government official

2. Preliminary Visits

A PRA team consists of 4 to 6 specialists of whom at least half are technical officers assigned to the area. The team meets with village leaders before starting a PRA to clarify what PRA will do as well as what it will not do.

3. Data Collection

Data collection involves meeting with local leaders initially. First, it involves the villagers drawing a map for the village which will show the water sources, fertile areas and where fields are, forestry and grazing areas. Second, important economic activities in the area are recorded (cash crops, food crops, animals reared and businesses). After this stage, the villagers are involved in data collection to verify the information from the leaders. Lastly, the researchers ask key leaders to wealth rank the villagers with the aim of identifying the poor. The ranking is done on at least three individuals independently.

4. Identification of the Poor

From the data collected, the researchers in conjunction with the local leaders identify the beneficiaries of the project giving the poor first priority. Normally, the identified farmers are asked to form a committee which will run the project.

Appendix 5.2

On-farm Seed Multiplication Project Chididi African Evangelical Mission

This contract is between the Christian Service Committee and the Chididi Evangelical Mission to carry out On-Farm Seed Multiplication.

The objectives of the project are:

- To increase smallholder access to seeds of improved varieties of various types of seed.
- To create income generating activities for church institutions.
- To create sustainable linkages between church institutions and the Ministry of Agriculture and Irrigation, specifically as relates to seed production.
- To educate farmers in simple seed selection and storage practices along with agronomic practices for various crops as recommended by the Ministry of Agriculture and Irrigation.
- To serve as demonstration sites for the introduction of recently released types of improved seed.

CSC of inputs for the production of 1 acre of sorghum.

Seed (4 kg @ K4/kg)	K16
Fertilizer (2 bags @ K110/bag)	K220

Labor (2 people x 4 months x K100/month)	K800
Actellic	K250
Sacks (12 sacks @ K10/sacks)	K120

agrees to loan Chididi African Evangelical Mission the amount of K1, 406 for the purpose of carrying out seed multiplication on their church farm. The money will be used for the purchase

Total	K1,406

The seed will be sold through churches the following season after which the loan will be repaid to CSC, along with 35 percent of the profits, by the end of November, 1995. This 35 percent will be given back to the church the following year, along with a second loan to make up the difference in the cost of inputs. This process will continue until there is no longer a need for a loan from CSC to continue the process, probably by the end of the third year.

Failure to repay the loan will result ibn the church being dropped from the project for future years.

The church will charge farmers whatever it is felt to be a reasonable price for the seed produced, keeping in mind that it also has to make a profit in order to stay in business.

The seed is only to be sold to farmers or to commercial entities who agree to sell the produce as seed. Failure to comply with this will result in the church being dropped from the project. If, however, all of the seed is not sold by end of November, 1995, the church may request permission from CSC to sell the seed to a commercial trader as grain.

The church will appoint a bookkeeper to be responsible for the project. CSC will assist with the training of this bookkeeper if necessary.

Totally separate accounts will be kept for this project. CSC will have the right to examine the accounts periodically. This is both to ensure that adequate records are being kept, and to allow CSC to be able to learn from the process, given that this is a pilot project.
The church agrees to work closely with the Ministry of Agriculture and Irrigation to ensure that quality seed is produced, and to ensure that farmers are using proper practices in cultivation, seed selection, and storage.

Church Representative ____

Chididi African Evangelical Mission______________________________

Agricultural Development Officer________________________________

Christian Service Committee____________________________________

Head of Programmes____

Christian Service Committee____________________________________

APPENDIX 6

Appendix 6.1

Mean Yields, Multi-location Bean Advanced Trials at Bunda College Bean/Cowpea CRSP Research Field, Malawi, 1993/94-1996/97.

