ECONOMIC ANALYSIS OF COWPEA SEED PRODUCTION IN PALAKKAD DISTRICT

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(2017-11-089)

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by

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THESIS

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DECLARATION

I, hereby declare that this thesis entitled **"ECONOMIC ANALYSIS OF COWPEA SEED PRODUCTION IN PALAKKAD DISTRICT"** is a bonafide record of research work done by me during the course of research and that it has not been previously formed the basis for the award of me of any degree, diploma, fellowship or other similar title, of any other University or Society.

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LIST OF ABBREVIATIONS

B:C	Benefit:Cost ratio
TE	Triennium Ending
VFPCK	Vegetable and Fruits Promotion Council of Kerala
SSC	State Seeds Corporation
KSSDA	Kerala State Seeds Development Agency
R^2	Coefficient of Multiple determination
HYV	High Yielding Variety
AICRP	All India Co-Ordinated Research Project
KAU	Kerala Agricultural University
NSC	National Seeds Corporation
SFCI	State farms Corporation of India
ICAR	Indian Council of Agricultural Research
SAUs	State Agricultural Universities
NSP-BSP Projects	National Seed project- Breeder seed project
KVK	Krishi Vignan Kendra
IIVR	Indian Institute of Vegetable Research
FS	Foundation seed

LIST OF SYMBOLS

ac	Acre
^{0} C	Degree Celsius
>	Greater than
mm	Millimeter
t	Tonnes
m	Metre
MH	Million hectares
MT	Million tonnes
%	Per cent
ha	Hectare
kg^{-1}	Per Kilogram
₹	Indian Rupee
Km^2	Square Kilometre

Introduction

INTRODUCTION

Vegetables occupy an important place in diversification of horticulture, which plays a pivotal role in nutritional security. With the changing paradigms of food and nutritional securities, the consumption of vegetables in appropriate quantity and quality has attained tremendous importance. To meet the ever increasing demand of Indian population, their production and productivity has to be increased. Although the use of improved varieties of different vegetable crops has witnessed tremendous growth in vegetable production and productivity, the demand for vegetables in the state continues to be an issue. The availability of quality seed is of major importance for increasing the vegetable production. However, the availability of quality seeds is a problem, and at affordable prices is still a great concern. Hence, it is imperative to streamline the vegetable seed production on a scientific basis.

In India, over the last decade the area under horticultural crops grew by 2.6 per cent per annum and annual production increased by 4.8 per cent. During 2017-18, the production of horticultural crops was 311.71 MT and the area cultivated was 25.43 MH. During 2017-18, the area under vegetables was 10.26 MH with a production of 184.40 MT in India. During 2015-16, the area under vegetables was 46724 ha in Kerala and the area under cowpea was 7695 ha. The contribution of vegetables remains highest (59 - 61%) in horticulture over the last five years. Apart from nutritional benefits, the production of vegetables improves the economy of a country as these are very good source of income and employment (Horticultural statistics at a glance, 2018).

India has been blessed with a wide and diverse climate and physio-geographical conditions. The climate is most suitable for growing various kinds of horticultural crops such as fruits, vegetables, flowers, nuts, spices and plantation crops. Seed being vital and crucial input for crop production, one of the ways to increase the productivity without adding appreciably to the extent of land now, under cultivation is by planting quality seed. Seed is thus the most important catalyst for other inputs to be cost effective. It plays a crucial role in ensuring sustainability, good

crop productivity, enhanced profitability, biodiversity at a reasonable level and environmental protection. Much of the farmer's efforts and investments on costly inputs like chemical fertilizers, farm machinery, irrigation, pesticides *etc*. would go waste if these inputs are not bundled with quality seeds. Scientific research for a farmer would be of little value unless, quality seed which are genetically true to type and possess other desired qualities, such as vigor, good germination potential, freedom from exogenous mixtures and undesired weeds is accessible. It may be right to say that the success story of Green Revolution in India is largely due to the availability and use of certified high yielding varieties (HYVs) of seeds by the farmers.

Cowpea [*Vigna unguiculata (L.) Walp.*] is one of the most essential legume. It is either grown as a grain legume, vegetable or as a fodder crop. Most cowpeas are grown on the African continent, particularly in Nigeria and Niger, which accounts for 66% of world cowpea production.

In Indian context, it is a minor pulse cultivated mainly in arid and semiarid tracts of Punjab, Haryana, Delhi, and West Uttar Pradesh along with considerable area in Rajasthan, Karnataka, Kerala, Tamil Nadu, Maharashtra and Gujarat. It is in fact a multifunctional crop, which provides food for man and livestock and serving as an important and reliable revenue-generating product for farmers and grain traders (Singh, 2002 and Langyintuo *et al.* 2003).

Cowpea is known for its drought hardy nature, its wide and droopy leaves which keep soils and soil moisture conserved due to shading effect. It is also known as Black-eyed pea or Southern pea *etc*. It has multiple uses like food, feed, forage, fodder, green manuring and also as a vegetable crop. The legume is a nutritious component in the human diet, and cheap livestock feed as well. Both the green and dried seeds are suitable for canning and boiling.

Cowpea can be grown throughout the year under Kerala conditions. It can be grown as a floor crop in coconut gardens and as an intercrop in tapioca during May-Sept. It can be grown as a pure crop in single-crop and as double-crop in rice fallows during rabi and summer seasons. Cowpea can be grown in homestead gardens all throughout the year and in kole lands of Thrissur district during summer where rice crop cannot be raised due to water scarcity. Cowpea can be grown during any season. As a rainfed crop, sowing is done in the month of June. The most suitable time of planting is after the first week of June. During the second crop season (Rabi), *i.e.*, September to December, Cowpea can be grown as a fringe crop along the rice field bunds. Sowing can be done on either side of bunds on the day of transplanting the paddy crop. During summer, cowpea can be grown as a pure crop in rice fallows after the harvest of paddy. (Package of practices, KAU)

Cowpea is a warm-season, annual, herbaceous legume. Plant types are often categorized as erect, semi-erect, prostrate (trailing), or climbing.

Cowpea varieties grown for vegetable and seed purpose:

a) Bushy: Bhagyalakshmi, Pusa Barsathi, Pusa komal

b) Semitrailing: Kairali, Varun, Anaswara, Kanakamony (PTB-1), Arka Garima

c) Trailing: Vellayani jyothika, Sharika, Malika, KMV-1, Lola, Vyjayanthi, Manjeri Local, Vyalathur Local, Kurutholapayar, Arka Mangala

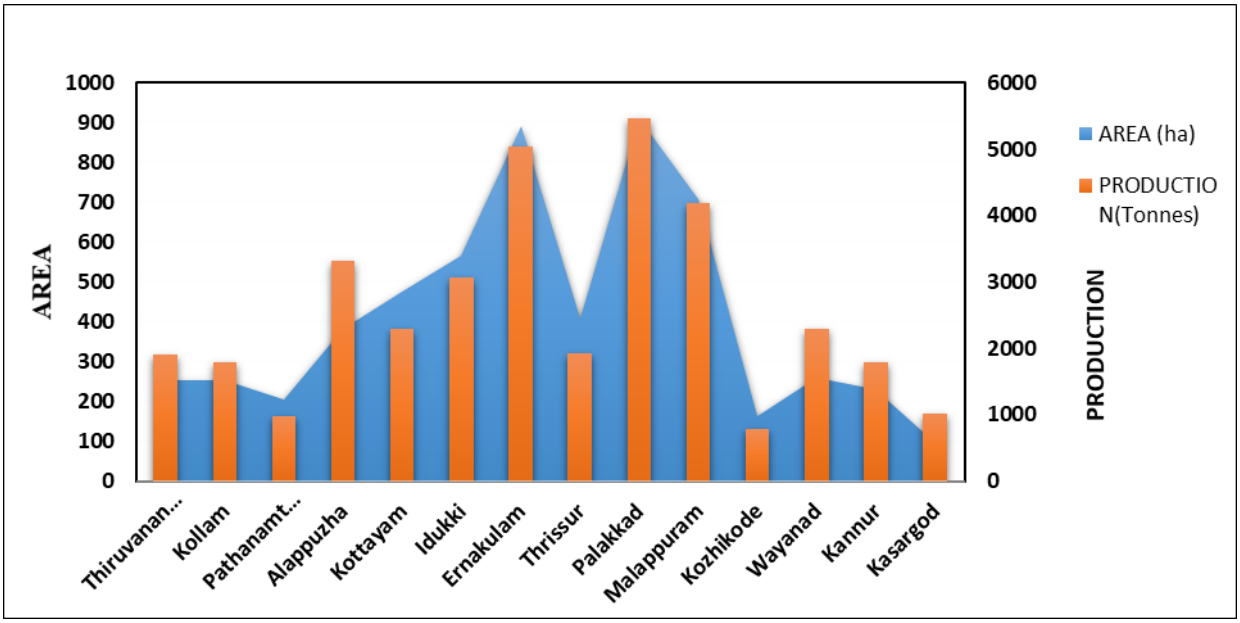
CHARACTERISTICS OF GOOD QUALITY SEEDS

- Good seeds lead to better germination (over 80%)
- Reduce the need for replanting
- Give more uniform plant stand and thus make harvesting easier
- Give more vigorous early plant growth which helps the plant to compete better with weeds and resist insect pests and disease attacks
- They have early maturity, and are pest/disease/drought tolerant or resistant
- They give higher yield

Kerala, which is blessed with maximum fertile land, suitable agro-climatic regions produces vegetables to meet the nutritional requirements of the

people. In order to improve the productivity of the crops and to sustain the development in the farming sector, the best participatory approach available is VFPCK.

Kerala is striving to move towards self-sufficiency in vegetables and in this context, the timely availability of quality seed is gaining importance. Hence, the study is being taken up to analyze the quality of cowpea seed during seed production. Palakkad has been selected for the study as the area (910.11 ha) and production (5469.306 t) of cowpea are high as shown in Fig 1.1. The area of different vegetables grown in Kerala is presented in the Table 1. During the year 2015-16, area of Payar was 7695 ha, followed by Bitter gourd (2623 ha), Amaranthus (1991 ha), Carrot (1812 ha), Koval (1630 ha), beans (1625 ha) *etc*. The major vegetables grown in for seed purpose are Snake gourd, Cucurbits, Bitter gourd, Ladies finger and other vegetables to increase the seed production and productivity in the area available with the farmers.



Source: Horticulture at a glance, 2018-19

Figure 1.1: Area and production of cowpea cultivated (2018-19) in Kerala

In the above background, the present study "Economic analysis of cowpea seed production in Palakkad district" was taken up with the following objectives.

1. To estimate the comparative economics of cowpea seed production with vegetable and pulse cowpea
2. To study the efficiency in cowpea seed production
3. To analyse factors affecting availability of quality seeds of cowpea to farmers
4. To identify the constraints and opportunities for seed production by public agencies and under farmer participatory mode

SCOPE OF THE STUDY

The present study would suggest about the feasibility of adopting vegetable seed production in Palakkad district. The costs and returns of vegetable cowpea and pulse cowpea growers and resource use efficiency will be analyzed. The factors affecting the availability of quality seed to the growers will be analyzed. The constraints faced by the seed growers during the production process and marketing will also be analyzed.

LIMITATIONS OF THE STUDY

Research studies are carried out by individual research, which is confined to limited area and the results may be applicable for the similar agro-climatic conditions only. Since the practice of maintaining records on the cost of cultivation was not prevalent among the farmers, hence the responses were drawn from their memory. This may result in recall bias. However, every possible effort was made to minimize the errors by cross-questioning, interview, and also visual observations.

