POTENTIAL AND LIMITATIONS OF SMALLHOLDER SEED PRODUCTION IN ETHIOPIA: THE CASE OF SORO DISTRICT

BY

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DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE IN AGRICULTURAL EDUCATION AND EXTENSION OF SOKOINE UNIVERSITY OF AGRICULTURE.

MOROGORO, TANZANIA.

2002

ABSTRACT

While the majority of smallholder farmers use traditional ways of ensuring their livelihood, small-scale farming is the most important sector of agricultural production in Ethiopia. With increasing effort of the Extension Package Program, farmers started to adopt improved seeds. However, the supply of improved seeds to small-scale farmers by the formal sector was not sufficient. To alleviate the seed shortage, the Smallhlode Seed Production (SHSP) program has been implemented as one of the alternatives to produce and supply seeds to small-scale farmers. This study examined the potential and limitations of smallholder seed production. A cross-sectional survey method was used for this study and respondents were selected randomly. Data were collected using an interview schedule for farmers, self-administered questionnaires for extension workers and other seed professionals, checklists for informal discussions with farmer groups and co-operative committee members as well as using personal observations. Likert-type interview items were also employed to determine opinions of farmers, extension workers and seed professionals. Data were analysed using Statistical Package for Social Sciences (SPSS) and descriptive statistics such as frequencies, percentages and cross-tabulation were used. The findings from the analysis show that SHSP has a potential in Ethiopia for increasing seed availability and improving seed distribution at prices that small-scale farmers can afford.

However. the findings indicate that it has limitations such as producing low quality seed. lack of ready market for produced seeds. inadequate supply of credit and lack of integrated efforts among organisations that can contribute a lot to the sustainability of SHSP.The study recommends the selecting of farmers that are interested and ready to devote their money. labour and skills for quality seed production. As seed quality was the major problem indicated by users. reinforcing the technical skills of farmers is important to improve the seed quality. beside this. close supervision and field inspection together with laboratory analysis should be done. To ensure the sustainability of SHSP and to alleviate the problem of market. strong linkages and co-ordination with ESE. farmers' co-operatives and other concerned organisations should be created.

DECLARATION

I. TSIGEDINGIL MENGIST MITKE. do hereby declare to the Senate of Sokoine University of Agriculture that this dissertation is my own original work. and has not been submitted for a degree award in any other University.

Signature 

Date 04/09/2002

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ACKNOWLEDGEMENT

First of all, I wish to thank the Almighty God for lighting the path and allowing me to successfully complete this study in good health, peace and harmony.

I wish to acknowledge with deep appreciation the tireless, constant and consistent guidance and encouragement of my supervisor, Professor A. Z. Mattee throughout my course programme, particularly during proposal formulation and write-up of this study.

I am grateful to Sasakawa Africa Fellowship (SAFE) Programme for offering me a scholarship and to my employer Southern Region Bureau of Agriculture for granting me study leave. I owe a deep debt of gratitude to all staff of SG2000 in Ethiopia, NSIA, Agricultural Extension Department at the Regional Bureau of Agriculture, ESE, PHSI, IAR and ACA who gave full support for this study. I wish to extend my thanks to the Department of Agricultural Education and Extension staff for their comments, advice and encouragement throughout this study. My special thanks also go to staff of Hadya Zone and Soro District Agricultural Development Offices, village level extension workers and all farmers of Jawe, Digiba and Wosheba PAs for their collaboration during the field work of this study.

I wish to extend my heartfelt thanks to Lemma Mitku and Dr. Marco Quinones who initiated and facilitated this study for me.

This study would not have been completed without the co-operation and efforts of many

individuals. I wish to thank all those who helped me in one way or another in bringing this work to completion. Especially, my thanks are due to Aressawum Mengesha, Zenebe Worku, *w/ro* Tenagne Sinshaw, Sileshi Mesele, Simayehu Tafese, *w/ro* Yewubinesh Workineh, Tesefaye Habite, Yonnas Sahilu, Abera Tumidedo, Dr. Woldemichael Alberto, Abitew Lagibo, Aweke Tirufat, Legesse Siyoum, Bisrat Retu, Gemeda Gagie, and *w/rt* Hirut for their invaluable help during the course of this study.

I am very thankful to my sisters Tenagnework, Tsigereda, Wogagen, Mekdes, Muluwork Serkalem, Yetish, Aynalem, Emebet, Mimi, Mititi, Senait and my brothers Captain Abel, Zelalem, Esayas, Kiflemariam, Derib, Assefa, Abrham, Aklog, and Etata for their valuable advice and support throughout the time of my study.

My heartfelt appreciation is to my beloved wife Tigist Minwuyelet who took care of the family in my absence and for her encouragement, support and help during the entir period of my study. I am also obliged to mention my appreciation to my children Selomie Tsigedingil and Robel Tsigedingil for their tolerance to the hardship they encountered while I was away for studies.

Lastly, but most importantly, my heartfelt thanks go to my father *Kes* Mengist Mitke and my mother *w/ro* Tirunesh Ejigsemahu who laid the foundation for my education.

DEDICATION

This dissertation is dedicated to the memory of my brother Yeshitla Mengist who passed away in a tragic car accident June 2000.

Yeshitla, I miss your physical presence, love, guidance and sense of humour. The pain of your departure is still very much in my heart. Though you are physically gone, you are always in my heart and thought. Day in day out I will always remember you.

May Almighty God rest your soul in eternal peace. Amen.

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LIST OF ABBREVIATIONS AND ACRONYMS

AUA = Alemaya University of Agriculture

ACA = Awassa College of Agriculture

CSA = Central Statistics Authority

DAs = Development Agents

ESE = Ethiopian Seed Enterprise

GDP = Gross Domestic Product

FAO = Food and Agriculture Organisation

FBSPMS = Farmers-Based Seed Production and Marketing Scheme

IAR = Institute of Agricultural Research

IDA = International Development Association

IFAD = International Fund for Agricultural Development

GDP = Gross Domestic Product

MAC = Ministry of Agriculture and Co-operatives

MoA = Ministry of Agriculture

NSIA = National Seed Industry Agency

PAs = Peasant Associations

PHSI = Pioneer Hi-Bred Seeds Inc.

SAFE = Sasakawa Africa Fellowship Programme

SHSP = Small-Holder Seed Production

SSA = Sub-Saharan Africa

SSDP = Seed System Development Project

SPSS = Statistical Package for Social Science

WTC = Wondo Trading Company

CHAPTER ONE

INTRODUCTION

1.1 Background Information

Over the last two decades, the level of food security has decreased dramatically in Sub-Saharan Africa (SSA) resulting in a general deterioration in the standard of living of the population. Per capita food and agricultural production has been inadequate in SSA countries. The challenge facing SSA agriculture is therefore to feed a population that is increasing at an annual rate of about 3% and will double in about 20 years (FAO, 1999).

To alleviate this problem, and increase food production, farmers depend on the steady flow of scientific and technological innovations and greater use of material resources (Oerke *et al.*, 1994). Reports show that the problem of food shortage of developing countries especially SSA countries could be overcome through the use of modern agricultural technologies mainly improved seeds.

Tripp (2001) argues that any discussion about agriculture or agricultural change leads inevitably to the subject of seed. Seed is farmers' most precious resource, and concerns about the viability of

traditional agricultural systems centre on the diversity and stability of seed supply. Oerke *et al.* (1994). further argue that it is recognized tha' future agricultural progress depends on the intensification of production rather than the expansion of cultivation. The small holdings of farmers could be productive through proper utilisation of improved seed. fertilisers. pesticides. and other necessary inputs. Seed is a basic input in agricultural production. It is also the cheapest input in agriculture. yet it has the most profound influence on crop yields.

According to FAO (1999). some of the benefits that can accrue to farmers from the distribution and use of good quality seed of improved varieties include enhanced productivity. high harvest index. reduced risks from pest and disease pressure. and high profits. The productivity of crops is directly linked to the genetic potential of the seed used and varies according to the use of recommended complementary inputs and the observance of cultural practices (World Bank, 1995). However, the quantity and quality of seed supplied by formal organisations represents not more than 20% of the total amount planted by smallholder farmers and for limited range of crops only. Smallholder farmers still need to go long distances to buy improved seed produced by formal organisations (Wright *et al.*, 1994; Due. 1998; Douglas, 1980).

1.2 Agricultural Situation of Ethiopia

Ethiopia is a country of immense diversity. The region is an important primary and secondary centre of domestication for some 38 crops. The country has as many as 20 distinct agro-ecological zones where crops and cropping patterns have evolved over a long period of time resulting in abundance of locally adapted materials (Gurmu, 1999). According to Central Statistic Authority (CSA, 1996), agriculture is the mainstay of Ethiopian economy and contributes about 50% of the Gross Domestic Product (GDP) and employs over 85% of the labour force. It is the major source of foreign exchange earnings. Moreover, it is also the major source of raw materials for the country's industries that are engaged in processing agricultural products.

Basically, two agricultural systems exist in the country, mixed farming mainly crop production and livestock keeping as the major means of livelihood and a source of food and draft power (oxen). The other farming system is the nomadic and semi-nomadic livestock raising in arid and semi-arid areas of the country. The small-scale farmers who produce 90-95% of cereals, pulses and oilseeds dominate the agricultural sector. Ethiopia has an area of about 1.12 million square kilometres, out of which 66% is considered potentially suitable for agricultural production. Cultivated land accounts for only 14.8% of the total area,

and out of this, smallholder farmers occupy 96%. The most important crops grown in order of area coverage are *teff*, maize, sorghum, barley and wheat (Sasakawa Global 2000, 1995).

Despite the enormous potential, the performance of agriculture is very disappointing and the country has been experiencing food shortage for the last several years. According to the Ministry of Agriculture (MoA, 1993), one of the problems constraining agricultural production and productivity is the low level of agricultural technologies, dependence on traditional tools and farming practices, and low application of modern inputs like improved seeds and fertilizers. Lack of knowledge and resources are the major factors responsible for the technological constraints. Therefore, according to the World Bank (1995), the only available short-term alternative to meet the critical need for increased food grain production is by increasing productivity. There are several mutually reinforcing ways of achieving enhanced productivity levels in agriculture. These include widespread use of improved seeds, better cultural practices, site-specific solutions to low productivity through intensive research and extension work, minimisation of post-harvest losses, and creation of more efficient pest management techniques.

1.3 Historical Development of Seed System in Ethiopia

This section covers the issues related to the historical development of seed system in Ethiopia including the national seed policy, seed production in Ethiopia, the Seed System Development Project and key institutions in seed system development.

1.3.1 The national seed policy

The Ethiopian seed program was very much ad hoc and seed production was uncoordinated until the late 1970s. The seed policy was not conducive for the development of a seed industry until the year 1992 (Gurmu, 1999). To create the right condition for the establishment of a strong seed system for the production and supply of good quality seed to the farming community, the government formulated the National Seed Industry Policy, which was issued in October 1992. The policy is instrumental to developing a healthy national seed industry conserving and sustaining genetic resources, reinforcing crop breeding research and supplying of high quality seed to farmers and for export purposes. The policy encourages farmers to participate in germplasm conservation as well as in the seed production and supply system. It also has an objective of creating a functional and efficient institutional linkage among seed industry participants.

1.3.2 Seed production in Ethiopia

Seed production in Ethiopia consists of varietal development and seed multiplication.

1.3.2.1 Varietal development

Plant breeding institutions are responsible for the development of high yielding improved crop varieties, which can alleviate the food shortage through increased agricultural productivity. In this regard, Institution of Agricultural Research (IAR) and the previous Alemaya University of Agriculture, now the Alemaya University, are the main plant breeding institutions in Ethiopia. There is as yet no private plant breeding activity (IFAD, 1996). Awassa College of Agriculture is also involved in the development, maintenance, multiplication and supply of improved varieties. All the breeding institutions provide breeder seed and parental material of hybrid maize to Ethiopian Seed Enterprise (ESE) which is responsible for multiplying breeder or pre-basic into basic seed on its own seed farms and contracted farms. But the private sector is not yet involved in multiplication of breeder seed into basic seed, even though the policy supports it to engage in seed production. Improved seed varieties for major crops, developed by IAR, have been available in commercial quantities since 1967 for regions in the south-east, and since

1978 for the nation as a whole through the activities of the ESE which is the dominant seed organisation in the country.

1.3.2.2 Seed multiplication

For centuries, Ethiopian farmers have used their own seed saved from previous harvests, or informally obtained from neighbouring farmers, usually in exchange for grain or any other commodity. These seeds also described as "land races", have been going through a natural mutation process over time to produce new versions of seed varieties to fit each agro-ecological niche (World Bank, 1995).

The multiplication of seed by the formal seed sector started in 1987 when ESE was established as an autonomous government organisation for the multiplication and distribution of improved seeds. The private seed organisation Pioneer Hi-bred Seeds Inc (PHSI) started seed production and distribution in 1990.

In the past, ESE produced certified (commercial) seeds under contractual agreements with state farms, as ESE was the main supplier of improved seed to state farms.

Currently, there are two formal seed organisations: one public (ESE) and one private (PHSI), which produce improved seeds for the farming communities. However, the seed supply by these organisations does not

exceed 5% of the total potential seed requirement. In Ethiopia, the use of improved seed by smallholder farmers is very low as they have no access to modern improved seeds. The annual total seed requirement, according to Gurmu (1999), is estimated to be 420,000 tonnes. About 96% of the national requirement is met from farm saved seed from previou_ harvests. On the average, ESE annually produces and distributes about 15,000 tonnes of improved seeds. On the other hand, the participation of the private seed sector in seed production and supply is very low.

1.3.3 The Seed System Development Project (SSDP)

To alleviate the problem of seed shortage by improving the national seed system, the Ethiopian government has recently (1995) devised a mechanism that could strengthen and broaden the participation of both the formal and informal seed sectors in the production and distribution of improved seeds. Thus, International Development Association (IDA), International Fund for Agricultural Development (IFAD), ESE and Federal Republic of Ethiopia, finance SSDP, which became effective on July 1996.

The SSDP has two components, the seed enterprise development component and capacity building component. The seed enterprise component supports the secondary seed multiplication scheme, which later became Farmers Based Seed Production and Marketing Scheme

(FBSPMS), which deals with smallholder farmers' seed production. Emphasis was given by the project on encouraging the emergence of smallholder farmers seed production business to meet the growing demand for improved seed. The project started as a pilot project in 1997/98 in accessible districts where the Extension Package Program had performed well. It also encourages private sector entry into seed business and supports the restructuring of ESE from centrally managed parastatal to a decentralised and commercially oriented enterprise. The second component deals with institutional strengthening and human resource development both in the formal and informal seed sectors.

FBSPMS is the major component of SSDP financed by IDA and IFAD. The main objective of FBSPMS is to contribute to the production of quality seeds to the national agricultural development systems through participation of smallholder farmers that would be organised and guided by the regional agricultural bureaux and National Seed Industry Agency (NSIA). It serves the following objectives (NSIA, 2000).

- To motivate groups of farmers to organise themselves and specialise in seed production for sustaining seed production and thereby income generation,
- To encourage and create a basis for private investors to enter into seed production and marketing, input supply, etc.,
- To assist in building regional seed supply capacity, and

- To produce and distribute the required type of variety of seed according to region-specific demand and thereby make seed available to farmers timely and at reasonable prices.