Variety or Line	1994/95		1995/96		1996/97		Three Year Average		
	Mean[a]	CV[b]	Mean[a]	CV[b]	Mean[a]	CV[b]	Mean[c]	CV[d]	R-Yield[e]
A286	352	52	1,389	35	371	43	704	82	0.88
PC 293-C11	486	39	1,220	27	602**	13	769	51	0.95
17k/2	417	41	1,343	33	556**	25	772	65	0.96
2-10	398	32	1,481	42	463	17	781	79	0.97
14N/2	593	40	1,157	37	602**	35	784	49	0.97
Sugar 46	611**	18	1,343	11	417	33	790	55	0.98
Enseleni	417	17	1,435	11	556**	0	803	61	0.99
Nasaka[f]	338	43	1,760	4	324	25	807	89	1.00
PVBZ 1589	507	16	1,266	27	787**	10	853	44	1.05
AND 660	338	17	1,528	16	694**	20	853	64	1.06
(2) A 334/4	477	12	1,667	25	417	33	853	76	1.06
BAT 336	435	71	1,389	36	741**	22	855	61	1.06
PVA 508	467	25	1,435	6	694**	20	866	52	1.07
Umvoti	347	16	1,574	13	695**	35	872	65	1.08
Sugar 47	361	48	1,621	5	648**	12	877	66	1.09
Kalima	338	45	1,528	16	787**	27	884	62	1.10
V 8025	394	23	1,759	9	555**	25	903	74	1.12
BAT 477	625**	29	1,435	20	648**	12	903	42	1.12
A 197	449	63	1,528	0	740**	11	906	56	1.12
25-2	699**	45	1,620	26	556**	25	958	59	1.19
G 05434	519	17	1,713	20	648**	12	960	62	1.19
Sugar 57	620**	10	1,805	15	602**	13	1,009	61	1.25
AFR 248	708**	35	1,621	10	741**	29	1,023	47	1.27
16-6	528	31	1,667	38	879**	9	1,024	60	1.27
Sugar 56	444	54	2,083	7	787**	10	1,104	69	1.37
Mean	474		1,533		620		876		
LSD0.05	256		478		93		511		

CV	33	19	19	63

[a] Mean of three replications
[b] Coefficient of variation for three replications
[c] Mean of nine replications
[d] Coefficient of variation for nine replications
[e] Yield index, Nasaka = 1.00
[f] Traditional bean variety
**Denote that mean yield is different from the mean yield of Nasaka at 5 percent level of significance.
Source: Mkandawire, A. B. C. (1998) Advanced Bean Trial Results from Bunda College Research Site

Appendix 6.2

Mean Yields, Multi-location Bean Advanced Trials at Dedza Bean/Cowpea CRSP Research Field, Malawi, 1993/94-1996/97.

Variety or Line	1994/95		1995/96		1996/97		Three Year Average		
	Mean[a]	CV[b]	Mea	CV[b]	Mean[a]	CV[b]	Mean[c]	CV[d]	Relative Yield[e]
Sugar 46	2,028**	27	145	3	131	13	768	127	0.84
17K/2	2,079**	2	154	13	185	83	806	119	0.90
PC 293-C11	1,727	27	181	20	561	98	823	95	1.01
Nasaka[f]	1,463	24	426	15	644	16	844	60	1.00
G 05434	1,894	11	310	35	537	26	913	82	1.08
Enseleni	2,129**	17	268	30	389	72	929	100	1.10
AND 660	1,745	10	412	35	963	26	1,040	58	1.23
25-2	2,763**	10	270	83	111	25	1,048	124	1.14
V 8025	2,005	28	574	32	704	20	1,094	69	1.30
A 286	2,111	9	486	84	695	39	1,097	74	1.30
2-10	2,171**	6	435	13	695	22	1,100	76	1.30
Umvoti	1,861	11	685**	25	768	57	1,104	56	1.31
Sugar 56	1,246	57	1,204	5	880	46	1,109	40	1.32
BAT 336	1,903	23	491	27	946	72	1,113	67	1.36
BAT 477	2,296**	23	435	24	676	74	1,135	84	1.36
(2) A344/4	2,171**	18	579**	59	685	33	1,145	70	1.36
16-6	1,829	35	532	54	1,134	53	1,165	62	1.38
A 197	1,593	21	352	42	1,579**	12	1,174	55	1.39
Kalima	2,083**	4	833**	30	824	43	1,247	53	1.48
Sugar 57	2,440**	11	458	16	916	5	1,272	72	1.51
14N/2	2,171**	5	671**	21	1,213**	24	1,352	50	1.60
PVBZ 1589	2,407**	7	699**	17	1,046**	48	1,384	60	1.77
AFR 248	2,324**	7	815**	15	1,232**	23	1,457	48	1.73
PVA 508	2,583**	9	810**	18	1,482**	24	1,625**	50	1.93
Sugar 47	2,255**	22		17	1,417**	15	1,633**	34	1.93
Mean	2,051		517		836		1,135		
LSD 0.05	550		224		496		737		
CV	16		26		36		69		