PRESENTATION OF THESIS

The study entitled "Economic analysis of Cowpea seed production in Palakkad district" is presented in five chapters. The 'introduction' chapter gives

brief importance seed production, seed production programmes in India and Kerala followed by scope and limitations of the study. The ‘Review and Literature’ chapter gives explanation about the results findings of the earlier research work in the related work. Methodology used in data collection and data analysis is explained in third chapter. Fourth chapter explains about the major findings of the research work. The last chapter explains about the overall view of the major implications of the research work.

Review of Literature

REVIEW OF LITERATURE

In this chapter, review of past literature and pertinent findings has been reported keeping in view of problem entitled "Economic analysis of cowpea seed production in Palakkad district." For the better reference, review has been divided into sub headings as follows.

2.1 Costs and returns of seed production
2.2 Determinants of yield in cowpea
2.3 Factors affecting availability of quality seeds
2.4 Constraints faced by farmers during seed production

2.1 COSTS AND RETURNS OF SEED PRODUCTION

Kumar *et al.* (2017) reported in their study of economics of fodder and seed production of cowpea that benefit cost ratio in case of cowpea fodder production was 1.92 and in case of cowpea seed production it was 1.49. The cowpea seed cost per Kg was Rs.36.74 when farmer was able to utilize the byproducts and Rs. 75.76 when farmer was not utilizing the byproduct.

Kumar and Singh (2017) calculated the costs and returns of quality seed production of cowpea in Uttar Pradesh and found that B:C ratio was 1.49. Average quality cowpea seed production was 529.13 $Kgha^{-1}$. Most of the expenditure was incurred on labour followed by manures and fertilizers. Cowpea is highly profitable if there is market for sale of green fodder.

Pal *et al.* (2016) estimated that there were twenty three per cent higher expenses during red gram seed production which was due to high labour charges for seed certification, cost of manures, cost of fertilizers and cost of pesticides. There were increase in yields due to high output and better rate obtained.

Kumar (2013) reported from his study on economic evaluation of seed business of pulses in Kurnool that cost of cultivation was low for Bengal gram

compared to Black gram. Manures and fertilizers followed by rental value of owned land, human labour, cost of seed and plant protection were the major costs incurred on black gram cultivation.

Soman (2012) estimated cost of cultivation at cost A2 and found that in Kudumbashree farmers, the major cost was allocated for erecting panthals. While for VFPCK and other farmers, the major cost was assigned for hired labour.

Sairam (2011) examined from his study on economics of commercial seed production of paddy in Chittoor district of Andhra Pradesh and reported that gross and net returns for seed farmers were more profitable compared to non-seed farmers.

Omonona (2006) reported from his study on maize and soyabean contract seed production in Nigeria that B:C ratio were 0.69 and 0.83 for maize and soyabean respectively. Variable costs were high for maize compared to soyabean.

Ranganath and Reddy (2005) reported from their study on economic analysis of Jowar seed production that major costs were attributed to jowar seed farms compared to non-seed irrigated farms and non-seed rainfed farms.

Kanna Babu and Rana (2003) reported that B:C ratio obtained for sorghum hybrid seed production was 0.45, which indicates that costs are high. Variable costs such as human labour and material inputs had major share in total costs.

Kutty *et al*. (1998) worked on economics of vegetable seeds production in Kerala. Among the vegetables grown, B:C ratio was high for okra compared to melon and Ash gourd. Major cost for okra was contributed by labour charges.

Naik *et al.* (1996) confirmed from their study on tomato seed production that medium farmers had B:C ratio 2.31 which was more profitable compared to other farmers.

Reddy *et al.* (1990) observed from their study on economic analysis of breeder seed production of cowpea in Karnataka that cowpea seed variety C-152 per ha was more efficient as the seed yields were 366 $Kgha^{-1}$ and 258 $Kgha^{-1}$ in summer and kharif seasons respectively. In addition to that, cost of cowpea seed production was high during kharif season compared to summer season.

2.2. DETERMINANTS OF YIELD

Kumar *et al.* (2018) performed the resource use efficiency in tomato and potato in Haryana and indicated that FYM, seeds, machine labour and weeding had significantly positive impact on yield of potato whereas human labour had negative impact on yield of tomato.

Sharma *et al*. (2016) studied resource use efficiency of maize production in Jammu and Kashmir and found that age of the farmer, education, female workers and the size of holding were the significant variables for improving technical efficiency among the sample farmers, whereas the male workers and children in the family showed the negative relationship with technical efficiency in the Jammu region of the state.

Chapke *et al*. (2011) worked on the allocative efficiency in Sorghum production and found that the inputs fertilizers, labour and agro chemicals which were underutilized whereas the inputs seeds and irrigation water which were excessively utilized during the sorghum production.

Deshmukh *et al.* (2010) examined the results of resource use efficiency for the production of pearl millet and found that bullock labour and family labour were positive and significant.

Warade *et al*. (2010) concluded from the study on allocative efficiency in cotton and reported that bullock labour, machine labour and seed were significant and excessively utilized on medium farms.

Hugar *et al.* (2009) conducted study on Bt cotton and found that protection chemicals was positive and found to be significant. The constant k was found to equal to one which indicates optimum utilization of resources.

Prasad and Prasad (2009) conducted regression analysis with data from soybean-jowar cropping system and found that the use of plant protection chemicals was positive and significant. In the case of cotton, inputs such as seed, human labour and machine labour were positive and found to be significant.

Satpute *et al.* (2009) studied resource use efficiency of organic and inorganic soyabean farming and found that seed and vermi compost were statistically significant for organic farming at 1 per cent level of significance.

Resource use efficiency was worked out for soyabean cultivation by Pant and Nagar (2005) and revealed that manures were statistically significant on all three farm size groups (small, medium and large sized farmers).

Prapoorna (2000) studied resource use efficiency of rainfed groundnut and found that manures and fertilizers significantly increase the yields of the crop.

Gopikrishna (1999) explained the allocative efficiency of inputs in the cultivation of red gram and Bengal gram and found that inputs such as human labour and plant protection chemicals were underutilized and bullock labour was over used.

Raghuwanshi *et al.* (1999) explained the resource use efficiency in wheat and found that inputs which includes seeds and irrigation were positive and significant in the case of medium farms. The variation in output was explained by 30 to 48 per cent of the independent variables.

Chandrasekhar and Gowda (1996) studied the resource use efficiency of groundnut cultivation and the results indicated that land, FYM and seeds were found to

be statistically significant. Land, FYM and seeds were the inputs which explained about 89.74 per cent level of variations in the output.

Hedgire (1993) conducted study on the resource use efficiency in summer groundnut production and found that regression coefficient was positive and significant. The inputs like female labour, phosphatic fertilizers, insecticides and irrigation explained variations in the output.

Tripathi (1992) studied the resource use efficiency of French bean and found that regression coefficient was positive with 5 per cent level of significance. The inputs like human labour, bullock labour, seeds, manures and fertilizers explained the variations in the output to the extent of 51.72 per cent.

2.3 FACTORS AFFECTING AVAILABILITY OF QUALITY SEEDS

Njonjo *et al*. (2019) suggested from their study on production practices, postharvest handling, and quality of Cowpea seed used by farmers in Kenya that physical purity and vigour were the major factors effecting availability of quality seeds to farmers.

Mbah and Nwunuji (2016) found from their study on factors limiting adaptation to climate change among farmers in Taraba state, Nigeria that constraints faced by farmers due to climate change were inadequate financial resources, high cost of farm inputs, poverty, limited access to improved livestock breeds, high cost of improved crop varieties.

Manjunatha *et al.* (2015) reported from the study on quality performance of seeds such as cotton, sunflower, pearl millet, sorghum, castor, hybrid, paddy and vegetables in Andhra Pradesh and Bihar and found that factors effecting accessibility of quality seeds by farmers were timeliness in availability of seeds, availability in adequate quantities, credibility of source of seed and price of seeds.

Usman *et al.* (2013) reported that cost, availability, and lack of technical knowledge of inputs of groundnut were responsible for poor use of the inputs. Hence, it was therefore recommended that government and research institutes should strengthen extension services to deliver improved technologies to the farmers.

As reported by CIAT (2008), factors effecting bean production were production, seed delivery system, marketing, agricultural research extension, problems of seeds producers and problems of land scarcity.

Ahmad *et al.* (2005) reported that farmers' access to certified seed, better land preparation, recommended dose of seed and fertilizer and availability of credit as the major factors that can enhance the carrot production in Punjab.

Aji *et al*. (2001) found that availability of seed and farm production factors, *i.e.*, land and farm labour formed a single factor that was found to be the most important factor influencing East-Javanese farmers' decision to purchase potato seed.

2.4. CONSTRAINTS FACED BY FARMERS DURING SEED PRODUCTION

Amiruddin and Uma (2019) reported that the major constraints in paddy seed production in Madurai district were water availability, land availability, availability of skilled labour and the cost of drying.

Kumar *et al.* (2019) reported that the major constraints faced by vegetable farmers of Haryana were lack of market information, higher price fluctuation, high cost of labour, problem of storage facilities, and lack of processing industries, higher price fluctuations, high cost of labour, high transportation costs and delay in payments.

Marketing constraints of pulses were studied from Haryana by Kumar *et al*. (2018) and noticed that unavailability of consistent market information, participation of maximum number of intermediaries in the market were the major hurdles.

Tiwari and Tiwari (2018) stated from their study on constraints in adoption of modern vegetable cultivation practices in Bastar Plateau in Chattisgarh that major bottlenecks were inadequacy of improved varieties, high cost of seeds, improper dose of fertilizer, lack of skilled labour, non-availability of disease and insect resistant varieties and price fluctuations which discourages the farmers.

Jat *et al.* (2017) reported that the constraints in adoption of improved cultivation practices of Black gram in Rajasthan were lack of training institutions for the farmers, non-availability of improved seed, lack of technical advice for crop cultivation, absence of regulated market and non-availability of fertilizers.

Kumar (2017) suggested from his study on seed production of paddy and chickpea in Mungeli district of Chattisgarh that the major constraints as reported by farmers were delay in payment of wages, shortage of labour and lack of training and guidance.

According to Sharma (2017) major constraints when soybean seed production was carried out in Chattisgarh were delay in payments to farmers, natural calamities, labour scarcity, unavailability of proper training and guidance; and hence efforts should be taken to increase the seed production of soybean by providing improved training and knowledge to the farmers to enhance profitability to farmers.

Singh *et al.* (2017) concluded that the constraints faced by Bihar farmers were overexploitation of natural resources and effects of climate change which had put an extra stress on rice based cropping systems.

Rohit *et al*. (2017) conducted study on constraints faced by the farmers in peri-urban vegetable cultivation in Uttar Pradesh and Haryana and noticed that unavailability of inputs including fertilizers at the right time and unavailability of labour during the harvest season were the major constraints.

Chattopadhyay and Mohapatra (2015) studied the perception of constraints in chickpea production in India and confirmed that abiotic and biotic stresses were the major bottlenecks for the Indian farming systems.

Wannur and Nagappa (2015) reported from farmer participatory groundnut seed production programme in Dharwad that high wage rate, lack of skilled labour and lack of timely supply of good quality seeds were the major production problems and additional cost of transportation, deduction in seed quantity and non-discloser of proper price of seeds were the major marketing problems in farmer participatory groundnut seed production programme.

Pandit and Basak (2013) studied the constraints faced in commercial cultivation of vegetables and reported that availability of seed, pest management, field management, marketing and extension media contact were the major constraints faced by farmers.

