Issues in Big Onion Seed Production and Marketing

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FOREWORD

Seeds are more important inputs in all plant based agricultural systems. They determine the upper limit of yield potential. Fertilizer, pesticide and irrigation will provide a good crop only if the plant growing in the field is capable of using these inputs effectively. Agricultural policies aimed at achieving food security must emphasize seed supply strategies that will ensure the availability of quality seed of locally adapted varieties for the farmers on a timely and affordable fashion. Identifying this, the Mahinda Chinthana "Vision for the Future" policy document of the present government has emphasized the need for providing good quality seed to increase the productivity of other field crop sector in Sri Lanka.

The present study is an attempt to identify the issues in production and marketing of big onion seed in Sri Lanka. Commercial cultivation of big onion in Sri Lanka started in early 1980's and the cultivation extent increased with annual fluctuations. It has been popular among the farmers due to high profitability and high return that can be earned in the short run. The total seed supply of big onion comprise of local production as well as imports.

This research was undertaken in Malale and Anuradhapura districts where the big onion seed production takes place. The study reveals that there is a high demand for locally produced big onion seed due to its high quality compared with the imported seed. Hence, there is a considerable potential to expand the production of big onion seed to achieve self sufficiency level.

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Lalith Kantha Jayasekara
Director

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EXECUTIVE SUMMARY

Commercial cultivation of big onion in Sri Lanka accelerated in early 1980's and the cultivation extent increased with annual fluctuations. Though, it has been popular among the farmers, scarcity of quality seeds is a major bottleneck in promoting domestic production. The total seed supply of big onion comprises local production as well as imports. The local seed supply is estimated at 40 percent of the total seed requirement. In this context, it is time to increase local seeds production. Though, the local seed production programme of big onion seeds has continued since 1990s, its progress is not at a satisfactory level. Hence, this study was undertaken to identify the structure of production and marketing of big onion seeds and to review the problems and constraints faced by the farmers in producing big onion seeds.

Three interrelated data collection mechanisms such as literature review, key informant discussions and questionnaire survey were used to collect information for the study. The study covered 212 farmers randomly selected from the major big onion seed producing areas in Galewela, Dambulla and Kimbissa of Matale district and Ipalogama and Maradankadawala areas of Anuradhapura district.

The study reveals that there are high risks in production of big onion seeds; hence farmers have a tendency of cultivating small plots. Survey found that 58 percent of sample farmers have produced less than 5kg of big onion seeds. Cultivation in *Yala* is more profitable than in Maha, but the storage of mother bulbs until *Yala* is a major problem in the area. Only 30 percent of farmers have proper storage facilities for mother bulbs while the rest have used conventional methods such as hanging or spreading on floor. Most of the farmers (67 percent) used their own mother bulbs for seed production. 55 percent farmers who had excess production of seed sold their production directly to the other farmers within or outside the area. Only 10 percent of seed producers have registered under the Seed Act. There is a high demand for local true seed and its price is five times higher than that of the imported seeds. Few private companies are engaged in big onion seed production and the major problem they face is lack of foundation seeds of recommended varieties and shortage of skilled labour.

To increase the big onion seed production, the study recommends giving more training to farmers on pest and disease control to increase big onion seed production as well as to reduce the cost of production. Proper mechanism of providing technology transformation should be established. Formation of farmers groups may help Agricultural officers to conduct training programs rather than going to individual farmers. Priority should be given to farmers who are willing to produce big onion true seeds on a large scale and they should be given more facilities for storage of mother bulbs and inputs to increase the seed production. Proper production programmes should be developed to produce basic seeds to meet the demand of private sector. It is recommended to explore the possibilities of establishment of cold rooms to store harvested seeds until the cultivation season of big onion, especially for the seeds produced in the *yala* season. It is essential to make farmers aware on packaging of seeds using proper packaging material before issuing to

the market. Annual government subsidy programmes should be adjusted to meet the farmers needs in time. Research programmes should be directed to explore the possibilities of producing big onion seeds in other areas such as Monaragala, Polonnaruwa, Vavuniya, Ampara and Mulative districts. Certification process of farmer produced seeds (informal sector) should be strengthened to ensure farmers access to good quality seeds. Seed testing points can be established at regional level to facilitate farmers to obtain certification of their product within a short period of time.

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CHAPTER ONE

Introduction

1.1 Background

Agriculture continued to play a significant role in the Sri Lankan economy, employing 32.6 percent of the employed work force and contributing 12 percent to the Gross Domestic Production (GDP) in 2011(CBSL,2011). Today the agricultural sector faces a different set of challenges. Nearly 70 percent of the farm families' cultivated holdings which are less than 0.8 hectare in extent. The per capita land availability is decreasing, while the food requirements are increasing. More food has to be produced with less land, water and other natural resources. The other challenge is to achieve development objectives without degrading the natural resource base. Low productivity and low price for farm products have also caused a reduction of the real income of the farm family.

Productivity at farm level mainly depends on the quality of inputs used by the farmers. Seeds are more important inputs in all plant based agricultural systems. They determine the upper limit of yield potential. Fertilizer, pesticide and irrigation will provide a good crop only if the plant growing in the field is capable of using these inputs effectively. Agricultural policies aimed at achieving food security must emphasize seed supply strategies that will ensure the availability of quality seed of locally adapted varieties for the farmers on a timely and affordable fashion (FAO, 2000)

Having identified the importance of this sector, successive governments since independence have paid special attention to this sub sector. Until mid 1980s, the public sector had the monopoly over the seed industry in Sri Lanka. An organized seed production and distribution programme was initiated by the Department of Agriculture (DOA) after selection and breeding of improved paddy varieties in the late 1950s. In between 1960 to 1980, the industry matured within the state sector and in late 1970s, the National Seed Certification Service began functioning. Improved seed for all food crops was produced, imported and marketed exclusively by the DOA until 1984, when the first step towards privatization was taken. Private sector was allowed importing and marketing of exotic vegetable seeds at that point. Until then, the highly subsidized seed prices, poor access to improved basic seeds and technology and a restrictive policy stifled any initiatives by the private sector to enter the seed industry.

In 1993, the Government sold off three seed farms and a committee comprising public and private sector was established to review the system of importing seeds. This committee was also later made responsible reviewing the seed prices of the Government, and the price increase over time.

In 1996, the Government approved the National Seed Policy, which sought to increase the role of the private sector in development, production and marketing, while reducing the role of the state primarily to regulation. In 1998 and 2000 respectively, another two seed farms were privatized. The Government produced only foundation seeds, which

were then issued to private growers for production and marketing. The majority of seeds used for paddy is actually retained by farmers themselves from their own crop. The Plant Protection Act, which envisaged a slackening of restrictions on the import of seeds, was approved by the Parliament in 1999.

In 2003, the National Seed Act was also passed. It requires any person placing seed material in the market to be registered. It also should be certified. The National Seed Council comprising public and private sectors was formally established in 2008 under the Seed Act No. 22 of 2003 to formulate and oversee the standards and procedures and recommend prices among other matters.

Seed production and marketing is very important and it should aim to satisfy the farmers' demand for reliable supply of a range of improved seed varieties of assured quality for an acceptable price. Effective demand is the amount of seeds that farmers will purchase from suppliers, such as seed dealers. However the availability of good quality seeds on time at an affordable price and in sufficient quantity continues to be a problem in Sri Lanka. At the beginning of every cultivation season farmers complain that they cannot get good quality seeds on time at an affordable price. It's highlighted in big onion cultivation as well.

Big onion is an important component of the daily diet in Sri Lanka creating a relatively constant year round consumer demand. Commercial cultivation of big onion in Sri Lanka accelerated in early 1980's and the cultivation extent increased with annual fluctuations. It has been popular among the farmers due to high profitability and high return that can be earned in the short run. Big onion is mainly cultivated in Matale and Anuradhapura districts and the total extent under big onion was 4,623 ha in the year 2009 with 78,029 mt of production. In 2009, Sri Lanka imported about 147,429 mt of big onion by expending about Rs.4,718 mn. Government trade policy tries to put a floor under prices to protect local farmers during harvesting season and then allow imports during the rest of the year to keep prices from rising too high for consumers.

According to the FOA statistics the average yield of big onion in the last five years(2006-2010) was 11.17 mt/ha and the country is behind compared with the average yield of other regional countries like India (15.52 mt/ha) and Pakistan(13.52 mt/ha). *Nasic red, Dambulu red, Pusa red* and *Rampoor* are the popular big onion varieties cultivated in Sri Lanka.

The total seed supply of big onion comprised of local production as well as imports. The local seed supply is estimated at 40 percent of the total seed requirement. The Government sector (DOA, PDOA, Mahaweli Authority) as well as a few private companies have initiated various programmes to increase the production of big onion seed in Matale and Anuradhapura districts and Mahaweli system H. Big onion seed can be imported with the permission of the Department of Agriculture (DOA) and few private companies are engaged in seed imports. Targeting the *Yala* season of 2010, a quantity of 39,710 kg of big onion seed has been imported. Marketing of big onion seed is totally handled by the private sector and Dambulla is the focal point of distribution of seed.

Rupasena(2009) revealed that 86 percent of the farmers in Dambulla area purchase seeds from the private sector, while 10 percent use their own seeds for cultivation.

1.2 Problem

Quality seed is one of the primary requirements for increasing productivity at farm level. Farmers' access to quality seed can be guaranteed only, if there is a viable seed supply system to multiply and distribute the seeds. The effective demand for seed depends on factors such as the quality of the seeds, timeliness of supply and affordable price. Due to lack of good quality seeds at affordable price, the farmers tend to use low quality seeds or tubers either available in the market at a cheaper rate or produced by them over several generations using the same stock.

Though the recommended seed rate for big onion is 6.5-8.5kg/ha, the farmers use higher rates to get required number of seedlings. Main reason for this is that they doubt about germination capacity of market seeds. Over 30% of big onion farmers used almost double the recommendation due to germination experience gained from market seed (Lesly *et al*, 2002). Only 5 percent of big onion farmers in Dambulla area were highly satisfied with the quality of seeds they used (Rupasena, 2009). The end result would be inferior quality, poor yield and low income. Hence, the challenge of supplying good quality seeds for planting will remain as a major constraint for big onion production systems in Sri Lanka until an efficient viable mechanism is designed and introduced.

1.3 Objective of the Study

The overall objective of this study was to identify the structure of production and marketing of big onion seeds in Sri Lanka.

The specific objectives are;

1. To identify and review various distribution channels of big onion seeds in Sri Lanka.
2. To assess the present status of imported big onion seeds in Sri Lanka. and,
3. To identify the problems and constraints faced by farmers in producing big onion seeds.

1.4 Data Collection Method and Sampling Procedure

Three interrelated data collection mechanisms were used to elicit necessary information for the study. Firstly, existing literature on seed production and marketing in Sri Lanka were reviewed to understand the structure of big onion seed production and distribution mechanism. Secondly, key informant discussions were conducted with the officers of DOA, Provincial Departments of Agriculture and leading seed importing companies. Thirdly, a structured questionnaire survey was used to understand the problems and constraints faced by farmers in producing big onion seed.

Objective 1

Stakeholders from seed producer to the consumer were interviewed using an unstructured questionnaire to understand the seed distribution channel and their limitations. Special

attention was paid to the local big onion seed production programmes initiated by the public and private sector when gathering information.

Objective 2
Secondary data such as imported quantity, type of seed, prices and tax rates were used to assess the present status of imported big onion seed in Sri Lanka. Further information were collected by interviewing key officers of major seed importing companies as well as government officers who are responsible for implementing the Quarantine Regulations and certification of seed.

Objective 3
Questionnaire survey was conducted to identify the problems and constraints faced by farmers in producing big onion seed. Matale and Anuradhapura are the major big onion cultivating and seed producing districts in Sri Lanka. These two districts were selected for the questionnaire survey. A total of 212 seed producing farmers were selected for the questionnaire survey from the selected two districts. Based on the quantity of big onion seed production of previous five years, 70 percent out of the sample was selected from Matale district and 30 percent was selected from Anuradhapure district. Required number of seed producing farmers was selected randomly using the farmer registry of the Office of the Deputy Director of Agriculture at district level.

1.5 Study Locations

The study area covered the major big onion seed producing areas in both districts such as Galewela, Dambulla and Kimbissa from Matale district and Ipalogama and Maradankadawala from Anuradhapura district.