The project supports the participation of small farmers by providing basic seed or first generation seed, fertilizers, chemicals and other materials like seed bags on credit. It also facilitates and funds the training of farmers, Development Agents (DAs) and professionals engaged in implementing smallholder seed production.

To put into force the newly designed SSDP, the government has established a parastatal organisation called National Seed Industry Agency (NSIA), which facilitates the development of the seed sector. It is responsible for developing seed laws, and to guide, co-ordinate, monitor and control the seed sector in order to improve and build a strong and sustainable national seed production and supply system in the country. As NSIA is responsible for the development of an effective and efficient national seed system, it also co-ordinates and encourages the private sector to be involved in improved seed production and supply system. Currently the participation of private sectors in seed production and distribution is almost non-existent.

1.3.4 Key institutions in seed system development

The main institutions that are responsible for the development of the seed system in the country are the National Seed Industry Agency, th- National Seed Industry Council and the Plant Genetic Resource Centre. These are described below:

a) National Seed Industry Agency (NSIA):- It is an autonomous government organisation fully responsible for the implementation of national seed industry policy and the overall development of seed sector in the country. The agency has the following objectives: (i) to oversee and ensure that thc seed industry develops and operates efficiently, (ii) to ensure that seed producers, farmers as well as the industries using agricultural raw materials and organisations exporting agricultural produce benefit from the seed industry, and (iii) to create an enabling environment for capacity building in research, development and training in the field of genetic resource conservation, crop improvement and seed technology.

b) National Seed Industry Council: - This is the umbrella body which guide, monitor and oversee the functioning of NSIA and the seed industry as a whole.

c) Plant Genetic Resource Centre: - Established in 1976, it collects, conserves, documents, and utilises the germplasm resources of edible and economically important plants.

1.4 Problem Statement

In Ethiopia, the annual potential demand of seed is estimated to be 420,000 tonnes. But out of this requirement, on average about 15,600 tonnes of improved seed are produced and supplied by both ESE and Pioneer Hi-Bred Seeds Inc (PHSI). The Extension Intervention Program, which targeted small-scale farmers who are the majority in the country, promotes the adoption of improved food grain seeds. Consequently, the demand for these improved seeds has increased considerably. However, the formal seed sector can not supply the seed actually demanded by farmers. Reports indicate that usually the seed produced by formal seed systems is not more than 5% of the total amount of seeds planted in the country which clearly indicates that the formal seed sector can not match with the fast growing seed demand of farmers.

As FAO (1999) contends, the agricultural policies aimed at securing on-going food supplies in a country must emphasise seed system strategies that will ensure the availability of quality and locally appropriate seed varieties to men and women farmers in a timely and affordable fashion. Thus, to alleviate the seed shortage, SHSP program was initiated and is being implemented in the country. The program has shown encouraging results with regard to production and timely supply of improved seeds at

affordable prices to the poor farmers who need it. Even though smallholder seed production is recommended as one of the alternatives to alleviate the existing seed shortage problem, there has not been a systematic assessment of the potential and limitations of this approach in fulfilling the seed demand of the country. This study examined the extent to which smallholder farmers improved seed production was being implemented with regard to technical mastery of seed production by farmers, views of farmers and seed professionals and support mechanisms including provision of credit, basic seed, extension services, and seed marketing and distribution.

1.5 Justification of the Study

This study examined the potential, production mechanisms, farmers' technical competence in seed production, attitudes of farmers and seed professionals toward smallholder seed production and organisational and financial sustainabiltiy of smallholder seed production. This study highlights the key issues related to smallholder seed production that can contribute to find solutions to problems hampering sustainability of smallholder seed production. Therefore, the findings and information obtained from this study are expected to be useful to and utilised by both government and non-government organisations, policy makers, planners

and extension workers to lay down the basis for the sustainability of smallholder seed production in Ethiopia.

1.6 Objectives of the Study

1.6.1 General objective

The general objective of this study was to examine the production mechanisms, opportunities and limitations of smallholder improved seed production practices in Soro District, Southern Nations, Nationalities and Peoples Regional State.

1.6.2 Specific objectives

The specific objectives of the study were to:

1) Identify the existing production mechanisms of smallholder improved seed production practices in Soro District.
2) Assess smallholder seed producers' knowledge and technical skills on improved seed production.
3) Determine the attitudes of seed producer and non-seed producer farmers towards smallholder improved seed production.
4) Determine the views of seed professionals involved in seed production and distribution towards smallholder improved seed production.

5) Assess organisational sustainability of smallholder improved seed production system.

6) Assess the financial sustainability of smallholder improved seed production system.

CHAPTER TWO

LITERATURE REVIEW

2.1 Overview

One of the major challenges facing developing countries especially those in SSA, is to achieve national food security (FAO, 1999). Schioler (1998) also explained that the nutritional standards in the last few decades have seen a worldwide improvement except Africa, south of Sahara. In these countries, the majority of staple food crops are annual cereals and legumes for which farmers have to obtain seed to produce a new crop each year (Kugbei, 2000).

Schioler (1998) contends that for the food supply and economy to be improved, agricultural production needs to be improved. The productivity of crops, according to World Bank (1995), is directly linked to the genetic potential of the seed used, and of course varies according to the use of recommended complementary inputs and observance of cultural practices. Many factors may have constrained the achievement of food self-sufficiency, and according to FAO (2000), the availability of quality seeds of wide range of varieties and crops to farmers is one of the major keys for achieving food security. Cromwell *et al.* (1993), also

argue that the potential and quality of seeds is extremely important in the complex, diverse and risky areas of developing world where there is little access to other techniques and technologies to increase agricultural productivity.

Maredia *et al.* (1996), contend that factors like economic, technological and environmental exigencies have made farmers unable to save adequate quantity and quality seeds of improved varieties. Therefore, increasing the local availability of low cost seed and enhancing farmers' ability to produce adequate quantity and quality seeds, may increase the access of improved seed to small-scale farmers.

2.2 Categories of Seed Supply Sectors

On the basis of organisations, types of exchange mechanisms, and varieties used, the seed sector can be sub-divided into two groups: the formal (modern) and informal (traditional) sector (Kugbei, 2000; Cromwell, 1996).

2.2.1 Formal seed sector in developing countries

The formal seed sector comprises those institutions, which are engaged in the multiplication, processing, distribution, and quality control of improved seed and use mainly market-oriented means of exchange. This

sector comprises mostly public and private seed enterprises (Kugbei, 2000).

The formal sector accounts for a small proportion of the overall seed used each year in developing countries (Kugbei, 2000). According to FAO (1999), the formal seed supply systems are currently not meeting more than 5-10% on the average needs of farmers in the region. Furthermore, this low rate covers only the most commercialised crops and, to some extent, the main cereal crops.

In Ethiopia, the formal sector owes its origin to the establishment of the Alemaya University of Agriculture (AUA) in the mid-fifties and the Institution of Agricultural Research (IAR) in the mid-sixties; institutions, which started developing, improved varieties of seeds for cereals, pulses and oil seed crops (World Bank, 1995).

Currently there are two, one public and one private, formal seed organisations, which produce improved seed for the farming communities.

The production and distribution of seed is mainly done by one public organisation, ESE, which was established in 1987 with the objective of supplying improved seeds to state farms and until 1990, it was virtually the sole producer of seeds in the formal seed sector. The main objectives of ESE were to (a) organise the production and marketing of improved

seeds developed by IAR and other agricultural research establishments; (b) import reliable high yielding varieties; and (c) organise seed cleaning and processing facilities at various locations of the county (World Bank, 1995).

This seed organisation produces improved seeds of cereals, pulses and oil seed crops. It produces hybrid maize varieties and is also responsible for multiplying and selling basic seeds developed by researchers and released by the national variety release committee (Gurmu, 1999).

ESE annually produces and distributes about 15,000 tonnes of seeds, which is about 4% of the total planted seed materials in the country.

Private seed companies form the other major part of the formal seed organisations (Kugbei, 2000). Private companies tend to concentrate on profitable crops, especially those in which hybrids exist. The low-value, self-pollinating cereals and legumes do not generally attract private investment and are either ignored or left in the hands of government agencies (public sector). This means that private seed organisations are mainly interested in profit-making and hence focus towards those types of seed for which there is an effective demand and which are profitable to produce (Kugbei, 2000; Cromwell *et al.*, 1993).

In Ethiopia, private sector became involved in the seed business very recently after Pioneer Overseas Corporation and ESE entered into a

memorandum of understanding in 1990 to set up a joint venture, PHSI, to procure, produce, process, distribute and sell seed produced by this organisation and other seed products in Ethiopia. To date, PHSI is the only corporate investment in the seed sector in Ethiopia. However, the contribution of this private sector in seed production and supply is negligible (Gurmu, 1999).

2.2.2 The informal seed sector

Maredia and Haward (1998), contend that the informal seed sector is composed of individual farm households each carrying out most seed system functions on its own with little specialisation. According to Cromwell (1996), the informal seed sector includes all the methods apart from buying seed from formal seed organisations by which farmers can obtain their seed requirements. FAO (2000), argue that the informal seed supply systems are comprised of farmer managed seed production activities and are based on indigenous knowledge and local diffusion mechanisms. These systems include methods such as retaining seed on-farm from previous harvest to plant the following season and farmer-to-farmer seed exchange networks.

Kugbei (2000) also explains that in many cases the informal seed sector comprises farmers in many marginal areas who save their own seed

because they do not have access to certified seed or can not afford it. Farmers in SSA mostly use farm-saved seeds in the case of self-pollinating cereals. Hence, on-farm saving is usually the most important source of seed for local production and food security, and therefore forms the backbone of seed supply systems. It is generally, estimated that on-farm sources supply over 80% of the area planted to main crops in developing countries.

Farmers rely on the production of their own seed for the following reasons: they may live in areas isolated from normal commercial seed supplies; lack of profit incentives for seed suppliers to bear the higher distribution cost in remote areas or simply the problem of distribution in difficult terrain and seed companies may tend to specialise in a small number of crop species such as hybrid maize, and therefore not be involved in production and marketing of staple crops, especially those with low multiplication rate (Kellly, and George, 1998).

In Ethiopia, reports show the same trend. For centuries, the Ethiopian farmers have used their own seed saved from the previous crop, or informally obtained it from neighbouring farmers, usually in exchange for grain or another commodity (World Bank, 1995). The annual seed requirement in Ethiopia is estimated to be 420,000 tonnes and about 96% of the national seed requirement is met from the informal seed sector of farm saved seed from previous crops (Gurmu, 1999).

At present the seed policy of the country encourages the participation of the informal seed sector in seed production and supply to meet the growing demand for improved seed.

Therefore, to enhance the availability and use of improved seed by boosting the seed production, measures have been taken by implementing the FBSPMS since 1997 (Solomon, 2001). The scheme is now being implemented by the regional states in co-operation with NSIA and is providing technical assistance, training and inputs to farmers participating in the scheme. Garay (1993), contends that the field results in this area of research and development indicate that development of seed supply systems under medium-and small farmer conditions are possible.

Likewise, in Ethiopia, the results in smallholder seed production obtained so far are encouraging (Gurmu, 1999). According to the report of Southern Region Bureau of Agriculture (2001), the seed produced by smallholder seed producers under the project assistance is distributed to the needy farmers at the right time with required quality.

2.3 Seed Quality

Seed quality is the sum of many seed attributes which include genetic purity (trueness to cultivar), high germination capacity and vigour, low

incidence of mechanical damage or injury, disease infections, insect damage, contaminants (noxious and common weed, other crop seeds, inert matter), and moisture content (Kelly and George 1998). Kelly and George (1998) argue that the primary objective of seed quality control and certification is to ensure that the seed being sold is of the highest possible genetical and physical quality and free of noxious weeds. Concern about quality (and action accordingly) begins with selection of the seed for multiplication, extend through production, harvesting, drying, processing, storage and distribution.

Storage refers to the period between the completion of the processing activities and the distribution for use as breeder/basic certified (commercial) seed. The objective of seed storage is to preserve seed health and viability by paying attention to prevailing temperature and preventing pest-insect attack. Therefore seed processing and storage facilities are an important concern in seed production that determines the quality of seed and its viability (World Bank, 1995).

The second source of improvement relates to the physical properties of the seed, including its size, physical purity, and germinability. Such improvements are derived from effective processing, quality control, chemical dressing, handling and storage operations, with resultant higher

quality seeds, which provide value through their enhanced performance and their compatibility with other production (Dalrymple and Sirvastava, 1994).

But in the case of informal seed production and distribution, the fact that small farmers have confidence in their own seed or go only to trusted neighbours or traders when short of seed shows that maintaining quality is crucial, even at subsistence level. There are no formal rules and regulations regarding the quality of seed exchange in such communities. However, local customs, close personal relationships, and interactions ensure fair dealings in seed exchange. Gurmu (1999) argues that farmers are quality-conscious and keep clean seeds for planting, using traditional means.

FAO (1999), contend that although genetically and physically the seed quality may not be as high as that in the formal seed supply systems, the advantages of low price, seed adaptability and easy access to seeds of traditional varieties offset the difference in quality.

2.4 Supportive Services to Seed Production

This sub-section describes the support services that are necessary for seed production such as extension service, provision of credit and agricultural inputs, and marketing of seeds.

2.4.1 Agricultural extension services

Extension services are fundamental to the success of agricultural development including seed production. Without an effective extension system responsive to farmers' needs, it would be difficult to develop a seed supply system, particularly on-farm improved seed production system. Extension also serves as a feedback mechanism to provide research with farmers' observation on varieties or technologies offered (FAO, 1999).

Agricultural extension services help to educate and assist farmers to solve their problems and thereby adopt improved farming practices and increase agricultural production (Ibrahim, 1992). Thus, extension agents are the main agents in this process, supporting the farmers in their seed production activities (Rana and Bal, 1982). Government extension staff were mostly used to train, supervise and advise smallholder farmers who were under seed production programs. Normally, these government extension officials already have their own allocated duties. In most

cases, they have a large area to inspect and are faced with a lot of problems for example, transport (Mtenga, 1999). Mtenga also noted the failure of smallholder seed producers to manage one or more of the requirements for seed production, which indicates that there was inadequate farmer training.

Experience from Nepal shows that hillfarmers are being trained in the production of quality seeds. Credit programs and extension services support the activities associated with the local production, storage and processing of seed (Rana and Bal, 1982).

2.4.2 Provision of credit and inputs

Seed production requires a higher capital outlay for purchase of agricultural inputs compared to non-seed crop production (Mtenga, 1999). Small-scale farmers in the vast majority of developing countries, including Ethiopia, are caught in a vicious cycle of low level of income, low investment in improved technology, and low level of productivity (MoA, 1993).

Jugale (1993) indicated that credit was an essential instrument for empowering smallholder farmers to adopt the recommended agricultural technologies especially those, which are expensive. However, according to Kugbei (2000), one of the major constraints small farmers face in

many countries is the limited availability of credit from formal sources such as commercial banks and the government to finance farming operations. In the absence of formal credit, seed programs working with small farmers often provide a credit package which covers the cost of inputs such as foundation seed, fertilizers, and mechanical cultivation, to be repaid using revenue earned from the seed they produce at harvest time.

In Ethiopia, all the requirements including basic seed or early generation seed, other inputs (fertilizers, pesticides, and herbicides), and bags were organised by NSIA and regional bureaux, and distributed to the participating farmers on credit - with 25% down payment and 75% payable after harvest. Many farmers however had defaulted on this credit and faced denial of further credit facilities (NSIA, 2001).