Sahu *et al.* (2013) reported from their study on constraints in adoption of vegetables production technology in Uttarakhand Hills that lack of knowledge about improved variety, seed rate and sowing time, lack of knowledge of IPM technologies, unavailability of improved seeds of vegetables, lack of irrigation facilities, lack of subsidy and training of scientific vegetable production technology were the major hurdles.

Socio-economic institutional constraints noticed during the pulses production were lack of knowledge and poor seed availability according to Kumar and Bourai (2012). In addition, infrastructural constraints noticed were poor seed storage facilities and poor marketing facilities.

Amrutha (2011) examined the constraints and techniques for improving pulses production in Tamil Nadu and found that use of poor quality seed, low area coverage, inadequate irrigation facilities, low investment were the major constraints in pulses production.

Shashikanth *et al*. (2011) reported that the constraints in red gram cultivation were high incidence of pests and diseases, and lack of availability of labour. Measures taken were forecasting of pests and diseases incidence, and recommendation of proper application of effective pesticides in the study area.

Constraints faced during pulses production were studied by Kumar *et al*. (2010) and noticed that scarcity of improved variety of seeds and manures, fertilizers on time, lack of information regarding weedicides were the limitations.

Mani *et al.* (2007) reported from their study on constraints of Pigeon pea cultivation in Lucknow district of Central Uttar Pradesh that incidence of pests and diseases and insufficiency of Sulphur based fertilizers were the major problems faced by farmers.

FAO (2004) reported that the major constraints observed by commercial seed sector were unavailability of access to seeds of new varieties, lack of resources and marketing of quality seed.

Kahair *et al.* (2003) analyzed the constraints in Soybean cultivation and found that major constraints were sale of marketable produce at reasonable price, lack of monitoring of crop by officials, shortage of capital availability, and also availability of less information regarding the agronomic practices for the management of crop.

Materials and Methods

MATERIALS AND METHODS

A brief report of the study area and the research design followed in the present study including sampling procedure, methods of data collection and tools of analysis are discussed under following sub-heads.

3.1. Description of the study area

3.2. Cowpea Seed production-Basic information

3.3. Sampling design

3.4. Analysis of data

3.1. AREA OF STUDY

Kerala is striving for quality seed production to meet population demand. The study was undertaken in Nenmara and Chittur blocks of Palakkad district of Kerala where the area was about 910.11 ha and production was 5469.306 t. Hence, Palakkad was selected for the study where the area and production were high for better study. The present study attempts an economic analysis of cowpea seed production in Palakkad district.

3.1.1. Palakkad district

Palakkad is the largest district in Kerala and is known as granary of the state. It is one of the most agrarian districts in Kerala which came into existence as an administrative unit on the 1st January, 1957. According to the 2011 census, Palakkad district has a population of 130955, which was 8.41 per cent of the total population of the state. Among the Districts, Palakkad district ranks 1st in area (4476 km^2). The major crops cultivated in the district include paddy, coconut, vegetables, rubber, spices and condiments. These crops occupy more than 95% of the total cropped area.

3.1.1.1. Location

Palakkad district has a total geographical area of 4,476 Km^2 which indicates 11.55 per cent of the state total geographical area (38,863 Km^2). It extends between 10°20'00" N and 11°14'00" N latitudes and 76°20'00" E and 76°54'00" E longitudes. It

is encompassed by Malappuram district on the north and northwest, Thrissur on the south and Coimbatore district of Tamil Nadu on the east. It is situated almost at the center of the state, spreading over the midland plains and mountainous highlands. Palakkad is one of the four districts that do not have a coastline in Kerala. (Fig.3.1)

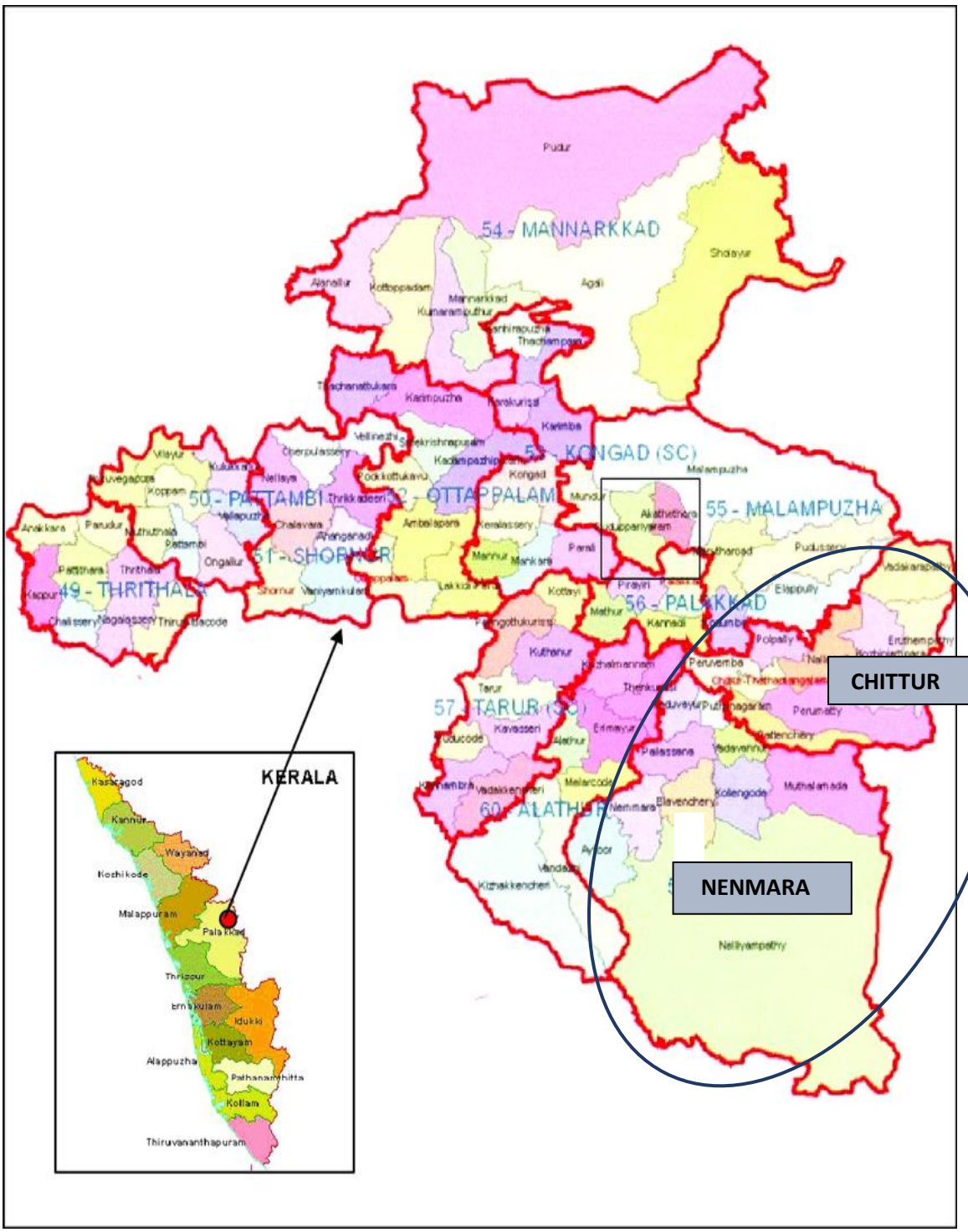
The land utilisation pattern of Palakkad district during 2010-11 is presented in Table 3.1. The net area sown in the district was around 43.97 percent of the total geographical area. Land under non-agricultural use which was 9.8 per cent in 1997-98 has decreased to 9.25 per cent in 2010-11. The net cropped area has marginally declined from 2120.56 Km^2 to 1968.18 Kms^2. There had been an increase in the area under current fallow from 14415 Km^2 in 2000-01 to 17048 Km^2 and the fallow other than current fallow had risen from 85.87 Km^2 in 2000-01 to 128.37 Km^2 in 2010-11.

Table 3.1. Land utilisation pattern in Palakkad district (2010-11)

Sl.no	Type of land	Area in Km^2
1	Forest area	1362.5 (30.44)
2	Land put to non-agricultural use	414.1 (9.25)
3	Barren and uncultivable land	27.56 (0.61)
4	Land under miscellaneous tree crops	10.23 (0.228)
5	Cultivable waste	240.33 (5.36)
6	Fallow other than current fallow	128.37 (2.86)
7	Current fallow	170.48 (3.8)
8	Still water	150.2 (3.35)
9	Social forestry	3.82 (0.085)
10	Net area sown	1968.18 (43.97)
11	Total geographical area	4476 (100)

Figures in parenthesis indicate percentage to total geographical area

Source: Directorate of Economics & Statistics, Govt. of Kerala; Agricultural statistics, 2010-11



Source: www.mapsofindia.com

Figure 3.1. <u>Map of study area (Palakkad district)</u>

3.1.1.2. Topography and climate

Palakkad has a tropical wet and dry climate. Temperatures remain moderate throughout the year, with exception in March and April which being the hottest months. High amount of precipitation is received in Palakkad, mainly due to the South-West monsoon. July is the wettest month and the rainfall is maximum (433.2 mm) in June in the year 2017. The maximum temperature was recorded as 38.4℃ in the month of March and minimum temperature was recorded as 24.2℃ in the month of December during the year 2016.

3.1.1.3. Demographic features

The population of Palakkad district as per 2011 census was 28,09,934 of which male and female were 13,59,478 and 14,50,456 respectively. The density of population was 627 per km^2 and the sex ratio in the district was 1067 females per 1000 males. The average literacy rate in Palakkad district as per 2011 census was 92.45% of which males and females were 95.43% and 89.67% literates respectively.

Source: **[Census data, 2011, panchayat level statistics, 2011, Palakkad]**

3.1.2. Description of selected panchayats

The two blocks of Palakkad district *viz.,* Nenmara and Chittur were purposively selected for the study. From each of the two blocks, two panchayats having maximum number of cowpea seed farmers were selected. From each of the selected panchayats, 20 farmers who are registered seed growers with at least 50 cents area under cowpea were selected. The basic details about the blocks are presented in Table 3.2.

Table 3.2. Basic details of selected blocks of Palakkad district

Particulars	Nenmara	Chittur
Area (Sq.km)	758.57	259.90
Total Population	1,38,272	4,37,738

Population density	182.27	625.40
Sex ratio	1056	1033
Literacy rate (per cent)	77	83.19

Source: [Census data, 2011, Panchayat level statistics, 2011, Palakkad]

The panchayat-wise area in cents according to type of land is presented in Table. 3.3. As evident from the table, wetland area accounted for about 64 per cent of total area which is more than half compared to area of dryland in Elevancheri panchayat of Nenmara block. The wetland area accounted for about 30 per cent of total area which is one-third of total area and dry land area is 57 per cent of total area of Kozhinjampara panchayat of Chittur block.

Table 3.3. Panchayat wise area according to type of land

Panchayat/ Area in ha	**Wetland**	**Dryland**	**Purampoke**	**Total**
Kozhinjampara (Chittur)	1321.25 (30.49)	2461.86 (56.82)	548.95 (12.67)	4332.06 (100)
Elevanchery (Nenmara)	31529.12 (64.42)	844.22 (35.57)	-	2373.34 (100)

Source: [Panchayat level statistics 2011, Palakkad]

Note: Figures in parenthesis indicate per cent to row totals

The cropping pattern in the selected blocks is presented in Table 3.4. Paddy is mostly grown when compared to vegetables. It is observed that the area of cowpea is high in Chittur compared to Nenmara.