1.6 Data Analysis

Collected data was processed by using suitable analytical techniques and tested with statistical tools where necessary.

1.7 Time Frame

This survey was conducted from July to September in the year 2010.

1.8 Organization of the Report

This report consists of five chapters: Chapter one introduction, chapter two literature survey, chapter three socio economic characteristics of selected seed producers, chapter four analyzing factors affecting the true seed production and chapter five summary and recommendations.

CHAPTER TWO

Literature Review

The review of literature in this study was based on three components,

1. Seed industry in Asia
2. Seed policy in Sri Lanka
3. Big onion seed production in Sri Lanka

2.1 Seed Industry in Asia

Crop and livestock farming are the main agricultural activities of most small farmers in Asia. The availability of quality seeds of a wide range of varieties and crop is one of the major factors required to achieve food security. The potential benefits which accrue to farmers from the use of good quality seed of improved varieties include enhanced productivity, better adaption, tolerance to environmental stress, higher harvest index, reduced risks from pest and disease pressure, improved grain quality and higher profits. Seed is also the key to optimum use of natural resources and, according to its provenance and the breeding goal, seed determines the requirements for inputs such as pesticides, fertilizer and agricultural technology (FAO, 2000). Seeds are particularly important in farming systems since a significant contribution to productivity can often be gained solely from the seed used, independent of other purchased inputs. Thus, the genetic potential of seed largely dictates crop yields and the productivity of other agricultural inputs and cultural practices. To become self- sufficient in food Asia- Pacific farmers should have on-going access to quality seed in both normal and crisis situations. Countries in the region should, therefore, develop seed security policies to insure that seed of the right varieties is readily available, at an affordable price, in sufficient quantity at the appropriate planting time. In this regard, FAO initiated a Special Programme for Food Security in 1994. This programme, which is specifically designed to assist Low-Income Food Deficit Countries (LIFDCs) to increase and stabilize food production and productivity, has seed security as one of its principal strategies. The seed supply sector in the region is comprised of both formal and informal systems.

Assessing seed requirement and planning is primarily a government activity throughout Asia, often centrally controlled and executed through state ministries and organizations. Agricultural statistics are collected through a series of surveys and annual seed requirements are computed for each crop by using the average seeding rate for each crop. Based on the capabilities of the formal seed sector that produces improved seed, an achievable target for annual replacement is planned and entrusted to the seed producers. In many countries, this process seldom leads to accurate predictions. The reasons largely result from deficiencies in the process, which can be summarized as follows:

1. There is a discrepancy in the statistics collected and extrapolations are made in the absence of field surveys.
2. Government instruments tend to be too bureaucratic.

3. Poor processing and storage of seed, and lack of reliable transport and delivery systems.
4. Low level of farmer acceptance and adoption of new varieties due to agronomic, economic or social preference (FAO, 2000).

Seed supply systems depend on different components, such as research, extension, input supply services, distribution and marketing. The neglect of any one component in the seed development chain affects the entire seed supply system. Furthermore, changes in policies of one component may have adverse effects on the performance of the others and jeopardize the development of an emerging seed supply system.

2.2 Seed Supply Sector

The seed supply sector normally comprised of both formal and informal systems. The formal seed supply systems include public and private institutions engaged in breeding, seed multiplication, processing, quality control, seed certification and seed storage and distribution. The activities of the formal sector are limited to the major food crops and high-value cash crops. The informal seed supply systems comprised of indigenous strategies used by farmers to improve the quality, quantity and distribution of seed.

2.2.1 Formal Seed Supply Systems

The formal seed supply systems, comprising of public and private sector seed entities, are generally represented by all official or organized seed production and supply programmes. The formal seed supply systems in the region are carried out for the most part by the public sector through government or semi-autonomous institutions. These institutions have a certain degree of financial independence, although their operational activities are determined by official policy rather than by market forces. This seed supply system is mainly concerned with the production of cereal seed with less emphasis on other crops. Private companies are also involved in seed production and distribution, especially in Japan, Republic of Korea, Philippines, Sri Lanka, India and Malaysia. A few private companies with 100% local investors and indigenous expertise have also been established in India for the production of seed for the domestic market and for export. It is also common that seed supply systems are assisted by donor agencies in the region.

The status of the formal seed supply system in the region varies from country to country. Generally, the formal seed sector supplies 10% or less of seed requirements. For instance, at percent in Sri Lanka, only 7% of the total rice seed requirement is supplied by the formal seed sector although 97% of the total rice growing area is cropped with improved varieties. In Thailand, rice seed production is the most important activity of the formal seed sector but it supplies only 8% of the national requirements. In India, only about 10% of rice seed is distributed as certified seed, and in Myanmar the formal seed supply systems provided only 4.4% of rice seed required during the 1996-1997 season. Sri Lanka's formal seed sector supplies 5.8% of maize and 0.8% of groundnut seed requirement, and in Myanmar 5.1% of maize and 1% of groundnut seed is supplied by the formal sector. These statistics indicate that the informal seed supply systems are the major sources of seed for Asia- Pacific farmers. (FAO, 2000)

2.2.1.1 Seed Production Systems

Principles of seed production in the formal seed supply systems differ from country to country, but many of the present systems have similar principles. In general, multiplications of recommended varieties begin with the release of a variety. Pre-release multiplication is undertaken by research and state owned enterprises if a larger seed volume is required for widespread release. Breeders' seed, and/or foundation and basic seed are produced under research supervision in order to ensure genetic and physical purity. State farms and semi-autonomous seed companies would undertake the production of certified seed under the supervision of a seed certifying agency.

In some instances, especially in countries such as India, Bangladesh and Sri Lanka the public sector uses private seed companies or approved contract growers to produce certified seed. The seed that is purchased from growers after certification is processed, cleaned, packaged and stored by the public enterprises. This is a model that is recently becoming popular in many other Asian countries, especially when the volume of seed to be produced cannot be handled by the public sector alone. India reported that private seed companies and sometimes growers' cooperatives take active roles in seed production either from breeders' seed supplied by the public sector agencies or from their own varieties that have been approved by the national variety registration and release committee. Most of the vegetable seed and some cereals are produced in this manner in India. The private sector prefers to produce high value crops and hybrids as their investments are geared towards greater margins of profit. Unlike the public seed sectors which maintain buffer stocks of seed, the private sector tends to supply only sufficient seed to meet market demands. In a few countries such as Thailand, Republic of Korea and Japan, breeder's seed is directly supplied to reputable seed farmers who grow, process and market the seed on their own as 'commercial' seed or 'truthfully labeled' seed. Only the formal seed sector in a few countries such as Sri Lanka, Bangladesh, Nepal, Thailand, the Philippines, India, (China and DPRK have public sector organizations which undertake seed production of potato and have invested heavily in this crop. Some of these countries in Asia obtain their annual certified seed requirements of potato from European seed companies. Others purchase small quantities of basic seed and use this material in local multiplication programmes to produce their own certified and commercial seed. Yet others are assisted with pre-basic seed by the International Potato Center (CIP) on a regular basis to ensure virus- free material in the seed production programmes. In countries such as China, DPRK, Thailand and India, the formal seed sector is well equipped with tissue culture and virus cleaning facilities and is dependent on many multinational companies. (FAO, 2000)

2.2.1.2 Quality Control

Seed produced by the formal seed sector is required to go through several testing procedures in order to maintain quality. The investment to implement such procedures is important to give credibility to the product marketed. Seed legislation that stipulates quality standards for each crop need to be followed. Physical and genetic purity, isolation distances of seed lots to avoid pollen contamination in cross-pollinated crops, seed health,

vigor and germinability in the field and the seed laboratory are basic elements in a quality control programme. Countries such as China, India, and Nepal, Philippines the Republic of Korea, Sri Lanka, Japan, Taiwan and Thailand are members of the International Seed Testing Association (ISTA) and adhere to standard seed testing procedures. There is no seed legislation in force in Bhutan, Cambodia, Malaysia, the Philippines, Vietnam and Laos. These countries however, have their own internal quality control systems following ISTA guidelines. In many instances, seed certification procedures are applicable only to major staples while other crops are subjected to internal control testing procedures that vary in every country. (FAO,2000)

2.2.1.3 Seed Processing

The majority of countries in the region have processing facilities but many do not have sufficient capacities to meet full requirements. For example, in China, nearly half the seed is hand threshed and cleaned. Seed cleaning, transport to the processing units and distribution to peripheral units for storage increase seed production costs. In other countries, mobile processing units are used to reduce costs. In some countries, most of the seed production programmes are concentrated in areas close to processing plants to reduce cost. The contract growers usually pre-clean seed often by traditional methods before supplying it to processing centers. In Indonesia, Singapore, Malaysia, Sri Lanka, and Southern India the majority of crops mature at the same time in a given season, which puts pressure on the cleaning and processing system. This situation forces seed producing organizations in these countries to handle more than one crop. Due to lack of facilities and trained personnel, these countries register substantial losses each season. The coordination of seed multiplication, transport, processing, bagging, storage and marketing require enormous managerial and technical skill to maintain the quality throughout. (FAO,2000)

2.2.1.4 Seed Storage

Three levels of storage are used in the formal seed supply systems in Asia. There is short-term storage at processing plants and other processing points, medium-term storage between processing plants and marketing outlets and long term storage for seed security in the event of natural disasters and crop failures during certain years. In specific instances, the tropical climate does not provide the environment for the storage of vegetable seeds and air-conditioned storage is essential to maintain viability. These facilities are capital intensive and expensive to maintain. Air-conditioned storage also falls within the long-term storage category. In climates where low temperatures and low humidity is experienced, some countries such as China and India resort to open air storage for short periods when permanent storage facilities are insufficient. Durable seeds, such as cereals, are also stored in this manner without losing their viability provided the seed is well dried and protected from foreign materials and pests. India, Bangladesh, and Sri Lanka have recently invested in storage systems for their seed corporations and have better facilities similar to those found in countries of South East Asia and the Far East. Indonesia, Singapore, and Malaysia are countries with high humidity and seed degeneration is fast if humidity control measures are not adopted. In

order to protect strategic seed reserves, many countries resort to storage in regions where seeds can be well preserved at lower cost. Movement of large stocks of seed to disaster areas in times of need may require sophisticated transport equipment that could reach distribution points quickly. Long term storage, however, entails the additional cost of re-cleaning seed before distribution, as a certain percentage is lost in storage. At times of replacement, older seed stocks are sold to the consumer market to recover some of the costs. At the village level, some countries in Asia have developed inexpensive storage facilities for durable seeds, mostly cereals, in order to reduce storage costs. (FAO,2000)

2.2.1.5 Seed Distribution and Marketing

More than 90% of the farmers of Asia are either small-scale commercial farmers who sell their surplus production to the market, or subsistence farmers who grow crops for their own needs. Large commercial farms are few and dispersed within countries. This situation complicates the distribution and marketing of seeds and planting material. One of the major reasons why improved seed fails to reach farmers on time is the difficulty of distribution to remote areas. Seed marketing infrastructure is not developed to a sufficient level in most countries of tropical Asia. In others, attempts have been made to established peripheral distribution and marketing outlets at regional, district and town level and in cases where the communication network is satisfactory, seed is even distributed at village level. Several countries such as Thailand, Indonesia, the Philippines, Bangladesh, ROK, Pakistan and India have closer liaison with the private seed companies and seed merchants to distribute seed produced by the formal seed sector. This has reduced the heavy burden of movement of large seed stocks to distant markets. In countries such as Sri Lanka, Japan and Malaysia with extensive road networks and private sector seeds distributors, seed disposal and marketing systems are efficient. In addition, these countries also have agricultural service centers and cooperatives that also assist in the distribution and marketing of seed. The high crop coverage under improved varieties in these countries illustrates the efficacy of these systems. (FAO,2000)

2.2.1.6 Pricing Policies

Cost of seed sold to farmers depends to a large extent on government policies of each country. Seed marketed by the formal seed supply system is a value- added product, which takes into consideration many factors such as cost of production, multiplication, cleaning, processing, testing, packaging, storage, transport and other costs. Since these seed enterprises are predominantly state-owned organizations, full cost recovery cannot be built into seed prices. As, farmers cannot afford to pay full cost for the seed. Therefore, the price of seed has to be subsidized by the state. In Asia, seed prices also depend to some extent on the crop species and varieties, multiplication ratio, seed size and viability of the species and investments needed in handling. Profit motive is of less importance to a public organization but equitable distribution to a larger clientele as a service organization takes priority. Private seed companies in the formal sector often avoid the production of such politically sensitive crops for obvious reasons. By virtue of the fact that a company’s profits determine their survival, any crops which are subsidized are avoided, unless there is a subsidy paid to such companies for producing seed for the

public corporations under contract. In any event, the private sector often opts to produce seed of high value crops and hybrids to avoid pricing competition from heavily subsidized programmes.

