MARKET ACCESS TO QUALITY PADDY SEED IN KERALA

By

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(2015-11-053)

THESIS

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DECLARATION

I, Fathimath Nufaisa P. (2015-11-053) hereby declare that this thesis entitled **"Market access to quality paddy seed in Kerala"** is a bonafide record of research done by me during the course of research and that the thesis has not previously formed the basis for the award of any degree, diploma, fellowship or other similar title, of any other University or Society.

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CERTIFICATE

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INTRODUCTION

Agriculture is the sole of Indian economy. Share of agriculture and allied sector in Gross Domestic Product (GDP) is 17.4 per cent (GOI, 2017). So development of agriculture sector is important for over all development of Indian economy. Development of agriculture sector is also important to ensure food security of the country.

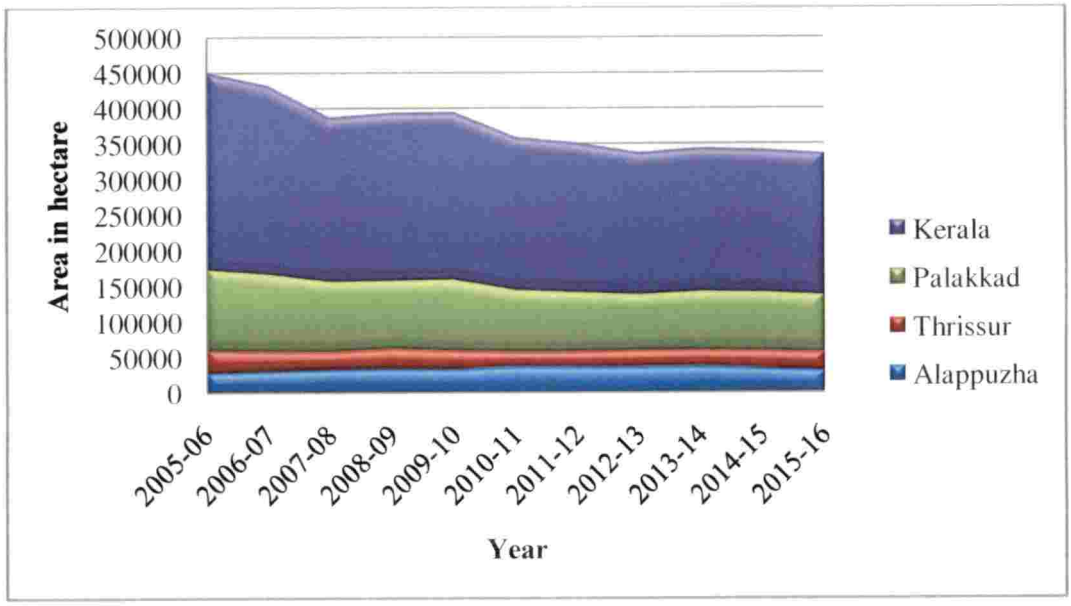
Out of various agricultural products, production of food grains need special attention as population is increasing at an alarming rate. Rice is the staple food for over 60 per cent of population and rice cultivation is the mainstay for rural population (Moe *et al.*, 2016). Rice area is diminishing globally over the years. Similar trend is observed in India and Kerala. In order to sustain at least the current level of production use of good quality rice seed is recommended. Crucial input in agricultural production is quality seed. Quality seed contribute nearly a quarter of overall increase in productivity. Understanding the importance of use of good quality rice seeds in enhancing productivity there had been notable efforts by both central and state governments in making available quality rice seeds.

The Indian seed programme is characterised by three generation system of seed production, viz., breeder seed, foundation seed and certified seed. The participants of this system comprises of both central and state governments including Indian Council of Agricultural Research (ICAR) and State Agricultural Universities (SAUs), public sector, co-operative sector and private sector institutions. Significant restructuring of Indian seed industry was done by Government of India through National Seed Project phase 1 (1977-78), phase 2 (1978-79) and phase 3 (1990-91). Seeds Act (1966), Seed Rules (1968) and Seeds (Control) Order (1983) together provide the legal frame work for the seed programmes in India. The contribution of organized sector is almost 30-35 per cent of the total seeds distributed in the country. Venkatesh and Pal (2014) estimated the value of seed business in India and it was found to be Rs. 65 billion in 2010. Out of this, the major share was for cotton (Rs.14.95 billion) followed by

paddy (Rs. 11.7 billion). Cotton and paddy together contributed to nearly 41 per cent of total seed business in the country.

In Kerala, also the area under rice cultivation is diminishing. The extent of reduction in area under rice between 2001-02 and 2015-16 is about 38 per cent. The decreasing trend of area under rice in Kerala and in major rice growing districts viz., Palakkad, Alappuzha and Thrissur is depicted in the figure (Fig. 1.1) below.

Figure.1.1. Area under rice in Kerala



It could be clearly observed that the area under rice is showing a decreasing trend over the years. The gross cropped area in the state which was around 4.5lakh ha in 2005-06 declined to less than 3.5 Lakh ha in a decade. Given the demographic pressure and other socio- economic conditions prevailing in Kerala, increasing the area would be near to impossible. The per capita land holding size in the state is 0.24 ha (GOI, 2014). At the same time, the statistics on production of food grains in the state indicates that our production is only 15 per cent of the demand (GOK, 2016). The state depends heavily on other states for the requirement of rice, the staple food. From the food security point of view of a state, this is quite alarming. In this scenario maintaining at least the present level

of production could be achieved only by adopting good cultural practices. Quality seed is the most basic component in agricultural production and the use of quality seed alone can account for 10-15 per cent increase in crop yield (Haq et. al., 2014). In a scenario of limited land resources, using quality seed emerges as the single most important option to enhance rice production.

Realizing the need to enhance production and availability of quality seed, Government of Kerala under the auspices of Kerala State Seed Development Authority (KSSDA) initiated steps to strengthen and re-structure the seed production programme on a scientific and systematic manner. The Kerala Agricultural University (KAU) apart from producing paddy seeds in the farms under its research stations, also stream-lined the farmer participatory seed production programme which was initiated under the National Seed Project-Breeder Seed Programme (NSP-BSP) at Regional Agricultural Research Station (RARS), Pattambi. The programme gained further impetus under the ICAR Mega Seed Project. Presently, quality paddy seed in the state is being produced and distributed through various farms both under the Department of Agriculture (DoA), Government of Kerala (GoK) and KAU as well as the Registered seed growers programme (RSGP) implemented by GoK and through farmer participatory seed production programme of various stations of KAU.

In spite of these efforts, availability of quality paddy seed, in the right quantity, at the right time and at the right place is still a matter of concern in the state. A systematic attempt to evaluate the seed market for rice in the state is the need of the hour. Hence, the study entitled 'Market access to quality paddy seed in Kerala' has been under taken.

Specific objectives of the study

- To document and assess the economic performance in rice seed supply chains
- To elucidate the demand-supply gap in rice seed production in Kerala
- To conduct SWOC analysis of rice seed market in the state

Scope of the study

Rice production scenario in Kerala is not so encouraging. Area under rice cultivation is diminishing over the years. As seed is the critical input in agriculture and efficiency of all other inputs depends mostly on the quality of seed used for agricultural production, enhancement of rice production through the use of good quality rice seed is advocated. As rice seed production is high volume low value system demanding substantial management than the grain production, the production and distribution of quality rice seed is generally done by public sector institutions. Even though several rice seed supply chains could be identified, research studies on the rice seed market is scanty in Kerala. The common informal seed distribution system comprising of farmer to farmer exchange often is constrained by low productivity. Hence this study is expected to bridge the research gap and also to provide inputs for developing an efficient seed market. It is also expected that the suggestions would aid in making appropriate policy decisions on rice seed production and distribution system in Kerala.

Limitations of the study

Social science research is carried out based on the primary data collected from respondents. There is every chance for the response to be biased. Also unwillingness or inability of respondents to give answers also causes errors in primary data. Moreover, as the study was carried out for the partial fulfilment of Master's Programme there were financial and temporal constraints. However, the study has been conducted with utmost care to avoid all these limitations to the extent possible.

Presentation of thesis

The study entitled 'Market access to quality paddy seed in Kerala' is presented in five chapters. The 'introduction' chapter gives a small account of importance of using quality paddy seed, seed production programmes in India and Kerala followed by objectives, scope and limitations of the study. Results and

findings of earlier research work in the related topic are explained in second chapter titled 'Review of Literature'. Methodology used in data collection and data analysis is discussed in the third chapter. Fourth chapter elaborates on the major findings of the research work and the last chapter 'Summary and Conclusion' gives us an encapsulated view of major findings and its implications on existing policy

Review of literature

2. REVIEW OF LITERATURE

This chapter aims at enhancing the theoretical background of the study through a review of past studies on similar topics by different researchers. It gives us an understanding of the way in which the problem has been addressed and clarity in the methodology to be pursued. In order to critically examine the related studies the whole chapter is divided into different sections as follows:

2.1 Quality seed in crop production

2.2 Rice seed supply chains

2.3 Economic performance in rice seed supply chains

2.4 Demand supply gap in rice seed production

2.5 Market access to quality rice seed

2.6 Constraint analysis of rice seed market

2.1 QUALITY SEED IN CROP PRODUCTION

A study conducted to compare the economics of wheat production using certified and uncertified seeds revealed that there was a definite increase in average productivity of wheat by 22.5 per cent. Even though cost of cultivation using certified seed was 11.3 per cent more than that using uncertified seed, the net profit per hectare for wheat was almost 26.5 per cent higher than that using uncertified seed (Sofijanova *et al.*, 2012)

Haq *et al.* (2014) reported that one of the basic inputs to cultivate crop is quality seed. Seed can be referred to as quality seed if it possesses varietal purity, freedom from weed seeds and physical impurities and it has germination capacity of above 90 per cent. They also reported that the use of quality seed alone can account for 10-15 per cent increase in crop yield and it is impossible to attain potential growth rate in agricultural sector without use of good quality seeds.

Saxena *et al.* (2014) conducted field demonstrations in Raipur district in Chhattisgarh to elucidate the advantage of using quality rice seed. Rice yield on using quality seed was 36.11 per cent higher than that while using local seed in Kharif 2010. In Kharif 2011, increase in yield with the use of certified seed was 18.45 per cent which again convinced farmers about the importance of quality seeds in cultivation.

Surekha *et al.* (2015) opined that use of quality seed can reduce cost of cultivation to a large extent. It is achieved through lower seed rate, maximising germination, uniform crop stand, fast establishment of seedlings, presence of very few off types and weeds, lower incidence of pest and diseases and uniform maturity without any mixtures, which ultimately fetches higher market price for the produce.

Kunwar *et al.* (2016) suggested that the key component in crop cultivation was use of good quality seed. Farmers usually do not get expected yield potential due to varietal differences, low seed replacement, poor seed quality and low adoption of good agronomic practices. However, improved seeds of high yielding varieties have proven to give 15-131 per cent more yield than traditional varieties.

Seed is the basic input for agriculture. Enhancement in agricultural production and productivity through use of fertilizers and manures, pesticides, irrigation etc ultimately require good quality seed. Average contribution of seed to productivity is almost 20 to 25 per cent. So, it is possible to enhance agricultural production and productivity by improving farmers' access to good quality seed (GOI, 2017).

2.2 RICE SEED SUPPLY CHAINS

Jaffee and Srivastava (1994) conducted a study to analyze the role of public and private sectors in enhancing the performance of seed systems in India. They advised a phased withdrawal of public sector from mass seed production and marketing as these functions were negligible. They opined that the gap will be

bridged by cooperatives, private firms, farmer associations and NGOs. However, they emphasized continuation of the critical and important role of public sector in plant breeding research, quality control, consumer protection and varietal maintenance.

Verma and Sidhu (2009) conducted a study to analyze sources, seed replacement rate and management of paddy seed in Punjab. Major rice seed source in Punjab was private seed dealers with a share of almost 48 per cent followed by authorized seed dealers (19%), farm saved (11%) and commission agents (11.5%) with the share of Punjab Agricultural University (PAU), fellow farmers, friends and relatives ranging from 1-2 per cent each. The seed replacement rate of paddy in Punjab was reported to be 24 per cent. The study recommended that farmers' awareness on the benefits of quality seeds and its replacement with seeds from reliable sources like PAU and state agriculture department should be augmented.

Adejobi *et al.* (2010) reported that performance of rice seed market in Nigeria was not up to the mark as demanded by the situations. Rice seed distribution networks were mainly concentrated in urban areas than rural areas where majority of the farmers reside. Also the research findings suggested that policies aimed at improving rural rice seed distribution networks, seed quality control and development of sufficient manpower were needed.

Malope (2011) examined the prospects and challenges of seed sector privatization in Botswana. Notion of privatization was raised as a result of some short comings in the current system. It included supply of poor quality seed, insufficient monitoring of seed production and distribution, and low returns to Department of Agricultural Research (DAR). However, it was suggested that seed sector need over all changes in institutional and policy frame work to support the entry of private firms.

Okry (2011) stated that there were formal and informal rice seed systems in Nigeria. Informal system consisted of local seed dealers and formal system, the

public sector institutions. It was the informal rice seed system that worked in harmony with the realities of peasant life. The study suggested the need to develop a synergy between the two systems. While formal system focuses on variety dissemination, the local seed dealers should concentrate on bulk seed supply and thus the whole system could efficiently meet the demand of rice farmers in Nigeria.

Rana *et al.* (2011) suggested that rice seed production and distribution system in Nepal could be broadly classified into two, formal and informal seed system. Formal system comprised of research institutions, government seed companies and private seed companies expected to deal with clearly defined products, i.e., certified seeds of specific varieties. The informal seed system comprised of farmer retained seeds and farmer exchange seeds. The study highlighted the significance of farmers' seed system in improving access to seed and for maintaining biodiversity. Farmers' seed selection practices included best plot selection, panicle selection and rouging of off types.

Saptoka *et al.* (2011) also reported existence of two rice seed systems in Nepal, formal and informal seed systems. Out of these almost 92.3 per cent of rice seed requirement was met from informal seed system. The study highlighted that most of the farmers depended on farm saved and farmer exchange seeds compared to those distributed by public and private institutions. Also, the formal system developed seeds were distributed mainly through public institutions and only very nominal amount was distributed through private dealers.

Eskandari (2012) stated that seed quality helps to attain potential crop yield in two ways. One is through rapid emergence of seedlings giving rise to highly vigorous plants and second through the optimal plant population that could be achieved as a result of uniform germination of seed.

Three major seed systems- conventional seed system, traditional local seed system and integrated seed system have been identified by Beye and Wolperies (2014) in Sub Saharan Africa and strategic models were developed based on the

roles of different actors in seed system. Strategic models included state managed, research and extension based seed system, seed sector by private seed companies, seed sector by small holder farmers and also seed sector run by small scale seed enterprises.

Roy (2014) claimed that farmer participatory quality seed production is one of the best methods to increase productivity. It was based on findings from a study conducted in West Bengal. In 2008, a self- help group named 'Suphala Beej Swarnirbhar Gosti (SBSG)' was formed in order to enhance participatory seed production of major crops such as rice, potato, pulses and mustard. The study highlighted that seed replacement rate of major crops were increased along with improvement of living standards of farmers involved in seed production.

Venkatesh and Pal (2014) analyzed the amount of quality seed production in India from 2003-04 to 2009-10. It was found that quality seed production almost doubled during these years in general. A moderate increase in quality seed production was recorded from 2003-04 to 2005-06 and afterwards a gradual decrease in production was noted from 47.5 per cent in 2003-04 to 38.9 per cent in 2009-10. During the period an increase in public sector share from 52.5 per cent to 61.1 per cent was recorded.

Kakoty and Barman (2015) conducted a study in Assam to analyze sources of rice seed and reasons for low seed replacement rate in paddy. It was found that the most important source of seed was self-retained seed. Major reasons for low seed replacement rate in paddy included lack of awareness about seed replacement rate, farm size, inadequate supply of seed etc.,

According to Deepana and Girish (2016), the rice seed market in Mandya district of Karnataka was dominated by two agencies, Karnataka State Seed Corporation Ltd. (KSSC) and National Seeds Corporation (NSC). KSSC was found to be the major player with a market share of 78 per cent, whereas it was only 10 per cent for NSC. Also compound growth rates of different seed

distribution agencies were worked out. It was found that the growth rate of paddy seed sales is negative showing that paddy seed market is saturated.