Table 3.4. Cropping pattern in selected blocks

Crop	Area in hectares	
	Nenmara	**Chittur**
Paddy	9909.66 (79.24)	10249.38 (54.35)
Vegetables	33.75 (0.26)	286.7 (1.52)
Coconut	1972.10 (15.76)	8003.05 (42.44)
Other vegetables	12.02 (0.096)	48.06 (0.25)
Pepper	135.07 (1.08)	20.85 (0.11)
Achinga (Payar)	140.87 (1.126)	249.08 (1.32)
Total	12505.47 (100)	18857.12 (100)

Source: Agricultural statistics, 2017-18, Department of Economics & Statistics, Kerala

Note: Figures in parenthesis indicate per cent to column totals

Block / Municipality wise number of operational holdings according to major size class are presented in Table 3.5. According to Agricultural census (2015-16), the number of operational holdings of marginal farmers is higher in Chittur block compared to all others in Nenmara block of Palakkad district.

Table 3.5. Block / Municipality wise number of operational holdings according to major size class (2015-16)

	Nenmara	**Chittur**
Marginal	32930 (95.99)	36489 (91.6)
Small	1255 (3.65)	2867 (7.2)
Medium	110 (0.32)	438 (1.09)

Large	10 (0.029)	25 (6.27)
Total	**34305 (100)**	**39819 (100)**

(Source: Agricultural census 2015-16, Department of Economics & Statistics, Kerala)
Note: Figures in parenthesis indicate per cent to column totals

3.2 COWPEA SEED PRODUCTION - SOME BASIC INFORMATION

Plant types in Cowpea are often categorized as erect, semi erect and trailing types. Cowpea varieties are grown for seed and vegetable purposes in Kerala. The varieties grown in the state along with the planting type are as follows:

a) Bushy: Bhagya Lakshmi, Pusa barsathi, Pusa komal

b) Semi trailing: Anaswara, Kairali, Varun, Kanakamony (PTB-1), Arka Garima

c) Trailing: Vellayani jyothika, Sharika, Malika, KMV-1, Lola, Vyjayanthi, Manjeri Local, Vyalathur Local, Kurutholapayar, Arka Mangala

In this study, farmers cultivating cowpea for seed production purpose includes semi trailing variety (Anaswara) and trailing variety (Vellayani Jyothika). For vegetable purpose the farmers cultivating trailing type variety Arka Mangala has been selected as this variety is the most popular one among the farmers.

3.2.1. Characteristics of KAU cowpea varieties:

Anaswara: Semi trailing, pods-light green, bold seeded and medium long, purple flowers; Pod length 28.13 cm; Average Pod weight 12.5 g, Seeds / pod - 19
Vellayani Jyothika: Trailing, light green pods, high yielding, pod yield 19 t/ha
Arka mangala: Pods are very long, light green, string less, round, tender with crisp texture, vigorous, photo insensitive. Pod matures in 60 days. Pod yield is 25 t/ha. Pods are green with smooth surface with duration 90-100 days. It is grown for vegetable purpose.

3.2.2. Cowpea seed production and distribution

Seed is regarded as the fundamental and critical input in agricultural production. One of the best methods to achieve increased production is introduction and multiplication of quality seeds. The generation system of seed

multiplication is to avoid varietal mix and also to enable the pure seed for production. The generation system of seed multiplication comprises of four classes *viz*., nucleus seed, breeder seed, foundation seed and certified seed.

3.2.3. Generation system of seed distribution

In Kerala, the generation system of four classes is practiced for all the notified varieties in seed production as in other states.

Nucleus seed

The initial small quantity of seed is preserved for purifying the variety and produced under the supervision of a Plant breeder which is known as nucleus seed. Its genetic purity is 100 per cent.

Breeder seed

Breeder seed is obtained by multiplication of nucleus seed under the supervision of a Plant breeder. Breeder seed is used to generate the foundation seed. Breeder seed is most important as it directly affects the purity of future generations of seed. The tag colour of breeder seed is golden yellow.

Foundation seed

Foundation seed 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 as foundation seed stage II (FS II). Production of foundation seed is monitored by the seed certification agency and the production of FS II is allowed only if there is shortage of breeder seed. No further production of foundation seed is permitted using FS II. The tag colour for foundation seed is white.

Certified seed

Certified seed is the progeny of foundation seed stage I and foundation seed stage II. Certified seed production is under the supervision of the seed

certification agency and the state seed corporation. The tag colour of certified seed is azure blue.

Rouging

Rouging is an important operation which is to be carried out by skilled labour in seed production. It is the process of removal of off-types in order to ensure purity of seed. In cowpea seed production, at least three rougings are carried out by manual labour. The isolation distance to be maintained for cowpea seed production is at least 5 m as per the TNAU portal.

3.2.4. Public sector agencies producing seed in India

After independence, the All India Coordinated Research Project on Vegetables (AICRP on vegetables) was established and tremendous progress was observed in the development of High Yielding Varieties (HYVs). Public agencies which produce vegetable seeds in India are National Seeds Corporation (NSC), State Farms Corporation of India (SFCI), State Seeds Corporation (SSC), State Agricultural Universities (SAUs) under the ICAR (Indian Council of Agricultural Research), National seeds project-Breeder seed production (NSP-BSP), Krishi Vigyan Kendras (KVK) and Indian Institute of Vegetables Research (IIVR) located at Varanasi.

3.2.5. Public sector agencies producing vegetable seeds in Kerala

A well-structured and organized vegetable seed production and distribution agencies are present in Kerala under public sector. The agencies are Kerala State Seed Development Authority (KSSDA), National Seeds Corporation (NSC), Kerala Agricultural University (KAU) and Vegetables and Fruits Promotion Council of Kerala (VFPCK).

3.3. SAMPLING DESIGN

The present study is based on primary data collected from a sample of 80 farmers. Palakkad district was selected for study as there is large number of registered seed production farmers. The two blocks selected for study were

Nenmara and Chittur because these blocks had maximum number of registered farmers in Palakkad district. The registered farmers under VFPCK's seed production of cowpea were selected for the study. From the list of registered seed farmers, the farmers growing both vegetable and seed cowpea were selected at random for the study. Sixty farmers were selected from Chittur block and 20 farmers were selected from Nenmara block in proportion to the area of seed production undertaken by VFPCK in the respective blocks.

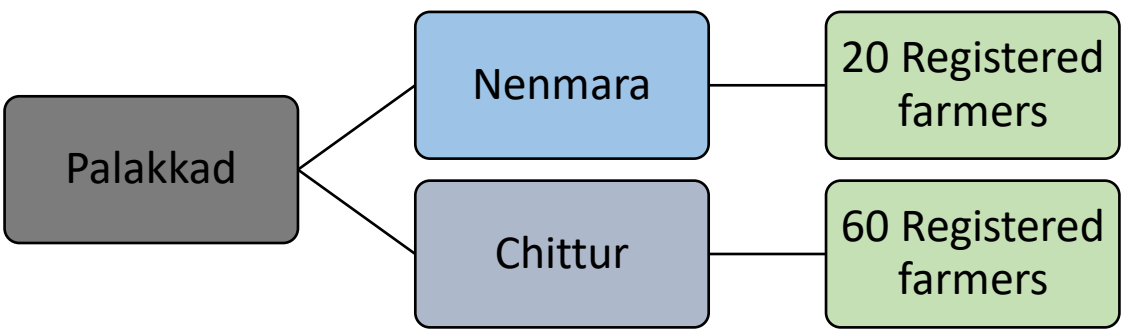


Fig 3.2. Sample distribution in two blocks of Palakkad district

3.3.1. Collection of data

Farm level data was collected from the individuals by personal interview method using a well-structured interview schedule. Information about socio economic conditions of farmers, costs and returns from vegetable and pulse cowpea for trailing, semi trailing varieties, seed yield per ha, cost of seed per kg, cost incurred for post-harvest operations, constraints in production and marketing were collected. Secondary data was also collected from various published and unpublished sources.

3.4. ANALYSIS OF DATA

3.4.1. Method of estimation of cost

3.4.1.1. Input wise cost concepts:

The structure of total input costs and their components:

1. Value of human labour (hired)
2. Value of machine power (hired)
3. Value of seeds (purchased)
4. Value of manures and fertilisers (purchased)
5. Value of plant protection chemicals
6. Value of rouging
7. Value of Land revenue and irrigation charges
8. Depreciation of farm building and farm implements
9. Interest on working capital
10. Miscellaneous expenses

3.4.2. Operation wise cost concepts

The structure of total costs and their components:

1. Land preparation
2. Sowing
3. Application of manures and fertilizers
4. Irrigation charges
5. Application of plant protection chemicals
6. Weeding
7. Rouging
8. Harvesting
9. Post-harvest operations
10. Depreciation
11. Interest on working capital

Cost of production

Cost of production is the cost of producing one quintal of seed or vegetable cowpea. Cost of production of cowpea per quintal is estimated by dividing the cost of cultivation per hectare by yield.

Returns

To assess the economics of cowpea cultivation for seed production and vegetable production, costs have to be related to returns. Gross returns were the total value of products at the market price. Net returns were derived by subtracting the total costs from the gross income.

Benefit - Cost Ratio

The production efficiency is revealed by B-C ratio. It was calculated by dividing the total returns by total expenditure incurred for production.

3.4.2. RESOURCE USE EFFICIENCY

The study of the resource use efficiency is carried out in agriculture sector to examine how efficiently farmers are using their resources.

An efficient farmer allocates his land, water, labour, and other resources in an optimal manner, so as to maximise his income, at least cost on sustainable basis. Some farmers may attain high physical yield of land at high cost while, others may achieve maximum profit per unit input used.

The important problem of increasing agricultural production in any region is to increase output per unit of input. Therefore it is necessary that the available resources to be used economically and efficiently. Farrel (1957) divided the economic efficiency into two components namely 1) technical efficiency and 2) allocative or price efficiency. Technical efficiency refers to the proper choice of production combination whereas Price or allocative efficiency refers to the proper choice of input combination. It refers to the achievement of optimum output so as to maximize net income. In this study we find the technical efficiency of seed production of pulse and vegetable cowpea using Cobb- Douglas (CD) production function.

The algebraic form of function is written as

$$Y = a \pi X_i^{bi}$$ (Gujarati *et al.*, 2004)

The functional form is written as follows

$$Y = ax_1^{b1}x_2^{b2}x_3^{b3}x_4^{b4}e$$

This is modified into a log linear model by the application of logarithms to either side resulting in

$$\text{Log } Y = \log a + b_1 \log X_1 + b_2 \log X_2 + b_3 \log X_3 + b_4 \log X_4 + e$$

Where,

Y = Yield of seed production of cowpea

X_1 = Quantity of fertilizers and manures

X_2 = Quantity of hired labour

X_3 = Quantity of family labour

X_4 = Quantity of pesticides

e = Stochastic error term

b_i's are regression coefficients of explanatory variables

The Cobb - Douglas function was estimated by using OLS method assuming the error term (e) to be randomly and normally distributed. The results of analysis were subjected to tests such as coefficient of multiple determinations and t test was carried out for each variable. The regression coefficients (b_i's) were tested for their significance using t test at chosen level of significance.

$$t = \frac{bi}{\text{Standard error of bi}}$$

3.4.2.1. Estimation of Marginal Value Product (MVP) and Marginal Factor Cost (MFC)

By comparing the MVP of each resource with the Marginal Factor Cost (MFC), MPP and MVP were calculated.

The marginal products were calculated at geometric mean levels of variables by using following formula

MPP = bi (G.M of Yi/ G.M of Xi)

Where

G.M of Yi = Geometric mean of output

G.M of Xi = Geometric mean of i^{th} independent variable

bi = regression coefficient of the i^{th} independent variable

`MVP can be calculated by using the formula

MVP =Px (MPP)

Where,

Px= Price of Cowpea (₹/kg)

The efficiency can be judged using following criteria or this is based on k values (MVPi/MFCi = ki). ki value refers to the ratio of marginal value product and marginal factor cost.