2.2.2 Informal Seed Supply Systems

The informal seed supply systems are comprised of farmer-managed seed production and management systems 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 in the following season and farmer-to-farmer seed exchange networks (Cromwell, *et al*, 1992). There has been little or no government emphasis on the informal seed supply sector in Asia and little is known about its operation in the region. As a result, there is a dearth of documentation relating to the informal seed sector. FAO reports indicate that 85% of the global seed requirements come from the informal seed system, indicating its importance in world agriculture. (Jayasinghe,2004)

2.2.2.1 Seed Processing and Storage

Seed processing technologies used by Asian farmers vary within communities and from country to country. Farmers select seed on the basis of specific characteristics including plant and seed size, seed color, and maturity levels. Once good seed is identified and threshed, the level of moisture in the seeds is lowered by sun drying. Commonly seen across Asia are inverted bell-shaped silos with cone-shaped roofs, thatched with straw. In the case of semi-perishable seeds such as grain legumes that are generally large-seeded and lose effectiveness in a short time, seed is usually stored in sealed bins. More recently, use of polyethylene material has become increasingly popular. Recalcitrant seeds and bulky seed material are stored in the informal seed supply systems in different ways. A new storage method developed by International Potato Centre (CIP) is being increasingly used in the tropical highlands of Asia and in other parts of the world including Africa and South America. (Jayasinghe,2004.) Seeds of onion, shallots, garlic and other bulb crops are either stored in structures similar to diffused light stores used for potato, or selected bulbs with the dried leaves attached are bundled and hung up in farmers' houses until planting time. The second method is practiced by small farmers who produce "true seed" from biannual crops such as onions and other alliums crops. Seeds of vegetable crops that remain viable for short periods after extraction are also stored in their pods. It is a common sight in farm-houses to see capsicum, okra, vegetable, cowpea, and chili hanging in bundles from kitchen roofs where the dry ambient air protects seeds from imbibing moisture and losing effectiveness. These traditional methods of storage are important systems of seed security practiced by farmers which preserve valuable gene pools for generations. (FAO,2000)

2.2.2.2 Quality Control

Superficially, it would appear that an informal seed exchange system would create problems in maintaining quality. Traditionally built into this system are certain simple but effective safeguards. Since good seed is considered scarce, this is an unwritten law in

the region. It is also a question of credibility that farmers and local seed traders require for the success of their seed business through honesty in seed trading. It is considered morally incorrect to provide a grower with low effective seed. Seeds men or farmers who barter or trade planting material will carry out a routine germination test before seed is traded. Before the beginning of a growing season, farmers will test their seed for effectiveness by carrying out a germination test. If most of them germinate, the seed will be used for planting. Should the test fail, the farmer will negotiate with a neighbor to barter for better seed. Quality is also controlled through the use of freshly grown seed. Usually, seed that has been stored for more than one year is replaced by new seed and the old seed sold as grain or used for food. No farmer is willing to sacrifice a season through use of inferior seed, as a good harvest is vital for survival, sustenance and food security. In areas such as seed quality, low yield potential, storage and processing, the informal sector can benefit from the technology and facilities provided by the formal seed sector, provided farmers are trained to improve their traditional methods. Seed would be available at the required time and at affordable prices. Good quality seed alone can increase production and productivity which in turn will help small farmers enter the production and marketing chain instead of remaining strictly at the subsistence level of production. Quality control and purity maintenance becomes problematic, especially in cross- pollinated crops. There is a need to introduce farmer- friendly and attainable regulatory systems into each country's seed quality control mechanisms. It would be far better to accept reality and adopt a pragmatic approach to on-farm seed quality control than impose stringent rules and regulations that cannot be enforced. If not "Truthful labeling" and lower standards than those of the formal seed sector may be the result. Instead of discouraging the informal seed sector, collaboration between the formal and informal sectors must be encouraged with the objective of upgrading the informal seed system over time. (FAO,2000)

2.2.2.3 Seed Marketing and Distribution

Historically, seed distribution systems have existed in the Asia- Pacific agrarian societies for thousands of years. Good seed was scarce in ancient civilizations. In times of war and famine, the granaries owned by feudal lords distributed seed for food as well as for crop production. Village leaders, rich landlords and better resourced farmers continued the traditional practice of barter, exchanging consumption grain or other produce for good seed at planting time. A form of credit was offered to tenant farmers by landlords who expected a share of the harvest for the seed offered as credit. Even today, the lateral spread of landraces or modern varieties take place in most of Asia through sale and /or exchange of seed, completely independent of the activities of the formal seed sector. In recent times, many communities have changed the barter system to a modern marketing system, where seeds men in rural societies have commercialized the marketing of seed to growers. If government subsidies or credit are not available, credit is provided by traders who either charge an interest on the cultivation loans provided, or expect the return of the loan with interest in kind. (FAO, 2000)

2.3 Seed Industry in Sri Lanka

The organized seed production and distribution programme in Sri Lanka was initiated by the Department of Agriculture (DOA) with the introduction of programmes for selection and breeding of improved paddy varieties in the late 1950s. Between 1960 and 1980, the industry matured within the state sector and in the late 1970s the national Seed Certification Service began functioning. With growing private sector interest in local seed production and government policy of scaling down commercial activities in the public sector, the DOA is interested in broad basing the national seed programme to allow more private sector involvement in the seed industry. Sri Lanka, needs to develop its seed industry rapidly to make high quality seed freely available to the farming community and thus to increase the overall agricultural productivity of the country. The new policies that lean towards developing an active seed sector based on many independent seed enterprises provides opportunities to place more emphasis on marketing, including distribution and promotion. Independent, competing enterprises have the incentive to improve the quality of seed and to promote its use by farmer/users in order to increase their share of the market. In the formal seed supply system, at present more than 90% of certified seed paddy, other field crops and local vegetable seeds produced by the Seeds and Planting Materials Division (SPM) of the DOA. Prior to 1990, all seeds produced by the SPM division were distributed in the country by the Extension Division of the DOA through Agrarian Services Centers (ASC).A village level officer called a KVS was assigned at each ASC to undertake seed sales. This was undertaken primarily as a service and therefore, no special attention was paid to improve seed sales, develop attractive packaging, identify appropriate pack sizes, etc. Since ASCs are scattered throughout the country, farmers had access to DOA seed. After 1990, however, with the change in the administrative structure and withdrawal of KVSs, private seed dealers emerged. At present, more than 90% of seed produced by the DOA is distributed by a dealer network, which includes private individuals, ASCs, Co-ops, and others. Normal distribution of seed was disrupted during the transition period, but has recovered substantially in recent years. ASCs were still the most common source of formal seeds in 1991, followed closely by private traders or dealers. Other sources were government seed farms and co-ops. Co-ops and private shops are located closer to the farming community. Therefore these sources, particularly co-ops, can be utilized to a greater extent in the future for quality seed promotion and distribution. (Preston *et al*, 1993)

The National Seed Policy of commercializing the seed and planting material sector was announced in 1996. The Seed Act focuses on enhancing the production and marketing of high quality seeds. Government initiated the duty free import of seed and planting material. The private sector is expected to play an important role in the seed industry. Government privatised in 1998 the Hingurakgoda and Pelwehera seed farms owned by the Department of Agriculture (DOA).

The Plant Protection Act No. 35 of 1999 in Sri Lanka made provision against the introduction and spread of any organism harmful to or destruction of plants and for the sanitation of plants in Sri Lanka. The Plant Quarantine Service fulfils the Quarantine and Phytosantary requirements of imported and exported agriculture commodities such as

plants and plant products and seeds with the expansion of free market economy, influx of agricultural commodities have increased by leaps and bounds. Facilitation of international movement of pest free plants and plants products play a vital role in the development of agriculture and related industries in the country, which in turn enhances the national economy.

2.3.1 Seed Policies

The Role of Government

The role of government should be to create a legislative framework which supports national seed institutions, creates the appropriate economic environment and minimizes government interference in the market. In such circumstances the private sector may be encouraged to play a greater role while guaranteeing the availability of seed of reliable quality to the farmer.

Seed Act, No.22 of 2003

The Seed Act passed by the parliament provided the necessary legal framework for the operation of seed industry in Sri Lanka. The National Seed Council was established under this Act. Subject to the provisions of this Act, the functions of the council are as follows.

a) to establish guidelines and principles to ensure production and distribution of seed and planting materials of the highest quality;
b) to undertake periodic review of the progress of seed and planting materials production;
c) to advice the Minister and other relevant authorities on all matters regarding the production of quality seed and planting materials and the supplying of seed and planting materials to farmers;
d) to review the quality standards of seed and planting materials, periodically, with a view to developing the seed and planting materials industry;
e) to establish appropriate minimum limits for germination viability, genetic purity, physical purity and appearance of seeds and planting materials and maximum limits for genetic impurities, damaged seeds, water content and pests allowed in seeds available in the market;
f) to determine the minimum labeling requirements for seed containers and for planting materials available in the market;
g) to determine the quality and minimum size of the seed containers for each species, kind or variety of seed available in the market; and
h) to take appropriate action with regard to the protection of new plant varieties.

The National Seed Council has the power, to recommend fees for any services or facilities provided by the agencies of the Department of Agriculture and for the registration of seed handlers; to identify the need for seeds and planting materials and to facilitate the provision of technical assistance to produce quality seeds and planting materials; to co-ordinate with public sector agencies in working towards the development of the private sector seed industry and to address issues relating to seeds and planting

materials; to secure funding and manpower resources required to develop a viable seed and planting materials industry; and to appoint special committees to carry out the decisions of the council.

Under the seed certification service the director should, exercise the exclusive right to certify seed and planting materials grown in Sri Lanka; issue seals, stickers, stamps and labels with the mark or seal of the seed certification service; prohibit any locally produced seed of any crop variety or hybrid from being described and sold as "certified seed" of that crop variety or hybrid if it has not been produced in accordance with the rules for production of certified seed published and administered by the seed certification service of the Department of Agriculture. In the case of imported seed, director should prohibit any seed of any crop variety or hybrid being described and sold as "certified seed" of that crop variety or hybrid unless the seed certification service of the Department of Agriculture has recognized the official system of seed certification in the country of origin of that seed, monitor the production and processing of seed and check that the standards for certification are met; enter premises and inspect seed conditioning and storage facilities; check registers of seed movement and identity; implement the standards for seed certification as may be determined by the council; use approved procedures in field inspection, seed testing, monitoring, seed conditioning, collecting seed samples and affixing certified labels to seed lots that quality for certification; ensure that certified seed are packed, sealed and labeled in the prescribed manner; take samples of locally produced and imported seeds and check conformity with prescribed standards; establish and publish standards for seed certification; and maintain and publish a list of producers and suppliers of certified seed and planting materials. For the purposes of this section the seed testing laboratories of the Department of Agriculture should be the designated laboratory.

2.4 Big Onion Seed Production in Sri Lanka

DOA imported over 95 percent of onion seed before 1990. Since then, the government permitted private sector to import onion seed (DOA, 1990). As importation of true seed costs a large amount of foreign exchange in addition to the problems associated with seed imports, DOA started true onion seed production at local level. The committee appointed by the DOA to study strategies for true seed production of Big Onion pointed out the problems that Sri Lanka faces with full dependence on imported true seeds. Possible interruption in seed supplies could occur as a result of changing policies of seed exporting countries as well as due to potential damage that could occur to seed in shipments in transit. True seed production in Sri Lanka would minimize such interruptions. (Preston *et al 1993)*

The process of seed production begins with selection of the best bulbs at harvest time. Around 60 percent of bulbs produced can be used for replanting as seed bulbs. Usually, bulbs must be kept for a period under cold storage conditions--a process called vernalization, which helps enhance flowering. Requirement of seed bulbs is about 4000 kg/ha. True seed production of Big Onion is an operation requiring skill. Big Onion flowers have the possibility of cross-pollinating with other cuitivars of big and Red Onion. Onion seed production is particularly subject to weather risks and storage

problems. Losses of germination and vigour occur in high temperature and humidity. Fortunately, in Sri Lanka, it is possible to avoid long term seed storage by timing the seed production season. Another common problem with tropical varieties of onion is their tendency to bolt.