Kunwar *et al.* (2016) claimed that there were two approaches for seed production and distribution in Timor-Leste under the Ministry of Agriculture and Fisheries. First one is the centralized seed production and distribution which was in practice from 2010 to 2011 and the second one is decentralized community based commercial seed production and distribution started during 2012-2015. Decentralised approach was 2.3 times more expensive than the other one. However, results have shown that there was a tremendous increase in seed replacement rate from merely 4 per cent to 20 per cent in 2015. Hence the ministry chose to continue with second approach.

Moe *et al.* (2016) claimed that major source of seed to rice farmers in Tatkon, Myanmar was informal sources that constitute farmer saved seed and farmer exchanged seed. Most of the farmers (59.16 per cent) got information on rice seed from fellow farmers. They also analyzed the quality of seed from farmer saved seed and from formally supplied seed. The results showed that formally supplied seed was of high quality and the other two was of low quality. Also, the study highlighted the need to strengthen farmers' rice seed system through training.

Pandey *et al.* (2017) conducted a study in Odisha regarding transitions in rice seed systems. The study revealed a strong need to restructure rice seed sector in the state consisting of formal and informal rice seed systems. In formal rice seed system, the dominance of public sector in rice seed production was highly noticeable which provides less space for the entry of private sector. It was suggested that the present situation ought to be redesigned to enable the entry of private sector that would ultimately lead to development of a more competitive market.

2.3 ECONOMIC PERFORMANCE OF RICE SEED SUPPLY CHAIN

Ranganath (2004) compared the economics of seed and non-seed production of jowar in Kurnool district of Andhra Pradesh. Results have shown that cost of cultivation for jowar seed crop was more (Rs.27030.75/ha) than that of non-seed irrigated farms (Rs. 21700.31/ha) and non-seed rain fed farms (Rs. 9891.22/ha). Also cost of cultivation showed an inverse relationship with the farm size. The net returns in seed production was Rs.15556.75/ha, Rs. 7869/ha for non-seed irrigated farms and Rs. 4101.53/ha for non-seed rain fed farms. Consequently, the B-C Ratio worked out to be 0.58, 0.37 and 0.42 for seed producers, non-seed irrigated farms and non-seed rain fed farms respectively.

Pouchepparadjou and Thimmappa (2009) compared economics of rice seed production and commercial rice cultivation. It was noticed that cost of rice seed production was more (Rs. 9394/acre) than that of commercial rice production (Rs. 7538/acre). It was mainly due to the extra cost incurred for seed drying, preliminary processing and registration and field inspection charges. However, gross returns from seed production was found to be higher than commercial rice production adding to the profitability of rice seed production. The major factor that attributed to the high return was the incentives given by the government to induce farmers to take up seed production.

Kumari (2011) reported that in Kerala, 70 per cent of total cost of rice cultivation was accounted for the labour engaged. The highest share of labour in cost of cultivation is attributable to the drastic decline in number of agricultural labourers in Kerala. The cost of cultivation of rice was the highest among the different states in India.

Hoque and Haque (2014) conducted a study in Bangladesh to elucidate the socio-economic factors influencing profitability of rice seed production. It was found that the rice seed production is not highly remunerative as they get an average BCR of 1.44 only. Various factors positively influencing rice seed production included farm size, contact with information sources, knowledge on quality rice production and age of the respondents.

Dhruthiraj (2016) claimed that the cost of cultivation for seed production of KAU rice varieties was higher in Karnataka (Rs.88,176/ha) as compared to Kerala (Rs.86,355/ha). It was mainly because Kerala farmers were supplied seed free of cost thereby reducing the input cost for rice seed production. It was also found that the average gross income was higher in Kerala (Rs. 156223/ ha) than that of Karnataka (Rs. 117513/ ha).

Pal *et al.* (2016) estimated economics of pigeon pea seed production in Uttar Pradesh. It was found that the ratio of fixed and variable costs in pigeon pea production was 32:68. Major share of total cost was accounted by labour cost (32.46%) followed by manures and fertlisers (6.85%), cost of plant protection measures (6.85%) cost of seed (2.49%) and bullock and machine labour (2.29%). However, on comparing grain and seed production in pigeon pea it was revealed that farmers' net return from pigeon pea seed production was 44 per cent higher than that of grain production.

2.4 DEMAND SUPPLY GAP IN RICE SEED PRODUCTION

George (2002) concluded that there was a huge demand supply gap in rice seed production in Palakkad district. Almost 94.70 per cent of total rice seed requirement in Palakkad district was met from farm saved seeds. Public sector agencies including State Seed Farms, RARS Pattambi, NSC unit Alathur and RSGP together constituted only five per cent of total rice seed requirement in the district.

Dudhat and Khunt (2006) conducted a study in Gujarat to analyse the growth pattern of quality seed production of major crops during 1980-81 to 2000-01. The results indicated that supply of certified seeds of wheat, rice and maize is expected to increase in coming years. At the same time, supply of castor, sorghum and groundnut is expected to decrease. The demand supply gap of quality seeds was estimated which indicated that there would be a wide demand supply gap in sorghum (100.31%) followed by maize (99.8%), groundnut (99.11%), rice (68.86%) and wheat (61.46%).

Kshetri (2010) claimed that the National Seed Company (NSC) was the formal seed supplier in Nepal. But NSC's contribution was only 3-5 per cent of total requirement. Also, seed was expensive, not available in time and the varietal preferences of farmers were not taken into account. It was found that only 2 per cent of total requirement for rice, 12 per cent for wheat seed and one per cent for maize seed were met by NSC. It compelled farmers to depend on farmer saved seed. It was reported that 90 per cent of total requirement for cereal seeds and 100 per cent for minor crops were met from farmer's own seed production and supply system.

In India, private sector seed companies were more involved in the seed production of low volume high value crops (like vegetables), making it difficult for public institutions to meet demand supply gap in seed production of high volume low value crops. It was also found that, comparatively a huge demand supply gap in cereal seed production existed, which amounted to 36.4 Lakh quintals, of which rice alone accounted for 22.7 Lakh Quintals. They suggested the need to encourage competition between public and private sectors in seed production so as to meet farmers' demand for quality seeds (Singh and Chand, 2011).

Joshi *et al.* (2012) conducted a study to find out seed replacement of paddy in Konkan region in Maharashtra. The results indicated that seed replacement rate (SRR) was only 15.13 per cent against the recommended SRR of 25 per cent. While examining the future supply of certified seeds, a negative trend was observed. At the estimated SRR there would be a demand for 10027.52 quintal in 2015. To achieve a seed replacement rate of 25 per cent, the demand supply gap of 27861.56 quintals has to be overcome.

Ravindra *et al.* conducted a study in 2017 to analyze the growth, demand and supply of quality seeds of pulses in India. The results have shown that there was demand supply gap in pulse seed production except in bengal gram during 2012-13 and 2013-14.

2.5 MARKET ACCESS TO QUALITY RICE SEED

A study was conducted by Okry *et al.* (2011) to analyze smallholder farmers' access to quality rice seed in Guinea. It was found that NGOs, farmer associations and contract seed producers play a major role in rice seed delivery whereas participation of governmental organizations were very negligible. So they recommended an alternative model for seed sector development involving local seed dealers to link formal and informal rice seed sector and thus to enhance smallholder farmers' access to quality paddy seed.

Awotide *et al.* (2012) ascertained that the access to certified improved rice seed enhanced rice farmers' income in Nigeria. Mass media contact, contact with extension agents, age of household head and years of formal education were identified as the major factors influencing access to certified seed. They also reported that, apart from access to quality seed, agricultural expenditure, household size and income from other crops positively influenced income of rice farmers in Nigeria.

Seed Voucher System (SVS) was an emergency rice initiative programme in Nigeria to support rice production. Through SVS, randomly selected farmers could obtain access to subsidized, certified, improved rice seed. Karmov*et al.* (2013) conducted a study to find its effectiveness and found that SVS had a positive and statistically significant impact on farmers' income. Better access to good quality seed was found to have improved the living standards of farmers.

Ali *et al.* (2015) reported that farmers' access to certified wheat seed was influenced by several factors such as level of education, wealth and income level of farmers and access to bank credit. Also, the study highlighted that farmers having access to seed were capable of achieving higher crop yield compared to those without access. Hence, the study suggested to bring out necessary policy changes to enhance farmers' access to certified and thus to achieve food security.

Dibba*et al.* (2015) planned a study to determine how accessibility to seed affects the potential adoption of an improved rice variety with special reference to new rice for Africa (NERICA) in Gambia. The result showed that adoption rate of NERICA was only 66 per cent. Awareness among farmers and access to seed were the two major factors contributing to this adoption gap. The study also revealed that, if every farmer were aware and have access to NERICA adoption rate would have been as high as 92 per cent.

Lack of access to quality seed has a wide range of adverse impacts on food production systems. It limits the seed choices of farmers which ultimately bound their ability to cope with biotic and abiotic stresses. Also it affects farmers' desire to catch diverse and changing market trends and also limits their capability to attain potential yield (CGIAR, 2016).

Rajendra *et al.* (2016) concluded that farmers' income from vegetable seed sale is positively and significantly influenced by access to certified seed. It was also noted that, access to quality seed can be improved by frequent contact with extension personnel and also by participation in farmer-led enterprises.

2.6 CONSTRAINTS IN RICE SEED MARKET

Menon (1985) stated that there is national and state seed agency networks to produce and distribute quality seed to farmers throughout India. But high prices, inefficient distribution, insufficient extension work and unscientific use of hybrid seeds were some bottlenecks for attaining the expected results. Also, farmers are willing to adopt seeds of new high yielding varieties if the returns justified added expenses.

Wijeratna and Silva (2004) examined the status of rice seed production in Srilanka. It was noticed that earlier there were inadequate seed supply and government supported private seed growers and rice farmers to produce their own seed. Although seed certification centre was set up, a major portion of seed production did not meet the minimum quality standards. *i.e.,* per cent of total seed

accepted was only 22 per cent for private seed growers and 58 per cent for government farms. The study point towards the need for intensive extension programmes to orient farmers and seed producers towards the production of high quality seed.

Tripathy *et al.* (2006) analyzed trends in production, adoption and utilization of high quality paddy seeds in Orissa. Their study pointed out that majority of the farmer who were benefited from subsidized quality seed supplied through department seed sales were large farmers residing within a distance of 5 kilometers from sales centers. Also 29.6 per cent farmers were having problem with regard to availability of appropriate quality and variety, 20.7 per cent farmers were affected by unavailability of desired varieties, 13.9 per cent affected by higher prices of seeds, 8.7 per cent were affected by unreliable quality, 7.1 per cent with transportation bottlenecks and 6.7 per cent with inadequate extension services. The study points out that the benefits of departmental sale of subsidized quality seed have not reached to the expectation of farmer.

Pouchepparadjou and Thimmappa (2009) studied the reasons for farmers' withdrawal from rice seed production in Puduchery. It was found that farmers had to face risk of rejection due to presence of other distinguishable varieties (ODVs). Also, there were problems like late release of subsidies, untimely payment by procuring agency, unavailability of quality seeds and delay in processing. These factors altogether tempted farmers to withdraw from rice seed production in Puduchery.

Tin (2009) reported that strengthening of farmers' seed system could be brought out by educating farmers. A farmer seed production school was conducted from 2003 to 2007. Ex-ante and ex-posto studies revealed that, majority of them resorted to seed production instead of grain production, seed rate was reduced by 50 per cent and also farmers started to use high quality improved seeds. Beyond these changes, farmers' knowledge on good agronomic practices were improved, there were more diffusion of knowledge among other fellow

farmers, community seed clubs were formed and subsequently farmer seed system was strengthened.

Pal *et al.*(2010) discussed about the constraints faced by farmers in adoption of pigeon pea seed production technology in Karnataka. Almost 76 per cent of farmers opined small holding size as the major hindering factor. Other constraints included non availability of labour, non availability of quality seed and high cost of cultivation.

According to Karthik and Manjunath (2011), major constraints faced by hybrid paddy seed growers could be classified into three categories, namely financial constraints, administrative constraints and acquisition and utilization constraints. Lack of timely and sufficient credit was identified as the major financial constraint. Administrative constraint included lack of timely supply of seeds and non-availability of market facilities at local level. Also lack of proper guidance, resources and knowledge were enlisted as major acquisition and utilization constraints.

Bishaw *et al.* (2012) conducted a study to compare physical and physiological quality of wheat and barley seed from different sources in Ethiopia and Syria. Results revealed that majority of seed samples which were managed by the farmers, met minimum physical purity and germination standards. Farmer's seed management practices included seed selection, cleaning, treatment and separate storage to improve or maintain quality. Contamination with weed seeds was found to be one of the major constraints for seed samples not meeting the standard of seed from formal sector.

Joshi *et al.* (2012) identified the major constraint for low seed replacement rate of paddy in Maharashtra. It included high price of certified seed, lack of preferred variety by the farmer and untimely supply of seeds.

Bottlenecks in rice seed value chain in Bangladesh were identified as lack of knowledge and understanding among private seed producers or companies

about HYVs of quality seed, short supply and high cost of breeder seed as perceived by private seed companies, lack of knowledge and skills among seed companies and dealers in rice seed post-harvest technology, lack of modern post-harvest infrastructure, poor storage conditions at farm household level and low quality of rice seed (Tulachan, *et al.* 2013).

Major constraints in effective functioning of seed system in Nepal were identified as absence of choice varieties to farmers as a result of time consuming process of variety development and release, and the time lag noticed in reaching the farmer. Farmers' access to newly developed varieties at the right place and time, at affordable price is very much limited and there is mis-match between demand and supply of quality seed as a result of incorrect demand assessment (Gauchan, 2015).

CGIAR (2016) has reported that farmers in Uganda have lost their confidence in formal seed sector due to high price and prevalence of fake seed. In order to satisfy farmers' need for high quality diverse seed, a novel category of seed known as 'Quality Declared Seed (QDS)' was introduced. It would be supplied by local seed businesses strengthening the seed networks and would ensure small holders' access to quality, low priced, diverse seed required to boost productivity and food security .

The review of past studies/literature done indicated that access to quality seed is the most serious issue in seed supply chains. In general, the formal system has been reported to have functioned at sub-optimal level across reporting countries. The 'Choice basket' was observed to be limited in the case of Formal seed supply system, which has been highlighted as a major constraint in the literature. It is also to be noted that systematic studies on seed distribution in paddy, the staple food crop has not been reported from Kerala, so far.

Materials and methods

3. MATERIALS AND METHODS

This chapter explains the methodology of research through different sections. The first section includes explanation on location of study and its features. This section is followed by sampling design, collection of data and data analysis.

3.1 AREA OF STUDY

To study rice seed supply chains in Kerala, three districts having maximum area under rice cultivation were selected, *i.e.*, the study was based on the data collected from Palakkad (82896 ha), Alappuzha (37403 ha) and Thrissur (22274 ha) districts. District wise area, production and productivity of rice in Kerala is given in Table 3.1. Location map of study area is given in Fig.3.1.