2.4.3 Marketing of seeds

Marketing is one of the most important, yet misunderstood, business activities and frequently means different things to different people. Although governments in developing countries have, in general, succeeded in establishing seed legislation as well as seed production and trading activities, government supply objectives are frequently not met and seed stocks remain unsold (Mumby, 1994).

Therefore, market for a certified seed is very important since if there is attractive market for their product, farmers will be encouraged to produce quality seed (Fergus and Seth, 1998). Attractive market encourages small-scale farmers to produce quality seed. In this regard, Kamani and Mbatia (1990), argue that farmers are ready to produce as much seed as required so long as there is a good market and good prices. But many seed development projects in the past failed due to the subjective and over-estimation of the market (Garay, 1993)

In Ethiopia, seeds produced by FBSPMS are expected to be purchased and distributed to the needy farmers by regional agricultural bureaux. However, as the bureau purchased less than one third of the seed produced by the smallholder farmers, some of the balance is inevitably retained by farmers for their own use (either as a seed or food grain), and the rest was sold to private grain traders as food grain rather than as seed (NSIA, 2001).

2.5 Sustainabilty of Smallholder Seed Production (SHSP)

Sustainabilty with regard to development programs is the ability of the local community to meet the program cost in order for the program to continue and the benefits of the program to be maintained after external

interventions or donor funding have been withdrawn (Lovell, 1992). However, except for a few cases, it is common that agricultural development projects collapse when the donor support is withdrawn (FAO, 1999).

Chapter summary

Generally, in Ethiopia, improved seed supply by formal seed organisations is not meeting the demand of smallholder farmers. Formal seed organisations mostly deal with crops, which are profitable to produce hybrid seed of maize and other crops, and less emphasis has been given to self-pollinating crops, which are more needed by small farmers. To increase the access of improved seeds to subsistence farmers, involving these farmers in seed production is recognised as one alternative means. For the smallholder seed production to be functional, strengthening agricultural extension service, provision of agricultural inputs and availability of credit are of paramount importance. Seed processing and storage facilities are an important concern in improved seed production that determines the quality of seed and its viability. Farmers need to dispose of the surplus seed they produce at a good price to make profit to ensure their financial capacity to buy inputs and other necessary materials on their own.

CHAPTER THREE

METHODOLOGY

3.1 Research Design

A cross-sectional design was used where data were collected at a single point in time from a sample selected to represent some larger population (Babbie, 1990). This design is useful for descriptive purposes as well as for the determination of relationships between variables at a particular time, taking into consideration that such relationships might change over time.

3.2 Sampling Procedures

3.2.1 The study population

The population for the study consisted of all household heads under the project of FBSPMS in the three selected Peasant Associations (PAs). Two sampling frames, one for seed producers and the other for non-seed producers were used. The lists of all seed producers and non-seed producers in the PAs therefore constituted the sampling frames. Extension staff, department heads and other seed professionals were also interviewed so as to get more information relevant to this study. Informal

discussions were also held with farmers groups and executive members of two primary multipurpose co-operative societies in the project area. Informal discussions were also held with the General Manager of ESE. and experts from Southern Region and Hadya Zone Co-operative Offices.

3.2.2 The sampling procedures

The selection of PAs for this study was based on accessibility and the number of years (at least four years) each PA had been engaged in seed production activities. Therefore, the three PAs namely, Jawe (engaged for five years), Digiba and Wosheba (each engaged for four years) were selected for this study. The study in total consisted of a sample size of 147 respondents, that is, 122 household heads of seed producers and non-seed producers, and 25 extension workers and seed professionals. Out of the total of 759 households involved in seed production from the three PAs, 62 were randomly selected and from a total of 1,273 non-seed producing households, 60 were picked randomly.

Table 1: Sample size distribution of household heads

Peasant Association	Total seed producers	Sampled seed producers	Total non-seed producers	Sampled non-seed producers
Digiba	248	20	327	20
Jawe	269	22	517	20
Wosheba	242	20	429	20
Total	759	62	1273	60

The selected extension workers who engaged in SHSP and other seed professionals are also included in the sample, these were 25 in total.

3.2.3 Data collection procedures

Data were collected using an interview schedule, checklists and self-administered questionnaire. The interview schedule was used for all the sampled household heads in the PAs, while the self-administered questionnaires were personally distributed to extension workers, department heads and seed professionals. The different checklists were used for discussions with groups of farmers and executive members of co-operatives, other officials and experts from co-operative offices. The household heads were visited and interviewed individually in their homesteads. Observations and secondary data collection from various sources in and outside Soro District were also done. To assess farmers' and professionals' views on SHSP, Likert-type interview items were used. Likert-type interview items result in a single score that represents the degree to which a person is favourable or unfavourable with respect to a particular object (Ajzen and Fishbein, 1980).

2.2.4 Pre-testing of the survey instruments

The survey instruments, interview schedule and questionnaires were developed at Sokoine University of Agriculture and submitted to professionals for checking on the content validity as well as clarity of questions, and whether the instruments corresponded to the objectives of the study. The survey instruments were pre-tested in the field to check for ambiguities in the wording of items, that is, meaningfulness and comprehensiveness, and to ensure that the amount of time required for completing the interview was not excessive. The pre-testing was done in the study area using a random sample of six farmers, three seed producers and three non-seed producers. After pre-testing, it was found that no major changes in content were necessary, although few items were not clear to respondents and these items were modified.

2.2.5 Data analysis

Data collected from the primary sources were coded, and analysed using the Statistical Package for Social Science (SPSS) computer program. Descriptive statistics such as frequencies, percentages and cross-tabulations were used. Frequencies were used for univariate analysis to obtain the variabilities and central tendencies of variables. Cross-tabulation and Chi-square test were also used for bivariate analysis to determine the relationship between variables.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.0 Overview

This chapter presents results of data analysis and discusses the findings of the study. The results and discussion of the findings are presented in line with the study objectives under the following sub-sections.

1) Description of the study area.
2) Respondents socio-economic characteristics.
3) Existing mechanisms of smallholder seed production.
4) Smallholder seed producers' knowledge and technical skills on seed production.
5) Financial and organisational sustainability of smallholder seed production.
6) Seed producers and non-seed producers' attitudes toward smallholder seed production.
7) Views of professionals on smallholder seed production.

4.1 Description of the Study Area

The study was conducted in Soro District, Hadya Zone, Southern Nations, Nationalities and Peoples Region. Choice of the study area was made after discussions with regional and Zonal Agricultural Extension officers. Soro is one of the four administrative districts of Hadya zone with a total area of 1234.54 square kilometres. The total human population of Soro District according to the Central Statistics Authority (CSA, 2001), is estimated to be 355,598 of which 177,690 are male and 177,908 female. The District has three agro-climatic zones- highland (20%), mid-altitude (57%) and lowland (23%). It has two rainy seasons, the main one from mid-June to September and the second short one from February to May, with annual rainfall ranging from 900-1300 mm. The major occupation in Soro District is mixed farming as a major means of livelihood. The main crops grown in the district are wheat, *teff*, maize, *enset*, pulses, potato, and sorghum. The major livestock found in the area include cattle, goats, sheep, equines and chicken.

The smallholder seed production program in the District started in 1997/98 with 37 farmers on 27.5 hectares and produced about 45 tonnes of wheat and 12.5 tonnes of *teff*. The main objectives of smallholder seed production is to alleviate rural poverty, improve household incomes and food security through the enhanced supply of improved seeds/landraces,

and multiplication of quality seed with proved adaptability to local agro-ecological conditions (IFAD, 1996). The number of seed producers in the District was growing at increasing rate and reached a peak in 1999/2000 (i.e.,715 participants). Starting from 2000/2001, the number of participants decreased alarmingly to 33 in 2001/2002 (personal communication with Tesfaye Habite, Zonal Co-ordinator of SHSP).

4.2 Respondents' Socio-economic Characteristics

This section examines socio-economic characteristics of the seed producer and non-seed producer household heads. The socio-economic characteristics examined in this study were age, gender, marital status, family size, education level, and economic status like source of income, number of oxen, and farm size. The purpose of choosing these characteristics was to understand whether there was any difference in socio-economic characteristics between smallholder seed producers and non-producer farmers, and to determine their influence on the potential of smallholder seed production.

4.2.1 Gender distribution

The gender distribution of respondents is shown in Table 2. The majority (91%) of respondents were men. In this case, men have higher

representation than women for the total sample. From the total seed producers, men showed higher representation (95.2%) than women (4.8%), because most households are headed by males.

Table 2: Distribution of respondents by sex

	Seed producers (n = 62)		Other farmers (n = 60)		Total (n = 122)	
Sex	number	percent	number	percent	number	percent
Male	59	95.2	52	86.7	112	91.0
Female	3	4.8	8	13.3	11	9.0
Total	62	100	60	100	122	100

4.2.2 Age distribution

The distribution of respondents involved in seed production and other farm activities by age is presented in Table 3. Results in Table 3 show that 8.2% of the respondents were between 18-28 years, 30.3% between 29-39 years, 36.9% between 40-50 years, 17.2% between 51-61 years, and 7.4% were above 61 years. The majority of the seed producers and other farmers were found in the age category of 40-50 years, 35.5% for seed producers and 38.3% for non-seed producers. The results show that there is slight age difference between seed producers and non-seed producers i.e., majority of seed producers (79.0%) are found in the age category of 18 - 50 years while 71.7% of other farmers found in 18 - 50 years. The proportion of seed producers above 61 years was 1.6% but for

other farmers was 13.3%. The average age of seed producers is 41 years while the non-seed producers is 45 years which indicates that the age difference is not significant and it also indicates that most of the respondents are found in the productive age.

Table 3: Distribution of respondents by age.

Age category (years)	Seed producers (n = 62)		Other farmers (n = 60)		Total (n = 122)	
	number	percent	number	percent	number	percent
18 -28	9	14.5	1	1.7	10	8.2
29 -39	18	29.0	19	31.7	37	30.3
40 - 50	22	35.5	23	38.3	45	36.9
51 - 61	12	19.4	9	15.0	21	47.2
Over 61	1	1.6	8	13.3	9	7.4
Total	62	100	60	100	122	100

4.2.3 Level of education

Literacy is positively correlated with the profitability of small enterprises (Page, 1979). Those owners who are able to read and write show significantly better performance in small enterprises than illiterates. Basic literacy and numeracy are also essential to the efficient management of business (Harris and Kate, 1971).

The study results indicate that the majority (51.6%) of respondents both seed producers and other farmers were not able to read and write. There is also a difference between seed producers and non-seed producer farmers in level of education. seed producers who obtained primary and

secondary education were 11.3 % and 35.5% respectively while other farmers were 6.7 % and 25% respectively. The overall situation of education level from the study results revealed that 58.1% of seed producers and 38.4% of non-seed producers can have easy access to different agricultural information through reading posters, extension leaflets, booklets, local newspaper and magazines. There is a slight difference in the level of education between seed producers and other farmers, i.e. 41.9% of seed producers and 61.6% of other farmers were illiterate. The proportion of seed producers who can read and write (11.3%), primary school (11.3%) and secondary school (35.5%) was greater than other farmers' proportion, that is, 6.7%, 6.7% and 25% respectively. The study also tested the relation between level of education and recruitment of farmers for the seed production programme using Chi-square and, the results show that there was no statistically significant difference. That means the recruitment of seed producers does not depend on the level of education of the respondents.

Table 4: Distribution of respondents by level of education

Education level	Seed producers (n = 62)		Other farmers (n = 60)		Total (n = 122)	
	number	percent	number	percent	number	percent
Illiterate	26	41.9	37	61.6	63	51.7
Read and write	7	11.3	4	6.7	11	9.0
Primary school	7	11.3	4	6.7	11	9.0
Secondary school	22	35.5	15	25.0	37	30.3
Total	62	100	60	100	122	100

Chi-square = 5.041 df = 3 sign. = 0.169

4.2.4 Family size

The study results indicate that there is a difference in the household size between seed producers and non-seed producers, that is, 43.5% of seed producers had a family of 9-11 members and 16.1% with a family size greater than 11 members while the other farmers 21.7% of them had a family of 9-11 members and 11.7% greater than 11 family members. The regional average household size is 4.7 and Hadya zonal average is 5.4 while the respondents' average household size is 7.5 which is greater than the regional and zonal average household size. Household size depends on the fertility level of the given locality and has been linked with poverty (Gelbad and Kant 1999). This is due to the fact that, women from lower income households have less access to family planning and other health services. The predominance of a larger family size in the study area could not only be the result of low level of using family planning, it is also aggravated by polygamy, which is practised in that area. Moreover, children are considered as an asset, therefore, farmers like to have higher number of children. In fact, larger family size is supposed to solve the problem of labour for agricultural activities. The study results show that 93.6% of smallholder seed producers have used their family labour in seed production, 45.2% used hired labour and 58.1% used relatives' labour.

Table 5: Distribution of respondents by family size.

Family size	Seed producers (n = 62)		Other farmers (n = 60)		Total (n= 122)	
	number	percent	number	percent	number	percent
None	6	9.7	1	1.7	7	5.7
1-4	3	4.8	4	6.7	7	5.7
5-8	26	41.9	35	58.3	51	41.8
9-11	21	33.9	13	21.7	40	32.8
> 11	6	9.7	7	11.6	17	14.0
Total	62	100	60	100	122	100

4.2.5 Respondents' marital status

Table 6 shows distribution of respondents by marital status. The results indicate that the highest proportion (95.1%) of respondents were married. 3.3% widowed and 1.6% were never married. There was no significant difference in marital status between seed producers and other farmers except that widowed (6.7%) found in other farmers and never married (3.2%) found only in seed producers.

Table 6: Distribution of respondents by marital status

Marital status	Seed producers (n =62)		Other farmers (n =60)		Total (n =122)	
	number	percent	number	percent	number	percent
Married	60	96.8	56	93.3	116	95.1
Never married	2	3.2	-		2	1.6
Widowed	-	-	4	6.7	4	3.3
Total	62	100	60	100	122	100

4.2.6 Farmers' source of income

Mixed farming was the major source of income for the majority of respondents. Table 7 shows farmers distribution by source of income. Among the total seed producers, 85.5% engaged in mixed farming-producing crops and raising livestock. Only 14.5% of the seed producers depend only on crop production and 3.2% of seed producers generate extra income from off-farm activities.

With regard to other farmers, the study results show that 95.0% of non-seed producers earn their livelihood from mixed farming, 3.3% from crop farming and 1.7% from livestock keeping. Besides farming, only 1.7% of non-seed producers earn other income from off-farm activities.

Table 7: Distribution of respondents by source of income

Income source	Seed producers (n =62)		Other farmers (n =60)		Total (n =122)	
	number	percent	number	percent	number	percent
Crop farming	9	14.5	2	3.3	11	9.0
Animal keeping	-	-	1	1.7	1	0.8
Mixed farming	53	85.5	57	95.0	110	90.2
Total	62	100	60	100	122	100

4.2.7 Landholding

One of the requirements to be a seed producer is to have suitable land and the required farm size that allow seed production. Those with better

and large farm size have a higher possibility to be a seed producer.