Kuruppuarachchi (1990) has calculated the total cost of big onion seed production and his calculations show that nursery, bulb crop and seed crop cost 9.9, 33.4 and 56.7 percent respectively of the total cost of producing seed. Further he mentioned that vernalization of mother-bulbs prior to planting would increase flowering by 20 percent and honeybees can increase pollination by 10 percent. He reported that variety K-1 can produce an average yield of 180 kg of true seed per hectare in farmers' fields. However, the research station at Kalpitiya has reported an average seed yield of 400 kg/ha. (Preston *et al 1993)*

Field crop Research and Development Institute has developed a package for true seed production and proved that yields could be effectively increased by using local seeds. Sri Lankan farmers fail to produce required amount of good quality seedlings with high yield from their nurseries because of the fact that they always depend on imported seeds. The best storage method of big onion seeds is to store as packed seeds (in polythene bags) under refrigeration. This will keep seed viability for about four months without a drastic decline in germination. However, seed moisture content at the beginning of storage should be as low as 7 percent. If refrigerator facilities are not available most suitable method will be to store seeds in sealed polythene at the room temperature. This method will permit to store seeds for 2 – 2.5 months without considerable reduction in viability. Metal and aluminum are the most suitable packaging materials for storage of big onion seed in order to minimize the effect of environmental condition on storability. Polythene packets and cloth bags are good if stored continuously in the refrigerator (FCRDI, 1987).
Present recommended varieties are suitable to produce true seeds under local condition with or without vernalization. Local weather condition during the period from November to April is conducive to develop disease incidences in the crop. A close planting spacing such as 15cm x 15cm or 22.5cm x 22.5cm could be used to plant mother bulbs to obtain a higher seed yield of true seeds (Mettananda,2002). By considering the cost of mother bulbs farmers could benefit by using a comparatively wider spacing such as 22.5cm x 22.5 or 22.5cm x 30cm in true seed production (FCRDI, 1993). Lesly (2001 and 2002) found that use of medium size bulbs and planting at 22.5cm x 22.5cm spacing is more suitable to get better seed yield and the vernalization advances the flowering by two weeks and shows more uniform flowering. Singh *et al*. (1990) reported that larger bulbs produce more seeds compared to small bulbs. However, Edirimanna and Lesly observed that optimum yield could be obtained by using medium size mother bulbs under local conditions (FCRDI, 1998 and 2001).

CHAPTER THREE

Socio-Economic Characteristics of Selected Big Onion Seed Producers

3.1 Introduction

Socio – Economic Characteristics such as age distribution, level of education, Primary and secondary occupation, family size and number of dependents and monthly income of selected big onion seed producers are discussed in this chapter.

3.2 Age Distribution of Selected Farmers

The table 3.1 illustrates the age distribution of selected farmers in Matale and Anuradhapura districts. Accordingly 31% of farmers belong to the age group between 30 and 40 years. A significant portion of farmers (44%) belong to the age group of less than 40 years of age. According to our observation and focus group discussions, young farmers are attracted to big onion cultivation due to the possibility of earning a considerable income within a short period of time. This situation leads to attract young farmers towards big onion true seed production. The mean and median of age distribution was 43 years indicating a normal distribution.

Table 3.1: Age Distribution of Selected Farmers

Age Range	Matale		Anuradhapura		Total	
	No.	%	No.	%	No.	%
20≤ 30	19	13	9	14	28	13
30≤40	42	29	23	35	65	31
40 ≤50	49	33	15	23	64	30
50≤ 60	32	22	16	25	48	23
60^{+}	5	3	2	3	7	3
Total	147	100	65	100	212	100

Source: Survey data, HARTI, 2010

3.3 Level of Education

The level of education of farmers is very important especially for sensitive crop cultivation like big onion as well as for big onion seed production. If the education level of farmers is at a satisfactory level, it will be an advantage for absorption of new technology by farmers.

Table 3.2: Level of Education of Selected Farmers

Level of education	Matale		A'pura		Total	
	No.	%	No.	%	No.	%
No Schooling	2	1	2	3	4	2
Primary(1-5)	35	24	10	15	45	21
Secondary(6-11)	89	61	37	57	126	59
Passed O/L	18	12	12	18	30	14
Passed A/L	3	2	4	6	7	3
Total	147	100	65	100	212	100

Source: Survey data, HARTI, 2010

The table 3.2 shows the level of education of the selected big onion seed producers in Matale and Anuradhapura districts. 59% of the farmers have received secondary level education. Only 17% of farmers have passed O/L or above. According to the survey 76% of the farmers have received secondary education or above. The survey did not show any significant difference between two study locations. The high level of secondary education as well as the large percentage of farmers been less than 40 year are the possible factors for the adaption of new technology.

3.4 Family Size

Small scale agricultural activities in Sri Lanka largely depend on family labor. Hence, the distribution of family size among the selected households is very important. According to table 3.3 most of the households (57%) belong to the category of family size of 3-4 members. The mean, median and mode family size was 4 members per family.

According to the table 3.4, 50% of the surveyed households had 3-4 dependents. Survey did not show a significant difference among two districts.

Table 3.3: Family Size of Selected Households

Family size	Matale		A'pura		Total	
	No.	%	No.	%	No.	%
1-2	9	6	5	8	14	7
3-4	82	56	38	58	120	57
5-6	53	36	22	34	75	35
6+	3	2	0	0	3	1
Total	147	100	65	100	212	100

Source: Survey data, HARTI, 2010

Table 3.4: Number of Dependents in the Family

Number	Matale		A'pura		Total	
	No.	%	No.	%	No.	%
1-2	65	45.5	30	48.4	95	46.3
3-4	70	49	32	51.6	102	49.8
5+	8	5.5	0	0	8	3.9
Total	143	100	62	100	205	100

Source: Survey data, HARTI, 2010.

3.5 Family Income and Income Earning Sources

For an understanding of the total family income it is necessary to consider all the family income sources (both primary and secondary occupations) and the income of all family members. According to our survey 93% of the respondents have selected farming as their primary income source. For this study we have selected big onion seed producing farmers and their main income earning source was farming. Big onion, vegetable and paddy are the main varieties of crops selected by most of the farmers depending on the area and season. Out of the total sample, only 30% of the farmers had been engaged in secondary level income earning activities and out of that a larger portion of farmers had selected livestock as a secondary income source.

The table 3.5 illustrates the monthly gross family income. According to the figures a larger portion of households (42%) had received gross monthly income of more than Rs. 25,000 in the two study locations. Only 4% was recorded with monthly income of less than Rs 10,000. This showed that 70% of the farmers earn more than Rs.20, 000/ month indicating satisfactory levels in the two study locations. It is important to note as per the Department of Census and Statistics, for a person to be above the poverty line, the monthly income has to be above approximately Rs. 3500 for an average household of 4 people.

Table 3.5: Monthly Household Income

Gross Monthly Income	Matale		A'pura		Total	
	No.	%	No.	%	No.	%
5000<10000	5	3.4	4	6.2	9	4.2
10000<15000	20	13.6	10	15.4	30	14.2
15000<20000	22	15.0	3	4.6	25	11.8
20000<25000	41	27.9	18	27.7	59	27.8
Over 25,000	59	40.1	30	46.2	89	42.0
Grand Total	147	100.0	65	100.0	212	100.0

Source: Survey data, HARTI, 2010.

3.6 Experience in Seed Production

Table 3.6: Experience in Seed Production

Years	Matale		A'pura		Total	
	No.	%	No.	%	No.	%
Less than 5	103	70	62	95	165	78
5-10	25	17	2	3	27	13
10+	19	13	1	2	20	9
Total	147	100	65	100	212	100

Source: Survey data, HARTI, 2010.

Big onion is one of the most important commercial crops grown in Sri Lanka. At the initial stage of introduction, the crop was totally depended on imported seeds. Later during 1980's experimental seed production started in Sri Lanka. According to our survey only 9% farmers had experience in producing big onion seeds for more than ten years. Most of the farmers (78%) had experience in big onion seed production for less than 5 years. Especially in the Anuradhapura district 95% of the farmers had experience of less than 5 years. It was a new experience to the farmers in the Anuradhapura district. The situation is somewhat different in the Matale district, where 30% of farmers recorded experience in producing big onion seeds for more than 5 years. Therefore, it's very clear that the big onion seed production is a new experience for most of the farmers and more attention of the officials is needed to give know how to the farmers to get better results to increase production.

CHAPTER FOUR

Production of Big Onion Seeds in Sri Lanka

4.1 Introduction

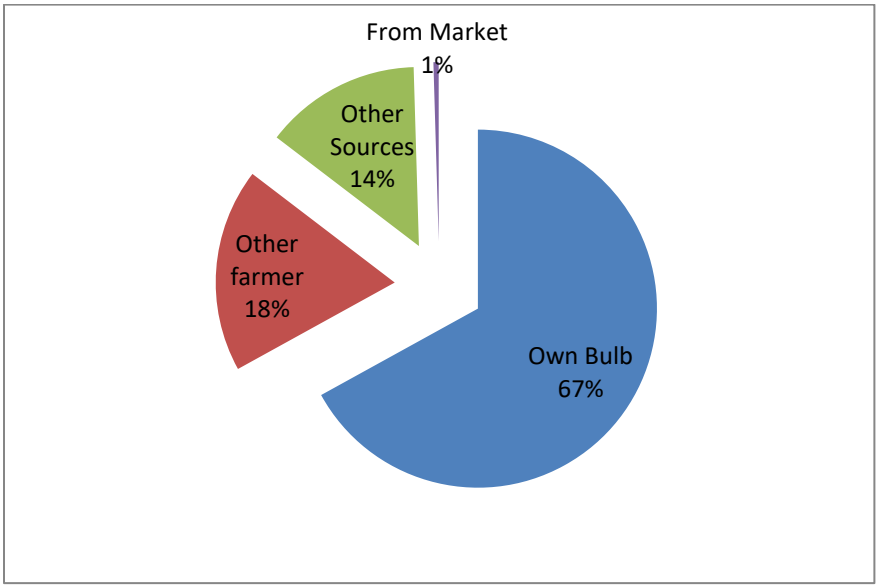
Onion seeds, which are short-lived and sensitive, require proper handling especially under tropical conditions because they are very small. They need intrinsic high vigor to produce healthy seedlings under field stresses. Production of big onion true seeds locally started during the latter stage of 1980's. The current seed requirement of farmers is met either by commercial seeds from the market or by self seed production programmes carried out by the farmers themselves. According to the Department of Agriculture, national seed requirement of big onion is estimated at around 30,000 kg at present and target is to produce 40,000 kg in 2014 to be self sufficient in locally. The procedure of true seed production and the present status of big onion seed production in Sri Lanka is discussed in this chapter.

4.2 Procedure of the Production of Big Onion True Seeds

4.2.1 Selection of Mother Bulbs

Selection of suitable mother bulbs is the first step of true seed production of big onion. Mother bulbs are obtained from the *yala* harvest and planting is done in the *maha* season to obtain seeds to be used in the next *yala* season. When harvesting the crop, mother bulbs should not be harvested and must be left in the field for two weeks to mature. Therefore, it is important to maintain an additional plot to obtain mother bulbs. The size of that plot depends on the amount of big onion seeds required. Mother bulbs should be obtained from a suitable variety according to the location. Normally, Dambulu red, Gelewela light red, Rampur, Pusa red and Bombay red varieties are selected by the farmers. Farmers obtain their mother bulbs from their own product or from nearby farmers, or through government subsidy programmes or promotion programmes. According to the survey 67% of the farmers out of the sample use their own mother bulbs for cultivation. Out of the rest, 18% of the farmers had got mother bulbs away from neighboring farmers. Farmers had taken steps to maintain separate plots for mother bulbs from the commercial cultivation plots, applying more organic fertilizer. The percentage of farmers who had used their own mother bulbs is higher in the areas selected from the Matale district than those of the Anuradhapura district. For example the percentage of farmers who used their own mother bulbs in Kimbissa, Dambulla and Galewela were 97%, 89% and 74% respectively, indicating a high rate of using their own mother bulbs for true seed production. The Ipalogama and Maradankadawela situations were different as they were new to seed production programmes. They were given mother bulbs by the DOA under the true seed production programme.