Fig. 3.1. Location map of study area

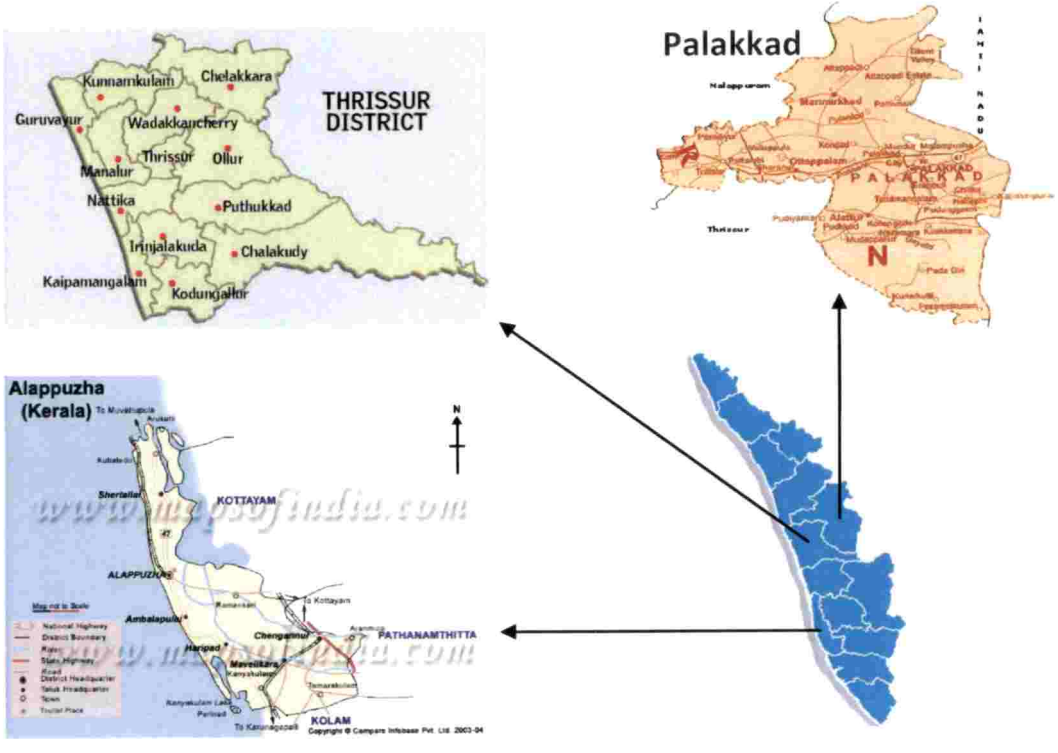


Table 3.1. District wise area, production and productivity of rice in Kerala (2015-16)

Sl No.	District	Area(Ha)	Production(MT)	Productivity(kg/ha)
1	Thiruvananthapuram	2001	5453	2573
2	Kollam	1363	3351	2155
3	Pathanamthitta	2467	8396	3313
4	Alappuzha	37403	89335	2816
5	Kottayam	15746	49506	3042
6	Idukki	661	2198	2478
7	Ernakulam	4052	12652	2126
8	Thrissur	22274	78886	3203
9	Palakkad	82896	228459	2816
10	Malappuram	7549	23649	2722
11	Kozhikode	2433	3608	1256
12	Wayanad	11481	23704	2575
13	Kannur	5080	11518	2103
14	Kasaragod	4205	8560	2227
	State	**199611**	**549275**	**2790**

(Source: GOK, 2017)

3.1.1. Palakkad

Palakkad, is known as 'Granary of Kerala' due to the presence of vast stretches of paddy fields. It is also the largest district in the state comprising 11.5 per cent (4480 Km^2) of total state's area.

Palakkad is situated at a latitude of $10^0 46' 27'' N$, longitude of $76^0 39' 32'' E$ and at an elevation of 95m (311ft) from the Mean Sea Level (MSL). The district is

borded by Malappuram in the north west, Thrissur in the south west, north east by Nilgiris and east by Coimbatore district of Tamil Nadu.

Palakkad is characterised by tropical wet and dry climate experiensing moderate temperature through out the year. March and April are the hottest months in an year. However, Palakkad gets an annual rainfall of 2110 mm. Almost 75 per cent of rainfall is through South West monsoon. Topographically Palakkad include lowland comprising midland and high land including hilly portions. Soil is lateritic both in mid and high lands.

According to 2011 census report, the total population in Palakkad is 2810892 and Sex ratio of Palakkad is 1067 females for every 1000 males which is in consonance with the unique pattern of Kerala state. Population growth rate for the decade 2001-2011 is 7.39 per cent and literacy rate for the district is 89.32 per cent (GOK, 2015).

3.1.2. Alappuzha

Alappuzha also known as 'Venice of the East' due to the presence of vast stretches canals connecting the cities. Alappuzha owns a network of lakes and criss-crossing rivers. Major rivers in Alappuzha include Manimala, Achankovil, Pampa and Meenachil.Kuttanad, a part of Alappuzha is called 'Rice bowl of Kerala'and it is the rarest natural area in the world where agriculture is being practised below Mean Sea Level (MSL).

Geographically, Alappuzha is a landmass between vast Arabian sea and a vast network of rivers flowing through it. It is situated between latitude of 9^0 29'N, longitude of $76^0$19' and at an average elevation of one metre MSL. Alappuzha shares border with Ernakulam, Kottayam, Pathanamthitta, Lakshadeep and with Arabian sea.

Climate of Alappuzha is hot and humid during summer due to its proximity to sea. Average monthly temperature is 27^0C. It experiences rainfall during both South West and North East monsoon with an annual rainfall is

2763mm. These showers heavily influences weather in Alappuzha. The entire district lies in low land and midland regions and no regions are present in high land regions. It is a sandy strip of soil criss-crossed by lagoons, rivers and canals. Also, no forest cover is present in Alappuzha district except Veeyapuram which was recently decalred as a reserve forest.

Area of Alappuzha is 1414 km^2, constituting nearly 3.64 per cent of area of the state. Total population in the district is 2109160, accounting to 6.61 per cent of the state population.Population density in the district is 1492/Km^2 and sex ratio is 1100. Literacy rate is 94 per cent and urbanization is 29.46 per cent (GOK, 2015).

3.1.3. Thrissur

Thrissur is known as the 'Cultural capital of Kerala,' due to its cultural, traditional and leaning through out history. Kerala Kalamandalam, the temple of traditional dance forms is situated in Thrissur. Rice cultivation in Thrissur district is mainly in the kole wetlands which satiate 40 per cent of the requirement of the state. Kole lands have been declared for protection in the Ramsar wet land convention.

Thrissur district is situated at a latitude of 10.4146^0 N, longitude of 76.3637^0 E and at an elevation of 2.83 metre(9.28 ft). In the north it is bordered by Malappuram, east by Palakkad and Coimbatore, south by Ernakulam and west by Arabian sea.

Land may be easily classified into high lands, plains and coastal area. Periyar, Chalakkudy, Karuvannur, Kurumali and Ponnani are the major rivers in the district. It features a tropical monsoon climate with average daily temperatures ranging from 35-37^0C; average summer temperature is 35^0C and average winter temperature is 20^0C with an annual precipitation of 3100 mm.Total area under the district is 3032 $km^2$with a population of 2974232. Out of which 1422052 are

females and 1552180 are males. Sex ratio is 1092 And population density is 982/km^2 (GOK, 2015).

Details on land utilization pattern in Alappuzha, Palakkad and Thrissur is given in Table. 3.2. and cropping pattern is given in Table. 3.3.

Table 3.2 Land utilization pattern in Palakkad, Alappuzha and Thrissur

Sl. No.	Particulars	Palakkad (ha)	Alappuzha (ha)	Thrissur (ha)
1	Total geographical area	447584	141011	302919
2	Forest	136257	0	103619
3	Land put to non-agricultural use	45231	22567	37613
4	Barren and uncultivable land	1795	29	259
5	Permanent pastures and other grazing land	0	0	3
6	Land under miscellaneous tree crops	698	72	191
7	Cultivable waste	23794	15064	8279
8	Fallow other than current fallow	14152	2670	8256
9	Current fallow	12746	3363	9515
10	Marshy land	0	33	4
11	Still water	15340	12143	6328
12	Water logged area	0	332	320
13	Social forestry	379	33	147

14	Net area sown	197192	84705	128385
15	Area sown more than once	104520	21914	49233
16	Total cropped area	301712	106619	177618

(Source: GOK, 2017)

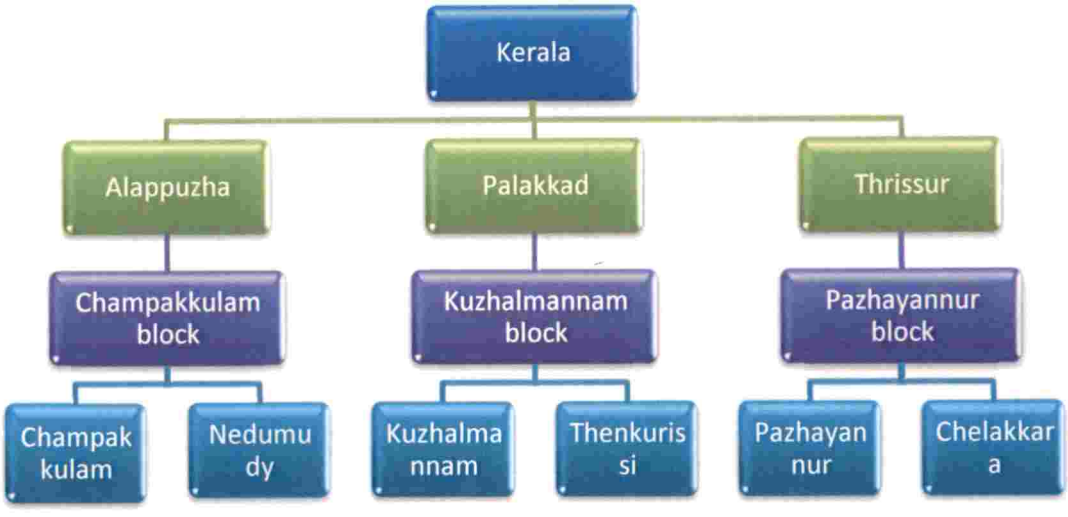
Table 3.3. Cropping pattern in Palakkad, Alappuzha and Thrissur

Sl No.	Crop	Palakkad (Ha)	Alappuzha (Ha)	Thrissur (Ha)
1.	Paddy	81120 (26.88)	31724 (29.75)	24625 (13.86)
2.	Pulses	1236 (0.40)	39 (0.03)	17 (0.009)
3.	Fruits	47268 (15.66)	13494 (12.65)	24625 (13.86)
4.	Spices and condiments	19834 (6.57)	3255 (3.05)	16525 (9.30)
5.	Vegetables	6938 (2.29)	2306 (2.16)	2967 (1.67)
6.	Oil seeds	60609 (20.08)	33339 (31.26)	81652 (45.97)
7.	Plantation crops	43645 (14.46)	4572 (4.28)	16276 (9.16)
8.	Tubers	2176 (0.72)	1711 (1.60)	648 (0.36)
9.	Sugar crops	1614.75 (0.53)	59.01 (0.05)	137.09 (0.07)
10.	Others	37271.25 (12.35)	16119.99 (15.11)	10145.91 (5.71)
11.	Total cropped area	301712 (100)	106619 (100)	177618 (100)

3.2 SAMPLING DESIGN

The study was conducted in three major rice growing districts in Kerala, *viz.*, Palakkad, Alappuzha and Thrissur. Both purposive and multistage random sampling method were used for sample selection. From each district,a block having maximum area under rice cultivation was selected. Kuzalmannam block in Palakkad, Pazayannur block in Thrissur and Champakkulam block in Alappuzha were thus selected. From each block, two panchayaths were selected randomly and from each panchayath, 10 rice farmers were selected. Thus , a total of 60 rice farmers formed the sample of the study. Rice seed growers were also selected from these panchayaths except in Alappuzha district as there were no rice seed growers in Alappuzha. Thus, a total of 15 rice seed growers selected from each of the four selected panchayaths in Thrissur and Palakkad constituted the seed growers' sample. Out of the total 60 , 10 rice seed growers in Palakkad were Participatory rice seed growers and all other seed farmers could be categorised under the Registered Seed Growers Programme (RSGP). It was noted that participatory rice seed growers programmes is not found implemented in Thrissur district. Sample selection is depicted in Figure. 3.2.

Figure 3.2 Sample selection



3.3 DATA COLLECTION

The study was based on both primary and secondary data. Primary data were collected from rice farmers and rice seed growers in the selected panchayaths. Primary data collection was based on structured pre-tested interview schedule prepared separately for rice farmers and rice seed growers. Information on socioeconomic details, crop and land , cost and returns of cultivation, constraints in rice seed production and access to quality rice seed etc were collected from the farmers.

Secondary data on rice seed production, procurement and distribution were collected from Kerala State Seed Development Authority(KSSDA), Regional Agricultural Research Station(RARS) Pattambi, National Seeds Corporation (NSC), Kanjikkode and various State Seed Farms (SSFs).

3.4 DATA ANALYSIS

Data collected from various sources were analysed using different statistical tools as explained below:

3.5 Descriptive statistics

Descriptive statistical measures help to summarize and interpret some of the general properties of a large set of data. It does not infer anything about the population from which the sample is being drawn. Descriptive statistical measures such as averages, frequencies and percents are used to describe general profile of respondents and also to explain general features of rice seed supply chains. For better understanding diagrammatic representations are also provided where ever possible.

3.6 Mapping of rice seed supply chain

Mapping of supply chain helps to show the flow of transaction from sourcing of raw materials and inputs to production, processing, marketing and final sale (Kumar *et al.*, 2012). It also aids to clearly identify different players involved in supply chain and their respective functions. Key informant interviews were used to map rice seed supply chains in Kerala.

3.7 Economic performance in rice seed supply chain

After identifying various rice seed supply chains in Kerala, the economic performance of seed production in the supply chain was elucidated as follows:

3.7.1 Cost of rice seed cultivation

3.7.1 Cost concepts

Cost concepts used in the Manual on Cost of Cultivation Surveys (CSO, 2008) was used for working out the cost of cultivation of rice seed production. Cost A1, Cost A2, Cost B1, Cost B2, Cost C1, Cost C2 and Cost C3 were calculated, accordingly. Different components of these costs are explained below:

Cost A1 = Value of human labour (Casual and permanent), Value of hired bullock power, Value of owned bullock power, Value of owned Machine power, Value of hired machine power, Value of seeds (Both farm produced and purchased), Value of manures (owned and purchased), Value of fertilizers, Value of plant protection chemicals, Value of weedicides, Irrigation charges, Land revenue cess and other taxes, Depreciation on farm implements and farm buildings, Interest on working capital, Miscellaneous expenses

Cost A2 = Cost A1+ Rent paid for leased in land

Cost B1 = Cost A1 + Interest on the value of owned fixed capital assets (Excluding land)

Cost B2 = Cost B1+ Rental value of owned land (less land revenue) and rent paid for leased in land

Cost C1= Cost B1+ Imputed value of family labour

Cost C2 = Cost B2 + Imputed value of family labour

Cost C3 = Cost C2 + 10 per cent of Cost C2 (To account for the managerial input of farmer)

The criteria used for imputation of various components in the cost concepts are given in the Table 3.4.

Table 3.4. Procedure for imputation of values of owned inputs

Sl No	Items	Criteria
1.	Family labour	Calculated on the basis of wages paid to hired labour for various cultural operations
2.	Implements	Valued at the cost on depreciation and small repairs and maintenance
3.	Farm produced manure	Valued at cost for purchasing same amount of manure in the study area
4.	Rental value of owned land	Charged at the lease rate prevailing in the study area for similar type of land as that of the sample
5.	Interest on owned fixed capital	It is calculated at a rate of 10 per cent of present value of asset
6.	Interest on working capital	Interest is calculated at a rate of 7.5 per cent of working capital calculated for the period of crop
7.	Payments in kind	It is evaluated at market price of the good in consideration
8.	Products and By-products	Calculated based on prevailing market price for same products

3.7 Constraints in market access to quality rice seed and Access to Seeds Index (ASI)

3.7.1 Constraints in market access to quality rice seed

Garrett ranking technique was used to identify major constraints faced by farmers in accessing quality rice seed in Kerala. Constraints first identified through the pilot survey were enlisted in the interview schedule and then farmers were asked to rank the constraints. The ranks given by farmers for each constraint were transformed into percent using the following formula:

$$\text{Per cent position} = \frac{100(R_{ij}-0.5)}{N_j}$$

Where, R_{ij} – Rank given for i^{th} factor by j^{th} individual

N_j – Number of factors ranked by j^{th} individual

Then, referring to the table given by Garett and Woodwoth (1969) the percent positions were transformed into scores and mean score was calculated for each constraint. According to the mean scores constraints were ranked in such a way that constraint having highest mean score was given rank one.

3.7.2 Access to Seeds Index (ASI)

Access to quality seed plays a major role in improving agricultural production and productivity world wide. Access to Seed Index (ASI) was adopted from report of Access to Seeds Foundation (ASF) with suitable modifications. There are three dimensions for access *viz.*, availability, affordability and profitability. These dimensions are measured on certain criteria such as availability of quality seed, availability of seed in sufficient quantity, price of rice seed, distance to the seed source and relative increment in yield while using seed from that specific source. Farmers were asked to rank these measures on a four point scale for each of the rice seed supply chain and based on the ranking, an

index was developed. Access to Seed Index (ASI) was worked out using the following formula:

$$\text{Access to Seed Index (ASI)} = \frac{\sum_{i=1}^{n} x_i}{maximum \sum x_i}$$

$x_i$is the score obtained for each of the measures.

3.8 SWOC analysis of rice seed market in Kerala

SWOC analysis is a strategic planning tool that can be used for concurrent evaluation and review process to make informed decisions based upon collective input from multiple stakeholders in a system (Harrison, 2010). Strengths (internal positives),weakness (internal negatives), opportunities (external positives) and challenges (external negatives) of rice seed market in Kerala were enlisted based on key informant interviews with scientists, research officials and agricultural officers and were used for arriving at informed decisions on improving the seed market system.