Results from Table 8. show that all the seed producers owned half a hectare and above. The majority (66.1%) of seed producers had farm size ranging from 1-2 hectares. 16.1% from 0.5-1 hectare and 17.8% had a farm size greater than 2 hectares. In case of non-seed producer farmers. the majority (51.7%) had farm size ranging from 1-2 hectares. 36.7% from 0.5-1 hectare. 6.7% had farm size greater than 2 hectares and 5% had a farm size below 0.5 hectare. There is also difference in landholding between seed producers and other farmers. The seed producers had larger landholdings compared to other farmers. Ninety five percent of seed producers have used their own farm land for seed production. 11.3% of them produced seed on rented land and 8.1% of seed producers have practised share-cropping to produce seed.

Table 8: Distribution of respondents by landholding

Landholding	Seed producers (n =62)		Other farmers (n =60)		Total (n =122)	
(ha)	number	percent	number	percent	number	percent
< 0.5	-	-	3	5.0	3	2.5
0.5 -1	10	16.1	22	36.7	32	26.2
1 - 2	41	66.1	31	51.6	72	59.0
> 2	11	17.8	4	6.7	15	12.3
Total	62	100	60	100	122	100

4.2.8 Draft oxen

The study results reveal that 67.7% of seed producers and 51.7% of other farmers owned two oxen each. Only 3.2% of seed producers and 14.4% of other farmers had no oxen. Farmers who had three oxen and above were few in number and account for 8.1% of seed producers and 1.7% of non-seed producers. Twenty one percent of seed producers and 33.3% of non-seed producers owned one ox. From the study results, it can be judged that the majority (96.8%) of seed producers had no problem of draft oxen. The study results also show that 96.8% of seed producers used their own oxen while 3.2% of them used hired and relatives' oxen for ploughing (Table 9).

Table 9: Distribution of respondents by ownership of oxen

Number of oxen	Seed producers (n =62)		Other farmers (n =60)		Total (n =122)	
	number	percent	number	percent	number	percent
No oxen	2	3.2	8	14.4	12	9.9
One ox	13	21.0	20	33.3	31	25.4
Two oxen	42	67.7	31	51.6	73	59.8
Three and above	5	8.1	1	1.7	6	4.9
Total	62	100	60	100	122	100

From the study results, it can be concluded that there is no significant difference between seed producers and non-seed producers with respect to family size and age distribution, while differences are observed in level of education, landholding, sources of income and number of oxen.

owned. The average landholding of seed producers was 1.6 hectares and non-seed producers 1.2 hectares. On average, seed producers owned 2 oxen while non-seed producers owned 1.4 oxen. Almost all (95%) of non-seed producers generate their livelihood from mixed farming, 3.3% and 1.7% of them from crop farming and livestock keeping respectively. But only 85.5% of seed producers earn their livelihood from mixed farming and 14.5% of them from crop farming. Regarding education, the majority (56.8%) of the seed producers have attained primary and secondary education while only 21.7% of non-seed producers attained primary and secondary education. Therefore, it can be said that seed producers have higher level of education and economic status compared to non-seed producers.

4.3 The Existing Smallholder Seed Production Mechanisms

4.3.1 Overview

Under this section, the background of seed producers, selection of farmers for seed production, farmers reasons why they became seed producers, provision of agricultural inputs to seed producers, and the situation of other mechanisms such as seed processing and storage, seed quality control, seed marketing and provision of extension service are discussed.

4.3.2 Participation of seed producers in Extension Package Program

It was believed by the implementing organisations that the participation of farmers in the extension package program will enable them to have the exposure to new improved crop husbandry practices that could be a basis for the smallholder seed production program. Usually, farmers who have the technical skills of improved cultural practices can easily manage improved seed production activities. Thus, smallholder seed production program gives priority for farmers who participated in the extension package program. The study results also proved that out of the total interviewed seed producers 93.5% were previously involved in the extension package program before they were recruited for seed production while 6.5% of them were not engaged. The selection criteria of the extension package program are similar to the criteria of smallholder seed production program except a few which are only applicable for seed production (eg. willingness to produce in group with contiguous farm land, and willingness to sell the seed to a delegated body, WTC).

4.3.3 Selection of farmers

The DAs are fully responsible for recruiting the participating farmers in

their working areas since they know those who are innovative and who performed extension packages well. They selected and recruited them based on the following criteria:

- Farmers' interest in seed production.
- Willingness to grow seed in groups with neighbouring farmers on adjacent land.
- Access to at least 0.5 hectare (for cereals) and having oxen.
- Good experience in extension activities with regard to crop management practices and application of farm inputs.
- Willingness to accept and implement the advice of extension agent, and the practical skills and knowledge obtained through training.
- Acceptance of the requirement of credit for farm inputs, i.e. 25% of down payment and the remaining 75% payable after harvest, and
- Willingness to sell their seed, after retaining enough for their own seed, at mutually agreed prices.

Farmers, who normally fulfil these requirements, were eligible for participating in the smallholder seed production program.

Table 10: Who convinced farmers to be seed producers

Convinced by	Seed producers (n = 62)	
	number	percentage
DAs	61	98.4
Myself	8	12.9
My neighbour	1	1.61

Table 10 shows that the DAs played a great role in convincing the farmers to be seed producers. Ninety eight percent of the seed producers were convinced by the DAs. Beside the effort of DAs, 12.9% have been also convinced by the situations they observed and decided to be seed producers. These seed producers, before and after contacts with DAs, had already been attracted by the crop stand on the field, the yield that the seed producers obtained and the advantages provided by the project (provision of farm inputs on credit, training and incentives for farmers who performed better than others). Only one person (1.6%) was convinced by a neighbour.

4.3.4 Reasons why farmers became seed producers

The results in Table 11 show that the most important motive force for the farmers to be seed producers was the income they expected from the seed sales. Thus, all smallholder seed producers are getting involved in the seed production business in order to obtain better income from seed sales and to improve their standard of living. Other reasons for being a seed producer are to get own seed (53.2%) and to specialise in seed production if there is reliable market (35.5%).

With regard to non-seed producers, 91.7% of them needed to be seed producers and only 8.3% were uninterested in seed production. This

implies that there are a lot of farmers who are really interested to engage in seed production.

Table 11: Seed producers' reasons to be seed producers (n = 62).

Farmers' reasons	number	percentage
Better income from seed sales	62	100
To get own seed	33	53.2
To specialise in seed production	22	35.5

With regard to other farmers. the results in Table 12 indicate that the reasons of other farmers to want to be seed producers are not much different from the reasons given by seed producers. Both the seed producers and other farmers focused on the income that will be obtained from seed sales as the motive force for their interest to engage in the seed production business.

Table 12: Reasons of non-seed producers for wanting to become seed producers (n=55).

Other farmers' reasons	number	percentage
Better income from seed sales	50	90.9
To specialise in seed production	16	29.1
To get own seed	6	10.9

The non-seed producers were also asked why they are not involved in seed production if they have interest to be seed producers. The results from Table 13 show that 61.8% of non-seed producer farmers confirmed

that the most important reason which prevented them from being engaged in seed production is lack of access to credit. 34.6% of them mentioned that they have not been recruited by the DAs to be seed producers. Moreover, lacking enough land for seed production is mentioned by 12.4% of non-seed producers as one of the reasons for not getting involved in the seed production business.

Table 13: Non-seed producers' reasons for not being involved in seed production (n=55).

Other farmers' reasons	number	percentage
No access to credit	34	61.8
I have not been selected by DAs	19	34.6
Land shortage	7	12.7

4.3.5 Provision of agricultural inputs

The study examined the types of inputs and under what terms these inputs were supplied to seed producers.

4.3.5.1 Seed provision

As ESE is responsible for multiplying breeder seed into basic seed, it was the major supplier of basic and first generation seeds to smallholder seed producers. The procurement of basic seeds from ESE was done by NSIA and distributed on credit to participating farmers by the District Agricultural Development Offices through DAs in their respective working areas. However, complaints were raised against ESE for not

supplying the required amount of basic and first generation seeds. As a result of this, farmers were forced to use commercial seeds which were distributed for the extension package program. When the researcher was attending the Sixth Annual National Seed Workshop, which was held in Addis Ababa, in December 2001, shortage of basic and first generation seeds was raised as major issue by implementing agencies, Bureaux of Agriculture and NSIA.

The study results show that 96.8% of the seed producers get their basic or first generation seed from DAs, 1.6% from ESE and 1.6% from their relatives.

The varieties of seeds to be grown by smallholder seed producers were mostly selected by DAs. The study results show that 71.0% of seed producers noted that the varieties were selected by DAs, 24.2% explain the selection was done by themselves together with DAs, and 4.8% of them said selection was done by themselves only.

Concerning the seed produced by smallholder farmers, 69.4% of the interviewed participants produced wheat, 1.6% *teff* and 29.0% of them produced both *teff* and wheat seeds.

4.3.5.2 Provision of fertilizers and herbicides

Provision of fertilizers and herbicides on credit was set as part of the project implementation plan. Participating farmers were eligible to get

farm inputs on credit from the project. The procurement of these inputs from input suppliers was done by District Agricultural Development Office and distributed to participating farmers by DAs. The study results indicate that all the seed producers obtained fertilizers in kind on credit, and 96.8% of them got the herbicide in kind on credit basis while 3.2% bought herbicides using their own money.

Generally, the majority (74.5%) of the seed producers mentioned that inadequate supply of agricultural inputs was one of the problems they were facing. This problem is related to lack of credit provision, since these inputs were supplied to them on credit, otherwise they were available at sufficient amounts at their vicinity if they were willing and able to purchase on cash.

4.3.6 Seed multiplication

Farmers participating in seed production were given credit service, agricultural inputs, training and technical assistance to make them able to produce quality seeds. They were also expected to produce the seed in groups. However, the study results show that all the seed producers produced the seed individually. They were also asked whether they have intention to produce in group or not, and 79.0% of them had no interest

to produce in groups, only 19.4% showed interest to produce in groups while 1.6% of them had no response.

Out of those who had interest to produce individually, 73.5% noted that group work is not conducive for seed production since quality work can not be performed in a group. 61.2% argued that group work does not satisfy individual interests, 44.9% of them liked to work individually rather than in group, while 42.9% of them were afraid that group work would create conflict among members, and 4.1% had no experience in group work (Table 14).

Table 14: Reasons of seed producers not to work in groups (n = 49).

Reasons	number	percentage
Quality work can not be performed in group	36	73.5
Group work does not satisfy individual interests	30	61.2
Personally interested to work individually	22	44.9
Group work creates conflict among members	21	42.9
Do not have group work experience	2	4.1

Farmers' tendency and their explanations for not producing in groups show that they have not been well acquainted with the advantages of group work. They associate the situation of group work to the actions of the previous military government that forced the farmers to establish service co-operatives and producers' co-operatives. The coercive

measures taken at that time have had a negative impact on the development of co-operative societies. The negative views of farmers towards co-operatives have not yet changed.

However, some of the participants have realised the advantages of farmers' organisations. Out of 62 interviewed participants, 19.4% of them have shown interest to work in groups, and all (100%) of them agree that group work will empower them to solve their problems. 58.3% accepted that group work as a means to facilitate marketing of their produce. 50% of them believed that group work will facilitate provision of credit and 33.4% also recognised group work as a means that can facilitate the provision of farm inputs (Table 15).

Table 15: Reasons of seed producers for working in group (n = 12).

Reasons	number	percent
Group work will empower us to solve our problems	12	100
It helps to search for good markets for our products	7	58.3
It facilitates provision of credit	5	41.7
It facilitates provision of farm inputs	4	33.3

By convincing the farmers, the seed association could be organised in stepwise processes. After establishing the organisations, as Mumby (1994) indicates that in the beginning, an association produces improved seed from those crops, which are planted by farmers in its immediate vicinity. As the association gains experience and seeks the services of

technically competent personnel it may extend the scope of its activities by adding new crops and seeking new markets.

Tripp (2001) noted that many local-level seed projects require the formation of farmer groups. Therefore, working in groups, as MAC (1998) and Krueger (1988) noted, has many advantages that include:

- Acquisition of useful information relating to community that would be difficult, if not impossible, to obtain from individuals.
- In smallholder seed production, farmers groups facilitate block farming which is very important in meeting the required isolation distance especially for maize and sorghum seeds.
- Farmers' groups facilitate distribution of inputs such as seeds, fertilizers and agro-chemicals.
- Groups allow extension agents to be in a better position to disseminate messages to farmers, and dealing with agricultural problems easier than rendering extension advisory services to scattered individual farmers.

The group tends to ease farmers' problem solving mechanisms, and will enable farmers to get services such as new technologies, training, study tour arrangement, credit and markets for their products.

4.3.7 Seed processing and storage

Before reaching the ultimate users (farmers), seeds need to be processed to avoid contaminants, shrivelled and damaged seeds that will reduce the quality of seed. Effective processing requires adequate management and competent technical skills.

With regard to the smallholder seed production, the project procured mobile seed cleaners, and threshing machines. Soro District has got one mobile seed cleaner and one threshing machine that are owned and managed by the district and zonal agricultural offices. The technicians who can operate the machines were also trained to give processing and threshing services in the project area. However, in the study area, farmers were not using the cleaning machine, they usually sell their raw seeds to a private company called WTC. The cleaning machine therefore gives service to this company to clean the seeds bought from the seed producers and the company covers the operating costs during the seed cleaning operation. As it was observed in the study area, some farmers were threshing their wheat seed manually on a cow dung-smeared threshing field. This indicates that farmers have no easy access to the threshing machine for threshing their seed.

Participants were asked what kind of, clean or unclean, seeds they sell, the results show that 88.7% of the participants sold raw seed which was not cleaned whereas only 6.5% sold clean seeds.

In the case of storage, of those farmers who threshed their *teff* or wheat seeds, 58.1% stored in traditional storage bins and 24.2% of them stored in sacks provided by the project, while 17.7% stored in both sacks and traditional storage bins. Generally, the majority (75.8%) of the seed farmers stored their seeds in traditional storage bins. Those who got the approval for their seeds were provided with sacks and supplied the seed to WTC. After collecting the seeds from the farmers, WTC uses co-operative stores found in that area. Farmers, who supplied their seeds fully, didn't face a storage problem. But those who didn't supply their seeds to WTC based on the agreement made between themselves and district agricultural office, faced problems of storage. They were forced to apply pesticides to protect the seed from storage pests; this meant extra expenses on the farmers. They also sold their seeds as grain at lower price contrary to their expectation.

The study results in Table 16 show that the majority (72.0%) of them faced a problem of storage pests, weevils and rodents. Apart from pest problems, some (8.1%) of the seed growers complained about inadequate supply of sacks from the project and 1.6% complained about theft of stored seed from traditional storage bins. On the other hand, 6.5% of the seed growers did not face storage problem and 12.9% of them did not respond to this issue.

Table 16: Storage problems of seed growers (n = 60)

Problems faced	number	percent
Pest damage	45	72.6
Inadequate supply of sacks from the project	5	8.1
Theft of stored seeds	1	1.6
No storage problem encountered	4	6.5
No response	8	12.9

4.3.8 Seed quality control

Depending on the stage of development of the seed sector, quality control may be either an internal activity by the producing organisation or a function carried out by an independent agency (Kugbei, 2000).

Smallholder seed production found at lower level needs technical assistance, close follow-up and organised field inspection to attain the required quality seeds. NSIA have mandated the regional bureaux of agriculture to inspect and certify the quality of seeds produced by smallholder farmers. Accordingly, the concerned experts at district, zonal and regional level have the responsibility to assist the seed production activities and to handle seed quality control.