Figure 4.1: Sources of Mother Bulbs Used for Seed Production



Source: Survey data, HARTI, 2010.

4.2.2 Establishment of a Nursery for Mother Bulbs

Nursery should be established in a suitable location and the bed should be sterilized and seeds should be treated before planting. Nurseries are prepared in April and if there is rain beds should be covered with polythene. The nursery period is around two to six weeks.

4.2.3 Harvesting of Mother Bulbs

After two months growth of leaves stop and bulb growth will continue. When the bulbs growth is at the optimum level, the leaves will fall from their neck. When about 50% of the leaves turned to yellowish colour, watering should be stopped. As mother bulbs are not obtained at the harvesting time of other bulbs, a fungicide (carbendezine) should be applied 2-3 weeks before harvesting of the mother bulbs. Mother bulbs can be harvested about 100 days after planting. After harvesting, bulbs are left to dry for some time. After drying properly, it is important to grade them by removing infected bulbs.

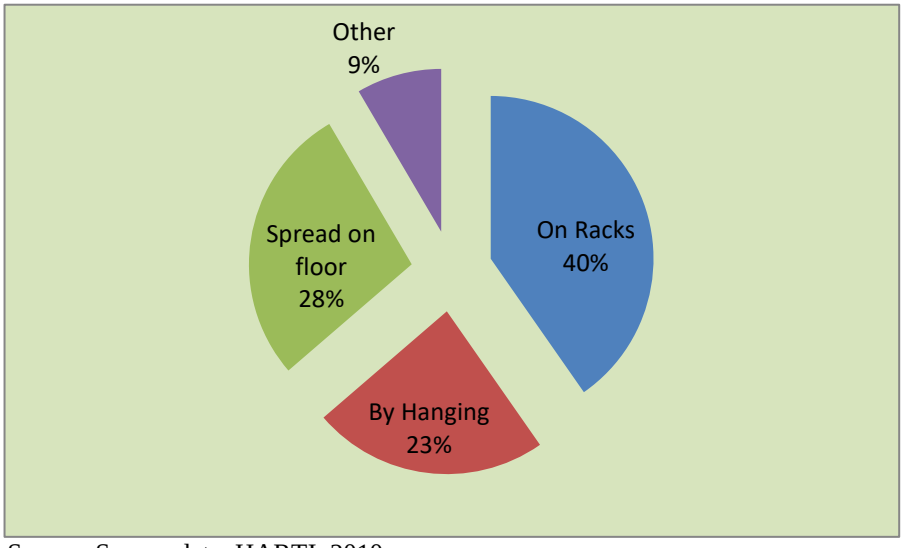
4.2.4 Storage of Mother Bulbs

Mother bulbs should be stored in a dry place as bundles or without leaves. Wooden racks can be used to store bulbs without leaves. When storing them in racks, spreading them is needed at 2-3 inches layers in order to facilitate proper ventilation. The Department of Agriculture has introduced a simple rack for storing mother bulbs. When storing as bundles with leaves they can be hanged in the kitchen or in a dry place. If seed production is done in the *maha* season, there is a need to store mother bulbs for a 4 month period and in *yala* season there is a need to store bulbs for 8 months. Inspecting bulbs

regularly to remove rotten bulbs is also necessary. If rotten bulbs remain, diseases will spread to healthy bulbs as well. Bulbs should be graded before vernalization.

Survey results show that 40% of the farmers out of the total sample use racks to store mother bulbs. Most of the farmers use wooden racks while the others used metal racks which are given by the provincial Department of Agriculture under a subsidy programme. Another 23% of farmers used the method of hanging with leaves. Farmers who have no storage facilities tend to spread mother bulbs on the floor of their houses. Only 30% of farmers out of the total sample had proper stores to store mother bulbs. Although the *Yala season* has been identified as more profitable in producing big onion true seed than that of the *Maha season*, the storage of mother bulbs which are produced in *yala season* until the next *yala season* is one of the major problems faced by the farmers in the area. To calculate wastage during storage, first we get the quantity of mother bulbs at the initial stage of storage. Then the remaining quantities of mother bulbs are measured at the point of sending for Vernalization. As per the survey the average losses of mother bulbs at storage until the next *maha* season was 22 percent, while the storing loss during *yala* was 38 percent. This is a considerable loss and measures should be taken to reduced the loss. Lack of proper storage facilities were recorded as the main reason for the high rate of loses.

Figure 4.2: Method of Storing Mother Bulbs



Source: Survey data, HARTI, 2010.

4.2.5 Vernalization of Bulbs

Bulbs are stored at 10-15^{0}C for 2-3 weeks before planting and that is called the process of vernalization. In Rahangala area, these bulbs can be stored under normal room temperature conditions or use cold rooms for vernalization. When transporting bulbs to Rahangala area, they are packed in wooden boxes (7" X 1.5" X 2") or plastic crates. About 25kg of bulbs can be packed in a box.

According to the survey results 95% of the farmers out of the total sample have sent their mother bulbs to Rahangala area for natural Vernalization. The DOA (Provincial and inter Provincial) in the Matale and Anuradhapura had special programmes to arrange facilities for farmers to send mother bulbs to Rahangala area. Farmers had to pay only transport cost of Rs.5.00 or Rs.10.00 per kg depending on the area. 74% of the farmers out of the sample stated that they had no problems in the Vernalization process. Another 15% of the farmers noted that low germination was caused due to damages in transportation of long distance from Dambulla or Anuradhapura to Rahangala area in the Nuwaraeliya district. Farmers emphasized the need of availability of Vernalization facility in a nearby area to reduce difficulties in transporting to Rahangala. The Field Crop Research and Development Institute (FCRDI) of DOA has been conducting research in the Reverstern area in the Matale district to check the possibility of Vernalization of mother bulbs by keeping them in that area. These trials are yet to be completed and if positive, farmers can benefit by vernalizing mother bulbs in a nearby area.

4.2.6 Planting of Mother Bulbs

A field which had not been cultivated with big onion previously with proper drainage, good fertility, enough sunlight is better for planting. Bulbs should be further selected before planting. They should be dipped in a fungicide for 30 min before planting. 4-6gms of fungicide can be mixed with 1kg of bulbs thoroughly. Suitable time of planting is early January for *maha* season. It is better to cultivate crops like sunhemp around the crop to attract insects to facilitate pollination. Bulbs are graded and bulbs with similar conditions are planted in a bed in order to obtain uniformity in flowering. Bulbs are planted 6″X 9″ spacing in maha season and 6″ X 6″ spacing in yala season. They are buried to ¾″ depth. 30-35 days after planting mother bulbs, flower buds will initiate. In order to prevent lengthening of flower stalks and drooping of flowers, a 6″ size nylon mesh is fixed 1′ – 1.5′ above the ground level to support plants. Then flowers will come out through the mesh and avoid moving with the wind.

To protect plants from the rain in the *maha* season, beds should be covered with polythene about 5′- 6′ high from the beds. During day time if there is no rain, it can be opened and covered in the evening.

Table 4.1: Quantity of Mother Bulbs Planted by the Selected Farmers

Qt of Mother bulbs planted(kg)	District			
	Matale		Anuradhapura	
	No.	%	No.	%
< 50	36	12.3	30	30.3
50 < 100	37	28.8	26	42.4
100 < 500	63	50.7	8	12.1
500 <1000	8	5.5	1	0.0
1000+	3	2.7	0	0.0
Total	147	100	65	100.0

Source: Survey data, HARTI, 2010

According to table 4.1, 41% of selected farmers in the Matale district have planted less than 100 kg mother bulbs during the previous season. Only 3% farmers were found in same district planting mother bulbs more than 1000 kg. On the other hand, 73% of the farmers in the Anuradhapura district have planted less than 100 Kg mother bulbs. This is a good indicator of self seed production by the surveyed farmers in the area.

4.2.7 Pollination

Flowers are pollinated by wind or insects and mostly pollination takes place due to insects (bees). It is better to cultivate crops like sunhemp around the crop to attract the insects to increase pollination.

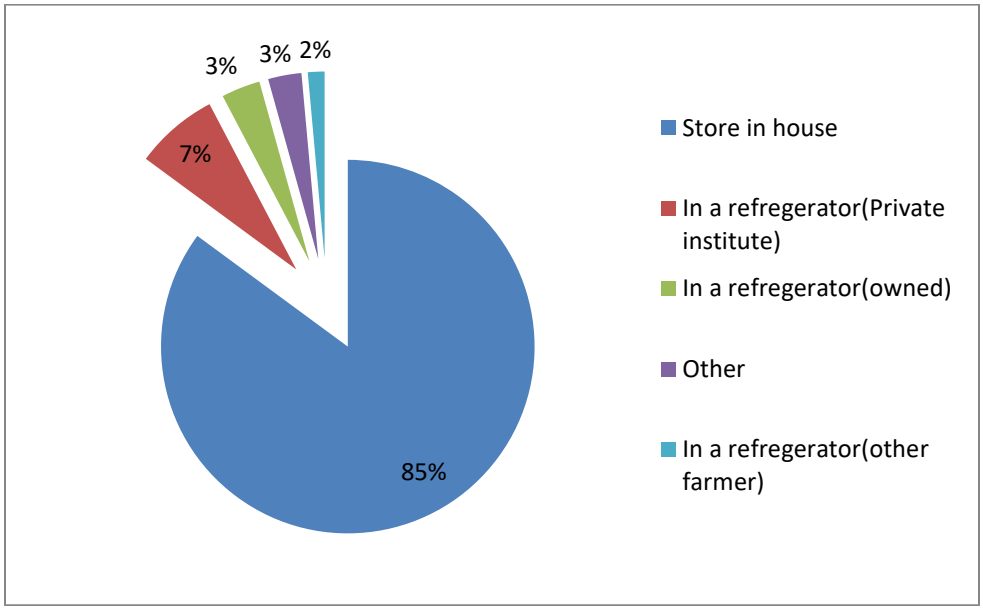
4.2.8 Harvesting of Seeds

Seeds can be obtained 100 days after planting mother bulbs. If planting is done at the beginning of January, seeds can be obtained in mid April (*maha* season), whereas if planting is done at the beginning of May, seeds can be harvested in mid August (*yala* season). When black colour seeds are visible in 10-20% of the florets in an inflorescence, harvesting is done. Harvesting cannot be done at once as inflorescences are not matured at the same time. Flowers are allowed to dry for 2-3 days and seeds can be removed easily when they are dried. The extraction of seeds from the dried onion seed pods is done manually and this operation is labour intensive and also inconvenient as the farmer have to work in the hot sun for long periods. The motor driven seed extracting machine developed in 2005 was tested and introduced to farmers. However, all the farmers in the sample have extracted true seed manually.

4.2.9 Storing of Seeds

Seeds obtained in the *maha* season can be used to cultivate in the coming *yala* season. Then storing time is short. However, seeds obtained in *yala* season have to be stored for 6-8 months to be used for cultivation in the next *yala* season. When storing for a longer period the moisture content should be 8% and stored at 10^0C temperature. The best storage method of big onion seeds is to store as packed seeds (in polythene bags) under refrigeration. This will keep seed viability for about four months without a drastic decline in germination. However, seed moisture content at the beginning of storage should be as low as 7 percent. If refrigerator facilities are not available most suitable method is to store seeds in sealed polythene at room temperature. This method will permit storing seeds for 2 – 2.5 months without considerable reduction in effectiveness. Metal and aluminum are the most suitable packaging materials for storage of big onion seed in order to minimize the effect of environmental condition on storability. Polythene packets and cloth bags are good if stored continuously in the refrigerator (Mettananda, 2002).