Results and discussion

4. RESULTS AND DISCUSSION

This chapter is discussed through five sessions viz., rice seed production scenario in Kerala, rice seed supply chains , economic performance of rice seed supply chains, constraints in access to quality rice seed, demand supply gap in rice seed production and SWOC analysis of rice seed market in Kerala. First session on rice seed production scenario in Kerala deals with importance of using quality rice seed, generation concept of rice seed production and different agencies involved in rice seed production and distribution in Kerala. The second session on rice seed supply chains explain different rice seed supply chains prevalent in Kerala and the socio-economic details of sample respondents. Third session explains the cost of production of rice seed production in different supply chains. Fourth session deals with constraints analysis of rice seed market in Kerala, next session is an attempt to work out demand supply gap in rice seed production in Kerala followed by the last session elaborating on SWOC analysis of rice seed market in Kerala.

4.1 Rice seed production and distribution scenario in Kerala

Seed is regarded as the fundamental and critical input in agricultural production, which can directly enhance agricultural productivity. Human population is growing at an exponential rate nowadays, increased requirement for food grains can only be achieved through increasing agricultural production. One of the best method to achieve increased production is introduction and spread of high quality seeds of new and improved varieties.

The generation system of seed multiplication ensures that farmers are continuously supplied with seeds of high quality. It helps to sustain the identity of variety by avoiding varietal mix and also enable to produce adequate amount of seeds to meet the needs of farmers. The generation system of seed multiplication comprises of four classes of seed according to the stage of seed multiplication, viz., nucleus seed, breeder seed, foundation seed and certified seed (Singhal, 2011).

4.1.1 Generation system of seed multiplication

In Kerala too, a planned generation system of seed production of rice is practiced for all notified varieties as in other states nationwide. The details are described below:

4.1.1.1Nucleus seed

The initial small quantity of seed preserved for maintaining or purifying the variety and produced under the personal supervision of originating/ designated /qualified plant breeder is known to be nucleus seed. Its genetic purity is always 100 per cent (Valarmathi and Balachandran, 2000).

4.1.1.2 Breeder seed

Breeder seed is obtained by multiplication of nucleus seed under the direct supervision of concerned plant breeder. Its quality is ensured by a monitoring team consisting of breeder of the variety, concerned Project Director/Co-ordinator, representative of State Seed Certification Agency and representative of National Seeds Corporation. Breeder seed is used to generate the next generation seed. i.e., foundation seed. Thus, purity of breeder seed is at most important as it directly affect the purity of further generations of seed. Tag colour of breeder seed is golden yellow (Singhal, 2011).

4.1.1.3 Foundation seed

Foundation seed (FS) is the progeny of breeder seed. Foundation seed produced from breeder seed is known as Foundation seed stage I (FS I) and foundation seed produced from FS I is known to be Foundation seed stage II (FS II). Production of foundation seed is monitored by seed certification agency and production of FS II is allowed only if there is shortage of breeder seed. FS II can be used only for production of next class of seed termed as 'certified seed'. No further production of foundation seed is permitted using FS II. The tag colour for foundation seed is white (Singhal, 2011).

4.1.1.4 Certified seed

Progeny of Foundation seed stage I and Foundation seed stage II are regarded as Certified seed (CS). Production of certified seed is also undertaken under the strict supervision of Seed Certification Agency and State Seed Corporation. Production of certified seed from certified seed is also allowed if there is serious shortage of foundation seed provided that the certified seed should be from foundation seed stage I. Tag colour of certified seed is azure blue (Singhal, 2011).

The Royal Commission on Agriculture in 1925 discussed the need for enhancing production and distribution of high yielding variety seeds and recommended the establishment of National seeds Corporation (NSC) in 1963. Along with seed production and distribution NSC was entrusted with additional responsibility of seed certification. Since 1972, the responsibility of seed certification was transferred to the states. In states like Haryana, Andhra Pradesh, Bihar, Himachal Pradesh, Karnataka etc there is an independent autonomous Seed Certification Agency (SCA) (Singhal, 2011). However, such an independent autonomous seed certification agency is not present in Kerala. The major rice seed production agencies in Kerala are described below:

4.1.2. Seed production, procurement and distribution agencies in Kerala

A fairly well- structured and organized rice seed production, procurement and distribution system is present in Kerala under public sector. This constitutes the formal rice seed supply in the state. The major share (almost 80%) of formal rice seed supply system is through Kerala State Seed Development Authority (KSSDA) followed by National Seeds Corporation (NSC) and Kerala Agricultural University (KAU). All of the three institutions undertake rice seed production in the farmers' field followed by institutional procurement and distribution. The details on these institutions are given below:

4.1.2.1 Kerala State Seed Development Authority (KSSDA)

Kerala State Seed development authority (KSSDA) functions under Department of agriculture development and farmers' welfare, Kerala as an autonomous body. It was registered in May 2000 under the Travancore-Cochin Literary Scientific and Charitable Societies Registration Act, 1955. Promotion of multiplication, production, procurement, processing and marketing of paddy and other seeds is the main objective of KSSDA. The seed production programme is carried out with the cooperation of Kerala Agricultural University, State Seed Farms, Krishibhavans and registered Padasekhara Samitis at panchayat level. The scheme is now being implemented in Ernakulam, Thrissur, Palakkad, Malappuram and Kannur districts in an area of 2000Ha per year. Presently KSSDA is handling 9000MT of paddy seed every year. KSSDA also has three godown cum processing plants at Alappuzha, Pandalam and Eruthiampathy (GOK, 2017).

. 4.1.2.2 National Seeds Corporation (NSC)

National Seeds Corporation Limited (NSC) is a company functioning under Government of India. It was established in the year 1963 with the sole objective of production of foundation and certified seeds. In addition seedlings/ saplings of fruit crops are also distributed through NSC. The company concentrates on the seed production of pulses, oil seeds and hybrids including vegetables. The major services provided through NSC include seed production, certification, seed quality control, seed handling processing and packaging, seed marketing and training.

Currently NSC undertakes seed production of nearly 60 crop varieties through registered growers all over the country in different agro-climatic situations. Nationwide, there are almost 8000 registered growers engaged in seed production under the supervision of NSC. There are 10 regional offices each located at Bangalore, Bhopal, Chandigarh, Chennai, Jaipur, Kolkata, Lucknow, Patna, Secunderabad and Pune (NSC, 2017). In Kerala, NSC has regional offices

at Kanjikode, Palakkad and another at Karamana, Thiruvananthapuram. These offices operate under the jurisdiction of Chennai Regional office. Distribution of seeds is the responsibility of the area offices in each state.

4.1.2.3 Kerala Agricultural University (KAU)

Kerala Agricultural University came into existence in 24th February, 1971 under 'The Agricultural University Act, 1971'. KAU became operational since 21st February, 1972 with two educational and 21 research institutions. Currently KAU has six educational institutions, 23 Research Stations, four training and extension centres and seven Krishi Vigyan Kendras (KVKs). In rice seed production scenario, main mandate of KAU is the production and distribution of breeder seed. KAU is involved in Truthfully Labelled Seed (TLS) production and distribution through research stations and also through farmer participatory rice seed production. The major rice seed supply chains including all these institutions are described below:

4.2.1 Rice seed supply chains

4.2.1.1 Rice seed supply chains in Kerala

Rice seed supply chains in Kerala can be broadly classified into two. Formal rice seed supply chain and informal rice seed supply chain. Informal rice seed supply chain constitutes the farmer saved and exchanged seed (George, 2002). Farmers usually save a part of their produce for sowing in the next season. Also seed exchange takes place between fellow farmers or between friends and relatives. It includes farmers who multiply breeder seed from research stations to distribute seed to farmers in Alappuzha on a commercial basis.

The formal rice seed system is mainly through public sector institutions such as KSSDA (Kerala State Seed Development Authority), Kerala Agricultural University research stations, KAU participatory rice seed production units and also through NSC (National Seeds Corporation). Rice seed production and distribution in Kerala can be summarized as given in the Figure 4.1 below. In this

figure relative size of different agencies depict the amount of seed supplied through the respective chains. Hence, KSSDA supply chain has been depicted bigger in size than the other two because a major share of rice seed supply in Kerala is through this chain.

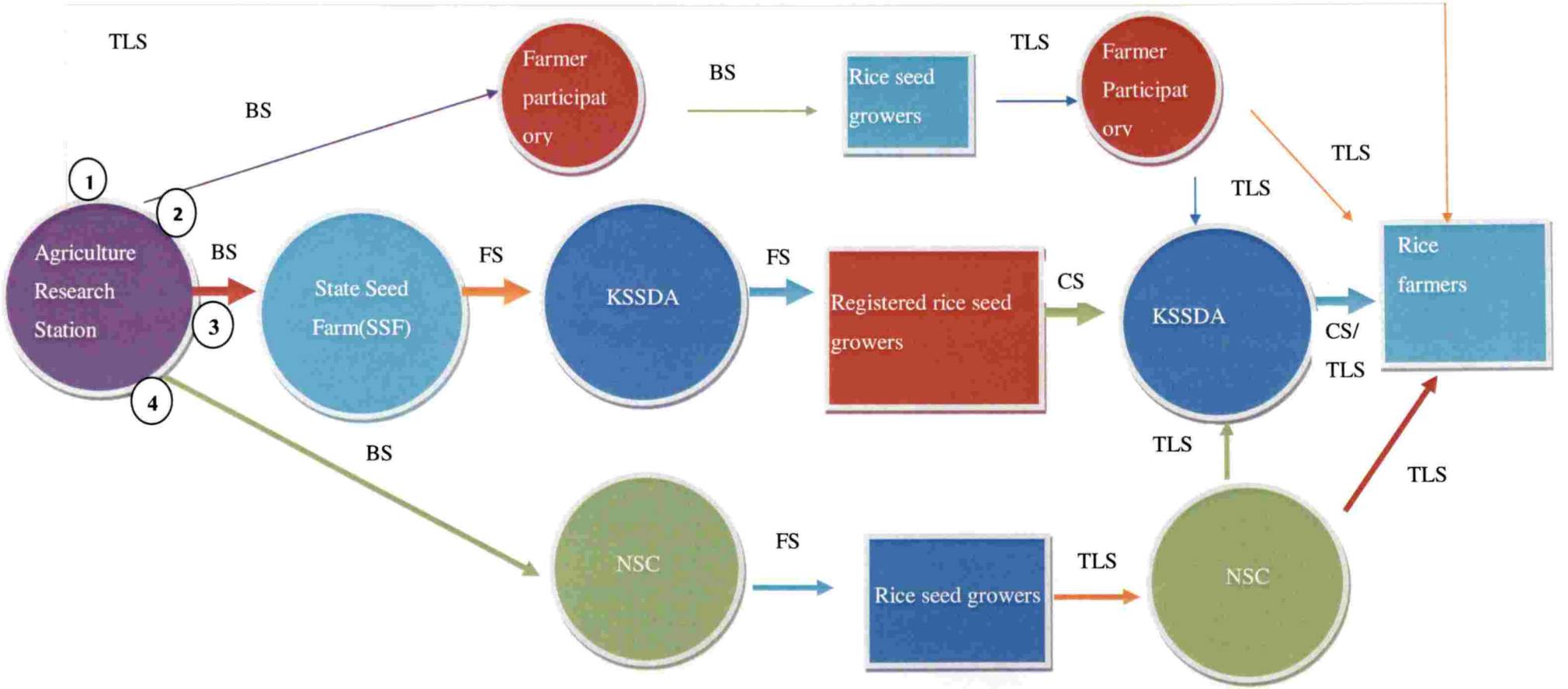


Figure 4.1 Rice seed supply chains in Kerala

BS: Breeder Seed FS: Foundation Seed CS: Certified Seed TLS: Truthfully Labelled Seed

NSC: National Seeds Corporation KSSDA: Kerala State Seed Development Authority

Chain 1: KAU research Stations ——→ Rice farmer

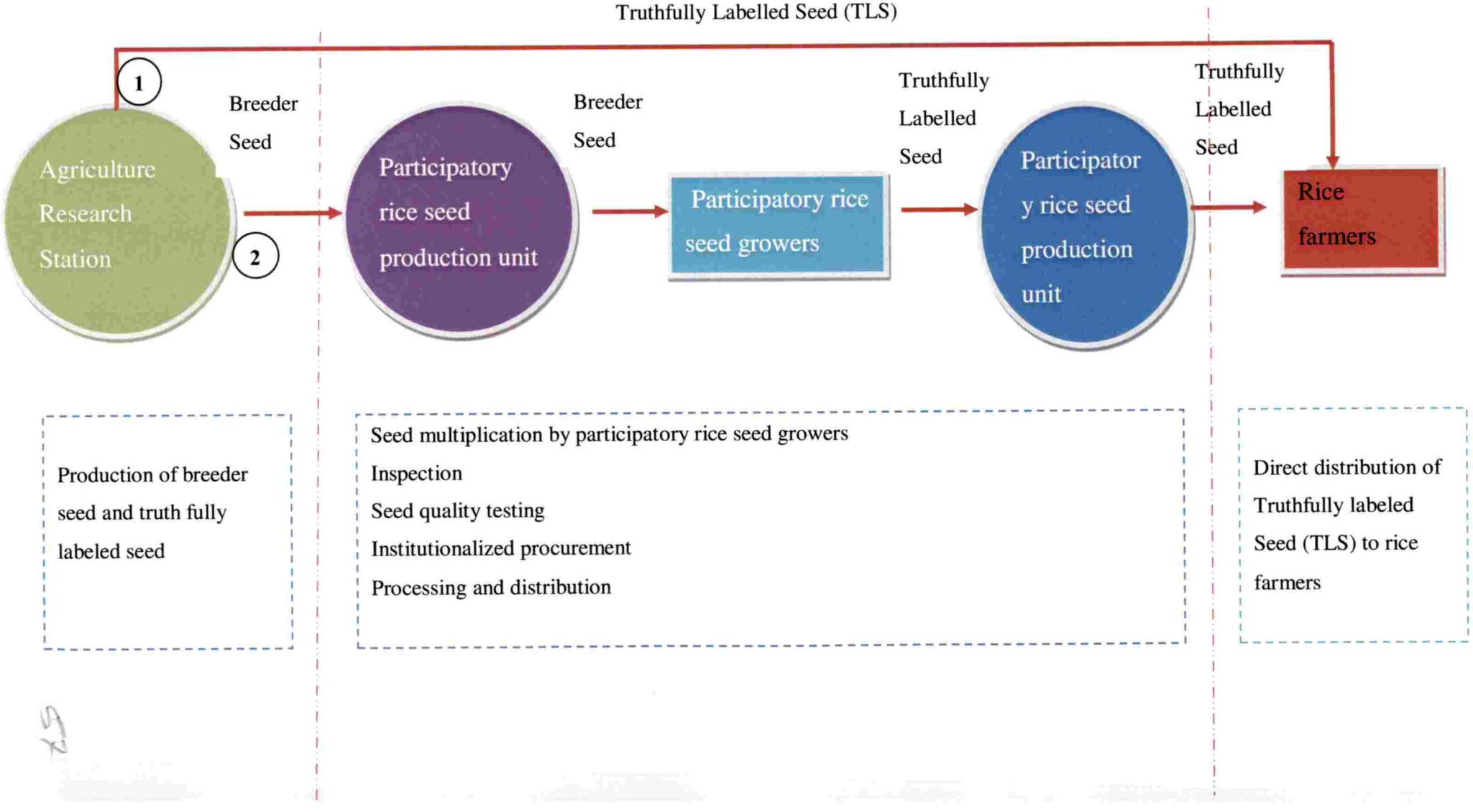
Kerala Agricultural University (KAU) has 23 research stations including six Regional Agricultural Research Stations. Research farms in these six Regional Agricultural Research Stations undertake rice seed production and also Agricultural Research Station, Mannuthy, Agronomic Research Station, Chalakudy and Rice Research Station, Moncompu distribute rice seed to farmers . The rice seed supplied through the research station to farmers are Truthfully Labelled Seed (TLS). TLS may be the progeny of either foundation or certified seed. Even though field standards, seed standards and production procedures are same as that of certified seed, TLS does not require a seed certification process, instead the producer themselves will declare and guarantee the quality attributes of the seed.