1. If ki >1, it indicates the under use or suboptimal use of the resource
2. If ki =1, indicates the optimal use of the resource which is known as allocative efficiency
3. If ki <1, it indicates excess use of the resource

3.4.3. FACTORS AFFECTING AVAILABILITY OF QUALITY SEEDS OF COWPEA

Multiple linear regression analysis (MLR) was used to study the factors effecting availability of quality seeds of cowpea. The following multiple linear regression was used for the present study:

$$Y = a + b_1 X_1 + b_2 X_2 + b_3X_3 + b_4X_4 + b_5X_5 + e_t$$

Whereas,

Y = Yield

X_1 = Cost of seed

X_2 = pests and diseases attack

X_3 = Distance to source of seed

X_4 = Cost of production of different varieties of seed

e_t = error term

The regression coefficients (b_i's) were tested for their significance by using the formula:

$$t = \frac{bi}{\text{Standard error of bi}} \sim (n\text{-}k\text{-}1)$$

Where, n = no. of observations

k = no. of independent variables

b_i = regression coefficients

3.4.4. GROWTH RATE ANALYSIS

To compute the compound growth rate from data, the following model was adopted

$$Y_t = ab^t$$ (Gujarati *et al.*, 2004)

Where,

Y_t = Area / production / yield / quantitative export of rice for the year't'

t = Time variable (1, 2,….., n) for each period /year

a = Intercept

b = Regression co-efficient

Compound growth rate in percentage was calculated using the relationship,

Compound Growth Rate (CGR) = ((Antilog b) – 1) X 100

3.4.5. CONSTRAINTS IN PRODUCTION AND MARKETING UNDER PUBLIC AGENCIES AND FARMER PARTICIPATORY MODE

To identify various constraints faced by registered seed farmers during seed production of cowpea, Garrett ranking technique was used. As the first step in analysis, major constraints in production and marketing were identified. The respondents were then asked to rank the identified problems and major constraints

were identified by Garrett ranking technique. This technique was used to convert the ranks into scores when number ranked items differ from respondent to respondent. In this method, the rank assigned to different constraints were transformed into percentage using 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 jth individual

Here 0.5 is subtracted from each rank because the rank is interval on a scale and its midpoint best represents the interval. Then, the percentage portions were transformed into scores on a scale of 100 points referring to the table given by Garrett and Woodworth (1969). From the scores so obtained, the mean score level was derived and constraints were ranked based on the mean score level.

Results and Discussion

RESULTS AND DISCUSSION

In this chapter, results are presented with different statistical tools to draw meaningful conclusions based on the objectives under the following sections.

4.1. Socio - economic characteristics of sample farmers

4.2. Current scenario of vegetables production

4.3. Costs and returns in cowpea seed production

4.4. Determinants of yield in cowpea production

4.5. Determinants of availability of quality seeds in cowpea

4.6. Constraints in production of cowpea seed

4.1. SOCIO ECONOMIC CHARACTERISTICS OF SAMPLE FARMERS

The primary data was obtained from 80 cowpea farmers who are both vegetable and seed growers. The two blocks selected for the study were Nenmara and Chittur because these blocks had maximum number of registered farmers. The registered farmers under VFPCK's seed production of cowpea were selected for the study. From the list of registered farmers, the farmers growing both vegetable and seed cowpea with at least 50 cents area were selected at random for the study. Sixty farmers were selected from Chittur block and 20 farmers were selected from Nenmara block in proportion to the area of seed production undertaken by VFPCK in the respective blocks. The primary socio-economic characteristics such as age, education, annual income, family size, experience in farming and land holding of the respondents were tabulated and analyzed with percentage analysis. The results of the analysis are presented below.

4.1.1. Age

The distribution of respondents on the basis of age was classified into four categories and are presented in Table 4.1. The results have shown that majority of

cowpea seed farmers fall under 50-60 years age group (51.6 per cent) in Chittur as well as Nenmara (45 per cent). It was observed that the cowpea seed farmers had relatively high experience in cowpea seed production. Hence, greater per cent of farmers were in this particular age category.

The study conducted by Nufaisa (2015) reported that rice seed farmers below 30-40 years of age had negative perception towards agriculture and their participation in agriculture was also very low.

Table 4.1. Age wise distribution of respondents

Blocks	**30-40 years**	**41-50 years**	**51-60 years**	**> 61 years**
Chittur	3	24	31	2
	(5)	(40)	(51.6)	(3.3)
Nenmara	2	5	9	4
	(10)	(25)	(45)	(20)
Total	5	29	40	6
	(7.5)	(32.5)	(48.3)	(11.65)

Source: Primary data (Figures in parentheses indicate per cent to total)

4.1.2. EDUCATION

Based on educational status, the respondents were classified into five categories as presented in Table 4.2. It was observed that the farmers from Chittur block with secondary school education were 61.6 per cent, whereas from Nenmara block farmers with secondary school education were 55 per cent and were mostly interested to do agriculture.

Table 4.2: Educational status of respondents

Educational status	Chittur	Nenmara	Average
Primary	5(8.33)	7 (35)	12(21.6)
Secondary	37(61.66)	11 (55)	48(58.3)
SSC	16(26.6)	2(10)	18(18.3)
Above SSC	2(3.3)	0	2(3.3)
Total	60(100)	20(100)	80(100)

Source: Primary data (Figures in parentheses indicate percentage to total)

4.1.3. Income status of respondents

Income is the key to success in any economic activity. The classification of sample farmers based on annual income has been presented in Table 4.3. It was found that 38.3 per cent of respondents in Chittur had an income between ₹1-1.5 Lakh, while in Nenmara it was found that 45 per cent of respondents had an income in the same income category.

Table 4.3: Distribution of respondents based on income status

Income group (₹)	Chittur	Nenmara
<50000	4 (6.7)	5 (25)
50000- 1 Lakh	17 (28.3)	4 (20)
1-1.5 Lakh	23 (38.3)	9(45)
1.5-3 Lakh	16(26.6)	2 (10)
Total	60(100)	20(100)

Source: Primary data (Figures in parentheses indicate percentage to total)

4.1.4. Family size

Seed production is a labour intensive process. The distribution of selected farmers based on family size is presented in Table 4.4. The family size was classified into three categories *i.e.*, less than four members, four to six members and more than six members. Nearly 80 per cent of respondents were in the medium-sized family category in Chittur with 4-6 members in their family, while in Nenmara, 40 per cent of respondents were in the same category. The findings support the fact that joint families are on a decline these days.

Table 4.4. Distribution of respondents based on family size

Size of family	Chittur	Nenmara
Small (<4)	2 (3.3)	3 (15)
Medium (4-6)	48(80)	8 (40)
Large (>6)	10 (16.6)	9 (45)
Total	60 (100)	20 (100)

Note: Figures in parentheses indicate percentage to total.

4.1.5. Experience in farming

Based on experience in farming, farmers were classified into five categories as presented in Table 4.5. It was observed that in Chittur, 41.6 per cent of respondents had 25-30 years' experience and in Nenmara, 40 per cent of respondents had 25-30 years' experience in seed production of cowpea. Thus, there were farmers with relatively higher experience in Chittur in seed production when compared to Nenmara block.

Table 4.5. Distribution of respondents based on experience

Experience (in years)	Chittur	Nenmara
20-25	10(25)	4(20)
25-30	15(41.6)	8(40)

30-35	20(33.3)	6(30)
> 35	15(25)	2(10)
Total	60(100)	20(100)

Note: Figures in parentheses indicate percentage to total

4.1.6. Land holding

The respondents were classified into marginal, small and large farmers based on the total land holding size which is presented in Table 4.6. The land holding size of the marginal farmers was less than 1 hectare, small farmers was 1-2 ha and large farmers had greater than 2 ha area. The results showed out that 58.3 per cent of respondents were small farmers (1-2 ha) in Chittur and 50 per cent of respondents were small farmers (1-2 ha) in Nenmara block. Fragmentation of land holdings due to inheritance may be the reason for the small holding size.

Table 4.6. Distribution of respondents based on land holding

Size of land holding(ha)	Chittur	Nenmara
Marginal farmers (<1 ha)	22(36.6)	7(35)
Small farmers (1-2 ha)	35(58.3)	10(50)
Large farmers (>2ha)	3(5)	3(15)
Total	60(100)	20(100)

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

4.2. CURRENT SCENARIO OF VEGETABLE PRODUCTION

4.2.1. Scenario of vegetables in the world

Major vegetable producing countries of the world are: China [554 Million Metric Tonnes]; India [169.1 Million Metric Tonnes]; USA [32.62 Million Metric Tonnes]; Turkey [24.93 Million Metric Tonnes]; and Russia [16.41Million Metric Tonnes] (FAOSTAT, 2017)

4.2.2 Scenario of vegetables in India

India is the second largest producer of vegetables next to China. The production of vegetables had increased from 101.2 MT (2004-05) to 169.1 MT (2017-

18) (Horticulture at a glance, 2018-19). India has a share of about 10.6 per cent of the total vegetable production in the world. Vegetables occupy 38.9 per cent of area and 61 per cent of total horticultural area and production of country (National Horticulture Board, 2014-15). Nearly 40 kinds of vegetables are being cultivated in India and the major vegetables grown are potato (27%), Onion (11%), Tomato (10%), Brinjal (7%), Cabbage (5%), Cauliflower (5%), Peas (3%) and others (32%) (Kumar *et al*., 2017)

4.2.3 Growth rates in area, production and productivity of vegetables in Kerala

To study the growth rates in area, production and productivity of vegetables in Kerala, time series data were collected from 1991-2018. Triennium endings (TE) are drawn for the years (1991-2018) and presented in Table 4.7. During the period of TE in 1991-93, to TE 1994-96, the average area under vegetables increased by 56.9 per cent, but the production declined by 6.2 per cent and productivity reduced by 17.7 per cent. During the period of TE 1994-96 to TE 1994-2003, there was a decrease in area by 64.9 per cent, the production was dropped by 8.1 per cent and productivity was improved by 87.7 per cent. During the period of 2006 to 2009, the area was increased by 34.7 per cent, production was increased by 7.29 per cent and productivity was declined by 7.7 per cent. The period of 2010-18 saw a decrease in area by 30.1 per cent and production by 28.2 per cent while productivity improved marginally by 5.6 per cent.