Figure 4.3: Method of Storing Seed

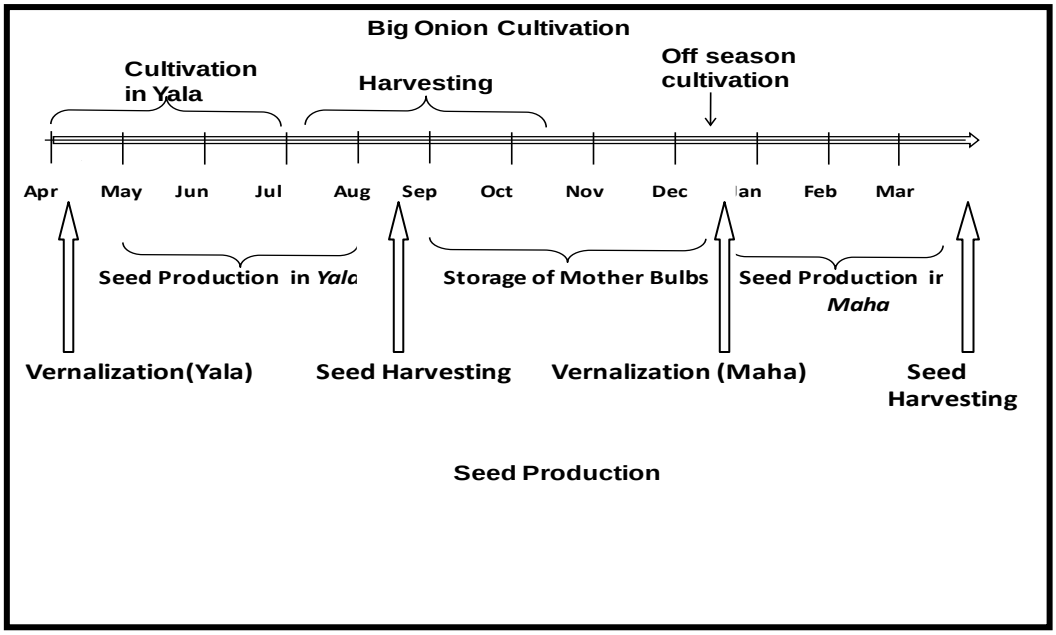


Source: Survey data, HARTI, 2010

According to the survey results, 85% of the farmers out of the sample had stored harvested seeds packed in polythene at room temperature in their houses. Especially farmers in Galewela, Ipalogama, Kekirawa and Dambulla who were engaged in true seed production in the *maha* season had a shorter duration for storage, than those who produced seed in the *yala* season. The PDOA in the Central province has a programme to support farmers who produced true seed in the *yala* season to store their seeds in cold rooms. Properly dried seeds packed with polythene, are collected by the Agricultural Instructor (AI) located in ASC and they send them to private or government cold rooms on behalf of the farmers. Farmers have to pay Rs 100.00/kg of seeds for the duration. The PDOA of Central province has also introduced polythene to pack harvested seed and it is very popular among the farmers in the area.

Figure 4.4 explains the production calendar of big onion and seeds production. According to the calendar the major big onion cultivation season is *yala* and cultivation takes place during the period April to July. Harvesting is done from mid July to mid October. Very few farmers practice off season cultivation during the *maha* season. Harvested mother bulbs from *yala* cultivation have to be stored until December for seed production in *maha* season. Vernalization of mother bulbs takes place during December and cultivation starts in January for *Maha* season. If farmers are involved in seed production during the next *yala* season, mother bulbs have to be stored eight for to nine months and proper storage facilities are needed to reduce the wastage.

Figure 4.4: Production Calendar of Big Onion and Seeds



4.3 Production of Big Onion True Seeds

The production of big onion true seed in the selected areas can be divided into two categories namely, Government supported big onion true seed production programmes and the private sector big onion true seed production. Each category is discussed in this section separately.

4.3.1 Government Supported Big onion True Seed Production Programme.

Though true seed production programme started in 1984/85 maha season, it has shown a considerable progress only in 2005 in the Matale district. In the Matale district, the highest production level was recorded in 2009/10 maha season (4,500kg). Galewela and Dambulla are the major big onion seed producing ASCs in the Matale district. Also considerable production is recorded in Kimbissa, Kongahawela and Naulla ASC areas of the district. In Anuradhapura and Mahaweli areas, the seed production only takes place in maha season and the seed production was at a low level before 2008. In the Anuradhapura district, seed production started in 2004/05 maha season. A significant production was recorded in 2009/10 maha season.

Table 4.2: Production of Big Onion True Seed in Selected Areas

Season	Amount of Mother Bulbs Planted (kg)				Production of Seed (kg)			
	Matale	**A'pura**	**Mahaweli***	**Total**	**Matale**	**A'pura**	**Mahaweli ***	**Total**
2005/06 Maha	25480	2400		27880	1300	185		1485
2006 yala	5000			5000	522			522
2006/07 Maha	30000	8100		38100	1725	720		2445
2007 yala	9043		210	9253	925		28	953
2007/08 Maha	48468	11500	3500	63468	1132	1140	350	2622
2008 yala	8036		325	8361	1083		46	1129
2008/09 Maha	55000	17400	13500	85900	4183	1700	1250	7133
2009 yala	21940		850	22790	2225		121	2346
2009/10 Maha	61000	42000	27500	130500	4500	4200	2750	11450

Source: Matale & Anuradhapura District Agricultural office, Mahaweli Authority
*= Include Mahaweli H, Huruluwewa and Moragahakanda

Provincial Departments of Agriculture in the Matale and Anuradhapura districts, Department of Agriculture (Inter provincial) and Mahaweli Authority intervened in big onion seed production via various production programmes and subsidy programmes. Farmers were directly contacted by the Agricultural Instructors (AI) to provide services of the government sector. Table 4-2 shows the seed production progress in each selected district and Mahaweli Authority. The number of farmers engaged in seed production in 2009/10 *maha* in the Anuradhapura district was higher than that in the Matale district, but the farmers in the Anuradhapura district were new to big onion seed production and they had taken small quantities of mother bulbs for cultivation as there were high risks behind seed production. According to the survey results, 61% of the farmers out of the total sample have planted less than 100 kg of mother bulbs. Only 1% was recorded as large scale seed producers planting over 1000 kg of mother bulbs. Especially in Anuradhapura district, most of the farmers had planted less than 100 kg of mother bulbs. This is because the farmers are encouraged by the government programmes to produce required amount of seed for big onion cultivation on their own but at the beginning farmers had engaged in cultivation in small quantities to reduce the risk.

If seeds are produced by farmers who do not cultivate big onion, they are guided to select suitable bulbs by introducing experienced farmers by the Departments of Agriculture and Mahaweli Authority and transport facilities are also provided. In case of vernalization of bulbs, they do transporting. In addition, they conduct training programmes to farmers from the initial stage of cultivation until the end of cultivation.

Government supported true seed production programs have encouraged farmers to produce their own big onion seed requirement. Hence, the subsidy progames targeted the new comer to production programme and provided them a package of subsidies including chemicals, polyethylene and fishing nets.

Table 4.3: Number of Farmers Engaged in Big Onion True Seed Production

Season	Number of Farmers			
	Matale	A'pura	Mahaweli*	Total
2005/06 Maha	379	105		484
2006 yala	51			51
2006/07 Maha	500	125		625
2007 yala	60		5	65
2007/08 Maha	671	235	49	955
2008 yala	113		8	121
2008/09 Maha	750	482	70	1302
2009 yala	170		20	190
2009/10 Maha	1000	1320	354	2674

Source: Matale & Anuradhapura District Agricultural office, Mahaweli Authority
*= Include Mahaweli H, Huruluwewa and Moragahakanda

4.3.2 Problems Faced by the Relevant Government Agencies in Production Programmes

In this section attention is paid to understand various problems faced by the government institutes in their production programmes of big onion true seeds.

It was noted that all mother bulbs need to be sent to Rahangala area of Nuwara Eliya district for the vernalization process within a short period of time. Providing transport facilities is a problem due to high cost and in order to overcome this problem Field Crop Research Institute (FCRI) conducted a feasibility study to find out the suitability in the Reverstern area of the Matale district.

According to previous research and the experience of the officers, *yala* season is more suitable for big onion true seed production. To produce seed in *yala* season mother bulbs have to be stored for an extra period of time. Establishment of a standard storage system to store mother bulbs and coordinating it is a problem due to lack of storage facilities.

Continuous training of farmers is needed to have a sustainable seed production programme in the respective areas. Farmer participation is not up to the expected level and therefore, targets cannot be achieved.

Inadequacy of officers to provide services is another problem. As seed production largely takes place in *maha* season, the rainy weather condition is a problem where the incidences of pest and diseases are high.

4.3.3 Problems Faced by Farmers in Producing Big Onion True Seeds

The identification of the problems faced by the farmers in producing big onion true seed is very important to increase the local production. With the idea of prioritization the problems, farmers were asked to state the most acute problems.

Table 4.4: Problems Faced by Farmers in Producing Big Onion True Seeds

Problem	Priority level (No. of farmers)				Total No. of Farmers	% of total
	1	2	3	4		
Pest and disease	52	26	3	1	82	75.93
High cost of Inputs	43	21	8	1	73	67.59
Problems in the subsidy programme	49	12	1	0	62	57.41
Lack of storage facilities for mother bulbs	19	14	4	2	39	36.11
Lack of knowledge	18	10	1	0	29	26.85
Damage due to rain	9	15	1	1	26	24.07
Problems in vernalization	4	6	2	0	12	11.11
Others	14	16	8	1	39	36.11
Total	**208**	**120**	**28**	**6**		

Source; Survey Data, HARTI, 2010

In our survey, 208 farmers had responded on problems faced by farmers. According to the data, 76% of the farmers out of the total sample had emphasized pest and disease as a major problem they faced. Further, 25% of the respondents had prioritized it as the first problem in producing big onion true seed production. It was high in Maradankadawala and Ipalogama areas which in the Anuradhapura district because most of the farmers in that area were new to big onion seed production and they had little experience in seed production. They had no proper knowledge in controlling pests and diseases. Due to the difficulties in controlling pests and diseases, farmers were reluctant to engage in big onion seed production. Big onion seed production takes place in *maha* season in most of the areas and the probability of occurrence of disease is very high in *maha* season. As a result, it is very difficult to get a better production. To overcome this problem they have suggested introducing controlling mechanisms for pests and diseases. Farmers especially requested more training on pest and disease controlling method.

Out of the total respondents, 68% of the farmers had reported high cost of inputs as a problem and it had been prioritized as the first problem by 21% farmers out of the total sample. As big onion seed cultivation is highly sensitive for fungi, farmers have to apply fungicides several times to protect the crop. According to the farmers they use more fungicide during the *maha* season as crop is more sensitive to rainy weather. In addition to fungicides, the usage of pesticides is also very high in the field. As a whole, the usage of these inputs is higher than that of the recommended dosage. Due to the high cost of inputs and high production risk, farmers tend to cultivate less number of mother bulbs to avoid risk. To overcome these problem farmers suggested reduction of input prices. The government has already provided fertilizer subsidy for big onion seed producers too and the high cost of other inputs is still a problem in the field.

With the idea of promoting big onion seed production the Government has provided subsidies in various forms such as materials and providing storage facilities. These programmes target the newcomers to seed production. Most of the farmers (57%) had emphasized that the subsidy programme had not met their needs. Insufficiency of materials, not receiving them on time and selection of beneficiaries are reported by famers as critical issues.

Lack of storage facilities for mother bulbs had been a problem for 36% of the respondents. Especially for the *yala* season cultivation, mother bulbs need to be stored for nearly eight months. According to the survey, only 30% of farmers had proper storage facilities for storing of mother bulbs. Farmers requested government support for building storage facilities to store mother bulbs in their premises.

4.3.4 Private Sector Big Onion True Seed Production

In addition to the government supported big onion true seed productions, few private sector companies have engaged in seed production in the Matale and Anuradhapura districts. CIC, Hayleys, Onesh and Agstra are the private sector big onion seed production companies in the Matale district.