Chain 2: Farmer participatory rice seed supply chain

One of the main mandates of Kerala Agricultural University (KAU) Research station is production of breeder seed of new varieties as well as part of germ plasm conservation. The breeder seed is distributed to participatory rice seed growers, who multiply the seeds for distribution among rice farmers. Seed production in farmers' field under participatory rice seed production programme is undertaken under the direct supervision and field inspection by scientists in the unit. In seed production, rouging is a critical operation unless in paddy production. Regular field visits and rouging is done by the skilled labourers trained under the participatory rice seed production programme of KAU. Before procurement seed samples will be taken for assessing seed quality. Seed will be procured from the seed growers only if the minimum quality standards are satisfied. Quality standards are specified for various parameters such as physical purity, genetic purity, germination percentage, seed vigour and seed health (Singhal, 2011).It is then cleaned, processed and distributed to rice farmers as Truthfully Labelled Seed (TLS).

Diagrammatic representation of both chain 1 and chain 2 are given in the Figure 4.2. Both these chains together is referred as KAU rice seed supply chain:

Figure 4 .2 KAU rice seed supply chain

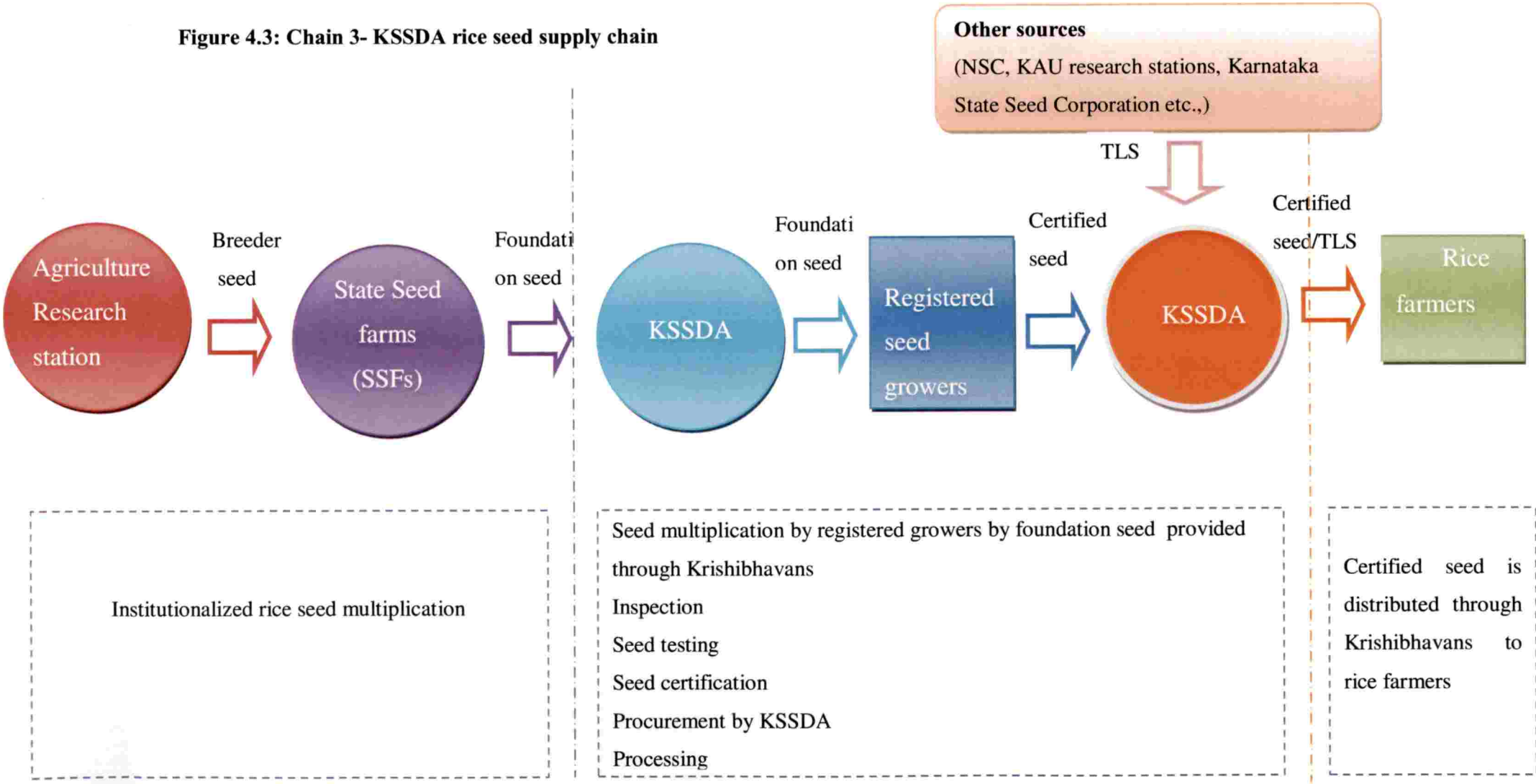


Chain 3: KSSDA rice seed supply chain

Rice seed production and distribution is organized by KSSDA through Krishibhavans. Breeder seed from Agriculture Research Station is multiplied to Foundation seed stage1 (FS 1) and foundation seed stage 2 (FS 2) in State Seed Farms (SSFs). There are 34 State Seed Farms (SSFs) all over Kerala. Then FS 2 is distributed to rice seed growers through Registered Seed Growers' Programme (RSGP). Farmers who are willing to take up rice seed production under RSGP can register in KSSDA through Krishibhavans. Usually registration is done through Padasekhara Samitis rather than individual farmers and it should be renewed each year. Registered seed growers will be supplied with FS 2 at 30 Kg/ acre at free of cost.

The multiplication of foundation seed to certified seed is taken up under the strict supervision of respective agricultural officer in terms of field inspection and rouging. Agricultural officers have to submit sowing report, three inspection reports and harvesting report regarding each Padasekhara Samitis to KSSDA through Additional Director of Agriculture (ADA). After 15-16 days of harvesting (dormancy period of rice seed), rice seed samples will be collected by ADA in the presence of agricultural officer. Then samples are sent to State Seed Testing Laboratory, Alappuzha or Seed testing Laboratory at Parottukonam. If the sample is accepted, a copy of result is sent for tag issue to office of Additional Director (Crop Production), Thiruvananthapuram. Tag number helps to trace the seed grower in case of any complaint on seed quality. Only after issuing the tag, procurement will be done. Sometimes before procurement, processing of seeds will be out sourced to accredited private agency on contract basis by KSSDA. Processing of the seeds is usually done in seed growers' godown and will be transported for storage. Seed growers will get payment for the quantity of processed seed. Otherwise seeds after preliminary processing will be directly taken to seed processing units at Eruthiampathy or Alappuzha and farmers will get payment for the amount of processed seed at Rs.30/Kg (KSSDA, 2014).The rice seed stored after procurement and processing will be distributed according to the demand from Krishibhavans. Figure. 4.3 . depicts KSSDA rice seed supply chain.

Figure 4.3: Chain 3- KSSDA rice seed supply chain

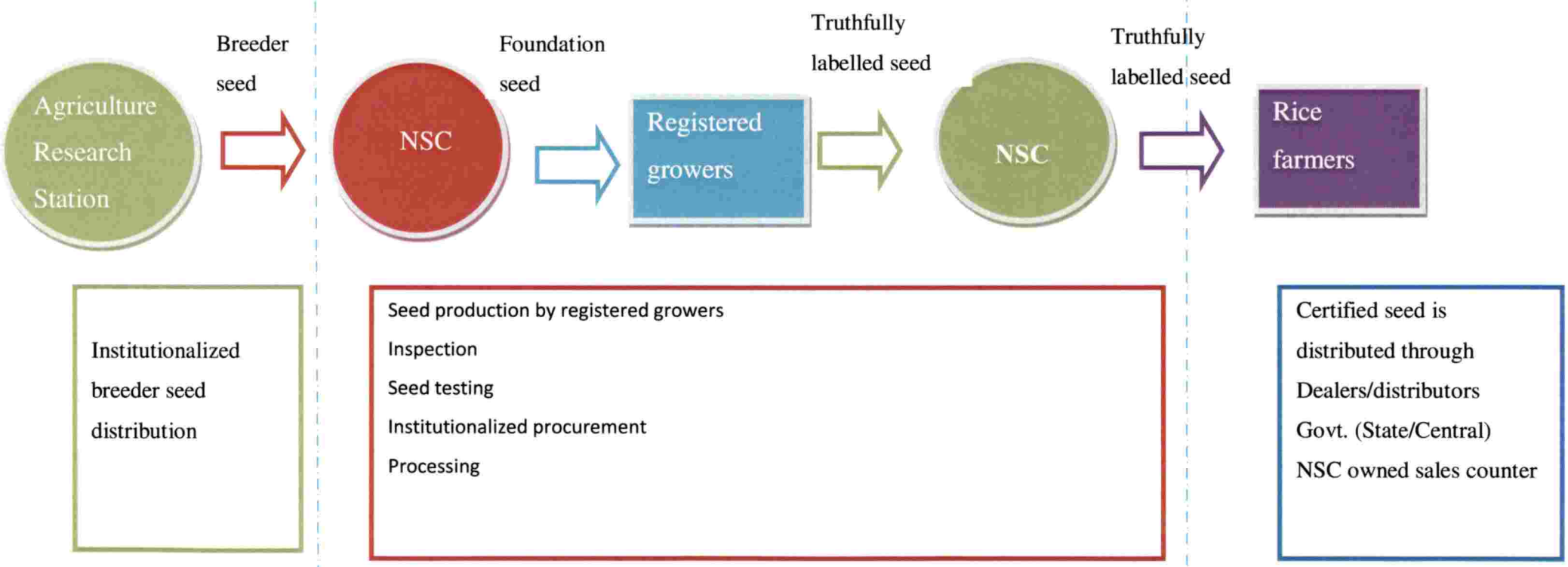


Chain 4: NSC rice seed supply chain

In NSC rice seed supply chain, the breeder seed procured from agriculture research stations is multiplied to foundation seed. Foundation seed is then distributed to registered growers for multiplication under the strict supervision of experts in the field. After seed testing and certification seed is procured and processed to make it ready for distribution to rice farmers. Marketing of seed is either through distributors/dealers, Government (state/central) and also through NSC owned sales counters.

NSC rice seed supply chain is depicted in the Figure 4.4.:

Figure 4.4: Chain-4 NSC rice seed supply chain



4.2.2 Socio-economic details of sample respondents

Respondents of this study included rice farmers and rice seed growers from three different districts. Seed growers included both registered and participatory seed growers. In this session socio-economic background of the respondents is analysed in terms of age of farmers, educational qualifications, annual income, source of income, land holding size, family size etc., to explain the results of study.

4.2.2.1 Age of the respondents

Rice farmers and rice seed growers were classified into six different age groups as shown in Table 4.1. It included categories such as those in the age group of less than 30 years, 30-50 years,51-70 years and more than 70 years. The results have shown that majority of rice farmers fall under 51-70 years age group (75 per cent). The case is same with rice seed growers wherein 70 per cent of the rice seed growers belong to 51-70 years group. The results are consistent with present scenario of rice cultivation in Kerala. The rice farmers and rice seed growers together constitute only 1.7 per cent under the age group 30 years. It highlights that the involvement of young generation in agriculture is negligible.

The study conducted by Adedugbe (2014) also supported the point that youth have negative perception towards agriculture and their participation in agriculture sector is very low.

Table 4.1 Age wise distribution of respondents

Age (Years)	Rice farmer (no.)	Rice seed grower (no.)
<30	1 (1.7)	0
30-50	8 (13.3)	10 (16.6)
51-70	45 (75)	42 (70)

>70	6 (10)	8 (13.3)
Total	60 (100)	60 (100)

Source: Primary data , Figures in parenthesis represent per cent to total)

4.2.2.2 Educational status of respondents

Based on educational status of respondents, they were classified into four categories as shown in Table 4.2. *viz.,* those having primary education, high school education, higher secondary and those with degree and above. It was evident that 50 per cent of rice farmers and rice seed growers were high school qualified (SSLC). Only 10 per cent of rice farmers and 13.3 per cent of rice seed growers fell under the primary educated category. The remaining farmers and rice seed growers were more or less equally distributed among the higher secondary, degree and above educational qualification class. Only one rice farmer was found to have a professional degree.

Table 4.2 Educational status of respondents

Educational qualifications	**Rice farmer (no.)**	**Rice seed grower (no.)**
Primary education	6 (10)	8 (13.3)
High school (SSLC)	30 (50)	30 (50)
Higher secondary	12 (20)	12 (20)
Degree and above	12 (20)	10 (16.7)
Total	60 (100)	60 (100)

Source: Primary data (Figures in parenthesis represent per cent to total)

4.2.2.3 Income status of respondents

Investment is the key to success in any economic activity. The income level of a person is an indirect indicator of his capacity to invest, take timely decision on crop management and so on. Income status of the respondents is studied in terms of their level of income and the source of income. The classification of sample farmers based on annual income is presented in the Table 4.3 and the source wise classification in Table 4.4. It was found that majority of the respondents had an annual income between Rs.1- 2 Lakh. Among them, 38.3per cent of both rice farmers and rice seed growers earned an annual income between Rs. 1-1.5 Lakh. Moreover, five per cent of rice farmers and 10 per cent of rice seed growers fell in the high income group with an income greater than Rs.2 Lakhs.

Table 4.3 Income level of respondents

Income group (Rs.)	Rice farmer (no.)	Rice seed grower (no.)
>50000	4 (6.7)	5(8.3)
50000-1 Lakh	17 (28.3)	9(15)
1-1.5 Lakh	23 (38.3)	23 (38.3)
1.5 – 2 Lakh	13 (21.7)	17 (28.3)
>2 Lakh	3 (5)	6 (10)
Total	60 (100)	60 (100)

Source: Primary data (Figures in parenthesis represent per cent to total)

Other than farming, some farmers also have alternate sources of income. Here, respondents were classified into two categories based on their income sources *viz.*, those with income only from farming activities and the other with

income from both farming and non-farming activities (Table 4.4). The results indicated that 53.3 per cent of rice farmers and 55 per cent of rice seed growers undertake farming as their main occupation, whereas, 46.7 per cent of rice farmers and 45 per cent of rice seed growers depend on sources other than farming also for their livelihood. This highlights the fact that almost half of the respondents found that they could not meet their income needs through farming alone.

The Situation Assessment Survey of farmers (2014) highlights that, in Kerala almost 61 per cent of agricultural households are reported to have non-agricultural activity as main source of income.

Table 4.4 Source of income to the respondents

Source of income	Rice farmer (no.)	Rice seed grower (no.)
Farming only	32 (53.3)	33(55)
Both farming and non-farming	28 (46.7)	27 (45)
Total	60 (100)	60 (100)

Source: Primary data (Figures in parenthesis represent per cent to total)

4.2.2.5 Family details of the respondents

Based on the family size (number of members) respondents were classified into those with a family size less than 4, 4-6 and greater than 7. (Table 4.5). Results clearly indicate that 71.7 per cent of the rice farmers and 53.3 per cent of the rice seed growers possess a family size between 4 and 6. *i.e.,* majority of the respondents have nuclear families. The rice farmers and rice seed growers, having a family size of six and less than six members, were 89.4 per cent and 73.3 per cent respectively. The findings are in line with the current trends where number of nuclear families is on the rise.

The result is also consistent with the report of GOI (2014) which states that average family size of agricultural households in India is 5.1.

Table 4.5 Family details of respondents

Family size (no.)	Rice farmer (no.)	Rice seed grower (no.)
>4	7 (11.7)	12 (20)
4-6	43 (71.7)	32 (53.3)
>7	10 (16.7)	16 (26.7)
Total	60 (100)	60 (100)

Source: Primary data (Figures in parenthesis represent per cent to total)

4.2.2.6 Land holding size of the respondents

Respondents were classified into marginal (>1ha), small (1-2ha) and large farmers (>2 ha) based on their land holding size (Table 4.6). Results pointed out that majority (nearly 72%)of rice farmers come under the small farmer category with less than 2 hectares of land and out of this 30 per cent are marginal farmers. Coming to the seed growers group, 53.3 per cent were large farmers followed by 33.3 per cent small farmers. Marginal farmers were less among rice seed growers, whereas, in rice farmers group, marginal and large farmers constitute 30 per cent each.

In Kerala, the distribution of landholding among all social groups is in such a way that 58.62 per cent of the land holdings are marginal (>1 ha) , 18.69 per cent are small (1-2 ha), while the remaining 22.69 per cent is distributed among semi-medium, medium and large size group (GOI, 2014).