Table 4.7: Area, production and productivity of vegetables in Kerala

	AREA('000 ha)	**PRODUCTION('00MT)**	**PRODUCTIVITY(kg ha$^{-1)}$**
TE 1991-93	155.4	2973.9	1390.5
TE 1994-96	243.9 (+56.9%)	2789.7(-6.2%)	1143.8(-17.7%)
TE 1997-99	187.7(-23.0%)	2834.6(+1.6%)	1573.9(+37.6%)
TE 2000-03	108.9(- 41.9%)	2560.4(-9.7%)	2362.9(+50.1%)
TE 2004-06	121.5(+11.5%)	2759.9(+7.8%)	2328.3(-1.5%)
TE 2007-09	160.7 (+ 32.2%)	3502.2(+ 26.9%)	2183.4(-6.2%)
TE 2010-12	148.2 (- 7.7%)	3488.5(-0.4%)	2353.5(+7.8%)

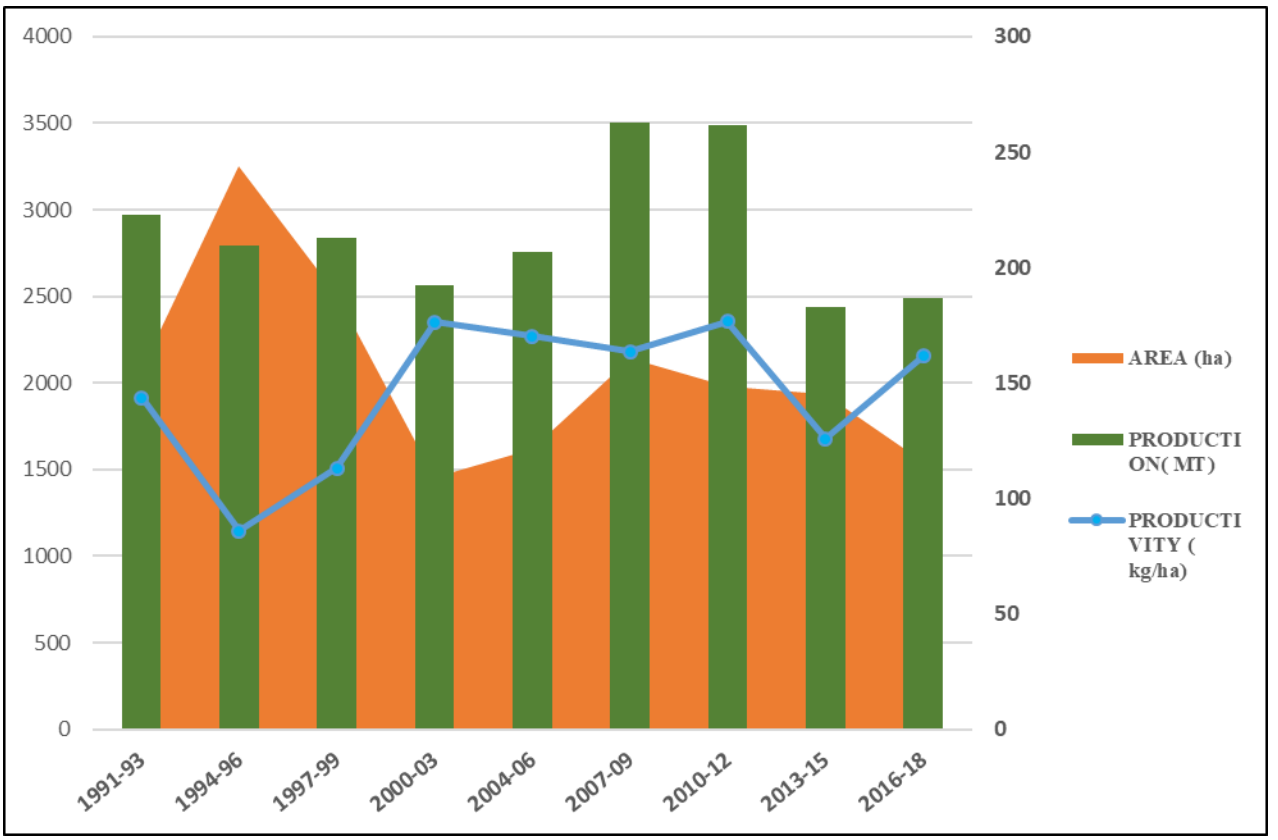
TE 2013-15	144.9(-2.2%)	2435.5(-30.2%)	1671.8(-29.0%)
TE 2016-18	115.6(-20.2%)	2493.6(+2.4%)	2249.7(+34.6%)

Compound growth rates of area, production and productivity of vegetables in Kerala are presented in Table 4.8 and fig 4.1. The growth rate of area of vegetables in Kerala was -0.26 and was non-significant. The growth rate for production of vegetables was negative (-0.14) and was non-significant. The Productivity of vegetables showed a positive (0.85) growth rate and is found to be significant. This indicates that there has been a significant increase in the productivity of vegetables in Kerala due to the introduction of HYVs during this period (1991-2018). The increase in productivity further led to an increase in production though the area under cultivation showed a negative growth rate.

Table 4.8: Compound growth rates of area, production and productivity of vegetables in Kerala (1991-2018)

	AREA	**PRODUCTION**	**PRODUCTIVITY**
Growth rate	-0.26	-0.14	0.85
Standard error	1.21	0.48	0.70
Significance value	-4.59	-3.39	0.81

Figure 4.1: Area, production and productivity of vegetables in Kerala (1991-2018)



4.3. ECONOMICS OF COWPEA SEED PRODUCTION

In this section, the economics of cowpea seed cultivation is discussed to compare the relative performance of Anaswara and Vellayani Jyothika varieties by comparing the relative profitability of these varieties. The cost of cultivation refers to the total expenses incurred by the farmer per unit area. Costs are calculated for different inputs such as input seed, human labour, machine labour, manures and fertilizers, pesticides, land revenue and irrigation charges. The cost of erecting panthals was calculated for the variety, Vellayani Jyothika, as it is a trailing variety. The average input wise costs and operation wise costs incurred in cowpea seed cultivation per hectare was calculated separately for Anaswara and Vellayani Jyothika varieties and the results are presented in tables respectively.

Total variable cost was high for seed farmers producing Anaswara variety in Chittur compared to Nenmara, as the wages were relatively higher in Chittur block. The cost of cultivation of Anaswara variety were relatively less compared to Vellayani

Jyothika, as the cost of erecting panthals is incurred as an additional cost in Vellayani Jyothika. Skilled labour is inevitable for the rouging operation which is used to skillfully remove the off-types before harvesting the crop for seed purpose. Thus, the operation of rouging is an additional cost incurred in seed production.

Balaji *et al.* (2016) reported from their study on economic analysis of vegetables cultivation in Coimbatore district of Tamil Nadu that the total establishment cost of panthals was relatively very high and amounted to about ₹ 2.5 lakhs per hectare.

4.3.1. Economics of Cowpea seed production for Anaswara variety

4.3.1.1. Input wise costs of cowpea seed production

The total variable cost for Anaswara variety of cowpea in Chittur block was found to be ₹ 120866.8 ha^1. The cost of human labour (38.67 per cent) had the highest contribution to the total cost followed by the cost of rouging (22.84 per cent) and the cost of manures and fertilizers which had 11.21 per cent of total cost. The land revenue and irrigation charges were very meagre at 0.71 per cent of total cost. The results are presented in Table 4.9.

The total variable cost for Anaswara variety of cowpea in Nenmara block was found to be ₹ 119356.2 ha^{-1}. The cost of rouging (23.6 per cent) had the highest contribution to the total cost followed by, manures and fertilizers (10.7 per cent), and machine power (6.6 per cent). The land revenue and irrigation charges were very meagre at 0.8 per cent. The results are presented in Table 4.9.

Table 4.9: Input wise costs of cowpea seed production for Anaswara variety (₹ha^{-1})

S.No	Particulars	Chittur (₹ha^{-1})	Nenmara(₹ha^{-1})
1	Human labour	53557.4 (38.67)	51236.5 (37.3)
2	Machine power	9000 (6.50)	9000 (6.6)
3	Cost of seed	2500 (1.81)	2500 (1.8)
4	Manures and fertilizers	15396.9 (11.21)	14723.9 (10.7)

5	Plant protection chemicals cost	7239.8 (5.37)	8238.5 (6.0)
6	Rouging cost	31623.7 (22.84)	32392.1 (23.6)
7	Land revenue and irrigation charges	979.04 (0.71)	1052 (0.8)
8	Miscellaneous expenses	369.73 (0.27)	463 (0.3)
	Total cost	120866.8 (100)	119356.2 (100)

Note: Figures in parenthesis are percentage to total cost

4.3.1.2. Operation wise costs of cowpea seed production

Operation wise cost of cowpea seed (Anaswara variety) in Chittur block was estimated and results are presented in Table 4.10. Rouging, application of manures and fertilizers and weeding accounted for the major share of 27.3 per cent, 12.9 per cent and 12.7 per cent respectively. This was followed by harvesting (11.52 per cent), sowing (10.64 per cent), application of plant protection chemicals (8.4 per cent), land preparation (7.54 per cent) and irrigation (0.57 per cent).

Operation wise cost of cowpea seed (Anaswara variety) in Nenmara block was estimated and results are presented in Table 4.10. Rouging, application of manures and fertilizers and weeding accounted for the major share of 27.1 per cent, 12.3 per cent and 10.1 per cent respectively. This was followed by harvesting (10.2 per cent), sowing (9.0 per cent), application of plant protection chemicals (8.6 per cent), land preparation (7.5 per cent) and irrigation (0.6 per cent).

Table 4.10: Operation wise cost of cowpea seed production for Anaswara variety (₹ha^{-1})

S.No	Particulars	Chittur (₹ha^{-1})	Nenmara(₹ha^{-1})
1	Land preparation	9000 (7.54)	9000 (7.5)
2	Sowing	12703.6 (10.64)	10709 (9.0)
3	Application of Manures and Fertilizers	15396.9 (12.9)	14723.9 (12.3)
4	Irrigation charges	677.7 (0.57)	721 (0.6)

5	Application of Plant protection chemicals	10021 (8.4)	10238.5 (8.6)
6	Weeding	15152.3 (12.7)	12087.7 (10.1)
7	Rouging	32623.7 (27.3)	32392.1 (27.1)
8	Harvesting	13750 (11.52)	12123.75 (10.2)
9	Post-harvest operations	10030.8 (8.4)	9000 (7.5)
10	Total Cost	120866.8 (100)	119356.2 (100)

Note: Figures in parenthesis are percentage to total cost

4.3.1.3. Cost of cultivation for Anaswara variety

Cost of cultivation which is the total expenditures incurred by the farmers for cultivating one hectare of Anaswara variety of cowpea in Chittur and Nenmara blocks are given in Table 4.11. For arriving at the total cost, the sum of maintenance cost, Depreciation, Interest on working capital (@7 per cent) were considered. The total cost of cultivation for Anaswara variety is high in Chittur (₹ 148386.8 ha^{-1}) compared to Nenmara (₹ 146710.2 ha^{-1}).

Table 4.11. Cost of seed cultivation for Anaswara variety (Chittur and Nenmara blocks)

S.No	**Particulars**	**Chittur (₹ha^{-1})**	**Nenmara (₹ha^{-1})**
1	Total variable cost	120866.8	119356.2
2	Depreciation	6113	7442
3	Interest on working capital (@7%)	11505	10156
4	Interest on fixed capital	9902	9756
5	Total	148386.8	146710.2

4.3.2. Economics of Cowpea seed cultivation for Vellayani Jyothika variety

4.3.2.1. Input wise costs of cowpea seed production

The total variable cost for Vellayani Jyothika variety of cowpea in Chittur block was found to be ₹130740.4 ha^{-1}. The cost of hired labour which contributed to 40.7 per cent had highest contribution to the total cost followed by the cost of rouging (24.2 per cent) and the cost of manures and fertilizers (11 per cent), plant protection chemicals contributed about 5.7 per cent, machine power contributed of about 6.9 per cent respectively. The land revenue and irrigation charges were very meagre at 0.8 per cent. The results are presented in Table 4.12.

The total variable cost for Vellayani Jyothika seed of cowpea in Nenmara block was found to be ₹129370.1 ha^{-1}. The cost of hired labour (34.1 per cent) had the highest contribution to the total cost followed by rouging which contributed to 21.7 per cent, manures and fertilizers which contributed to 10.5 per cent, the cost of erecting panthals contributed about 5.7 per cent and the machine power had 6.1 per cent of total cost. The land revenue and irrigation charges were very meagre at 0.7 per cent. The results are presented in Table 4.12.