The participants were asked as to how they ensured the quality of their produced seeds. The majority (83.9%) needed the technical assistance, close follow-up and field inspection of DAs that can ensure their quality seed production and 53.2% required external assistance of the professionals from district, zone and regional agricultural offices. Most

participating farmers admitted that the quality seed production requires their best effort and the most valuable technical assistance of other professionals in seed production techniques and quality control. However, the majority of the seed producers complained about the recurrent unseasonal rain which fell at the time of harvesting and as a result, seed farmers have not been able to produce the required quality seed. Due to this fact, farmers were not able to sell their product as a seed which led them to incur losses.

4.3.9 Marketing of seeds

Historically, more attention and resources have been devoted to the physical aspects of seed production and storage than to the difficult organisational issues involved in managing sales and distribution (Mumby, 1994).

Similarly, when the project was formulated, the major focus was on the production of improved seeds to alleviate the prevailing seed shortage in the country. During the project formulation, the marketing aspect was not given due attention resting on the assumption that informal seed exchanges will absorb the seed produced by smallholder farmers. Because of this reason, the marketing aspect was not a big concern in IFAD's Informal Seed Sector Project description and implementation plan for FBSPMS. However, the marketing of seeds in the study area has

become a major problem for seed producers. The study results from Table 17 showed that from 1998/99 total wheat seed produced by seed growers, only 10.7% was purchased by WTC, 6.8% used as own seed and exchanged through informal system as seed to neighbours and relatives, 26.6% was used for home consumption and 55.9% sold as a grain in the market. Similarly, from 1999/2000 produced wheat seed, 40.6% was purchased by WTC, 6.1% was used as own seed and disposed of in informal markets as seed to their neighbours and relatives, 18.1% was consumed at home and 35.2% was sold as grain in the market. Generally, out of the total produced wheat seed, 82.5% in 1998/99, and 53.3% in 1999/2000, was sold as grain and consumed at home. In case of *teff*, even though the amount produced was very small, the seed growers faced the same problems. Of the total produced *teff* seed in 1998/99, only 12.5% was used as own seed and disposed of as seed through informal seed exchange to neighbours and relatives. The remaining seed, 12.5%, was consumed at home and 75.0% was sold in the market as grain. From 1999/2000 total produced *teff* seed, only 19.2% was sold to WTC, 9.5% was used as own seed and exchanged as seed through the informa system, 13.8% was consumed at home and 57.5% was sold as a grain. Generally, out of the total produced *teff* seed, 87.5% in 1998/99 and 73.4% in 1999/2000 was marketed as a grain and consumed at home. In 2000/2001-production year, nothing was sold to WTC all seeds produced

by smallholder farmers having been marketed as grain and consumed at home.

The study results make it clear that the seeds produced by smallholder farmers could not be distributed as expected through informal seed exchange system. Thus, it needs formal and organised market facilities to distribute the seeds to the ultimate users either in the district or other areas where it is needed. As a result of the small coverage of informal seed distribution system, on average only less than 6.7% of the total produced seed was sold or exchanged through this system. From the study results, it can be recognised that farmers have the capacity and potential to produce the required quality seed if they are well trained and supported in terms of finance and technical assistance by the seed professionals. However, the problem in the study area was lack of attractive market for their seeds which was likely to create a negativ impact on the sustainability of SHSP. As Mumby (1994) explains, marketing should identify, anticipate and satisfy the needs of the farmers, as well as realise the objectives of the supplier (producer).

Table 17: Amounts of seeds sold to WTC, consumed and sold as a grain

Seed distribution	1998/99				1999/2000			
	Wheat		*Teff*		Wheat		*Teff*	
	Tonnes	percent	Tonnes	percent	Tonnes	percent	Tonnes	percent
Purchased by WTC	1.9	10.7	-	-	38.7	40.6	1.8	19.2
Exchanged as a seed in informal markets	1.2	6.8	1.0	12.5	5.8	6.1	0.7	9.5
Consumed as grain at home	4.7	26.6	1.0	12.5	17.2	18.1	1.3	13.8
Sold as grain in the local markets	9.9	55.9	6.0	75.0	33.6	5.2	5.6	57.5
Total	17.7	100	8.0	100	95.3	100	9.4	100

The study results also show that all of the interviewed smallholder seed producers engaged in seed production to seek better income from seed sales. On the other hand, the seed users (farmers) only obtained little amounts of seeds from the program, as on average, over 73.0% of the total seed is marketed as grain and consumed at home which really defeats the objective of the smallholder seed production scheme. From this situation, we can realise that only achieving the production target may not be a good indicator of the successful implementation of the seed production project unless it attains the final goal, supplying the required quality seeds to farmers.

The regional bureaux of agriculture tried to encourage farmers by promising an attractive market and premium price to smallholder seed producers which is stated in the contractual agreement made between the district office and seed producers. Actually, this was not being implemented in accordance with the agreement even though the number of smallholder seed producers increased every year except for the yea 2000/2001. From the study results the following problems caused the inefficiency of seed marketing:

i) During the project formulation, seed marketing was left to the informal methods of seed supply and distribution through barter, gift, exchange and selling on cash. But practically, the informal system was incapable of accommodating the produced seeds.

ii) No attempt was made to encourage farmers' co-operatives to get prepared and take part in seed marketing, even though currently they have low financial capacity to carry out this business. Discussions were held with executive members of primary co-operatives, and they expressed their interest to get involved in seed marketing, but they are not ready at this time since they have financial problems. The same view was expressed when discussions were held with experts of regional and zonal co-operative offices.

iii) Lack of assessment of the effective demand of seeds in the district. In this case, the regional, zonal and district level agricultural offices were not aware of the effective demand of seeds in the district that could actually be utilised within the district, and they only stuck on the production of seed. If they assessed the demand, they could have reduced the number of seed producers and plan how much to produce based on the situations which determine the effective demand such as availability of credit, market situation, crop pattern and intensity, demand for seeds, farmers purchasing power of seed, level of technology adoption and other related factors. Estimating the effective demand would lead to a situation where seed production and farmers would produce what they can actually sell. As Kelly and George (1998), noted that the first step should be to determine which cultivar will meet the growers' needs for a specific market outlet, next step is to assess the potential size of the

market and the share of that market which can be captured by a particular cultivar.

iv) Low price of grain: when the farm income is reduced due to low produce prices and high prices of inputs, farmers retain their grain of non-hybrid crops, switch from hybrids to non-hybrids or grow different crops. The farmer will have to balance the cost with the benefit before being convinced to spend money on inputs such as seed and fertilizers. Unfortunately, seed is often the one item that farmers believe is possible to save money on, even though less is usually spent on seed than other inputs (Mumby, 1994).

The price of grain has dropped in the last two years (2000 and 2001). Before the year 2000, for instance, the price of wheat in the study area at harvest time on average was Ethiopian Birr 1300/tonne and starting mid-June the price has gone up to Ethiopian Birr 1800-2000/tonne. But during the last two years the price of one tonne of wheat dropped sharply to Ethiopian Birr 500-600 at harvest time and 650-700 in July to September, which are months of grain shortage. The sharp fall in grain price has discouraged farmers from buying farm inputs including seeds, instead they started to use their own farm saved seeds. This situation reduced the marketable volume of improved seeds produced by smallholder farmers.

v) Farmers' experience to plant same recycled seed for long time. Usually farmers mostly use farm-saved seeds from previous harvests. Farmers groups in the study area were asked how long they circulate and use one seed without changing it and they explained that it depends on the yield it gives every year. If the yield decreases, then the farmer is forced to replace the previous seed by new one, which he expects will yield higher. The other factor, which determines the replacement of old seed by new one, is the availability of other better seeds at the right time and at affordable price. If it is available with reasonable price that farmers can afford, it can be changed every year. The other important reason mentioned by farmers' groups is the availability of credit for input purchase. If there is credit service, farmers prefer to plant new seeds every year to get a good harvest.

Farmer groups noted from their experience that, recycling the same seed for many consecutive years is not advisable. Normally, the yield starts declining, according to their experience, after the first harvest and it decreases sharply after the second harvest. Thus, all the informal groups confirmed that considering all the situations, one seed for self-pollinated crops actually on the average have been used for 3-4 years.

Similarly, other farmers who were not involved in seed production were also interviewed about the continual use of the same seed. The results (Table 18) show that 6.7% of them recycle and use same seed for four

years. 36.6% for three years. 35.0% for two years and 21.7% replace their seed every year. On average. farmers use same seed for 2-3 years.

Table 18: Number of years for continuously using recycled seed (n = 60)

Number of years	number	percent
One year	13	21.7
Two years	21	35.0
Three years	22	36.6
Four years	4	6.7
Total	60	100

Therefore. when forecasting effective demand of seeds. farmers' experience in using one seed for long time without changing it should also be considered.

vi) Concentrating on cereal seed production. The target of increasing the improved seed supply is to achieve food self-sufficiency through increased productivity and production. Accordingly. much emphasis was placed on producing improved seeds of cereals. To this effect. smallholder farmers were encouraged to engage in cereal seed production (wheat and *teff*). Of course. even though it is not as well established as for cereals. producing seed for pulse crops was also started. But seeds of other high value crops were not given due emphasis by the project.

vii) Inadequate supply of credit to the farmers. It is known that small-scale farmers lack adequate capital and need credit to fill this gap for

purchasing agricultural inputs. The regional state, therefore tried to facilitate credit to smallholder farmers, and entered into agreement with commercial and development banks of Ethiopia by offering its budget as a collateral in case of failure of loan recovery. However, this system proved difficult for the regional state, because the credit repayment was very low. Due to this fact, the credit service was blocked in some areas where there was very low recovery. As a result of lack of credit, lower grain price and other problems, farmers tended to use their own farm-saved seeds, which brought a negative impact on the distribution of agricultural inputs including seeds.

Generally, the market situation became a problem for farmers that led the farmers into bankruptcy. Concerning this issue, smallholder seed producers' representatives at the Sixth Annual National Seed Workshop, underscored the problems of low price and lack of market for their seeds and other agricultural products. Finally, they requested the intervention of the government to solve this major problem of farmers.

4.3.10 Extension service

The regional bureau of agriculture views activities of smallholder seed production as one component of the Extension Package Program. The smallholder seed production program is being implemented as a support

of the Extension Package Program to facilitate the delivery of the required seeds to farmers engaged in Extension Package Program and other farmers who are not engaged. Thus, the extension workers at all levels, extension supervisors and DAs consider the SHSP as part of their regular activities. To this effect, the extension experts have been involved in training, supervision and technical assistance of their subordinates.

The seed farms are being used as part of extension demonstration plots for teaching other farmers about new crop varieties, and improved cultural practices. Even though DAs are expected to perform all agricultural development activities including smallholder improved seed production in their respective working areas, they have a problem of transport, field equipment and office supplies. Moreover, they were expected to distribute agricultural inputs to farmers, collect down payment and the loan after harvest from seed producers and other farmers in their respective working areas, which are the duties that should be performed by other concerned organisations. This situation increases the workload on DAs and this in turn negatively influences the extension service delivered to the farmers.

4.3.11 Training of farmers and extension workers

Before the smallholder seed production program was implemented in 1997/98, inception workshops were conducted at different levels to create awareness of extension agents, subject-matter specialists and other officials. During the implementation, training in seed production techniques was organised by the project for extension workers at all levels and participating farmers. The participating farmers were trained on seed production techniques and marketing. The study results show that the majority (80.7%) of the seed producers mentioned that they have received training service from the district agricultural office, but 19.3% of them had no response concerning training.

Field days were also organised on a well-managed seed farm to let seed producers from different project areas and other farmers from the project and other areas learn and share experience with seed growers and exchange views about smallholder seed production. The field days also created an opportunity for professionals from the project and other areas to come together and share experiences and exchange ideas among themselves and the farmers.

To this effect, the seed farms, in the district, were being used as demonstration plots since the beginning of the seed production. Demonstrations are being used as one of the tools to train farmers and professionals. Marini and Mwisa (1996) indicate that other farmers were

expected to learn proper farming practices by using SHSP farms as demonstration fields.

DAs, extension supervisors and extension workers at district and zonal levels who were engaged in the seed production project, have also been trained on seed production techniques and seed quality control.

4.3.12 Current situation of seed producers

The study results show that 83.9% of the interviewed seed producers have already discontinued seed production and only 16.1% of them are currently producing seed. From the study results, a high proportion of dropouts of participants from the seed production is observed which implies that the participants were not consistent in seed production activities. As a result, the turnover of seed producers was very high and this in turn has had an influence on the specialisation of seed production by smallholder farmers. DAs are also forced to train new participants as the experienced ones leave the business.

Table 19 shows that a higher proportion (74.4%) of the respondents have indicated that lack of credit facility as the major problem which made them dropout of the seed production business. This implies that smallholder farmers lack the capacity to resume the seed production business on their own without the support of financial institutions. The

second most important problem mentioned by 42.3% of them was lack of ready market for their seed, followed by low profitability from the seed sales (34.6% of them agreed), which seriously affected their financial position and discouraged them from continuing the seed production. Others (28.8%) faced the problem of land shortage, since farmers are not allowed to produce the same seed on the same land for consecutive years under smallholder farmers' management. They have to replace with other crops preferably legumes by employing crop rotation techniques to control weeds, diseases and to maintain soil fertility. Because of this, those who lack adequate land should acquire farmland through renting or sharecropping, but if there is no alternative, the farmers are forced to stop producing seeds.

Table 19: Reasons for dropping out of seed production (n=52).

Reasons	number	percentage
Lack of credit	39	74.4
No available market	22	42.3
No profit from seed sales	18	34.6
Land shortage	15	28.8

Table 20 shows that the proportion of seed producers decreases with the number of years of participation in seed production. Out of the total interviewed participants, only 1.6% of them have produced seeds for five consecutive years without break starting from the project

implementation; 4.8% have produced for four years, 14.5% for three years, 32.3% for two years and the majority (46.8%) have produced for only one year.

Table 20: Distribution of participants by number of years engaged in seed production (n = 62).

Years of participation	Number	percentage
One year	29	46.8
Two years	20	32.3
Three years	9	14.5
Four years	3	4.8
Five years	1	1.6
Total	62	100

4.4 Farmers' Technical Competence

4.4.1 Overview

This sub-section presents the assessment of technical skills and knowledge of seed producers on seed production.

4.4.2 Seed producers' knowledge on seed production techniques

Most of the seed producers have participated in the Extension Package Program and had knowledge on improved agronomic practices. Seed producers, before being engaged in seed production activities, were

trained on seed production techniques to improve their knowledge and technical skills of seed production.

The study results show that almost all (98.4%) of the seed producers have the knowledge of seed production and were able to realise the differences between seed and grain production techniques and they noted that seed production differs from other farm activities in some husbandry practices. Only 1.6% of them had no sufficient knowledge on seed production.

The results from Table 21 show that 59.0% of seed producers recognised the difference in land preparation between seed production and other farm activities and they indicated that there are serious land selection criteria and more intensive land preparation for seed production than for regular farm activities. Fifty seven percent of them also indicated rouging (difficult activity for them) which is done in seed fields to make the seed free from any other varieties of the same or other crops, which is not done on grain crop fields. Forty nine percent of the seed producers identified the difference in weeding and pest management practices - there is intensive weed and pest control in seed production compared to other grain production activities. The difference in rate of farm inputs application between seed production and grain production is also observed by 37.7% of interviewed seed producers. In seed production, the seed producers noted that they should strictly follow the

recommended rate of inputs and should apply the inputs accordingly. But for regular farm activities farmers are not too much worried to strictly stick to the recommended rate of inputs to be applied. The other differences using isolation distance between seed farms and other farms recognised by 6.6%. timely planting and harvesting by 24.5%. and careful preparation and using of threshing fields for seeds compared to grain threshing field by 8.2%.