Table 4. 5: Private Sector True Seed Production (kg) – (2004-2010)

Year	CIC	Haylese	Onesh	Total
2004/05	233			233
2005/06	300			300
2006/07	337			337
2007/08	740			740
2008/09	1417			1417
2009/10	3000	132	84	3216

Source; Survey data,HARTI,2010

CIC is the leading big onion true seed producer producing 3000 kg of seed during the financial year of 2009/ 10. Seed production is done in the *maha* season using poly tunnel with high technology. They have enough cold storage facilities for mother bulbs. The

cold storage was built with the collaboration of the Regional Economic Advancement project (REAP). They have their own mother bulb production programmes and out grower system for mother bulbs. Produced seeds are tested in the company laboratory which has ISO quality certification. Agri Found light red ("Galewela light Red") and "Pusa Red" (Dambulu Red) are the varieties of seed produced by CIC. Produced seeds are packed in aluminum packages. Lack of foundation seed and lack of technical support by the DOA are pointed as the major problems in producing big onion seeds by the CIC.

Hayles started big onion true seed production in 2009/ 10 *maha* season. They had bought mother bulbs from the farmers within the area on the recommendation of the Agriculture Instructor (AI). They have produced only 132 kg of seeds and have distributed them to farmers through dealers. Before releasing the seeds they had tested for germination in their own labs. Produced seeds are packed in aluminum packets. Lack of foundation seeds and skilled labour shortage are the major problems they had faced in seed production process.

Onesh is another big onion true seed producing company located in the Dambulla area. They had started big onion seed production in 2009/ 10 *maha* season and produced 84 kg of seed. They have planned to increase the seed production within the Matale district as well as in Ampara district.

Another seed dealing company called Agstra is also engaged in the big onion true seed business but not like other companies. They have an out grower system and provide services such as free Vernalization of mother bulbs, field supervision and financial supports for the individual farmers. At the same time these farmers also benefit from the government led seed production programes. Therefore, the quantities of seed produced by these farmers are calculated under the DOA programme. After the production of seed, Agstra buy the seeds from farmers and store in their cold rooms until the next cultivation season. Therefore, Agstra is not engaged in the seed production like other seed producing companies. It is in the buying and selling business, rather than producing seed.

4.4 Cost of Production of Local True Seeds

Cost of production of local true seed was calculated based on the data collected in *maha* 2009/ 10 and *yala* 2010. All the cost items were collected under six categories namely cost of labour (including and excluding family labour), cost of agro chemicals, cost of fertilizer, cost of materials, cost of mother bulbs and cost of other inputs.
Returns of producing local true seed was calculated as,

1. Returns to labour
   Rs./ Man day (including family labour)

2. Returns to capital
   Excluding imputed costs

According to the table 4.6 productions of local true seed is financially more feasible in *yala* season than in to the *maha* season. The values of returns to labour and returns to capital were 3785.30 and 4.95 respectively in *yala* season and it was low in *maha* season. The average yield of local big onion true seed production was higher in *yala* season due to favorable climatic conditions that prevailed in *yala* season for production of true seed under open environmental conditions. In *maha* season production of local true seed is costly and is a difficult task due to high cost of pest and decease management and maintaining a rain protection environment for seed plots. According to the field experience, most of the seed producing farmers had maintained small plots and they could manage rain protection activities using family labour during the *Maha* season. If it is done on a commercial level in the *maha* season, the labor cost may be very high because it is essential to open and close polythene cover every day to protect the seed plots from rain water as well as cold weather at night. According to table 4.6 it is very clear that the labor cost including imputed cost is very high in *maha* season due to the rain protection activities of seed beds. As a result the labour cost with imputed cost is very high in maha season compared to the *yala*.

Cost of pest and disease management is also very high in the *maha* season due to the unfavorable climatic conditions for production. According to table 4.6 it is two times higher than that in the *yala* season. In addition, the material costs are very high in *maha* season due to the need of providing a rain protecting environment over the seed production beds.

Due to high profitability of local seed production, farmers should be more attracted towards seed production, but according to the field experience farmers are reluctant to engage in local seed production due to the difficulties and risks. Especially in *maha* season seed production is very risky and difficult to manage on a commercial scale. On the other hand, farmers pay more attention for commercial big onion production in *yala* season rather than paying attention to seed production. Hence, the engagement of seed production is slow and it needs to be accelerated to meet the seed requirements locally.

Table 4.6: Cost and Return of Producing a Unit (kg) of Local True Seed

Parameter	Maha 2009/10	Yala 2010
Cost of producing a unit of local true seed		
Cost of labour including impute cost(Rs/kg)	3500.83	1615.58
Cost of labour Excluding impute cost(Rs/kg)	288.20	248.63
Cost of Agro chemicals (Rs/kg)	448.32	220.55
Cost of fertilizer	110.58	173.58
Cost of materials (Rs/kg)	902.65	28.84
Cost of Mother Bulbs (Rs/kg)	1474.27	1303.47
Cost of other inputs (Rs/kg)	109.70	38.42
Total cost including imputed cost (Rs/kg)	6546.36	3380.44
Total cost Excluding imputed cost (Rs/kg)	3333.73	2013.49
Yield and returns of producing a unit of local seed		
Average yield (seed kg/ 100 kg of mother bulbs)	6.80	9.50
Price of produce (Rs/kg of seed)	9847.30	9961.32
Profit including imputed cost(Rs/kg of seed)	3300.94	6580.88
Profit excluding imputed cost(Rs/kg of seed)	6513.57	7947.83
Return to labour(Rs/man day)	1875.71	3785.30
Return to capital	2.95	4.95

Source: Survey data, HARTI, 2010

4.5 Marketing of Local True Seeds

Marketing activities of local big onion true seeds are discussed in this section such as distribution channels, testing, packaging, storage, certification, and pricing.

Seed Distribution

There are two major groups producing local big onion true seeds namely individual farmers and seed companies. The demand for locally produced big onion true seeds is very high due to high quality of local seeds, compared with the imported seeds. Hence, selling of locally produced seed is very easy. The identified distribution channels of locally produced big onion true seeds are given bellow.

1 Seed producers ⟶ big onion cultivators

2 Seed producers ⟶ PDOA[1] ⟶ Big onion cultivators.

[1] Provincial Department of Agriculture

3 Seed producers → Farmer Organizations → PDOA → Big onion cultivates.

4 Seed producers → Farmer organizations → Big onion cultivates

5 Seed producers → Traders → Big onion cultivators

6 Seed producing companies → Traders → Big onion cultivators

7 Seed producing companies → Farmers

Most of the farmers in the sample areas cultivate small plots of land of less than 100 kg of mother bulbs due to high risks of seed production. According to the survey, 58% of the farmers had produced less than 5 kg of seeds during the particular season. 40 % of farmers out of the total sample had no excess production to sell. They were small scale producers who meet their own seed requirements.

The major distribution channel of big onion true seeds was direct selling to the cultivating farmers. Seed producers receive orders of seeds in advance before the harvesting of seeds due to high demand within the area. According to the survey 57% of seed producers out of the total number of farmers who had marketable surplus had directly sold their excess production to the big onion cultivators within the area or outside the area. This was recorded as the major path for distribution of big onion true seeds.

The second channel is producers who supply to the PDOA and big onion cultivators. PDOA have various subsidy programmes to increase big onion true seed production as well as commercial cultivation. PDOA purchase produced seed from farmers with the aim of redistribution to the growers especially to those who wish to enter the seed producing programme. On the other hand PDOAs have special programmes with other PDOAs to increase big onion cultivation. For example the PDOA of central province had sent big onion true seeds to the Eastern and Uva Provinces to expand cultivation. According to the survey 20% of the farmers with marketable surplus had sold their production to the PDOA at market rate.

The third channel consisted of seed producers, Farmer Organizations, and big onion cultivators. A special case was found in the Maradankadawala area where there was an agro well society formed by the farmers who do cultivation using agro wells. The government subsidies under different programmes targeting the increase of big onion seed production, are channeled to the farmers via this society. After the harvesting of seeds, farmers had to sell their excess seeds to this society. Then the society deducts subsidy rates for the given materials and pays the balance. What society collects works like a revolving fund and during the next season farmers can get benefits using that fund.

Agricultural officer in the area was satisfied with the activities of the Agro well society because he could provide his services easily than going to individual farmers. PDOA had purchased seeds from this society to be sent to the other PDOAs and farmers. On the other hand, the farmer organization had also sold collected seeds to the farmers within the area directly.

The fifth channel comprised of farmers, traders and big onion cultivators. Few traders could be found in the Dambulla area who collect big onion true seeds from farmers. Sometimes they provide transport facilities to the farmers to send mother bulbs for vernalization in the Rahangala area. They also provide advisory services for the farmers regarding big onion true seed production. Especially the seed produced in Yala season is collected by these traders and stored in their cold rooms and is issued during the next *Yala* season for big onion cultivation keeping a profit margin.

The sixth and seventh channels are based on seed production by seed producing companies. Very few big onion true seed producing companies could be found in the Dambulla area and distribution takes place through traders or directly through the big onion producers.

Testing and Certification

According to the Seed Act No. 22 of 2003, all the stakeholders in seed business have to register and seeds to be certified by the Department of Agriculture. In case of big onion true seed production, 90% of the farmers engaged in seed selling have not registered as seed producers and seeds are never tested before selling. Transactions of seeds between farmers take place based on the mutual understanding of the farmers. According to the focus group discussions, different malpractices were recorded in local true seed selling such as mixing with imported seeds with locally produced seeds.

All the local big onion true seed producing companies are registered under the Seed Act and seeds are tested in their laboratories.

Packaging

80% of the farmers engaged in seed selling have used polythene as packing material. Another 12 percent have used aluminium packages which are distributed by the Provincial Department of Agriculture in the Central Province. Others have not used any packing material for seeds as transactions take place with the neighboring farmers. Local seed producing companies use very attractive aluminum packages for seeds.

Pricing

According to the experience of farmers, the quality of locally produced big onion true seeds is better than that of the imported seeds. Hence, the demand for locally produced big onion true seed is very high and supplies are not adequate to cater to the demand. Hence the price of locally produced big onion true seed is nearly five times higher than

that of the imported seeds. According to the table 4.7 Maximum price of Rs.11,000.00/kg was recorded from Ipalogama, Dambulla and Kimbissa areas. The average of Rs.9800.00/kg was recorded from all the study locations. Minimum price of Rs.6000.00/kg was recorded in Dambulla and Ipalogama areas as transactions take place among relatives and neighboring farmers.

Table 4.7: Selling Price of Local True Seed

DSD	Selling price of seeds (Rs/kg)		
	Min	Max	Average
Galewela	9,000.00	10,000.00	9,704.08
Ipalogama	6,000.00	11,000.00	9,941.18
Maradankadawala	10,000.00	10,500.00	10,016.00
Dambulla	6,000.00	11,000.00	9,727.27
Kibbissa	8,000.00	11,000.00	9,652.17
Average in all the areas			9,800.00

Source; Survey data, HARTI, 2010

4.6 Import of Big Onion True Seeds

Present status of imported big onion true seeds is discussed in this section. At the initial stage of big onion cultivation in Sri Lanka, cultivation totally depended on imported seeds. Even at present (2010) imported seed is the main source for commercial big onion cultivation. According to the official records of quarantine divisions of ports and air ports of DOA, India is the only exporting country of big onion true seeds in to the country. Nasik Red, Bombay Red and Rampur Red are the high demand seed varieties in Sri Lanka.

Seed importers should be registered under the seed Certification Division of the DOA and permits are issued by the above institute. All the importers have to follow Quarantine regulations enforced by the Government. According to the seed certification and plant production Division of the DOA, less than 20 importers have registered as big onion seed importers.

Imported seeds are marketed via traders in producing areas. Dambulla area is the hub of trading of imported big onion true seeds. Imported seeds are packed in aluminum bags in 0.5kg or 1kg. Seeds are stored under normal room conditions. Prices of imported seeds vary from Rs.1300.00-3600/kg depending on the variety and quality of seeds.

Identified distribution channels of imported big onion true seeds are as follows.

1. Importers → Farmers
2. Importers → Traders → Farmers
3. Importers → Traders → Regional Traders → Farmers

As mentioned earlier, Dambulla is the hub for the distribution of imported big onion seeds. One direct importer is located in Dambulla area and he does direct selling of big onion true seeds to the farmers. He is the major importer among the other importers and he handles one third of total imports of big onion true seeds.

The second channel consisted of importers and traders. Although they are located in Dambulla area, seeds are distributed to other major traders within the area for selling. Payments for seeds take place after selling seeds.

The third channel consisted of importers, Major traders, Regional level traders and farmers. Regional level traders outside Dambulla get true seeds from major traders in Dambulla area for selling at regional level. The businesses also take place based on payment after the selling of seeds.