Table 4.6 Categorisation of respondents according to landholding size

Land holding size (ha)	Rice farmer (no.)	Rice seed grower (no.)
Marginal (<1 ha)	18 (30)	8 (13.3)
Small(1-2 ha)	25 (41.7)	20 (33.3)
Large (>2 ha)	17 (28.3)	32 (53.3)
Total	60 (100)	60(100)

Source: Primary data (Figures in parenthesis represent per cent to total)

4.3 Economic performance of rice seed supply chains

4.3.1 Economics of rice seed production in farmers' field

Primary data collected from rice seed growers on various cost incurred during rice seed production was utilized for calculating cost of cultivation of rice seed production in Kerala. Cost A1, Cost A2, Cost B1, Cost B2, Cost C1, Cost C2 and Cost C3 was worked out and presented in the Table 4.7 given below:

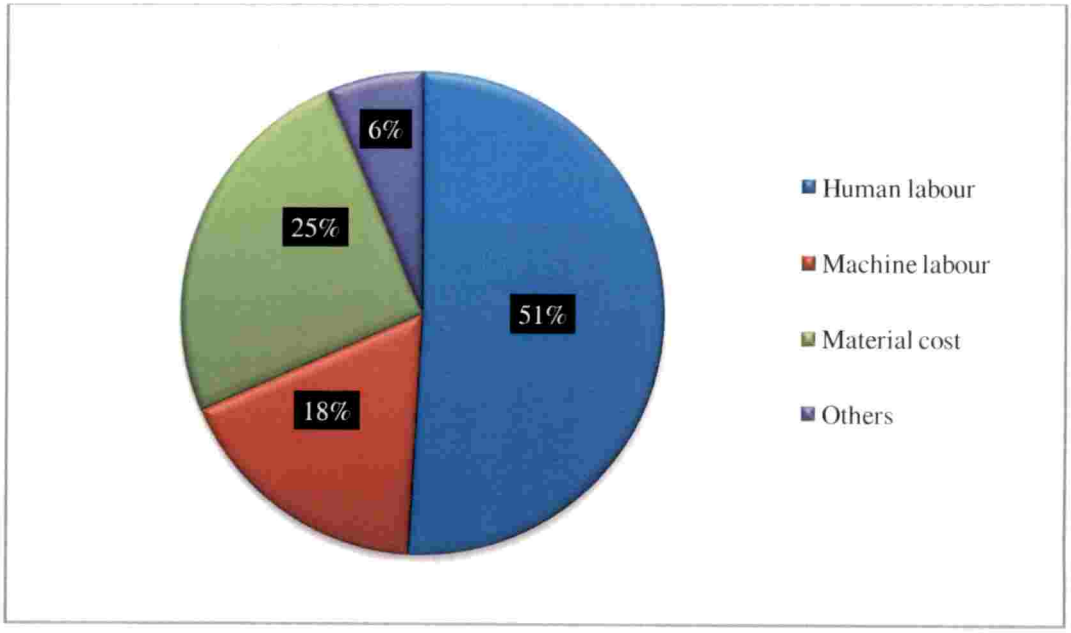
Table 4.7 Cost of cultivation of rice seed production

Sl No.	Particulars	Cost (Rs/ha)	Per cent to Total cost A1
1	Human labour	34724	50.60
2	Machine labour	11954	17.42
3	Cost of seed	928	1.35
4	Manures	6262	9.12
5	Fertilisers	7841	11.43
6	Plant protection chemicals and weedicides	2492	3.63
7	Irrigation charges	1463	2.13

8	Others	2960	4.31
	Total (Cost A1)	68628	100
9	Rent paid for leased in land	36000	–
	Cost A2 (Cost A1+9)	104628	–
10	Interest on value of owned fixed capital assets	979	–
	Cost B1(Cost A1+10)	69608	–
11	Rental value of owned land rent paid for leased in land	36208	–
	Cost B2 (Cost B1+11)	105815	–
12	Imputed value of family labour	0	–
	Cost C1 (Cost B1+12)	69608	–
	Cost C2 (Cost B2+12)	105815	–
13	10% of Cost C2	1058	–
	Cost C3 (Cost C2+13)	116397	–

The cost for rice seed production including all the paid out cost i.e., at Cost A1 was found out to be Rs. 68628/ ha. Here most of the rice seed growers (53.3%) fell under large farmers and possesses an area of more than 2 hectares. Thus, all cultivation practices are done through agricultural labourers and no family labour is seen involved in seed production. Hence Cost B1 and Cost C1 were found to be the same and also Cost B2 and Cost C2 were found to be same. Cost C3 accounts to Rs. 116397/ha and it is obtained by addition of 10 per cent of Cost C2 with cost C2, 10 per cent of Cost C2 account for the managerial input of the rice seed farmer.

Figure 4.5 Input- wise cost of rice seed production in cost A1



From Figure 4.5, it is clear that human labour accounts for the major part (51%) of rice seed production cost in Kerala. Poor mechanisation may be attributed as one of the reason. Human labour cost is followed by material cost (25%) and machine labour (18%). The result obtained is on par with the report of GOK (2014). The report says that 51 per cent of cost of cultivation of rice at Cost A is accounted by hired human labour followed by machine labour (17%) and cost for farmyard manure and chemical fertilizers (11 %)

4.3.1.1 Income measures for rice seed production

On calculating cost of rice seed production incurred by rice seed growers, various income measures such as gross income and Benefit Cost Ratio at cost A1 and cost C3 was calculated for rice seed growers (Table 4.8). Gross income to the rice seed growers was found to be Rs. 152089.8/ha .Benefit Cost Ratio (BCR) was also calculated both at cost A1 and cost C3, BCR at Cost A1 was 2.22 and that at Cost C3 was 1.31. Rice seed production was found to be economically profitable both at Cost A1 and cost C3 as BCR is greater than one at both these costs. The results are consistent with the result obtained by Dhruthiraj (2016) where BCR of

rice seed production in Kerala at Cost A1was 2.38. Hoque and Haque (2014) also found that BCR of rice seed production in Bangladesh is greater than one and average BCR was found to be 1.4.

To compare the profitability of rice seed production between registered seed growers and rice seed farmers, cost of rice cultivation in Kerala was taken as the cost of cultivation for rice seed farmers. Because during survey it was found that seed exchange between farmers occur if the crop stand is free from pest, diseases and weeds so that there is no much additional cost incurred. The cost of rice seed cultivation by registered seed growers was found to be Rs. 68628/ ha and according to Dhruthiraj (2016) cost of cultivation of rice by farmers is Rs. 55710/ha. Higher cost of cultivation for registered seed growers indicates that additional cost is incurred by them for seed production, whereas it is not needed in case of seed production by rice farmers.

Table 4.8 Income measures for rice seed production in Kerala

Sl No.	Particulars	Value
1	Average yield (Kg/ha)	5313
2	Gross Income (GI)	152090
5	Benefit Cost Ratio at Cost A1	2.22
4	Benefit Cost Ratio at Cost C3	1.31

4.3.2 Economics of rice seed supply chains

4.3.2.1 Economics of rice seed supply chain-1

Economics of on- farm rice seed production and distribution from KAU research stations were worked out using cost concepts adopted by CACP. For calculating cost of cultivation and cost of production, primary data was collected from three KAU research stations:- Regional Agricultural Research Station,

Pattambi in Palakkad, Agricultural Research Station, Mannuthy in Thrissur and Rice Research Station, Moncompu in Alappuzha. Cost A1, Cost B1, Cost B2 and Cost C3 were obtained. Managerial cost of rice seed production in research station was taken as 10 per cent of cost C2. Hence from Cost C3 (Rs/ha) cost of production (Rs/Qtl) was worked out in order to compare different rice seed supply chains in terms of cost of production. The details are given in the Table 4.9.

Table 4.9 Economics of rice seed production in KAU research stations

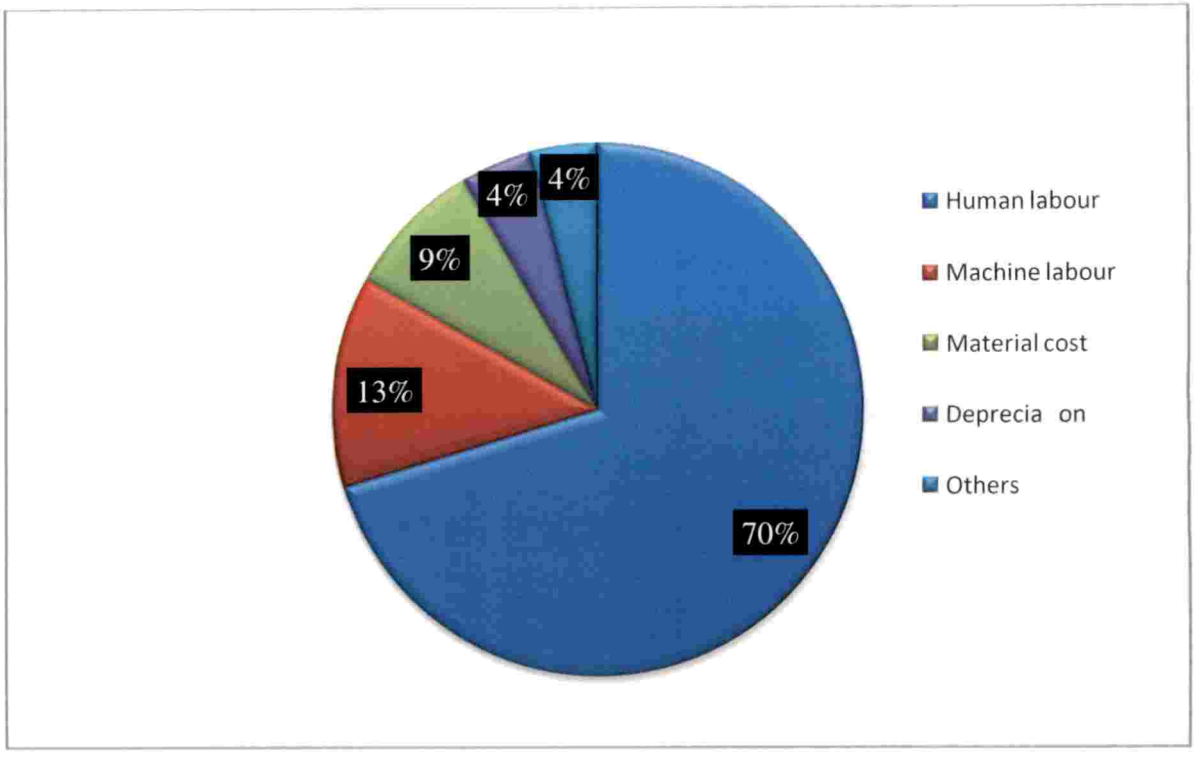
Sl No.	Particulars	Cost (Rs/ha)
1	Human labour	152250 (70.24)
2	Machine labour	28065(12.9)
3	Seeds	3641(1.67)
4	Fertilisers	6265 (2.89)
5	Plant protection chemicals	3200 (1.47)
6	Weedicides	5017 (2.31)
7	Irrigation charges	3662 (1.68)
8	Land revenue	202 (0.09)
9	Depreciation on farm buildings and farm implements	9386 (4.33)
10	Interest on working capital	25953 (2.33)
	Cost A1	216740 (100)
11	Interest on fixed capital assets (excluding land)	25953
	Cost B1 (Cost A1+11)	242693
12	Rent paid for leased in land and owned land	34583
	Cost B2 (Cost B1+12)	277278
13	Imputed value of family labour	0

	Cost C2 (Cost B2+13)	277278
14	10 per cent of Cost C2	27728
	Cost C3 (Rs./ha)	305003.5
	Average yield of processed seed(Kg/ha)	4962
	Cost of production (Rs/ Qtl)	6064
	Gross income (Rs/ha)	221674
	Returns(Rs/Qtl)	4465
	Benefit - Cost Ratio	0.76

(Figures in parenthesis refers to percentage of Cost A1)

Cost of cultivation of rice seed in KAU research station at Cost A1 was found to be Rs.216740/ha, this is much higher than the cost of production of rice seed in farmers' field (Rs. 68628/ha). The reason for increased cost of rice seed production in KAU research farms may be due to the higher cost of human labour. In research stations, both permanent and casual labourers are usually engaged who will be paid according to the government approved wage rates. Even though the approved labour norms are there, the efficiency of labour is often found to be less when compared to private seed farmers. Moreover individual management is reported to be efficient than public management. Also as compared to individual rice seed growers, KAU research station owns several costly farm implements and machineries which again add to cost A1 in the form of depreciation for farm implements and machineries. But their contribution in reducing the costs and improving the productivity is again sceptical.

Figure 4.6 Component-wise cost of on-farm rice seed production in KAU at Cost A1



From Figure 4.6, it can be observed that labour wages itself accounts to 70 per cent of cost A1 which is followed by machine labour cost (13 per cent), material cost (9 per cent) and depreciation on farm implements and machinery (4 per cent). The result highlights the need for efficient utilization of machineries available in the farm. The study by Kumari (2011) also confirms the result, where the share of labour cost in rice cultivation is reported to be almost 70 per cent and one of the reason highlighted include labour unavailability and high labour costs.

4.3.3. Economics of farmer participatory rice seed supply chain (Chain-2)

Farmer participatory rice seed supply chain is characterised by rice seed production in farmers' field coupled with institutional procurement, processing and distribution. To find out economics of this chain, primary data were collected from participatory rice seed production unit at College of Horticulture,

Vellanikkara and from RARS, Pattambi. Average cost of production (Rs/Qtl) of rice seed was worked out and is given in the Table 4.10.

Table 4.10 Economics of farmer participatory rice seed supply chain

Particulars	Rs/Qtl seed distributed	Per cent to total cost
Price paid to participatory seed growers	3000 .00	77.77
Inspection charges	3.31	0.08
Roguing	33.87	0.88
Plastic bag for procurement	11.4 0	0.29
Loading charges	26.23	0.68
Unloading charges during procurement	15.67	0.41
Labour charge for drying and processing	90.03	2.33
Processing cost (electricity cost)	7.26	0.18
Salary for skilled assistant	114.01	2.95
Depreciation on farm machinery and farm implements	373.20	9.67
Machine maintenance and repair	4.42	0.11
Gunny bag for distribution	105.00	2.72
Transportation cost	71.36	1.85
Miscellaneous	1.44	0.04
Total cost (Rs/Qtl)	3857.26	100
Returns (Rs/Qtl)	4000	-
Benefit-Cost Ratio	1.04	

It was observed that total cost of production and distribution accounts to Rs. 3857/Qtl. Out of which 77 per cent of total cost was paid to rice seed growers

followed by depreciation on farm buildings and farm machineries (9.67%), salary for skilled assistant (2.95%), gunny bag for distribution (2.72%) and Labour charge for drying and processing (2.33%).

4.3.3.2 Economics of KSSDA rice seed supply chain (Chain 3)

KSSDA caters to the major portion of rice seed requirement in Kerala. They undertake rice seed production through registered rice seed growers. The seed is procured and distributed after processing. Cost of production of rice seed in KSSDA rice seed supply chain is given below in the Table 4.11.

Table 4.11 Economics of KSSDA rice seed supply chain

Particulars	Rs/Qtl of rice seed distributed	Per cent to total cost
Cost of foundation seed distributed to seed growers	54	1.20
Cost paid to registered rice seed growers	3000	66.89
Transportation cost	628	14.00
Processing cost	233	5.19
Electricity and other costs	150	3.34
Gunny bag for distribution	165	3.68
Loading and unloading charges	90	2.00
Salary for staff	150	3.34
Depreciation on farm buildings and farm implements	15	0.33
Total (Rs/Qtl)	4485	100

Returns (Rs/Qtl)	4000	
Benefit-Cost Ratio	0.89	

Comparative analysis of economic performance of different rice seed supply chain is given in Table 4.12.

Table 4.12. Economic performance of different rice seed supply chains

Rice seed supply chain	Cost of production (Rs/Qtl)*	Benefit Cost Ratio (BCR)
Chain 1 (on- farm rice seed production)	6064	0.76
Chain 2 (KAU farmer participatory rice seed production)	3857	1.04
Chain 3 (KSSDA rice seed supply chain)	4485	0.89

(* While calculating cost of production cost incurred for the service of agricultural scientist is not taken into account.)

Economic performance of rice seed production under the identified supply chains was analyzed using Commission on Agricultural Costs and Prices (CACP) cost concepts and Benefit Cost Ratio (BCR). BCR of rice seed production in KAU research farm was 0.76 followed by 0.89 for KSSDA and 1.04 for participatory rice seed production in KAU. Seed production systems in KAU research farms and KSSDA was found to be economically inefficient as indicated by the BCR values.

4.4 Constraint analysis in rice seed market

4.4.1 Constraints faced by rice seed growers

The constraints faced by rice seed growers in rice seed production and marketing were analysed using Garrett ranking technique. The results are given in the Table 4.12.