[a] Mean of three replications
[b] Coefficient of variation for three replications
[c] Mean of nine replications
[d] Coefficient of variation, nine replications

[e] Yield index, Nasaka = 1.00 [f] Traditional bean variety
**Denote that mean yield is different from the mean yield of Nasaka at 5 percent level of significance.
Source: Mkandawire, A. B. C. (1998) Advanced Bean Trial Results from Champhira Research Site.

Appendix 6.3

Mean Yields, Multi-location Bean Advanced Trials at Champhira Bean/Cowpea CRSP Research Field, Malawi, 1993/94-1996/97.

Variety or Line	1994/95		1995/96		1996/97		Three Year Average		
	Mean[a]	CV[b]	Mean[a]	CV[b]	Mean[a]	CV[b]	Mean[c]	CV[d]	Relative Yield[e]
A 197	324	26	648	48	564	47	512	49	0.57
Sugar 56	352	43	1,519	7	287	15	719	85	0.81
AND 660	944	53	1,081	11	259	33	762	61	0.85
14N/2	1,222	17	892	41	306	16	807	56	0.90
2-10	1,102	9	1,091	30	278	27	823	54	0.92
Sugar 47	796	52	1,253	25	509	74	853	54	0.96
PC 293-C11	1,347	79	927	15	324	35	866	81	0.97
BAT 477	1,120	19	1,169	5	315	10	868	50	0.97
Enseleni	1,028	27	1,249	36	357	56	878	56	0.98
BAT 336	1,000	15	1,342	31	319	29	887	57	0.99
Nasaka[f]	991	74	1,288	21	398	95	892	66	1.00
AFR 248	1,120	37	1,266	22	322	51	903	57	1.01
17K/2	1,139	26	1,366	12	222	43	909	61	1.02
G 05434	1,157	19	1,485	24	148	71	930	69	1.04
(2) A344/4	1,088	66	1,619	23	143	54	950	81	1.07
Sugar 46	1,268	28	1,409	36	232	45	969	66	1.09
A 286	1,463	9	1,301	43	158	10	974	70	1.10
Umvoti	759	16	1,956**	25	269	24	985	79	1.10
PVA 508	1,236	10	1,499	2	250	40	995	59	1.12
PVBZ 1589	1,468	27	1,057	32	472	6	999	51	1.12
V8025	1,120	11	1,656	4	315	37	1,030	57	1.15
Kalima	1,143	17	1,509	7	444	60	1,032	48	1.16
Sugar 57	1,398	12	1,386	19	370	23	1,051	51	1.18
16-6	1,171	17	1,872**	8	195	49	1,079	69	1.21
25-2	1,616**	33	1,529	47	334	22	1,159	66	1.30
Mean	1,095		1,334		311		913		
LSD0.05	608		552		229		542		
CV	34		25		45		64		

[a] Mean of three replications
[b] Coefficient of variation for three replications
[c] Mean of nine replications
[d] Coefficient of variation, nine replications

[e] Yield index, Nasaka = 1.00 [f] Traditional bean variety
**Denote that mean yield is different from the mean yield of Nasaka at 5 percent level of significance.

Source: Mkandawire, A. B. C. (1998) Advanced Bean Trial Results from Champhira Research Site.