Non-seed producers were also asked whether they have knowledge about seed production program in their area or not. The results show that 90% of them have knowledge about the seed production program in their locality. while 10% of them didn't know anything about it.

Table 21: Differences between seed production and other farm activities identified by seed producers (n = 61).

Source of differences	number	percentage
Land preparation	36	59.0
Rouging	35	57.4
Weed and pest management	30	49.2
Rate of application of agricultural inputs	23	37.7
Time of planting and harvesting	15	24.6
Using threshing field	5	8.2
Difference in using isolation distance	4	6.6

Farmers in the study area were also well aware of some wheat and *teff* improved varieties and gave the local names for some popular varieties they planted. The names were given on the basis of their yield and other

characteristics that the varieties have. For instance, farmers named HAR604 the improved wheat variety as *legamo*. This implies that farmers were well familiar with improved varieties and also realised the characteristics and yields of varieties that were supplied to them.

4.4.3 Farmers' technical skills

Technical aspects of seed multiplication (in agronomic terms) are related to the physiological interaction between crop varieties and inputs such as water, land, fertilizers, machinery, and labour to produce a measurable response or output in the form of seed yield per hectare. The capacity to combine inputs to produce output determines the technical efficiency in seed production (Kugbei, 2000).

Seed producers were interviewed to determine whether they manage the seed production techniques or not. The majority (80.6%) of them confirmed that they can properly manage the seed production techniques while 19.4% of the producers were doubtful of managing the seed production techniques. Those who have produced seeds for a longer time have the capacity to manage the seed production techniques properly. The Chi-square test (Table 22) also proved that there was statistical significance between their technical competence and the number of years they were engaged in seed production which implies that their experience

helped them to master seed production techniques well, compared to those with less experience in seed production.

Table 22: Distribution of seed producers by their technical competence and experiences (n = 62).

Number of years	Management of seed production techniques		
	Capable	Doubtful	Total
One year	18	11	29
Two years	19	1	20
Three years	9	-	9
Four years	3	-	3
Five years	1	-	1
Total	50	12	62

Chi-square = 9.94 Df = 4 Sign. = 0.016

Statistical significance is also observed between their level of education and their technical competence, which implies that the level of education has a contribution for their technical competence in seed production (Table 23). Out of those who lacked adequate technical skills, all of them (100%) had problem with proper rate of seeding and spacing, 16.7% lacked skill of rouging and 8.3% lacked land preparation skills. During field observation, in some seed farms the problems of weeds and off-types were observed which is the result of poor management of the seed farms.

Table 23: Distribution of seed producers by their technical competence and education level (n = 62)

Level of education	Managing seed production techniques capable	doubtful	Total
Illiterate	15	11	26
Literacy	6	1	8
Primary school	7	-	7
Secondary school	22	-	22
Total	50	12	62

Chi-square = 13.95 Df = 3 Sign. = 0.003

As discussed in sub-section 4.3.11, seed producers were trained on seed production techniques. However, as the study results indicate, 19.0% of the trained seed producers noted that they had problem to manage the seed production techniques. The study results from Table 24 also proved that there is no statistical significance between farmers' training and their technical competence.

Since improved seed production is a new production practice for the farmers, technical assistance is quite important to make it successful and produce quality seeds. DAs were fully responsible for giving technical assistance for farmers. The study results show that the majority (80.6%) of seed producers have received technical assistance on seed production while 19.4% did not receive such assistance.

Generally, the field observation results together with farmers' response on training and their technical inefficiency imply inadequate training of

farmers and lack of efficient technical assistance in some parts of the project areas.

Table 24: Training of seed producers and their ability to manage seed production techniques

Training	Ability in seed management techniques Capable	Doubtful	Total
Trained seed producers	47	11	58
Not trained seed producers	3	1	4
Total	50	12	62

Chi-square = 0.087 Df = 1 Sign. = 0.076

4.8 Financial Sustainability

Financial sustainability of smallholder seed production means the ability of smallholder seed producers to be independent of external financial support (Mtenga, 1999).

In the case of smallholder seed production in Soro District, all round financial support is given by the project, credit for farm inputs, training cost (for farmers, DAs, and extension workers), provision of sacks, threshing and seed cleaning services. The project purchase basic or first generation seed and transport it to the project areas. Farmers who fulfil the conditions and are selected as seed producers are eligible to get all benefits from the project. They are only expected to contribute their

labour, oxen and land for the seed production. Thus, farmers are totally dependent on the financial support of the project. The study results show that 74.2% of seed producers confirmed that they will not continue the seed production if the credit service runs out. Only 22.6% would have interest to continue seed production even if external financial support runs out and 3.2% of them were not sure whether they would continue or give up the seed production when credit service stopped. Of those whc will continue the seed production, 83.3% have plans to run the business using their own money and 16.7% have plans to search for other credit sources to supplement their finances.

Out of those who discontinued seed production, 74.4% gave up producing seed because they lacked access to credit from the project. Thus, the situation clearly indicates that the majority of farmers have no interest to continue seed production on their own without the credit service which implies that the financial position of smallholder seed producers isn't yet strong enough to create financial sustainability.

The current marketing problem and low seed price also play a role for the low level of financial capacity of smallholder seed producers. The study results show that out of all interviewed seed producers, 62.3% paid their loans and the rest (37.7%) have not yet paid back their loans. The majority (87.0%) of defaulters confirmed that lack of market was the main reason for not repaying their debts and 65.2% complained of

unseasonal rain, which spoiled their harvest, as a cause for their failure to repay their credit. As Kugbei (2000), noted the problem of poor loan repayment is exacerbated during years of adverse weather, when farmers do not realise much income from their farms. Sixty one percent of them did not get better income to repay their loan, due to low price of seeds (Table 25).

Table 25: Reasons of seed producers for not repaying their loans (n = 23)

Reason	number	percent
No available market for their produced seeds	20	87.0
Unseasonal rain damaged the harvest	15	65.2
Low seed price (which was sold as grain)	14	60.9

4.9 Organisational Sustainability

When the project first started, innovative farmers were selected and trained to engage in seed production. Farmers were selected who had adjacent land with others to make block farming which allows easy access for supervision of seed farms, and easy contact among the seed producers. The contiguous land encourages farmers to work together and to share experiences among themselves. However, the professionals did not encourage the formation of formal groups or associations. Because of

this, farmers were not well aware of the advantages of formal groups and/or seed associations. Thus, they tended to produce the seed individually. Traditionally, farmers practice teamwork (locally called *debo*) at peak times when extra labour is needed. On the basis of farmers' tradition, formal groups and seed associations could be established. Currently, seed producers are faced with a serious problem of lack of market. Those who were discouraged and could not withstand the problem have already left the seed production business. They do not have organisational basis to solve the problems they faced. On the other hand, from the study results, it is observed that the organisations involved in SHSP are limited in number and most of the activities were done by few organisations, bureau of agriculture and NSIA. As it was discussed earlier, DAs also provided the supportive services as part of their duties. It is observed from the study results that so far there is no strong ground for organisational sustainability of smallholder seed production.

4.10 Attitudes of Farmers Towards SHSP

To assess both seed producers' and non-seed producers' attitudes towards SHSP, Likert-type interview items were used. From the items farmers were expected to indicate positive or negative attitudes on smallholder

seed production. If both seed producers and other farmers have positive attitudes toward smallholder seed production, it will be an indication that this program offers a potential approach to alleviate seed shortage through producing and making improved seeds easily available to small-scale farmers. But if farmers show a negative attitude toward this scheme, then this will mean that the sustainability of SHSP will be low.

4.10.1 Opinions of farmers on benefits of SHSP

The majority of both the seed producers and non-seed producers have the same opinion concerning the advantages of SHSP with respect to promising yield compared to the traditional seeds, easy accessibility to the farmers and lower prices.

The majority (91.9%) of seed producers noted that when WTC bought their seed based on the contractual agreement made between seed producers and District agriculture office, they obtained better income and some of them were able to buy oxen, constructing corrugated iron houses, and they were able to cover school fees, government taxes and other expenses (Table 26).

Table 26: Attitudes of seed producers on SHSP (n = 62)

Items	Agree number	%	Undecided number	%	Disagree number	%
SHSP benefited small farmers	57	91.9	1	1.6	4	6.5
SHSP brings better income compared to other farm activities	60	96.8	-	-	2	3.2
I would substitute SHSP by other activities preferably cash crops	5	8.1	5	8.1	52	83.8
SHSP is not possible without the support of other organisations	54	87.1	-	-	8	12.9
Producing seed in group is better than producing individually	12	19.3	21	33.9	29	46.8

On the other hand, according to seed producers, even though they were not able to sell their seeds to WTC, they were able to sell as grain in the local market at relatively better price compared to grain produced by other farmers, because the quality of the seed is superior to other grains.

Individual farmers who were not seed producers were also asked about their views towards the advantages of smallholder seed production. The results indicate that 91.7% of non-seed producers confirmed that improved seeds produced by smallholder farmers yielded more than their traditional seeds, 85.0% of them noted that they benefited from low price compared to ESE seed price and 86.7% of them mentioned that it was easily available compared to ESE seeds (Table 27).

Table 27: Attitudes of non-seed producers on SHSP (n = 60)

Items	Agree number	%	Undecided number	%	Disagree number	%
Improved Seeds produced by small farmers give higher yield than traditional seeds	55	91.7	5	8.3	-	-
Lower price is the other benefit of SHSP	51	85.0	5	8.3	4	6.7
Another advantage of SHSP is being easily accessible	52	86.7	6	10	2	3.3

The majority (86.7%) explained that they bought seeds produced by smallholder farmers while 13.3% of them refrained from buying such seeds. Of the farmers who bought the seeds, the majority (78.9%) accepted its yield potential which was better than their traditional seeds. 69.2% of them bought because of its availability to them and 30.8% were attracted by the lower price compared to ESE price. But the farmers who were reluctant to purchase farmers' produced seeds were interested to use their own seeds and some of them (25.0%) had no enough land to use improved seed.

Farmers' groups were also asked about their opinion about the advantages of SHSP. The study results show that all groups identified the advantages of improved seeds production by farmers. Some of the advantages that all groups agreed on were:

- Low price, easy accessibility and better yield compared to traditional seeds.

- Farmers, who have no ability to buy on cash, can exchange for other grains or commodity.
- They have the opportunity to observe the adaptability of the new variety to their locality and they can also evaluate the crop stand on the field and the yield condition at harvesting time.
- They have learned improved cultural practices from seed farms when they passed by and during field days on the seed farms.

Generally, from the individual farmers and farmers groups' opinion, it can be said that smallholder seed production supplies seeds timely to small farmers at affordable price who otherwise had less access to improved seeds produced by the public and private organisations.

4.10.2 Opinions of farmers on institutional support

It is apparent that institutional support plays a great role for the sustainability of smallholder seed production. Seed producers (87.1%) also believe that without the support of other organisations, their seed production business could not be sustainable and achieve its final goal. Farmers' opinion on institutional support has a clear message for those institutions who take part directly or indirectly in smallholder seed production to strengthen their support in integrated way to lay down the basis for its sustainability.

4.10.3 Opinions of farmers on seed production skills

In this regard, as discussed in section 4.4.3, the opinion of the majority of seed producers is positive. However, there are few seed producers who have different views who considered seed production as a complex activity which could not be managed by small farmers, otherwise majority of them confirmed that they have the skills and knowledge to manage seed production business. The majority (91.9%) of the seed producers are proud to be seed producers and 69.4% of them need to specialise in seed production business (Table 28).

Table 28: Opinion of farmers on production skills of seed producers

(n = 62)

Items	Agree number	%	Undecided number	%	Disagree number	%
SHSP is complex and couldn't be managed by small farmers	7	11.3	6	9.7	49	79.0
SHSP needs more effort than regular farm activities	59	95.2	1	1.6	2	3.2
SHSP practices are not different from other farm activities	5	8.1	3	4.8	54	87.1
Small farmers couldn't manage seed production techniques	8	12.9	3	4.8	51	82.3
It is possible to specialise in improved seed production	43	69.4	15	24.2	4	6.4
I am proud to be seed producer	57	91.9	5	8.1	-	-

4.10.4 Opinions of farmers on quality of seeds

All the seed producers confirmed their capacity to produce quality seeds if they are given the necessary skill training, technical and financial support from concerned organisations. They noted that they are producing the required quality seed that is inspected and approved by the bureaux of agriculture (regional, zonal and district experts).

Non-seed producer farmers were also interviewed to obtain views about the quality of seeds produced by smallholder farmers compared to their traditional and ESE seeds; and except 8.3% of them who have no response on the quality comparison of smallholder farmers' seeds with traditional and ESE seeds, the majority expressed their views. The results from Table 29 show that 90.0% of them noted that improved seeds of smallholder farmers were superior to the traditional seeds in their quality, 1.7% of them replied that the quality is not better than traditional seeds. However, 88.3% of non-seed producers noted that the seed produced by smallholder farmers had low quality and germination rate compared to ESE seeds, only 3.3% confirmed better quality and germination rate of seed produced by smallholder farmers (Table 29).

Table 29: Views of non-seed producers on quality differences among smallholder, traditional and ESE seeds (n = 60)

Differences	number	percent
Quality of farmers' seeds was better than local seeds	54	90.0
The quality of farmers' seeds was not better than traditional seeds	1	1.7
Quality of farmers' seeds was lower than ESE seeds	53	88.3
Quality of farmers' seeds was higher than ESE seeds	2	3.3
Germination rate of farmers' seeds was lower than ESE seeds	53	88.3
Germination rate of SHSP seeds was better than ESE seeds	2	3.3
No response	5	8.3

Forty two percent of them confirmed that they have faced weed problem while the same proportion of non-seed producers didn't face this problem. The study revealed that only 20.0% of interviewed non-seed producers needed to use improved seeds produced by small farmers, and 26.7% of them had not yet decided which seeds to use, while 53.3% of them had no interest to use the improved seeds of small farmers if they get other alternative, seed supply from ESE. Generally, 60.0% of them complained about the quality of seeds produced by small farmers in their locality, and they refrained from buying these seeds. Therefore, 68.4% of them noted that they prefer to buy ESE's seeds even though the price is higher than seeds of smallholder farmers (Table 30).