Table 4.14Constraints faced by rice seed growers

Constraints	Mean score	Rank
Lack of timely procurement and payment	64.21	1
High labour cost	60.58	3
Unavailability of skilled labour for rouging	57.26	4
Poor quality foundation seed	50.17	5
Lack of proper storage facilities for drying and storage of rice seed	47.5	6
Climate change	63.83	2

The major constraint faced by rice seed growers in Kerala was regarding the delayed procurement and payment for rice seed. Delay in procuring rice seed from farmers may lead to quality deterioration of the seed which in turn may affect the productivity of next crop. Only if the payment for the product (seed) is received on time, the farmer could invest for the next season crop. Delay in payment may thus become a limiting factor for the farmers in financing cultural operations for the upcoming season. The second constraint was loss due to climatic variability. Higher labour cost was regarded as the third important constraint as a result of which cost of rice seed production will increase. The other constraints were unavailability of skilled labour for rouging, poor quality foundation seed and lack of proper storage and drying facilities.

4.4.1 Constraints in market access to quality paddy seed faced by rice farmers

Major constraints faced by rice farmers in Kerala were ranked using the information obtained during data collection. Garrett ranking technique was used and the results are given in Table 4.13.

Table 4.13 Constraints in access to quality rice seed

Constraints	Mean score	Rank
Lack of timely availability of rice seed	66.98	1
Poor rice seed quality	64.03	2
Subsidized rice seed is not available in sufficient quantity	63.30	3
High price of rice seed	62.66	4
Information on new varieties are not available	58.26	5
Lack of varietal availability	57.75	6

Results pointed out that the major constraint faced by rice farmers in accessing quality rice seed is timely availability of rice seed. *i.e.*,non-availability of seed in time can be regarded as the major bottleneck faced by rice farmers in Kerala. It is followed by poor rice seed quality, *i.e.*, farmers are not satisfied with the quality of rice seed made available to them. Majority of them opined that often seed supplied to be of inferior quality. Third major constraint was, insufficient quantity of subsidized rice seed. Farmers opined that the recommended quantity of subsidized rice seed, *i.e.*,30kg/acre in Palakkad and Thrissur and 40kg/acre in Alappuzha is insufficient for sowing. The fourth constraint was high price of rice seed followed by lack information on new varieties and lack of diverse varietal availability.

The study conducted by Joshi *et al.*(2012) in Maharashtra delineated the same results. Results highlighted that the major constraints in attaining sufficient Seed Replacement Rate in paddy included untimely supply of rice seed, high price of certified seeds and lack of availability of preferred varieties to the farmers. Gauchan (2015) in a study conducted in Nepal also opined that due to inaccurate demand supply assessment of seed, farmers lack access to timely availability of seed at affordable price.

4.4.2 Access to Seed Index

Access to Seed Index (ASI) was developed for the rice seed supply chains (KSSDA rice seed supply chain, KAU rice seed supply chain and NSC rice seed supply chain) based on the primary data collected from farmers. It was developed based on three dimensions of rice seed accessibility such as availability, affordability and profitability. Various parameters such as availability of quality rice seed and availability of seed in sufficient quantity (availability), price of rice seed and distance to the seed source (affordability) and increment in yield while using seed (profitability) were ranked on a four point scale. The higher ASI index is an indicator of more efficient supply chain. The results are given in the Table 4.14.

Table 4.15 Access to Seed Index for rice seed supply chains in Kerala

Sl No.	Rice seed supply chain	Access to Seed Index (ASI)
1	KSSDA rice seed supply chain	0.68
2	KAU rice seed supply chain	0.60
3	NSC rice seed supply chain	0.48

(Source: Primary data)

From the above results it is clear that KSSDA rice seed supply chain is having highest ASI of 0.68 followed by KAU rice seed supply chain (0.60) and NSC rice seed supply chain (0.48). On analysing the scores obtained for each measure, it was observed that highest score for quality seed was obtained by KAU rice supply chain and highest score for price of rice seed was for KSSDA supply chain in which farmers get subsidy for the seeds directly. However, in the case of KAU rice seed supply chain, they have to pay full amount while buying seed and subsidy will be paid later according to the availability of funds through krishibhavans. Therefore farmers gave a higher rank to KSSDA supply chain in case of price of rice seed. KSSDA supply chain also scored highest for distance to the source. Because rice seed is supplied through krishibhavans in this chain,the source of seed supply is very near to them compared to KAU research stations and NSC. Profitability measure (or relative increment in yield while using the seed from the specified source) highest score was obtained for KAU rice seed supply chain. Unlike the large seed volume handled by KSSDA, KAU handles only a meagre amount and hence, KAU is able to concentrate more on the quality of seed produced thereby having potential to add to the yield. In this context, the observation by Awotide *et al.* (2012) that farmers' access to new and improved varieties could enhance their income becomes relevant.

4.5 Demand supply gap in rice seed production in Kerala

Supply of rice seed in Kerala was assessed based on the data on rice seed distribution gathered from KSSDA, NSC and all Agricultural Research Stations in Kerala, for the last five years (2010-11 to 2016-17). The data collected were compiled to get the information on total institutional rice seed supply in Kerala. The data is given below in the Table 4.15.

Table 4.16 Total rice seed supply in Kerala from 2012-13 to 2016-17

Year/Agency	KSSDA(MT)	KAU Research stations* (MT)			NSC (MT)	Total supply of rice seeds (MT)
		Breeder seed	Foundation seed	TLS		
2012-13	7565.888 (92.74)	12.922	0.981	174.796 (2.14)	416.882 (5.12)	8157.563 (100)
2013-14	9330.424 (94.34)	9.654	0.323	106.008 (1.07)	453.974 (4.59)	9890.406 (100)
2014-15	7833.011 (92.97)	9.959	0.342	254.383 (3.02)	337.830 (4.01)	8425.224 (100)
2015-16	6286.72 (88.13)	108.46	1.89	133.72 (1.87)	712.68 (10)	7133.12 (100)
2016-17	7089.2 (76.65)	21.72	0.997	391.36 (4.23)	1768.07 (19.12)	9248.6 (100)

(Figure in parenthesis represents per cent to total supply in each year- *In research stations out of BS and TLS produced, only TLS is directly distributed to farmers for cultivation, hence only TLS is given as per cent to total)

The major contribution to formal rice seed supply in Kerala is by KSSDA (88.97%) followed by NSC (8.57%) and KAU (2.46%). Deepana and Girish (2016) studied about rice seed market in Mandya district in Karnataka. The results have shown that Karnataka State Seed Corporation (KSSC) was the major player contributing 78 per cent of total rice seed supply followed by NSC contributing only 10 per cent.

Demand for rice seed in Kerala was worked out on the basis of the published data on gross cropped area under High Yielding Variety (HYV) rice

cultivation in the state for the period 2012-13 to 2016-17. Area under rice cultivation was multiplied with seed rate (80 kg/ha) of rice for arriving at the total demand for rice seed in Kerala during the same years. The rice seed demand from 2012-13 to 20116-17 is given in the Table 4.16 below:

Table 4.17 Rice seed demand from 2012-13 to 2016-17

Year	Gross Cropped Area (ha)		Total	Demand for rice seed (MT)
	Local varieties	High yielding varieties		
2012-13	12791.85 (6.48)	184485.4 (93.51)	197277	14758.83
2013-14	13079 (6.55)	186533 (93.44)	199611	14922.64
2014-15	10259.08 (5.17)	187900.38 (94.82)	198159	15032.03
2015-16	10542 (5.35)	186328 (94.64)	196870	14906.24
2016-17	7058.69 (5.32)	125623.31 (94.68)	132682	10049.86

(Source: GOK, 2012-13; 2013-14; 2014-15; 2015-16; 2016-17)

The demand supply gap in rice seed production was worked out as the difference between the quantity of rice seed required for each year and the rice seed supply in the corresponding year and is given in the Table 4.17.

Table 4.18 Demand supply gap in rice seed production in Kerala from 2012-13 to 2016-17

Year	Total supply of rice seeds(MT)	Rice seed demand in Kerala (MT)	Demand supply gap in rice seed production in Kerala (MT)
2012-13	8157.563	14758.83	6601.267(44.74)
2013-14	9890.406	14922.64	5032.234 (33.72)
2014-15	8425.224	15032.03	6606.806 (43.95)
2015-16	7133.12	14906.24	7773.12 (52.15)
2016-17	9248.6	10049.86	801.26 (7.97)

(Figures in parenthesis represent per cent to the total rice seed requirement)

While analysing demand-supply gap in rice seed production in Kerala over the years from 2010-11 to 2016-17, it is evident that demand supply gap ranges from 30 per cent to 50 per cent except in 2016-17 where demand was found to be very low. Even if there is a reduction in demand supply gap in 2013-14, overall trend shows that demand supply gap is increasing. It may be due to the overall crop failure following adverse climatic situations that led to low seed recovery and less quantity available for supply. Also it may be noted that as the formal demand supply gap is 30-50 per cent, the informal rice seed supply in the state ranges from 50 to 70 per cent. As we have discussed earlier, informal rice seed supply include farmer saved seed and farmer exchange seed.

The results are indicative of the opportunity to intervene in a more intensive and scientific manner to improve the productivity and production of rice given the precarious situation of limited area available in the state. It also

necessitates the need to stream line the research and extension strategies to accommodate the need of the hour, may it be organic farming or integrated intensive farming.

4.6 SWOC analysis of rice seed market in Kerala

Strength, weakness, challenges and opportunities of rice seed market in Kerala were listed out after discussion with key informants in the study area. Key informants included research scientists, agricultural officers, officials in seed distribution agencies and farmers. The major strengths, weakness, challenges and opportunities of rice seed market in Kerala are given below:

4.6.1 Strengths

- Increased awareness of farmers on the need to use quality seed
- Presence of a fairly well organized rice seed production and distribution system in the government segment
- Comparatively extended viability of paddy seeds as compared to vegetable seeds. Hence, the seed growers can store rice seed to sell at a higher price in the forth coming crop season

4.6.2 Weakness

- Rice seed being high volume low value seed, storage and transportation become more expensive
- Unwillingness on the part of farmers to buy seed at the market price in the existing institutional seed market. General observation is that farmers will buy from the organised market only if the seed price is subsidised
- Delay in sample collection for seed testing and certification procedures from the seed growers. This would result deterioration of seed quality
- Lack of adequate infrastructural facilities for handling, primary processing and storage of rice seed

- Paucity of time and trained man- power for overseeing the seed quality and seed field certification procedures
- Introduction and spread of new weeds in the field. At times the seed supplied by different agencies was found to contain new weed species which were not in Kerala
- Lack of an autonomous institution for seed certification. Dilution of seed certification occurs when the responsibility of seed production, certification and distribution vested in the same authority
- An accurate projection of the variety-wise seed requirement for the upcoming season is lacking. Owing to this, the seed produced may not be in accordance with the requirement of the farmers
- Lack of sufficient staff to co-ordinate rice seed production and distribution in various districts

4.6.3 Opportunities

- Manifold increase in production that is possible through the use of high quality seed. The area under rice cultivation and the area that could be brought under rice being limited in the state owing to plethora of socio-economic-edaphic reasons. Use of high quality seeds and seeds of improved varieties alone can increase rice production
- Use of quality seed can bring down cost of cultivation through reduced physical impurities; thus lowering seed rate, higher genetic purity which ensures absence of other crop seeds, weed seeds and objectionable weed seed and other distinguishable varieties.
- Use of healthy quality seed also reduces disease spread and input cost incurred on plant protection activities
- Popularisation of new high yielding varieties through rice seed distribution system

4.6.4 Challenges

- Declining area and production under rice in Kerala
- Loss of viability during storage due to the tropical humid climate in Kerala
- Extinction of traditional rice varieties and thus loss of biodiversity
- As three generation system of rice seed is followed, accurate forecasting of rice seed demand is difficult
- High incidence of pest and diseases
- Labour shortage and increasing cost of cultivation
- Incidence of rain during harvesting make drying and processing of seeds tedious

Summary and Conclusion

5. SUMMARY AND CONCLUSION

The present study entitled 'Market access to quality paddy seed in Kerala' was conducted in three major rice growing tracts of Kerala, viz., Palakkad, Alappuzha and Thrissur. The objectives of study were to document and assess the economic performance of rice seed supply chains in Kerala, to elucidate demand supply gap in rice seed production and also to conduct SWOC analysis of rice seed market in Kerala.

Primary data were collected from rice seed growers and rice farmers in Palakkad, Alappuzha and Thrissur. Multistage random sampling method was adopted to select the respondents. Sixty rice farmers and 60 rice seed growers were interviewed using structured pre- tested interview schedule. Thus a total of 120 farmers were surveyed. Primary data collected included information on socio-economic details, rice seed production details, costs and returns of rice seed production, source and accessibility to rice seed and constraints in rice seed production. Secondary data were collected from KAU research stations, KSSDA and NSC on supply of rice seed. Key informant interviews were conducted with agricultural officers, officials in rice seed production agencies, scientists and farmers to gather information on strengths, weakness, opportunities and challenges of rice seed market in Kerala.

Analysis of primary data on socio economic characters of respondents was done using frequencies and percentages. Age wise, 71 per cent of rice farmers and 70 per cent of rice seed growers were in the age category of 51-70 years and only 1.7 per cent of rice farmer was having an age of less than 30 years. The results revealed that participation of youth in agriculture was negligible. While analysing income status of respondents it was observed that 38.3 per cent of both rice farmers and rice seed growers were having an annual income between 1-1.5 Lakhs. At the same time 5 per cent of rice farmers and 10 per cent of rice seed growers were having annual income greater than Rs. 2 Lakhs. Economic status of rice seed growers was comparatively better than rice farmers. While looking at the

source of income to rice farmers and rice seed growers it is clear that 53.3 per cent of rice farmers and 55 per cent of rice seed growers were having farming as the main source of income. More than half of rice seed growers (53.3%) and 71.7 per cent of rice farmers were having family size between 4 and 6.

Rice seed production and distribution scenario in Kerala can be broadly documented as formal rice seed supply chain and informal rice seed supply chain. Informal supply include farmer saved seed and farmer exchanged seed between fellow farmers, friends and relatives. Formal rice seed supply can be explained through different agencies such as KSSDA (Kerala State Seed Development Authority), NSC (National Seeds Corporation) and KAU (Kerala Agricultural University). The major formal rice seed supply chains are explained below:

Chain 1: KAU Research Station – Rice farmer

Kerala Agricultural University being the institution for education, research and extension in the field of agriculture plays an important role in production and distribution of rice seed in Kerala. The chain 1 represents on- farm production and distribution of rice seeds from KAU research stations. Truthfully Labelled Seed (TLS) is distributed through this chain.

Chain 2: Agriculture Research Station – Participatory rice seed production unit – Participatory rice seed grower – Participatory rice seed production unit – Rice farmer

Apart from on-farm production and distribution of rice seed KAU undertake participatory rice seed production and distribution. Breeder seed or foundation seed from research stations will be supplied to participatory rice seed grower through the unit. Seed quality is ensured through rouging done under the supervision of skilled assistants in the unit followed by field inspection by concerned scientist from time to time. This is done to ensure that the seed produced satisfies all the quality standards of the crop. On harvesting, the seed will be procured and processed in the unit. Seed samples are also collected for

seed testing. If the smaple satisfies required quality parameters for germination per cent, physical purity, genetic purity and viability. Then, the processed seed will be supplied through Padasekhara Samitis, Krishibhavan and individual farmers.Truthfully Labelled Seed (TLS) is distributed through participatory rice seed production unit.

Chain 3: Agriculture research station – State Seed Farm (SSF) – KSSDA – Registered rice seed grower – KSSDA – Rice farmer

KSSDA (Kerala State Seed Development Authority) plays an important role in production and distribution of rice seed in Kerala. It is working in co-operation with Krishibhavan and registered Padasekhara Samitis in each panchayat. Seed production is done in the field of registered rice seed growers under the supervision of respective agricultural officers. Seed samples would be drawn by the Department officials (ADA). If the sample satisfies required quality parameters for germination per cent, physical purity, genetic purity and viability. Then it is procured by KSSDA and distributed after cleaning and processing. KSSDA accounts for major portion of formal rice seed supply in Kerala. Certified rice seed is distributed through KSSDA.

Chain 4: Agriculture research station – NSC (National Seeds Corporation) – Registered rice seed growers – NSC (National Seeds Corporation) – Rice farmer

NSC (National Seeds Corporation) is a national agency for production and distribution of almost 60 crop varieties all over India. NSC distributes foundation seed to rice seed growers which is then multiplied to certified seed under the supervision of NSC. Then it is distributed to farmers through NSC owned sales counters, seed distributors and dealers.