Appendix 6.4

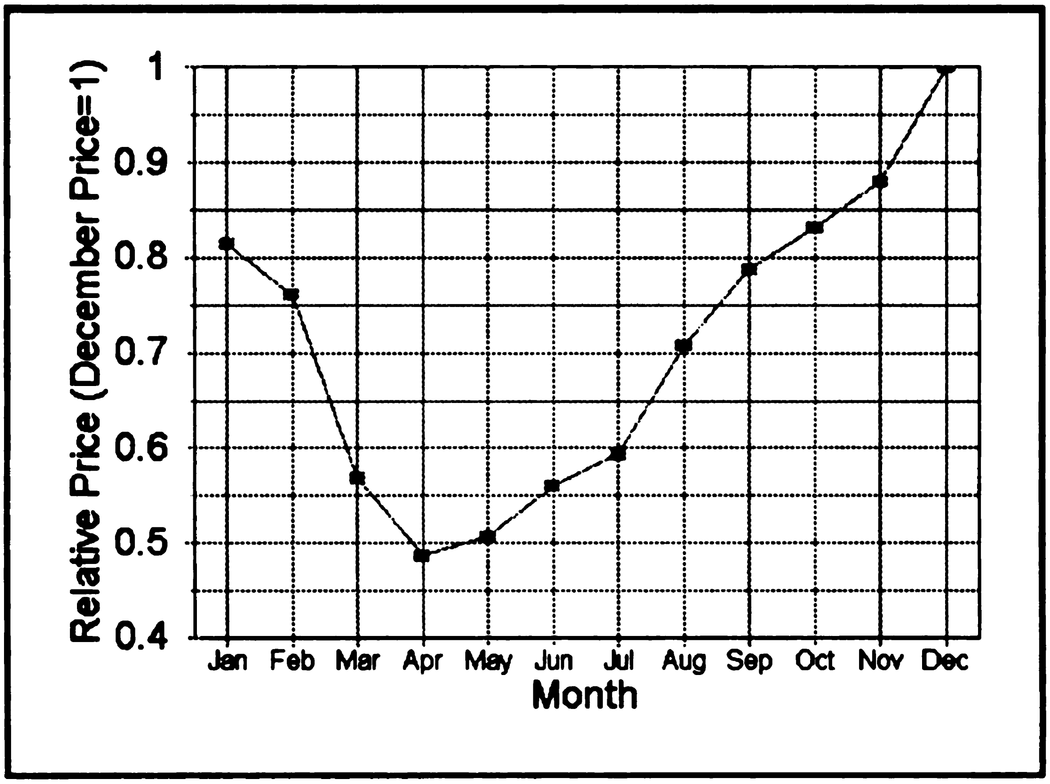
Bean Monthly Price Variation for Chimbiya Market, Malawi, 1989 to 1995

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1989	*Price*	1.67	1.65	1.46	1.12	0.97	0.94	1.16	1.50	1.76	2.01	1.76	2.01
	CPI	0.79	0.78	0.69	0.53	0.46	0.45	0.55	0.71	0.83	0.95	0.83	0.95
1990	*Price*	1.75	1.47	1.00	0.86	0.90	0.93	1.08	1.21	1.43	1.48	1.43	1.48
	CPI	1.04	0.88	0.60	0.51	0.54	0.55	0.64	0.72	0.85	0.88	0.85	0.88
1991	*Price*	1.75	1.61	1.27	1.00	0.95	1.13	1.20	1.66	1.67	1.83	1.67	1.83
	CPI	0.93	0.86	0.68	0.53	0.51	0.60	0.64	0.88	0.89	0.97	0.89	0.97
1992	*Price*	2.12	1.79	1.45	1.25	1.73	1.96	1.90	2.00	2.14	2.39	2.14	2.39
	CPI	0.59	0.49	0.40	0.35	0.48	0.54	0.52	0.55	0.59	0.66	0.59	0.66
1993	*Price*	3.50	3.18	1.95	1.72	1.86	2.10	1.98	3.03	3.59	3.21	3.59	3.21
	CPI	1.10	1.00	0.61	0.54	0.58	0.66	0.62	0.95	1.13	1.01	1.13	1.01
1994	*Price*	4.14	3.87	3.24	2.62	2.85	3.25	3.47	3.64	3.98	4.64	3.98	4.64
	CPI	0.62	0.58	0.49	0.39	0.43	0.49	0.52	0.54	0.60	0.69	0.60	0.69
1995	*Price*	9.56	11.09	7.83	8.27	8.37	9.48	9.96	9.92	11.08	11.33	11.08	11.33
	CPI	0.64	0.74	0.52	0.55	0.56	0.63	0.66	0.66	0.74	0.75	0.74	0.75
Mean Index		0.81	0.76	0.57	0.49	0.51	0.56	0.59	0.71	0.79	0.83	0.88	1.00

Source: FEWS/MOAI, 1997

Appendix 6.5

Bean Monthly Price Variation for Chimbiya Market, Malawi, 1989 to 1995



April is the bean harvest time and November-December is the planting time

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