Table 30: Attitudes of non-seed producers on using seeds produced by small-scale farmers (n = 60)

Items	Agree number	%	Undecided number	%	Disagree number	%
Quality of seeds produced by SHSP is the major problem	36	60.0	6	10.0	18	30.0
I prefer to use farmers' seed rather than formal seed	12	20.0	16	26.7	32	53.3
Even though, the price of seeds produced by ESE is higher, I prefer to buy it	41	68.4	11	18.3	8	13.3

Discussions were also held with different farmers groups from each development centre about the quality of seed produced by smallholder farmers in their respective areas. All groups noted that they had their own criteria for measuring seed quality. Commonly used criteria by farmers include free from weed seeds, not broken, not shrivelled, uniform in size, not mixed with other grain seeds (has no mechanical damage), high yielder (assessed after harvest), disease resistant (assessed after planting), adaptable to their locality and good germination rate. The farmers categorised their criteria into two: (i) criteria used before planting, by observing the seed they can assess the quality, and (ii) after planting they assess germination rate, the crop stand, disease resistance and yield condition. The farmers further explained that they make their own research to identify a good quality high yielding seed. They usually use the above mentioned criteria, even when they buy/exchange traditional seeds in informal way from their locality. Using their own

criteria, the different farmers groups were requested to compare the quality situation of seeds produced by smallholder farmers and the formal seed organisation (ESE). According to their views, the farmers' improved seeds had a problem of contamination with weed seeds compared to formal seeds. On the other hand, the seeds produced by formal seed organisation had a problem of mechanical damage (broken) and shrivelled seeds compared to smallholder farmers' seed. Farmers categorised the problems as major and minor problems based on their experiences. Contamination with weed seeds is a major problem for them and the problem of broken and shrivelled seeds is a secondary problem. They therefore need, as much as possible, to buy quality seeds free of weeds, not shrivelled and broken. Regarding the traditional seeds and improved seeds produced by smallholder farmers, the groups also gave their judgement and the groups confirmed that the smallholder farmers' seeds were by far better than their own traditional seeds in terms of both quality and yield.

From the farmers groups and other farmers' views towards the quality of smallholder seeds, it is clear that the quality of seeds should be improved to meet the demand of farmers by supplying quality seeds.

4.10.5 Opinion of farmers on quantity of seeds

The majority (78.3%) of other farmers were afraid that the quantity of seeds produced by smallholder farmers is too low, while 16.7% of them agreed to its adequacy in supply. Only 5.0% of them had no opinion on the quantity of seeds produced by smallholder farmers which implies that either they did not use the seeds of small farmers or they did not face supply problems.

4.11 Professionals' Views on Smallholder Seed Production

The professionals interviewed in this study were FBSPMS project co-ordinators in NSIA, regional bureaux of agriculture, zone and district agriculture offices, regional extension department head, extension experts, supervisors and DAs who have been involved in project implementation activities. Other professionals who are involved in seed production were also interviewed, from ESE, ACA, EPHSI, Institute of Bio-diversity and Research and SG2000 organisations.

4.11.1 Professionals' opinions on advantages of SHSP

All of interviewed professionals accepted SHSP as a potential alternative approach to solve the problem of shortage of improved seeds in the

country, especially in remote and inaccessible areas through timely supply of improved seeds with affordable prices (Table 31). Previously, apart from shortage of seeds, the supply to small farmers was also a serious problem. To alleviate this problem of inadequate supply, the Regional Bureau of Agriculture and its subordinates, Zonal and District Agricultural Offices were still doing the seed transportation and supply to small-scale farmers. Due to this fact, the timely supply of seeds was not possible in remote areas. Thus, producing seeds by small farmers in and around the farmers' area is a means to alleviate the problem of accessibility of seeds.

The other advantage mentioned by professionals is SHSP could be used as a means of teaching media for farmers about improved crop husbandry practices. The seed farms could be used as demonstration fields and other farmers can have access to learn the new practices whenever they pass by or they can directly discuss with their neighbours who are engaged in improved seed production. The informal farmers' groups also confirmed this advantage when discussions were held about SHSP in their locality. According to professionals' views, SHSP could be a permanent business in which farmers can derive their income through sales of improved seeds. This could be strengthened by creating links with formal seed organisations as contract seed growers.

The other advantage of SHSP is that it reduces the transportation and distribution cost since the seed is produced in the vicinity of farmers.

Table 31: Advantages of smallholder seed production as mentioned by professionals

(n = 25)

Advantages	number	percent
It ensures timely supply of improved seeds	25	100.0
It improves skills of seed producers	18	72.0
It is a means to derive better income for seed producers	15	60.0
It offers lower price to small farmers	14	56.0
It reduces cost of transportation	7	28.0
It creates awareness about new improved varieties	4	16.0

4.11.2 Opinions of professionals on quality of seeds

The majority of interviewed professionals accepted that small-scale farmers could produce the required quality seeds if they are given the skill training, technical support with intensive field inspection and financial support. They also suggested that the quality of seed should be tested and certified by authorised body to ensure good quality seeds to the farmers. However, 12% of them noted that farmers couldn't produce certified seeds. They argued that farmers are subsistence and have no capacity to produce certified seed. The other reasons mentioned are farmers' lack of technical skills and knowledge of seed production as well as facilities for seed production. However, the reasons forwarded by

these professionals could be overcome by providing small-scale farmers with adequate technical skills and credit facility. Thus, through well-organised all-round assistance, it could be possible to make small-scale farmers competent seed producers.

4.11.3 Opinions of professionals on sustainability of SHSP

Sustainability of smallholder seed production is important to ensure reliable and long lasting seed supply to small-scale farmers. In this regard, the professionals noted that sustainability of smallholder seed production needs well organised and integrated support of organisations involved in SHSP. According to the majority (92.0%) of them, the most important factor that should be considered for sustainability of SHSP is reliable markets with attractive price which allows farmers to generate better income from seed sales to build their financial base that will lead them to produce the seed on their own (Table 32).

The second point stressed by the professionals is provision of credit; small-scale farmers have no capacity to purchase agricultural inputs for seed production since this needs high capital compared to other farm activities and which is not affordable by farmers. Therefore they need credit to fill this financial gap to make them capable of buying agricultural inputs. Farmers must also be trained to make them well

equipped in managing the seed production techniques and SHSP needs close supervision and technical assistance.

Table 32: Suggestions of professionals for sustainablity of SHSP (n = 25)

Suggestion	number	percent
Creating efficient market for produced seeds	20	92.0
Facilitate credit service for agricultural inputs	15	60.0
They have to be well trained to equip with technical skills	10	40.0
Giving continuous technical support	8	32.0
Farmers should be willing to produce seeds	3	12.0
There should be compensation for crop failure	1	4.0
Seed producers should be organised in groups	1	4.0
Create link with seed producers as contract growers	1	4.0

4.11.4 Limitations of smallholder seed production

In this study, the professionals indicated a lot of limitations of smallholder seed production which were also mentioned by farmers. Lack of reliable market, land shortage, lack of efficient credit service, lack of knowledge and skills, shortage of basic seeds, especially for pulses, poor quality seed, unreliable weather (unseasonal rain), high prices of agricultural inputs while the price of agricultural products is low, poor credit recovery and lack of seed associations are mentioned as important limitations of SHSP (Table 33).

Table 33: Limitations of smallholder seed production mentioned by professionals (n = 25)

Limitations	number	percent
Lack of reliable market to the produced seeds	16	64.0
Lack of efficient credit	11	44.0
Small and fragmented landholding	11	44.0
Lack of knowledge and technical skills	10	40.0
Shortage of seeds (basic) especially for pulses	7	28.0
Lack of infrastructure (store, transport, etc.)	6	24.0
Low quality of seed produced by smallholder farmers	4	16.0
Bad weather condition (unseasonal rain)	4	16.0
Inadequate extension service	4	16.0
High price of agricultural inputs	3	12.0
Lack of seed associations (co-operatives)	2	8.0
Poor credit recovery	2	8.0

Generally, the majority of the professionals accepted the idea of SHSP to be attainable. The views of professionals indicate that smallholder farmers could produce seeds for both cross-pollinated crops and self-pollinated crops. According to professionals' view, smallholder farmers can easily manage the seed production techniques for self-pollinated and open-pollinated varieties. On the other hand, the seed production for cross-pollinated crops needs high technical skills, which may not be managed by smallholder farmers. Because of this, 60.0% of the professionals noted that smallholder farmers could not maintain the required quality seed for cross-pollinated crops. Thus, 88.0% of the professionals, rather advised that smallholder farmers to get into seed production of open-pollinated varieties and 56.0% of them have the

opinion that quality conscious seed professionals would not let farmers to produce cross-pollinated crops (Table 34).

Table 34: Attitudes of professionals towards smallholder seed production

Items	Agree number	%	Undecided number	%	Disagree number	%
Producing certified seeds for cross-pollinated crops by smallholder farmers is a dream	10	40	2	8	13	52
Producing certified seeds for open pollinated varieties by smallholder farmers is a dream	5	20	1	4	13	76
Seed production for cross-pollinated crops is an exclusive domain of large scale farmers	12	48	3	12	10	40
Seed production for open pollinated varieties is an exclusive domain of large scale farmers	1	8	2	8	21	84
Smallholder farmers can specialise in seed production	17	68	3	12	5	20
smallholder farmers should limit themselves in producing open pollinated varieties	13	52	4	16	8	32
Smallholder farmers can properly operate seed production techniques	13	52	4	16	8	32
SHSP could be threat for formal seed organisations	6	24	2	8	17	68
Market will not be a problem so long as quality seed is produced	5	20	1	4	19	76
SHSP couldn't be sustainable without financial and other supports of government or other organisations	22	88	2	8	1	4
Quality conscious seed professionals will not let smallholder farmers to produce open pollinated varieties	6	24	3	12	16	64

Table 34 cont'd

Quality conscious seed professionals will not let smallholder farmers to produce cross-pollinated crops	14	56	4	16	7	28
Smallholder farmers should be encouraged to get into the seed production of open pollinated varieties	22	88	2	8	1	4
Smallholder farmers should be encouraged to get into the seed production of cross-pollinated crops	11	44	3	12	11	44

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

The overall objectives of this study were to examine the production mechanisms, opportunities and limitations of smallholder seed production. This chapter gives brief summary of the conclusions and recommendations derived from the findings of this study. The conclusions and recommendations are presented according to the stud, objectives.

5.2 Conclusions

The following general conclusions are made based on the findings of the study.

1. SHSP has the potential to alleviate the shortage of improved seeds by producing and increasing the accessibility of seeds at affordable price to small-scale farmers who have less access, and it enables them to increase crop production. It also seems a good means to smallholder seed producers for generating income from seed sales.

2. Most of the seed production mechanisms of SHSP are being done by Bureau of Agriculture and its subordinate offices. This has created a big workload for extension workers particularly DAs. and the time used for these non-extension activities has had a negative impact on the extension service. Other organisations. which could play a role in SHSP have not yet been actively involved.

3. Even though some seed producers lack knowledge and technical skills of seed production, the majority of them confirmed their knowledge and technical ability to produce improved seed. However, the seed quality problem mentioned by the majority of other farmers indicates that seed producers still need to be equipped with the necessary technical skills to produce better quality seed.

4. Regarding financial sustainability, the study results show that almost all farmers involved in seed production business are totally dependent on the credit given by the project. Therefore, from the study results it can be concluded that SHSP is financially unsustainable in the current situation.

5. There is no integrated approach to make smallholder seed production organisationally sustainable when the project is terminated. Moreover,

seed producers do not have their own organisation that can create a bas- for organisational sustainability for seed production business during the project life and after the project withdrawal.

6. Generally, both seed producers and non-seed producers have positive attitudes on the benefit of SHSP. Non-seed producers noted that the seed produced by smallholder farmers gives higher yield compared to their traditional seed and more easily accessible to them at affordable price. However, according to the opinion of non-seed producers, SHSP has the problems of lower seed quality due to contamination of seeds with weeds which was considered as the major problem by the users.

7. The majority of professionals have positive attitudes toward SHSP. They consider SHSP as a potential approach to solve the problem of seed shortage, but the majority of them advised farmers to engage in seed production of open-pollinated varieties as the seed production of cross-pollinated crops needs high technical skills and intensive management which could be difficult for subsistence farmers.

5.3 Recommendations

This section gives recommendations derived from the study conclusions in order to improve and meet the sustainability of SHSP.

a) Recommendations with regard to seed production mechanisms:

i) Organisations involved in SHSP have to realise the problem of seed quality and take necessary action to improve the quality to satisfy the interest of users through identifying the sources of seed quality problems and acting accordingly. Moreover, intensive field inspection and laboratory tests must be conducted to assure farmers of quality seed. Other professionals of external organisations should also do the certification of seed rather than doing it by regional agriculture bureau staff who are also involved in the production mechanisms of SHSP.

ii) To ensure good marketing and better distribution, the following points should be considered and implemented accordingly.

-Determining effective demand of improved seeds for the district by DAs through consulting directly the farmers in their respective working areas or using different techniques. Eventually, based on the effective demand, determine how much and what type of seeds to produce and limiting the number of farmers who can actually produce the required amount of seeds by selecting those who are technically efficient, interested and devoted to producing quality seed.

- Creating strong linkages between ESE and seed producers that lead to contractual agreement between the two parties that can create a good condition for improving marketing and distribution of seeds and also for provision of basic seeds. technical assistance. field inspection and quality control by ESE professionals.
- Encouraging private organisations and co-operative societies to engage in seed marketing and distribution under close supervision and support of responsible body.
- Giving considerable attention for producing high value crops (pulses and oil seeds). and forage seeds which can have demand if the promotional work is also done hand in hand with seed production.
- Finding ways for disposing the excess supply of seeds from one distric. to seed-shortage areas by implementing efficient seed quality control that can assure farmers of good quality seeds.
- Strengthening the extension service to promote the improved varieties produced by smallholder farmers, and facilitate the credit service to improve the purchasing power of resource-poor farmers.

b) Recommendations on reinforcing the knowledge and technical skills of seed producers:

The DAs together with seed producers should identify what knowledge and skills they lack and organise seminars, practical skill training, and

study tours to enable them get equipped with the necessary seed production techniques. Moreover, DAs should visit, closely supervise and give technical assistance to those who need their help. To perform these activities effectively, the number of seed producers should be limited to a manageable size so that DAs can properly supervise and give technical assistance. Strengthening field days to let seed producer and non-seed producer farmers share experience and exchange views should also be given due emphasis.

c) Recommendations on financial sustainability:

To ensure financial sustainability of SHSP, care has to be taken starting from farmers' selection. The farmers who are supposed to engage in seed production, in the first place, could be interested and ready to devote their money, labour, and skills for the achievement of better quality seed production. The system of credit provision should also be arranged in a way that leads farmers to finance the seed production activity on their own in a stepwise process.

d) Recommendations on organisational sustainabilty:

Different organisations that can contribute for the achievement of SHSP should get involved in, and create strong linkages for organisational sustainability of the program. Government, non-government, private and farmers' organisations should collaborate and integrate their efforts for

effective implementation of SHSP. Especially, research institutions should be able to generate new varieties based on the needs and problems of the farmers and supply basic seed for the seed producers. The activities performed by bureau of agriculture such as provision of credit service and farm inputs could be handled by the concerned financial institutions and input suppliers. Promoting the existing farmers' co-operatives to engage in provision of inputs and marketing of seeds produced by smallholder farmers is a basis for organisational sustainability of SHSP. Moreover, the seed producers should be encouraged to establish their own seed associations to have the organisational basis for tackling the problems they are facing.

e) Recommendations on attitudes towards smallholder seed production: To change the negative attitudes of non-seed producers on the quality of seeds, necessary action should be taken to improved seed quality and the promotional work on new seed varieties should also be strengthened to make them acquainted with the new varieties produced by smallholder farmers. Organising field days for non-seed producers could play a substantial role in creating awareness and sharing experiences with seed producers.