Table 4.12: Input wise costs of cowpea seed cultivation for Vellayani Jyothika variety (₹ha^{-1})

S.no	Items	Chittur (₹ha^{-1})	Nenmara (₹ha^{-1})
1	Hired labour	53163.5 (40.7)	50236.9 (34.1)
2	Machine labour	9000 (6.9)	9000 (6.1)
3	Cost of seed	5000 (3.8)	5000 (3.4)
4	Manures and fertilizers	14397 (11.0)	15397 (10.5)
5	Plant protection chemicals cost	7496 (5.7)	7896.2 (5.4)
6	Rouging cost	31865.9 (24.2)	31895.9 (21.7)
7	Land revenue and irrigation charges	1056 (0.8)	1025 (0.7)
8	Cost of erecting panthals	8360 (6.4)	8360 (5.7)
9	Miscellaneous expenses	402 (0.3)	589 (0.5)

Total cost	130740.4(100)	129370.1(100)

Note: Figures in parenthesis are percentage to total cost

4.3.2.2. Operation wise cost of cowpea seed for Vellayani Jyothika variety

Operation wise cost of cowpea seed cultivation (Vellayani Jyothika variety) in Chittur was estimated and results are presented in table 4.13. Rouging, application of manures and fertilizers and weeding accounted for the major share of 24.3 per cent, 15.12 per cent and 11.14 per cent respectively. This was followed by application of plant protection chemicals (10.3 per cent), harvesting (9.21 per cent), sowing (8.8 per cent), , land preparation (6.9 per cent), cost of erecting panthals (6.39 per cent) and irrigation (0.57 per cent).

Operation wise cost of cowpea seed cultivation (Vellayani Jyothika variety) in Nenmara was estimated and results are presented in Table 4.13. Rouging, application of manures and fertilizers and weeding accounted for the major share of 24.6 per cent, 14.9 per cent and 11.7 per cent respectively. This was followed by application of plant protection chemicals (9.9 per cent), harvesting (9.5 per cent), sowing (7.8 per cent), land preparation (6.9 per cent), cost of erecting panthals (6.4 per cent) and irrigation (0.3 per cent).

Table 4.13: Operation wise cost of cowpea seed cultivation for Vellayani Jyothika variety (₹ha^{-1})

S.No	Particulars	Chittur (₹ha^{-1})	Nenmara (₹ha^{-1})
1	Land preparation	9000 (6.8)	9000 (6.9)
2	Sowing	11545 (8.8)	10172 (7.8)
3	Application of Manures and fertilizers	19770 (15.12)	19397 (14.9)
4	Weeding	14569 (11.14)	15232 (11.7)
5	Application of Plant protection chemicals	13496 (10.3)	12896.23 (9.9)
6	Irrigation	865.04 (0.66)	433.47 (0.3)
7	Cost of erecting panthals	8360 (6.39)	8360 (6.4)
8	Rouging	31865.9 (24.3)	31865 (24.6)

9	Harvesting	12044.5 (9.21)	12381 (9.5)
10	Post-harvest operations	9224.9 (7.05)	9632.5 (7.4)
	Total cost of cultivation	130740.4 (100)	129370.1 (100)

Note: Figures in parenthesis are percentage to total cost.

4.3.2.3. Cost of seed cultivation for Vellayani Jyothika (Chittur and Nenmara blocks)

Cost of cultivation which is the total expenditure incurred by the farmers for cultivating one hectare of Vellayani Jyothika variety of cowpea in Chittur and Nenmara blocks are given in Table 4.14. For arriving at the total cost, the sum of maintenance cost, Depreciation, Interest on working capital (@7 per cent) and Interest on fixed capital are considered. The total cost of cultivation for Vellayani Jyothika variety is high in Chittur (₹ 164065.4 ha^{-1}) compared to Nenmara (₹160293.1 ha^{-1}).

Table 4.14. Cost of seed cultivation for Vellayani Jyothika variety (Chittur and Nenmara blocks)

S.No	**Particulars**	**Chittur (₹ha^{-1})**	**Nenmara (₹ha^{-1})**
1	Total variable cost	130740.4	129370.1
2	Depreciation	6113	7442
3	Interest on working capital (@7%)	11505	10347
4	Interest on fixed capital	15707	13134
5	Total cost of cultivation	**164065.4**	**160293.1**

Sandhya (2000) reported that the cost of cultivation for cowpea seed production is ₹ 53867.08 ha^{-1}, in which manures accounts for higher proportion followed by panthals cost.

4.3.3. RETURNS FROM COWPEA SEED PRODUCTION

The average price at which the cowpea seed was procured by VFPCK for Anaswara and Vellayani Jyothika varieties were ₹ 260/- and ₹ 550/- per kg respectively before the price revision. The average price at which the cowpea seed was procured by

VFPCK for Anaswara and Vellayani Jyothika varieties were ₹ 297/- and ₹ 605/- per kg respectively after the price revision.

4.3.3.1. Additional income obtained from seed production

During the seed production, three pickings are for vegetable cowpea and the remaining crop is allowed for seed production. Vegetable yield was high for Anaswara variety (965 $kgha^{-1}$) in Chittur block compared to Vellayani Jyothika variety (868 $kgha^{-1}$) in Chittur.

Table 4.15. Additional income obtained from seed production

		Anaswara		Vellayani Jyothika	
S.No	**Parameters**	**Chittur**	**Nenmara**	**Chittur**	**Nenmara**
1	Cowpea vegetable yield ($kgha^{-1}$)	965	945	868	853
2	Price of cowpea ($kgha^{-1}$)	35	35	35	35
3	Total returns (₹kg^{-1})	33775	33075	30275	29855

4.3.3.2. Incremental Returns obtained due to revision in procurement price

Procurement price for Anaswara seed was ₹ 260 kg^{-1} and for Vellayani Jyothika variety was ₹550 kg^{-1}. Procurement price of cowpea Anaswara seed after revision (as on October 7, 2019) was ₹ 297 kg^{-1} and for Vellayani Jyothika seed it was ₹ 605 kg^{-1}. The incremental income after revision of procurement price is presented in Table 4.16. Percentage increase in returns were highest i.e., ₹ 353.65 ha^{-1} for Vellayani Jyothika variety in Chittur block compared to Anaswara variety.

Table 4.16. Incremental income from cowpea seed after procurement price revision

		Anaswara		Vellayani Jyothika	
S.no	**Parameters**	**Chittur**	**Nenmara**	**Chittur**	**Nenmara**
1	Gross returns (before price revision) (₹ha^{-1})	235015	231455	383925	379105
2	Gross returns (after price revision) (₹ha^{-1})	263653	259686	419290	414030
3	Percentage increase	12.18	12.19	9.20	9.21

This is in support of the study conducted by Sandhya (2000) who reported higher gross returns from vegetable and seed production in Chittur taluk of Palakkad district which was due to high seed yield in the block.

4.3.4. ECONOMICS OF COWPEA VEGETABLE PRODUCTION

4.3.4.1. Input wise costs of Cowpea vegetable variety Arka Mangala

The total cost of cultivation of Arka Mangala variety of vegetable cowpea in Chittur was found to be ₹ 92390.65 ha^{-1}. The cost of hired labour (56.1 per cent) had the highest contribution to the total cost followed by cost of manures and fertilizers (14.9 per cent), machine power (9.9 per cent), cost of erecting panthals (9.2 per cent). The land revenue and irrigation charges contributed about 1.1 per cent of total cost. The results are presented in Table 4.17.

The total cost of cultivation of Arka Mangala variety of vegetable cowpea in Nenmara was found to be ₹ 91302 ha^{-1}. The cost of hired labour (46 per cent) had the highest contribution to the total cost followed by cost of manures and fertilizers (12.4 percent) and the cost of machine labour had 8.3 per cent of total cost. The land revenue

and irrigation charges contributed about 0.9 per cent. The results are presented in Table 4.17

Table 4.17: Input wise costs of cultivation of cowpea vegetable for Arka Mangala variety

S.No	Items	Chittur (₹ha^{-1})	Nenmara (₹ha^{-1})
1	Hired labour	52236 (56.1)	51236 (46)
2	Machine labour	9000 (9.9)	9000 (8.3)
3	Cost of seed	2250 (2.5)	2250 (2.1)
4	Manures and fertilizers	13526 (14.9)	13604 (12.4)
5	Plant protection chemicals cost	5632 (5.9)	5423 (5.0)
6	Cost of erecting panthals	8360 (9.2)	8360 (7.7)
7	Land revenue and irrigation charges	1015 (1.1)	1026 (0.9)
8	Miscellaneous expenses	370 (0.4)	403 (0.4)
9	Total cost	92390	91302

Note: Figures in parenthesis are percentage to total cost

4.3.4.2. Operation wise cost of cowpea vegetable production

Operation wise cost of cowpea vegetable (Arka Mangala variety) in Chittur was estimated and results are presented in Table 4.18. Harvesting, application of manures and fertilizers and sowing accounted for the major share of 20.9 per cent, 17.8 per cent and 16.62 per cent respectively. This was followed by weeding (15.17 per cent), land preparation (9.74 per cent), application of plant protection chemicals (9.42 per cent) and irrigation (1.1 per cent).

Operation wise cost of cowpea vegetable (Arka Mangala variety) in Nenmara was estimated and results are presented in Table 4.18. Harvesting, application of manures and fertilizers and sowing accounted for the major share of 21.19 per cent,

17.13 per cent and 15.9 per cent respectively. This was followed by weeding (15.9 per cent), land preparation (9.8 per cent), application of plant protection chemicals (9.52 per cent) and irrigation (1.2 per cent)

Table 4.18: Operation wise cost of cowpea vegetable cultivation for Arka Mangala variety

S.No	Particulars	Chittur (₹ha^{-1})	Nenmara(₹ha^{-1})
1	Land preparation	9000 (9.74)	9000 (9.8)
2	Sowing	15358 (16.62)	14569 (15.9)
3	Application of manures and fertilizers	16526 (17.8)	15646.81 (17.13)
4	Weeding	14017.9 (15.17)	14563 (15.9)
5	Application of Plant protection chemicals	8704.46 (9.42)	8698 (9.52)
6	Irrigation charges	1025 (1.1)	1109.19 (1.21)
7	Cost of erecting panthals	8360 (9.04)	8360 (9.15)
8	Harvesting	19399.29 (20.9)	19356 (21.19)
9	TOTAL	92390.65 (100)	91302 (100)

Note: Figures in parentheses indicate percentage to total

4.3.4.3. Cost of cultivation for Arka Mangala vegetable

Cost of cultivation which is the total expenditures incurred by the farmers for cultivating one hectare of Arka Mangala variety of cowpea in Chittur and Nenmara blocks are given in Table 4.19. For arriving at the total cost, the sum of maintenance cost, Depreciation, Interest on working capital (@7 per cent) were considered. The total cost of cultivation for Arka Mangala variety is high in Nenmara (₹ 119991 ha^{-1}) compared to Chittur (₹ 119495 ha^{-1}).

Table 4.19. Cost of vegetable cultivation for Arka Mangala variety

S.No	Particulars	Chittur (₹ha^{-1})	Nenmara (₹ha^{-1})
1	Total variable cost	92390	91302

2	Depreciation	6113	7442
3	Interest on working capital (@7%)	11236	11345
4	Interest on fixed capital	9756	9902
5	Total	119495	119991

4.3.4.4. Returns from cowpea vegetable cultivation

The cowpea vegetable yield of Arka Mangala variety in Chittur and Nenmara blocks of Palakkad district are presented in Table 4.20. The average cowpea vegetable yield ha^{-1} of Arka Mangala variety in Chittur and Nenmara blocks are 5467 kg and 5500 kg respectively. The average price of vegetable cowpea of Arka Mangala variety was ₹ 35/- per kg in Nenmara and Chittur during the period of study. The gross returns for vegetable cowpea per hectare, Arka Mangala variety in Nenmara was relatively high compared to Chittur due to the higher productivity in Nenmara.