Economics of rice seed production in farmers' field was worked out. It was found to be Rs. 68628/ha, out of which hired human labour accounts to 51 per cent followed by material cost (25%) and machine labour (18%). Average rice seed yield at farmers' field was 5331 Kg/ha with a gross income of Rs.

152089/ha. Benefit Cost Ratio was found to be 2.22 at Cost A1 and 1.66 at Cost C2.

Major constraints faced by rice seed growers were analyzed using Garrett ranking technique. The results have shown that untimely seed procurement and payment was the foremost constraint faced by seed growers followed by Climate change, and high labour cost. Constraints faced by rice farmers in access to quality rice seed was also analysed and the major constraint noted was lack of timely availability of rice seed followed by poor rice seed quality and unavailability of subsidized rice seed in required quantity. Access to Seed Index (ASI) was also worked out in order to compare different supply chains in terms of accessibility to rice farmer. KAU rice seed supply chain (chain 1&2) was having highest ASI (0.657) followed by KSSDA rice seed supply chain (0.644) and NSC rice seed supply chain (0.433).

SWOC analysis of rice seed market was also performed by enlisting strengths, weakness, challenges and opportunities of rice seed market in Kerala. Key informant interviews were conducted to perform SWOC analysis.

Policy suggestions

- To avoid mismatch between demand and supply in rice seed production, realistic rice seed production plans need to be introduced. So that more accurate forecasting of rice seed demand is possible. Also seed production plans have to be prepared at Krishibhavan levels well in advance of the crop seasons
- In Kerala, both producer and seed certifier are same. Dilution of seed certification occurs when the responsibility of seed production, certification and distribution vested in the same authority. So implementation of separate seed certification agency as in most of other state is recommended
- Provision of more rice seed storage and facilities at seed growers' level is also recommended for reducing quality deterioration and loss in storage.

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Setting up of community level procurement and processing centres under the auspices of Primary Cooperative Societies/ Local Self Body utilising both State / Central funds may be advocated. Replication of existing models if any with suitable modifications is also suggested.

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Appendix I: Questionnaire for rice farmers

Introduction

I am Fathimath Nufaisa, Msc.Agricultural economics student. I am here to gather information as part of my research work on **Market access to quality paddy seed in Kerala.** This information is **confidential** and will be used only for my research work and no farmer will be referred by their names. So,I am expecting your sincere cooperation to provide truthful information.

District: Block: Panchayath:

I. Socio-economic details of the farmer

1. Name of the respondent:
2. Age :
3. Gender:
4. Address:
5. Contact number:
6. Educational qualification:

Below SSLC ☐ SSLC ☐ Plus Two ☐

Degree ☐ Post graduation ☐ Diploma ☐

Specify (If any other).....

II. Income details:

- Annual income

<50,000	50000-1 lakh	1 lakh- 1.5 lakh	1.5 lakh- 2 lakh	>2 lakh
☐	☐	☐	☐	☐

- Source of income

Farming alone ☐

Farming+ Business ☐

Farming+ Government job ☐

Farming+ self employed ☐

Specify if any

other.....

III. Family details:

Sl No.	Name	Relation with respondent	Age	Education	Occupation

IV. Land details:

Ownership status	Wetland(Ha)	Dry land(Ha)	Total (Ha)
Own land			
Leased-in			
Leased out			

Rental value of own land (leased out):

Rental value of leased-in land :

V. Crop details

Year	Season	Variety of rice	Area	Yield/ha		Total returns
				Grain yield & Selling price	Straw yield&Selling price	
2015-16	Virippu					
	Mundakan					

VI. Details on seed:

Source of seed: farm saved/Through farmer exchange/Krishibhavan/Research station/specify if other

Characteristics of source

Particulars	Source of seed		
	KAU	KSSDA	NSC
Availability of quality seed	Poor/Satisfactory/Good/ Very Good	Poor/Satisfactory/Good/ Very Good	Poor/Satisfactory/Good/ Very Good
Availability sufficient quantity seed	Not available/Less available/Available/ Always available	Not available/Less available/Available/Always available	Not available/Less available/Available/Always available
Price of rice seed	Very high/High/medium/ Low	Very high/High/medium/Low	Very high/High/medium/Low
Distance to the seed source	Very far/far/near/Very near	Very far/far/near/Very near	Very far/far/near/Very near
Relative increment in	(Reduction inyield/No	(Reduction inyield/No increment/slight	(Reduction inyield/No increment/slight

yield	increment/slight increment/high increment)	increment/high increment)	increment/high increment)

Reason to prefer the source: High quality/ Low price/ Easy availability/ No other source/ specify if any other

If Krishibhavan, quantity of seed provided:

Price of seed: Krishibhavan (with subsidy/without subsidy)-

Research station-

Farmer exchange-

Farm saved-

Specify if any other-

Is it sufficient? Yes/No

How do you rise crop? Sowing in both seasons ☐

Sowing in virippu and transplanting in mundakan ☐

Specify if any other.....

Seed rate followed: Sowing- Transplanting-

How frequently you replace rice seed?

Replace in every season/once in a year/specify if any.....

Do you save farm produce for seed purpose for next season?

If yes, at what rate do you save (Kg/acre)?

VII. Constraints in access to quality paddy seed:

(Rank the below given constraints accordingly)

Problem	**Occurrence of problem(Yes/No)**	**Ranking of problem (on a 5 point scale)**
Poor seed quality		
Problem with availability in time		
Not available in required quantity		
Lack of varietal availability		
High price of rice seed		
Information regarding new varieties are not available		

VIII. Suggestions to overcome these shortcomings

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Thank you Sir,

Appendix II: Questionnaire for rice seed growers

District: Block:

Panchayath:

IX. Socio-economic details of the farmer

7. Name of the respondent:

8. Age :

9. Gender:

10. Address:

11. Contact number:

12. Educational qualification:

Below SSLC ☐ SSLC ☐ Plus Two ☐

Degree ☐ Post graduation ☐ Diploma ☐

Specify (If any other).....

X. Income details:

- Annual income

<50,000 ☐ 50000-1 lakh ☐ 1 lakh- 1.5 lakh ☐ 1.5 lakh- 2 lakh ☐ >2 lakh ☐

- Source of income

Farming alone ☐

Farming and non-farming activities ☐

Specify non-farming

activity.....

XI. Family details:

Sl No.	Name	Relation with respondent	Age	Education	Occupation

XII. Land details:

Ownership status	Garden land(Ha)	Wetland(Ha)	Dryland(Ha)	Total (Ha)
Own land				
Leased-in				
Leased out				

Rental value of own land(leased out):

Rental value of leased-in land :

XIII. Rice seed production details:

Experience in farming:

Number of years of experience in rice seed production:

Doing rice seed production under:

Registered seed growers' programme ☐

Participatory seed production programme ☐

Please specify if any other.....

Institution to which you are linked for rice seed production:

Number of years of experience under the institution:

How will you decide on which variety is to be cultivated? And how much quantity?

Is there variation every year? Yes/No

If yes, How it is varied? And do you know why?

Which are all the rice varieties particularly suited to your location?

Season	**Area (Ha)**	**Variety**	**Returns**						**Total returns**
			Main product		**By product**				
			Seed (tonnes)	**Price (Rs.)**	**Straw (tonnes)**	**Price (Rs.)**	**Bulk seed (tonnes)**	**Price (Rs.)**	
Virippu									
Mundakan									
Puncha									

XIV. Cost of rice seed production

Area(ha): Seed rate (Kg/ha): Bullock cost (Rs/day) :

Season: Wage rate(Rs/day): Male- Female-

Tractor(Rs./Hr):

Variety: Combine harvester(Rs/hour): Other machine cost : .

(Specify if any)

Cultivation practice	Labour cost			Machine cost	Bullock cost	Qty	Unit price	Total cost
	Male (No.)	Female (No.)	Total					
Sowing								
Nursery preparation								
Land preparation								
Soil ameleoration								
Basal dose application								
Transplanting								
Irrigation								
Weeding								
Plant protection								
Manures and fertilizers								
Harvesting								
Threshing								
Winnowing								
Transportation								
Loading and unloading charges								
Storage cost								
Specify if any								

XV. Quality of rice seed produced:

1. Do you know the class of rice seed given to you for seed production? Breeder seed/ Foundation seed/Certified seed
2. Do you know class seeds are selling after procuring from you? Foundation seed/Certified seed/Truthfully labelled seed
3. Do you replace rice seeds every season? Yes/No
4. If yes, how frequently? And Why?
5. Do you cultivate more than one variety in a single season? Yes/No
6. If yes, what is the isolation distance?

7. Do you follow roguing? Yes/ No

8. How rouging is being done? Who? When? How frequently?

9. Draining before harvest for uniform maturity? Yes/No

10. Harvesting at 80% maturity?Yes/No

11. How harvesting is being done? Labour harvest/ Machine harvest

12. If labour harvest, Do you thresh it just after harvesting?

13. If machine harvest, Does it affect the quality of seeds ? Yes/No

14. What is the moisture per cent needed for seeds?

15. How it is checked while drying?

16. Where so you store seeds until procurement? Is it in sacks? Yes/No

17. If yes, how many sacks are piled one above other?

18. Do you check seed quality yourself? How? What are the parameters?

19. Is there any seed quality test by authority before procurement? Yes/No

20. If yes, How many samples?

21. How samples are being taken?

22. What are all the parameters of seed quality?

23. Was there any instances of problem due to insufficient quality seeds? Yes/No

24. If yes, How many times? Why? How did you cope up?

25. Do you get support from krishibhavan or any other government institution? Yes/No

26. If yes, how?

27. How frequently officials/AO visit the field?

28. Who bear the cost of such visits?

XVI. Procurement details:

Do they procure rice seeds in time? What is the gap? Will it affect quality of seed?

Any experience of loss due to incorrect procurement?

Do you get payment for your seeds in time?

Does the entire quantity of rice seed produced get procured by Authority? Yes/No

If no, what is the limit?

Do you have ever suffered from this limitation?

How will you overcome the situation if one such comes?

XVII. Constraints faced in rice seed production:

(Rank the below given constraints accordingly)

Constraints	Occurrence of problem(Yes/No)	Ranking of problem (on a 5 point scale)
Lack of timely procurement and payment		
High labour cost		
Unavailability of skilled labour for rouging		
Poor quality foundation seed		
Lack of proper storage facilities for drying and storage of rice seed		
Climate change		

XVIII. <u>SWOC analysis of rice seed supply:</u>

As a rice farmer, have you ever experienced/come across unavailability of quality seeds when you need it most? Yes/No

Do farmers get seeds of specific variety whenever they need it? Yes/No

What is your opinion about performance of rice seed distributed to rice farmers through . Research stations :
Unsatisfactory/Satisfactory/Good
Krishibhavan(KSSDA) : Unsatisfactory/Satisfactory/Good

Do agircultural officer/ extension officer advise farmers to buy seeds from there? Yes/No

Opinion about current rice seed supply chain:

Any suggestions for improvement:

.....

.....

.....

.....

Thank

you Sir

Appendix III: Questionnaire for officials in research farms

1. Name of the institution:

2. Address:

3. Name and designation of the respondent:

4. Major activities/functions in rice seed production:

   Seed production and distribution under farmer participatory programmes ☐

   Seed production and distribution through registered seed growers' programme ☐

   Seed production only and direct distribution to farmers ☐

   Please specify (if any other).....
   .....

5. Which are all the varieties of rice handled?

6. Average quantity of rice seed

   - Procured/ year
   - Produced/ year
   - Distributed/year

7. Cost of rice seed production (If the agency is undertaking production themselves)

Crop:

Season:

Wage rate(Rs./day): (1) Male : (2) Female :

Machine cost (Rs/Hr):

Sl No.	Cultivation practice	Cost
1.	Land preparation	
2.	Sowing	
3.	Transplanting	
4.	Weeding	
5.	Fertilizer application	
6.	Irrigation	
7.	Pesticides, fungicides and insecticidal application	
8.	Rouging	
9.	Harvesting	
10.	Threshing	

- Area under rice seed production?
- Average yield of rice seed?

8. Cost of seed handling (If agency is involved in seed distribution)

Sl No.	Particulars	Cost (Rs./Kg)
1.	Transportation cost	
2.	Loading and unloading charges	
3.	Storage cost	
4.	Processing cost	
5.	Labour cost	
6.	Establishment cost of seed processing unit	

9. Returns:

Variety	Seed(Qty)	Price	Returns	Returns from by products					
				Straw(Qty)	Price	Returns	Admixture seed (Qty)	Price	Returns

10. To whom do you sell admixture seeds?

11. What is the procurement price? (only if seed production is through registered seed grower/farmer participatory)

12. Is the margin sufficient for your functioning?

13. How distribution is being done?

14. What are the distribution strategies adopted?

15. Are there any intermediaries between farmers and the farms?

16. At what price farmers are getting seed?

17. Do you think that famers prefer seed from the agency?

18. Which are all the parameters for ensuring seed quality?

19. Monitoring of seed production (If seed production is done through registered seed growers or through farmer participatory seed production):

- How quality of rice seed is ensured?
- Frequency of farm visit?
- Who bear cost of farm visit and other related charges?
- How rouging is being done?

- Details on any support given to farmers for rice seed production:

20. Is there any link with other government institutions?

21. Do you think that there is demand supply gap in rice seed production in Kerala?

22. What are the major strengths, weakness and challenges?

23. What are the major constraints faced by the agency?

24. Suggestions to overcome these problems:.....
.....
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.....
.....

Thank you

MARKET ACCESS TO QUALITY PADDY SEED IN KERALA

By

FATHIMATH NUFAISA P.

(2015-11-053)

ABSTRACT OF THE THESIS

Submitted in partial fulfillment of the requirement for the degree of

Master of Science in Agriculture

(Agricultural Economics)

Faculty of Agriculture

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ABSTRACT

Seed is the basic and critical input in agricultural production. It helps to enhance production without adding much to the extent of land under cultivation. Area under rice in Kerala fell from 2.34 Lakh hectares in 2009-10 to 1.99 lakh hectares in 2015-16, the production corresponding to the above period registered a reduction of only 0.49 Lakh tones. Availability and access to quality seeds is one of the important aspect in maintaining at least the current level of production of rice in the state. Hence the present study was carried out to document the major rice seed supply chains in Kerala and to assess their economic performance, to elucidate the demand - supply gap in rice seed production and to conduct a SWOC analysis of the rice seed market in the state.

The study was conducted in three major rice growing districts in Kerala viz., Palakkad, Alappuzha and Thrissur. From each district one block having maximum area under rice cultivation was selected and from each block two panchayaths were randomly selected. Primary data collection was done from 60 rice farmers and 60 rice seed growers in the selected panchayaths. Relevant data were also collected from Kerala State Seed Development Authority (KSSDA), Kerala Agricultural University (KAU) research stations and National Seeds Corporation (NSC).

Rice seed supply chains in Kerala could be broadly classified into formal and informal system. The informal system constitutes farm saved seed and seed exchange among farmers, friends and relatives. The formal rice seed supply system constitutes institutionalized rice seed supply mechanisms. Major formal rice seed supply chains identified were KSSDA rice seed supply chain, KAU rice seed supply chain and NSC rice seed supply chain.

Economic performance of rice seed production under the identified supply chains was analyzed using Commission on Agricultural Costs and Prices (CACP) cost concepts and Benefit Cost Ratio (BCR). BCR of rice seed production in KAU research farm was 0.76 followed by 0.89 for KSSDA and 1.04 for participatory rice seed production in KAU. Seed production systems in KAU research farms

and KSSDA was found to be economically inefficient as indicated by the BCR values.

Demand- supply gap in rice seed production was worked out as the difference between the quantity of high yielding variety seed required for the area reported and the quantity of seeds distributed through the formal supply chains. The demand supply gap over the years (2012 to 2016) ranged from 30 per cent to 50 per cent of the total demand indicating that 50-70 per cent of total rice seed demand was met through formal rice seed supply system. KSSDA was found to be the major source of rice seed supply (88.97 per cent) followed by NSC (8.57per cent) and KAU (2.46 per cent).

Constraints faced by rice farmers in access to quality rice seed was analyzed using Garrett ranking technique. Timely availability of rice seed was the major constraint followed by poor rice seed quality. Analysis of constraints faced by seed growers have shown that lack of timely procurement and payment was the major constraint. Strengthening of seed production system with establishment of separate seed certification agency and sufficient seed storage and processing facilities at seed growers' level was suggested.