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APPENDICES

Appendix I

Interview schedule for seed producer and non-seed producer farmers

Section I:- Demographic information

1. Name of respondent _____

2. Age in year _____ 3. Sex:- male ____ Female ____ 4. Family size _____

5. village _____ district _____ zone _____

6. Marital status

a). Married c). Widowed

b). Never married d). Divorced

7. What is your level of education ?

a) Not reading and writing (illiterate) b) Reading and writing (literate)

c) Primary school e). d) Secondary school

Section II.:- Background information

1. What are your primary income sources ?

a). Crop production b). Livestock production c). Mixed farming

d). Self-employment e). Paid employment

2. What are your secondary income sources ?

a). Off -farm activity b) Crafts c) Others (specify) _____

3. What crops do you grow and for what purpose ? (tick)

	P U R P O S E S		
Crop Type	Food	Cash	For Both

4. How many hectares do you have ?

a). Below 0.5 hectare d) 1.5 - 2 hectares

b). 0.5 - 1 hectare e) Above two hectares

c) 1 - 1.5 hectare

5. How many oxen do you have ?

a). No ox b). One ox c). Two oxen d). Three and above

6. Have you ever involved in extension program ? a) yes ___ b) no ___

III. Information on smallholder seed production practices

1. Are you a seed producer ? yes _____ no _____

(If the answer is no skip to section vi).

2. What is/are your major objective/s of producing improved seeds ?

a) To get better income b) To use own seed

c) Both of them d) For other purpose (specify)

3. When did you start producing improved seeds ? (year started) _____

4. Are you now producing improved seed ? a) yes ____ b) no ___

5. If yes, in question 4, for how many years ? _____

6. If no, in question 4, why ?

a) Lack of attractive market

b) I have no profit from seed sales for the last season

c) Lack of credit

d) Lack of agricultural input supply

7. How did you get farmland for seed production ?

a) Own land b) Rented c) Share cropping d) gift

8. What varieties of improved seed did you produce in the last two seasons?

CROPS	Improved Varieties Produced	
	First season	Second season

9. What is your source of farm power ?

a) Hand hoe b) Own ox c) Hired ox d) Hired tractor

10. What is your source of labour?

a) Family labour b) Hired labour c) Relative labour d) other (specify)__

11. From where did you get the seed materials for seed production ?

a) From seed producers b) From NGOs c) From extension worker

d) From project e) From relatives

12. Who initiated you to produce seed ?

a) Myself b) Neighbour c) Development agent

d) Relatives e) others (specify) _____

13. How many hectares of seed did you grow ?

Year	Crop in Hectare				
	wheat	teff	maize	potato	pulses
Last year					
This year					

14. Have you observed any difference between seed and grain crop production practices? a) yes _____ b) no _____

15. If yes, what are the differences?

a) _____

b) _____

c) _____

16. Do you manage to operate the seed production techniques by yourself?

a) yes ___ b) no ___

17. If no, for which crop/s ? a) _____ b) _____ c) _____ d) _____

18. What knowledge and technical skills do you lack ?

a) land preparation b) spacing

c) timely weeding d) rouging e) others (specify)

19. Who taught you seed production practices ?

a) Neighbour b) Extension workers c) Others (specify) _____

20. Do you produce seeds in group or individually ?

a) Individually b) In group

21. What are the specific tasks of the group ?

a) Co-ordinate timely supply of inputs

b) Facilitate credit to the group members

c) Co-ordinate group work to solve labour shortage

d) Facilitate marketing of produced seed

22 What advantages do you get by producing in group ?

a) Labour supply b) Create easy access to credit and input supply

c) Search for attractive market d) Other (specify) _____

23. If it is individually, do you have an intention to produce in group ?

a) yes __ b) no __

24. Please, explain in either case.

a) _____

b) _____

25. What kind of assistance did you get from the following organisations in connection with improved seed production ?

Organisation	credit	input supply	Training	Technical assistance	Marketing	Storage	Processing

26. Do you like to continue or specialise in producing improved seed ? a) yes b) no

27. If the answer in question 30 is no. why ?

a) It is not profitable b)It is labour intensive so that I can't afford it

c) I can't manage the production techniques d) Others (specify) _____

28. If the answer in question 30 is yes. why ?

a) It is profitable b) I want to be a seed producer

c) I can have my own seed d) Others (specify)

29. What are the most important and general constraints you faced in seed production? (put them in order of priority) ?

a) _____

b) _____

c) _____

Section IV. Information on credit and input purchase

1. Under what terms do you get inputs ? (Tick)

Input obtained	Inputs			
	Seed	Fertilizer	Pesticide	Herbicide
On credit				
Bought using own money				
Through barter system				
As a gift (grant)				

2. If it is on credit. what is the term of credit ? (Tick)

Types of Inputs	terms of credit	
	In kind	In cash
Seed		
Fertilizer		
Pesticide		
Herbicide		

3. If it a gift, from who did you get the input ?

Inputs offered	Offered by
Seed	
Fertilizer	
Pesticide	
Herbicide	

4. If you have got inputs on credit, have you paid back the credit ? a) yes b) no

5. If no, what are the reasons for not paying the credit ?

a) _____
b) _____
c) _____

6. If credit service stopped, how do you continue producing seeds ?

a) I will produce using own money.

b) I will find another means to get credit and produce seed.

c) I will not have the capacity to continue seed production.

Section V.:- Information on seed processing, storage and marketing

1. How do you ensure that you are producing seeds of the required quality ?

a) _____
b) _____
c) _____

2. What kind of seed do you sell ? a) Clean seed b) Raw seed

3. If it is clean seed, did you process (clean) the seed yourself ? a) yes ___ b) no __

4. If yes, how do you process (clean) your seed?

a) Manually (human labour) b) By machine

6. To whom do you sell your seeds (either raw or clean) ?

a) To public seed organisation b) To private seed organisation

c) Seed traders d) To farmers e) To co-operatives

7. How do you manage to dispose your seed which is not sold ?

a) I give freely to relatives b) I used as grain for home consumption

c) I sell it as grain in the market d) exchange/ bartering

e) other means (specify) _____

9. What is the mode of payment for the seeds you sell ?

a) cash b) credit

10. How do you use the money obtained from selling seeds ? Please, put them in order of priority:-

a) _____

b) _____

c) _____

d) _____

11. Do you keep cost records of seed production?

a) yes _____ b) no _____

12. Can you, please, estimate the cost of producing seeds for the last season ?

Crop type	Total Cost	
	Half hectare	One hectare

13. Did you get any profit after selling seeds you have produced last season ?

a) yes _____ b)no _____

14. What problems do you face in seed marketing? (put them in order of priority) ?

a) _____

b) _____

c) _____

15. How do you store your seeds ?

a) Local storage structure (storage bin) c) Service co-operatives stores

b) Sacks d) Other means _____

26. What problems do you face in storing seeds ?

a) _____

b) _____

c) _____

Section VI.:- Attitude Measurement

The purpose of this section is to know views of seed producer and non-seed producers farmers on smallholder improved seed production.

"SA" stands for 'Strongly Agree'. "A" stands for 'Agree'. "UD" stands for 'Undecided. "DA" stands for 'Disagree'. and "SDA" stands for 'Strongly Disagree'.

Statements	SA	A	UD	DA	SDA
SHSP helps to get better income as compared to other farm activities.					
One needs more effort in SHSP than normal farm activities.					
Farmers involved in SHSP don't get benefit from it.					
SHSP is a complex farm activity and could not be managed by smallholder farmers like us.					
I am proud to be improved seed producer.					
SHSP also gives benefit to small farmers who buy improved seeds produced by farmers and use it.					
SHSP is not different from other normal farm activities.					
I would substitute with other farm activities preferably cash crops.					
I can produce the required quality improved seed.					
SHSP is not possible without the support of government and/or other organisations.					
I would advise my friends to be producers of improved seed.					
Producing improved seed has attractive market as compared to other crop production.					
I will strengthen and continue producing improved seed in the future.					
It is possible to specialise in producing improved seed so I would like to specialise in seed production.					
Producing seed in group is better compared to individual basis.					
Producing seed in individual basis is better than group basis.					
Low price is the only advantage of seeds produced by smallholder farmers.					
Improved seeds of SHSP are yielding higher than our traditional seeds.					
Seed quality is the main problem of SHSP.					
I initiated to buy seeds produced by small farmers because I see their stand on the field.					
I would rather use seed produced by professional even though the price is higher than of seeds of smallholder farmers.					
There is quality difference between the seeds produced by smallholder farmers and other large -scale producers.					
I will rather use seed produced by smallholder farmers because I can't afford price of seeds produced by professional seed producers.					
I used seeds of SHSP and I didn't face seed quality problem					
I used seeds of SHSP and I faced seed quality problem.					
The seed of amallholder farmers is not different from my traditional seed.					
Seeds produced by SHSP are easily accessible compared to ESE seeds.					

Section VII.:- Information from other farmers on smallholder seed production.

1. Do you know about the seed produced by smallholder farmers ? a) yes b) no

2. Would you like to be seed producer ? a) yes _____ b) no _____

3. If no. why would you not like to be a seed producer ?

a) It is not profitable b) It is not manageable (It needs special skills)

c) It is labour and capital intensive d) I have no interest to be a seed producer

4. If yes. why are you not involved in seed production ?

a) I have no access to credit for input purchase

b) I have no enough land for seed production

c) I have not been selected by the development agent

5. Why would like to be a seed producer ?

a) To improve my income b)To use own seed

c)To specialise in seed production

8. Did you buy the improved seeds produced by farmers ? a) yes __ b) no __

9. If no. why?

a) It is poor quality b) The price is higher

c) I prefer to use my own seed

d) I prefer to use the seed produced by commercial seed producers.

10. If yes. Why ?

a) It provides better yield as compared to local seed

b) The price is lower than commercial seed

c) It is easily accessible to me.

d) Others reason (specify).

11. From whom did you buy the seeds ?

a) From public seed sector b) From private seed sector

c) I used my own local seed c) I exchanged from my neighbour

e) I bought from market f) others (specify) _____

12 Did you observe differences between improved seeds produced by farmers and other formal seed sectors ?

13. If it is yes. in question 12. what differences did you observe ?

a)_____

b) _____

c) _____

14. Did you observe any difference between the seeds produced by farmers and ESE ?

a) yes _____ b) no _____

15. If yes. in question 14. what differences did you observe?

a) _____

b) _____

c) _____

16. In terms of price. how do you see the prices of improved seeds produced by farmers as compared to the seed of other formal seed producers ?

a) Higher than the public and private producers b) The same

c) lower than the public and private producers ____

17. In terms of quality. is there difference between the seeds produced by smallholder farmers and other organisations ? a) yes _____ b) no _____

18. If yes. what differences did you see ?

a) _____

b) _____

c) _____

19. Which one is easily accessible to you?

a) Improved seeds produced by farmers

b) Seeds produced by private sectors

c) Seeds produced by public sector

20. For how many years do you use one seed without changing it ?

a) One year b) Two years

c) Three years d) Four years and above

21. Do you think the improved seeds produced by small farmers are accepted and used by the beneficiaries? a) yes _____ b) no _____

22. If no why ?

a) It is poor quality

b) The price is not affordable

c) They prefer to their own seed (traditional seed)

d) They prefer to use seeds of commercial producers

e) No information on seed produced by smallholder farmers

Appendix II

Questionnaire for leaders/heads, professionals and development agents

Section I. Demographic data.

1. Name of respondent _____

2. Name of the organisation _____

3. Duty station _____

4. Sex:- male _____ Female ____ 5. Age in years _____

6. Educational level

   a) Certificate ___ c) B.Sc. _____ e) MSc _____

   b) Diploma ____ d) Ph.D. _____ f) Other (specify) _____

7. Job title _____

Section II. Information on smallholder farmer's seed production.

1. Is your organisation involved in smallholder farmer's seed production

   a) yes ____ b) no _____

2. If yes, in question 1, how is your organisation involved in smallholder farmers seed production ?

   _____

   _____

   _____

3. If no, in question 1, why ?

   _____

   _____

4. What are the advantages of smallholder seed production ?

_____

_____

_____

5. Why did your organisation/project get involved in smallholder seed production ?

_____

_____

6. What views do you have towards the production of certified seed by smallholder farmers ?

_____

_____

_____

7. Do you think farmers can produce the required quality seed? a) yes __ b) no __

8. Please, explain either case

_____

_____

_____

10. Can farmers be seed inspectors? a) yes ____ b) no ____

11. Explain in either case

_____

_____

_____

12. Do you think smallholder seed production will be sustainable?. a) yes ___b) no __

13. If yes, in question 12, how and under what circumstances can it be sustainable ?

_____

_____

_____

14. If no. question 12. why can't it be sustainable ? (What factors influence its sustainability ?)

_____

_____

_____

15. What institutional support/collaboration is needed for smallholder farmer's seed production to be sustainable ?

_____

_____

_____

16 What are the limitations of smallholder farmer's seed production ?

_____

_____

_____

17. How could the limitations be overcome ?

_____

_____

_____

18. Is smallholder seed production system competing or complementing the formal seed production system ?

a) yes _____ b) no _____

19 If the answer in question 18 is competing, how ?

_____

_____

_____

8. How farmers dispose their seeds?

_____

_____

_____

_____

Section IV.:- .Attitude Measurement

The purpose of this section is to know the leaders/heads, professionals and development agent's views on smallholder improved seed production.

"SA" stands for 'Strongly Agree', "A" stands for 'Agree', "UD" stands for 'Undecided, "DA" stands for 'Disagree', and "SDA" stands for 'Strongly Disagree'.

Statements	SA	A	UD	DA	SDA
Producing certified seeds for cross-pollinated crops by smallholder farmers is a dream					
Producing certified seeds for open-pollinated varieties by smallholder farmers is a dream					
The quality of seeds for open-pollinated varieties is compromised					
The quality of seeds for cross-pollinated crops is compromised					
The idea SHIPS for open-pollinated varieties is unattainable					
The idea SHSP for cross-pollinated crops unattainable					
Seed production for cross-pollinated crops is an exclusive domain of large scale farmers					
Seed production for open-pollinated varieties is an exclusive domain of large scale farmers					
Smallholder farmers can specialise in seed production					
smallholder farmers should limit themselves in producing open-pollinated varieties					
Smallholder farmers can properly operate seed production techniques					
SHSP could sustainable without the support of other organisations					
SHSP could be threat for formal seed organisations					
Market will not be a problem so long as quality seed is produced					
SHSP couldn't be sustainable without financial support of government or other organisations					
Quality conscious seed professionals will not let smallholder farmers to produce open-pollinated varieties					
Quality conscious seed professionals will not let smallholder farmers to produce cross-pollinated crops					
Smallholder farmers should be encouraged to get into the seed production of open-pollinated varieties					
Smallholder farmers should be encouraged to get into the seed production of cross-pollinated crops					
If credit is not available, SHSP program will not be achievable					

Appendix III

i) Checklists for ESE manager. co-operative experts

1) What linkage does your organisation have with SHSP ?

2) Do you have an intention to make smallholder seed producers your contract growers? (for ESE)

3) What are the efforts made by co-operative office to solve the problem of market for seed produced by smallholder farmers?

4) What do you suggest for the sustainability of SHSP and what could be the role of your organisation in this regard?

ii) Checklists for farmer groups

1) What are the differences between seed and grain?

2) How do you select quality seed?

3) What criteria do you consider to buy a quality seed?

4) How do you produce your traditional seeds?

5) What advantages did you get from SHSP in you locality?

6) How do you compare seeds produced by smallholder farmers with ESE and your traditional seeds in terms of quality and yield potential?

iii) Checklists for executive members of primary co-operatives

1) What are the advantages of SHSP?

2) What are the contributions of your co-operative to successful implementation of SHSP?

3) What problems did seed producers encounter?

4) What efforts made by your co-operative to solve the problems?