According to the official records, India is the only big onion true seeds exporter to Sri Lanka. On the other hand, Sri Lanka is one of the major markets for Indian big onions. Therefore, India prefers to export big onions rather than exporting true seeds to Sri Lanka. Due to this, the quality of imported big onion true seed is questionable. Farmers complain that the germination rate of imported big onion true seeds is low and maintaining quality of big onion is also low due to the low quality of imported seeds. According to the focus group discussions, different malpractices were recorded from the field regarding the imported seeds, as explained below.

1. Mixing of expired seeds with new seeds.

If importers or traders could not sell all the imported quantities during a particular season, sometimes they mix the remaining quantity with newly imported seeds. Then the germination rate of seed is reduced.

2. Changing the labels of expired seed packets.

This is also another allegation of farmers and traders, they state that some importers remove the labels of expired seed packs and relabeled and send them to the market again in the next season as new seeds. This type of malpractices has to be stopped and it should be certified that the farmers receive good quality new seeds.

Table 4.8: Imports of Big Onion True Seeds

Year	Importing Country	Variety	Quantity Imported (Kg)		
			Sea Port	Air Port	Total
2006	India	Rampur OP	9,000		
	India	Rampur Red Orient F1	8,000		
	India	Orient F1	400		
	India	Nasik Red	3,000		
	India	Royal Selection	6,000		
	India	Nayak		350	
	India	Ajay		700	
	India	Bonus		700	**28,150**
2007	India	Nasik Red		2,000	
	India	Rampur Red	11,000		
	India	Bombay Red	9,500		
	India	Rampur RedM.2	850		
	India	Rampur OP	2,740		
	India	Bonus	15,000	200	
	India	Nayak		200	
	South Africa	Red Creole		4	**41,494**
2008	India	Nasik Red	8,500	700	
	India	Bombay Red	1,875	3,100	
	India	Rampur Red	2,440		
	India	Rampur OP	15,000		
	India	Bonus		250	
	India	Nayak		1,530	**33,377**
2009	India	Nasik Red	9,600	1,750	
	India	Bonus	250		
	India	Pusa Red	250		
	India	Nayak	1,000		
	India	Bombay Red	8,839		
	India	Rampur Red	1,000		**22,689**
	India	Nasik Red	8,700	750	
2010	India	Bombe Red	4,500	1,020	
	India	Rampur Red	24,040	200	**39,210**

Source: Quarantine Divisions - Department of Agriculture

CHAPTER FIVE

Summary and Recommendations

5.1 Findings

Big onion is one of the most important commercial crops grown in Sri Lanka. At the initial stages of introduction of big onion cultivation the crop totally depended on imported seeds. In the latter stages in 1980's seed production started at experimental level. According to the survey only 9% farmers had experience in producing big onion seeds for more than ten years. Most of the farmers (78%) had experience in big onion seed production for less than 5 years. Especially in the Anuradhapura district, 95% of the farmers had experience of less than 5 years. Situation is somewhat different in the Matale district where 30% of farmers have experience in producing big onion seeds for more than 5 years.

Farmers obtain their mother bulbs from their own product or from neighbouring farmers, or through government subsidy programmes or promotion programmes. According to the survey 67% of the farmers out of the sample use their own mother bulbs for cultivation. Out of the rest, 18% of the farmers had obtained mother bulbs from neighboring farmers. Farmers had taken steps to maintain separate plots for mother bulbs from the commercial cultivation plots, applying more organic fertilizer. The percentage of farmers who had used their own mother bulbs is higher in the areas selected from the Matale district than those of the Anuradhapura district. For example the percentage of farmers who used their own mother bulbs in Kimbissa, Dambulla and Galewela were 97%, 89% and 74% respectively, indicating the high rate of using their own mother bulbs for true seed production. The Ipalogama and Maradankadawela situations were different as they were new to seed production programmes. They were given mother bulbs by the DOA under the true seed production programme.

Survey results show that 40% of the farmers out of the total sample use racks to store mother bulbs. Most of the farmers use wooden racks while the others used metal racks which are given by the provincial Department of Agriculture under a subsidy programme. Another 23% of farmers used the method of hanging with leaves. Farmers who have no storage facilities tend to spread mother bulbs on the floor of their houses. Only 30% of farmers out of the total sample had proper stores to store mother bulbs.

As per the survey the average losses of mother bulbs at storage until the next *maha* season was 22 percent, while the storing loss in *yala* was 38 percent. Lack of proper storage facilities were recorded as the main reason for the high rate of loses.

74% of the farmers out of the sample stated that they had no problems in the Vernalization process. Another 15% of the farmers noted that low germination was caused due to damages in transportation for long distance from Dambulla or Anuradhapura to Rahangala area in the Nuwaraeliya district.

According to the survey results, 85% of the farmers out of the sample had stored harvested seeds packed in polythene at room temperature in their houses. Especially farmers in Galewela, Ipalogama, Kekirawa and Dambulla engaged in true seed production in the *maha* season had a shorter duration for storage, than those who produced seed in the *yala* season. The PDOA in the Central province has a programme to support farmers who produced true seed in the *yala* season to store their seeds in cold rooms. Properly dried seeds packed with polythene, are collected by the Agricultural Instructors (AI) located in ASC and they send them to private or government cold rooms on behalf of the farmers. Farmers have to pay Rs 100.00/kg of seeds for the duration.

In our survey, 208 farmers had responded on problems faced by farmers. According to the data, 76% of the farmers out of the total sample had emphasized pest and disease as a major problem. Further, 25% of the respondents had prioritized it as the first problem in producing big onion true seed production.

Out of the total respondents, 68% of the farmers had reported high cost of inputs as a problem they were facing and it had been prioritized as the first problem by 21% farmers out of the total sample.

With the idea of promoting big onion seed production the Government has provided subsidies in various forms such as materials and storage facilities. These programmes target the newcomers to seed production. Most of the farmers (57%) had emphasized that the subsidy programme had not met their needs. Insufficiency of materials, not receiving them on time and selection of beneficiaries are reported by famers as critical issues.

Most of the farmers (80%) engaged in seed selling have used polythene as packing material. Another 12 percent have used aluminium packages distributed by the Provincial Department of Agriculture in the Central Province. Others have not used any packing material for seeds as transactions take place with the neighboring farmers. Local seed producing companies use very attractive aluminum packages for seeds.

The price of local big onion true seed is five times higher than that of the imported seeds. It is a good indicator of high demand for locally produced big onion true seeds to the high quality of local seeds compared to imported seeds. Hence, there is a high potential to expand the local true seed production.

The study found that there is a high risk in production of big onion seeds as the crop is more sensitive to climatic conditions. Hence, farmers cultivate small plots to avoid risks. The survey found that 58 percent of the sample farmers had produced less than 5kg of big onion seeds. They could manage small plots of seed using family labour rather than hired labour to reduce the cost of production.

The average yield of local big onion true seed production in *yala* season is higher due to the favorable weather conditions under open environmental conditions. In *maha* season production of true seed is costly and difficult due to high cost of pest and decease management and maintaining a rain protected environment for seed plots.

Production of local true seed is financially more profitable in the *yala* season compared to the *maha* season. The value of return to labor and return to capital in *yala* season was Rs.3785.30/man day and 4.95 respectively and Rs.1875.71/man day and 2.95 respectively in *maha* season indicating more financial profitability in *yala*. Total cost and average yield also show positive results in *yala* season compared to the *maha* season.

Although the *yala* season is financially more profitable, farmers produce in the *maha* season due to difficulties of storage of mother bulbs until *yala* season and also thy had to pay more attention to the big onion cultivation during the *yala* season. According to the survey, only 30 percent of the farmers had proper storage facilities for storing mother bulbs while the rest had to use conventional methods such as hanging or spreading on floor.

The major path of seed distribution was recorded as direct selling by seed producer to big onion cultivators indicating the existence of informal seed distribution systems. Most of the farmers (55 percent) who had excess production of seed in a particular season had sold their produce directly to the other farmers within or outside the area.

Few private companies are engaged in big onion true seed production and the major problems faced by them are lack of recommended varieties of foundation seeds, shortage of skilled labour and lack of private public partnership.

According to the Seed Act the seed producers and all the stakeholders in seed businesses have to register and seeds are to be certified. But only 10 percent of farmers have registered under the Seed Act and seeds produced by farmers had never been tested or formally certified by any authority before issuing to big onion cultivators. But Seed produced by the private companies and collected by private sector companies from farmers are tested in their laboratories before issuing to farmers.

Private sector is engaged in importing seed from India and price of imported seed ranged between Rs.1300.00-3600/kg depending on the variety and quality of seeds.

5.2 Recommendations

The study recommends giving more training to farmers on pest and disease control to increase big onion seed production as well as to reduce the cost of production. These are the major problems faced by farmers in producing big onion true seeds. Proper mechanism of providing technology transformation should be established. Formation of farmers groups may help Agricultural officers to conduct training programs rather than going to individual farmers.

Priority should be given to the farmers who are willing to produce big onion true seeds on large scale and they should be given more facilities such as storage of mother bulbs and inputs to increase the seed production.

Proper production programme should be developed to produce basic seeds to meet the demand of private sector.

It is recommended to explore the possibilities of establishing of cold rooms to store harvested seeds until the cultivation season of big onion. Especially for seeds produced in the *yala* season.

It is essential to educate farmers on packaging seeds using proper packing material before issuing to the market. Annual government subsidy programmes should be adjusted to meet the farmers need in time.

Research programmes should be directed to explore the possibilities of producing big onion seeds in other areas such as Monaragala, Polonnaruwa, Vavuniya, Ampara and Mulative districts.

Certification process of farmer produced seeds (informal sector) should be strengthened to ensure farmers access to good quality seeds. Seed testing points can be established at regional level to facilitate farmers to obtain certification of their product within a short period of time.

REFERENCES

Annual Report 2011, Central Bank of Sri Lanka.

Cromwell. E.Friis-Hansen and Tuner M. (1992), The seed sector in developing countries: A framework for performance analysis.ODI working paper 65, London.

DOA (1990), Strategy for Local True Seed Production of Large Onion. A report submitted to the Director of Agriculture.

Edirimanna, E.R.S.P. (2003), Varietal Evaluation of Big Onion, in Dharmasena P.B.Samarathunga H. and Nijamudeen M.S. (Eds.) Fifty years of research 1950-2000 (Review of past findings of Agricultural Research Mahailuppallama) Field Crop Research and Development Institute, Mahailuppallama, Department of Agriculture, Mahailuppallama, Sri Lanka.

Edirimanna, E.R.S.P and Rajapakse, R.G.A.S. (2003), Effects of cultural practices on seed yield of big onion (*Allium cepa* L.), *Annals of the Sri Lanka Department of Agriculture,* vol.05, 2003 pp,69; Department of Agriculture, Peradeniya, Sri Lanka.

FAO (2000), Seed production and improvement: assessment for Asia and the Pacific.

Field Crop Research and Development Institute (FCRDI), Mahailuppallama, Administrative reports, Various Issues.

Jayasinghe, U. (2004), Seed Production in the Developing Countries: CIP Strategy.

Kuruppuarachchi, D.S.P. (1990), "True Seed Production of Large Orion at Kalpitiya", proceedings of National Workshop held at ARTI, 8th January, 1990, Colombo.

Lesly, W.D., Malaviarachchi M.A.P.W.K., Jayawardena, S.N. and Kumararathne M.J.M.P. (2002), Farmer management practices on the productivity of big onion in the dry zone of Sri Lanka, *Annals of the Sri Lanka, Department of Agriculture,* Peradeniya, Sri Lanka. vol. 04, pp. 385.

Mettananda K.A. (2006), Mother bulb storage of big onion (*Allium cepa* L.) for seed production during the *Yala* season, *Annals of the Sri Lanka Department of Agriculture;*

Preston S.P. and Wickramasinghe Y.M.C., (1993), Present Status and Future Prospects of Onions Production in Sri Lanka. Diversified Agricultural Research Project, DOA, Sri Lanka.

Rupasena, L.P. (2009), Big onion Production and Marketing in Matale District, *Govikatayuthu Adyanaya* (Sinhala language), Hector Kobbekaduwa Agrarian Research and Training Institute, Sri Lanka, Vol 8, pp.27.