Table 4.20. Returns from cowpea vegetable cultivation of Arka Mangala variety

S.No	Parameters	Chittur	Nenmara
1	Cowpea vegetable yield ($kgha^{-1}$)	5467	5500
2	Price of cowpea (₹kg^{-1})	35	35
3	Gross returns(₹ha^{-1})	191345	192500
4	Net returns (₹ha^{-1})	60171	64276

4.3.4.5. COSTS AND RETURNS OF COWPEA SEED AND VEGETABLE PRODUCTION

Average costs and average returns of cowpea seed and vegetable production are presented in Table 4.21. The results showed that for farmers cultivating Anaswara variety,

the cost of cowpea seed per kg in Nenmara was at ₹ 85.8 and in Chittur it was ₹ 85.3 kg^{-1}, whereas the average returns per kg of cowpea seed in Chittur and Nenmara were ₹ 135/. In Vellayani Jyothika variety, the cost of cowpea seed per kg (Nenmara) was ₹ 107.7 kg^{-1} and in Chittur it was ₹ 108.5 kg^{-1}, whereas the average returns per kg in Nenmara and Chittur were ₹ 254/-.

In Arka Mangala variety, average cost of production of vegetable cowpea in Nenmara and Chittur were (₹ 21.8kg^{-1}), whereas the average returns per kg in Chittur and Nenmara were ₹ 35/-.

From the results, it is evident that cowpea seed production is more profitable compared to vegetable production.

Table 4.21. Comparison of costs and returns of cowpea seed and vegetable production

Varieties	**Anaswara**		**Vellayani Jyothika**		**Arka Mangala**	
Blocks	**Chittur**	**Nenmara**	**Chittur**	**Nenmara**	**Chittur**	**Nenmara**
Average Yield ($kgha^{-1}$)	1739	1708	1511	1488	5467	5500
Average Costs(₹ha^{-1})	148386.8	146710.2	164065.4	160293.1	119495.65	119991
Average Returns(₹ha^{-1})	235015	231455	383925	379105	191345	192500
Average Costs (₹kg^{-1})	85.3	85.8	108.5	107.7	21.85	21.81
Average Returns(₹kg^{-1})	135	135	254.08	254.7	35	35

4.3.4.6. BENEFIT COST RATIO

The B:C ratio for both Chittur and Nenmara farmers were calculated separately and are presented in Table 4.22. B:C ratio is a concept of profitability, in which higher value indicates more returns per rupee of cost incurred. Anaswara seed farmers from

Chittur block had higher B:C ratio (1.58) compared to Nenmara where the B:C ratio was 1.57. Vellayani Jyothika farmers from Nenmara block had high B:C ratio (2.36) while in Nenmara, B:C ratio was 2.34. Arka Mangala vegetable farmers from Nenmara and Chittur had same B:C ratio, which was 1.60.

Table 4.22: B:C ratio for cowpea seed and vegetable farmers

	Anaswara		**Vellayani Jyothika**		**Arka Mangala**	
Blocks	Chittur	Nenmara	Chittur	Nenmara	Chittur	Nenmara
B:C ratio	1.58	1.57	2.34	2.36	1.60	1.60

4.4. DETERMINANTS OF YIELD IN COWPEA PRODUCTION

Cobb- Douglas production function was used to find the resource use efficiency for cowpea seed cultivation. It can be fitted separately for small and large farmers by using the function as follows.

The algebraic form of function is written as

$$Y = a \pi X_i^{bi}$$

The above function can be modified into log- log form.

$$\ln Y = \ln a + b1 \ln X1 + b2 \ln X2 + b3 \ln X3 + b4 \ln X4 + ui$$

Where, Y= Yield of production of cowpea

X_1 = Quantity of fertilizers and manures

X_2 = Quantity of hired labour

X_3 = Quantity of roguing labour

X_4 = Quantity of plant protection chemicals

e = Stochastic error term

b_i s are regression coefficients of explanatory variables

Yield is the dependent variable and Quantity of fertilizers and manures, Quantity of hired labour, Quantity of rouging labour, Quantity of plant protection chemicals are the independent variables in the above equation. The co-efficient of determination (R^2) explains the variation in the dependent variable caused by the independent variables included in the production function. The elasticity of production was given by the estimated regression coefficients (bi) of respective inputs (Xi). The regression coefficient (bi) indicates the percentage change in the yield (Y) if the input quantities (Xi) change by one per cent while all other factors remain constant at their geometric mean levels.

The estimated Cobb-Douglas production function for cowpea seed farmers has been presented in Table 4.23. The coefficient of determination (R^2) for cowpea farmers was 0.75, which indicated that 75 per cent of variation in yield was explained by the independent variables involved in the function such as quantity of labour, quantity of manures, rouging (man days/ ha), quantity of plant protection chemicals.

Among the different independent variables, the quantity of labour was found to be significantly influence the yield at one per cent level of significance. The coefficient of quantity of manures was found to be positive, which indicates that increase in the independent variable tends to increase the dependent variable *i.e.,* yield of cowpea by 0.76 per cent. The coefficient of the variable, skilled labour for rouging (man days/ha) was found to be positive, which indicated that the increase in independent variables tends to increase the income by 0.006 per cent. The coefficient of quantity of plant protection chemicals was found to be negative, which indicated that increase in independent variables tends to decrease the income by 0.03 per cent.

Table 4.23: Estimated Cobb Douglas production function for cowpea seed farmers

S.No	Particulars	Coefficient	t value	p value
1	Intercept	-0.57	-1.81	0.07

2	Quantity of labour (man days)	0.56**	2.54	0.013
3	Manures (kg/ha)	0.76	6.90	1.41
4	Rouging labour(man days/ha)	0.006	0.05	0.95
5	Quantity of plant protection chemicals	-0.03	-0.99	0.32
6	R^2	0.81		
7	Calculated F value	83.9		
8	No. of observations	80		

**Significant at 1 per cent level

The coefficients are obtained with log value

4.5. RETURNS TO SCALE

The Cobb Douglas production function estimates the elasticities of the various inputs. If the sum of coefficients is greater than one, it indicates an increasing returns to scale and if it is less than one, it indicates decreasing returns to scale. However, if it is equal to one, the function is said to exhibit constant returns to scale. From the regression analysis, the total sum of coefficients was 1.29 per cent, which means that one per cent increase in all the independent variables will increase the yield by 1.29 per cent. Since, the value was greater than one, it showed increasing returns to scale.

4.6. MARGINAL PRODUCTIVITY ANALYSIS

Marginal Productivity analysis was carried out and allocative efficiency was worked out to detect how the farm efficiently utilizing the resources. The ratio of MVP to MFC was computed to know the allocative efficiency of cowpea. The results are presented in Table 4.24.

The allocative efficiency for the cowpea seed farmers is presented in Table 4.24. The k ratio for the resources such as quantity of labour and quantity of manures and fertilizers were found to be greater than one, which indicates the sub optimal

utilization of resources. The constant of rouging (man days/ha) and quantity of plant protection chemicals was found to be less than one, which indicates the excess utilization of resources.

Table 4.24. Marginal value product (MVP) and Marginal factor cost (MFC) for cowpea production

S.No	Particulars	Geometric mean	MVP	MFC	MVP/MFC=K
1	Yield	314.38	-	-	
2	Quantity of labour (man days/ha)	38.09	1202.9	306.07	3.93
3	Quantity of manures and fertilizers	1021.01	7.37	6.20	1.18
4	Rouging (man days/ha)	7.43	214.16	683.57	0.31
5	Quantity of plant protection chemicals	363.27	-6.75	7.42	-0.91

4.7. CALCULATION OF COWPEA SEED REQUIREMENT IN KERALA

District- wise cowpea seed requirement for Kerala are presented in Table 4.25. On an average, seed rate required per hectare for semi-trailing variety (Anaswara) and trailing variety (Vellayani Jyothika) are 25-30 $Kgha^{-1}$ and 4-5 $Kgha^{-1}$ respectively. Cowpea seed requirement is calculated by taking the recommended cowpea seed rate required per hectare and projecting it with the area of cowpea crop grown in Kerala. Average seed rate of cowpea utilized was 13.5 $Kgha^{-1}$. Palakkad is the only district which requires large amount of seed (12.3 t per year) for cultivation since it has the largest area under cultivation in the state.

Table 4.25. Cowpea seed requirement for districts of Kerala

Districts of Kerala	Area (ha)	Cowpea seed requirement (in tonnes)
Thiruvananthapuram	254.62	3.44
Kollam	254.11	3.43
Pathanamthitta	204.64	2.76
Alappuzha	382.68	5.17
Kottayam	474.74	6.41
Idukki	564.57	7.62
Ernakulam	891.72	12.04
Thrissur	406.88	5.49
Palakkad	**910.11**	**12.28**
Malappuram	708.85	9.57
Kozhikode	162.25	2.19
Wayanad	261.23	3.53
Kannur	231.48	3.12
Kasargod	95.17	1.28
TOTAL	**5803.05**	**78.33**

4.8. DETERMINANTS OF AVAILABILITY OF QUALITY SEEDS IN COWPEA

Determinants of availability of quality seeds to farmers are presented in Table 4.26. The regression analysis was carried out by analyzing different independent variables such as cost of seed, pests and diseases attack, distance to source of seed and cost of production for different varieties. The results indicate that the coefficient of pests and diseases attack was negative and it significantly influenced the yield at 5 per cent level of significance. The coefficient of costs of production of different cowpea varieties was positive and it significantly influences the yield at five percent level of significance. The coefficient of cost of seed was

found to be positive and it does not significantly influence the yield. The coefficient of distance to source of seed was found to be negative, which indicates that as the distance to the source of seed increases, farmers ability to purchase the quality seed may decrease and it does not significantly influence the yield.

Table 4.26: Estimated regression analysis for factors affecting availability of cowpea seeds to farmers

S.No	Parameters	Coefficients	Standard error	t value	P value
1	Intercept	13.17	85.29	0.15	0.87
2	Cost of seed	0.70	0.08	8.82	3.19
3	Pests and diseases attack	-82.06**	38.27	-2.14	0.03
4	Distance to source of seed	-10.02	71.11	-0.14	0.88
5	Cost of production of different varieties	0.0016**	0.0006	2.34	0.021
6	R^2	0.62			
7	F value	31.3			
8	No. of observations	80			

** Significant at 5% level of significance

4.9. CONSTRAINTS FACED DURING COWPEA SEED PRODUCTION

4.9.1. Constraints faced by farmers during seed production

It was reported that the farmers face a number of problems during the seed production. A proper understanding of the constraints faced by the beneficiaries helps in taking the appropriate measures to overcome such constraints.

In the present study of Economic analysis of cowpea seed production in Palakkad district, the beneficiaries are selected from Chittur and Nenmara blocks where there is large production. The selected farmers for cowpea seed production faced the number of constraints which are listed in Table 4.27. High cost of input seed was the major constraint faced by the beneficiaries with Garrett's score of 50.6, followed by limited returns of vegetable cowpea (50.4), high wages to labour (32.6), pests and diseases attack (29.7), availability of required seed in quantity (29.6), limited quantity of inputs (28.5)and availability of seed in time (28.0). A study conducted by Sandhya (2000) in vegetables seed production concluded that the major constraints observed in the study were heavy incidence of pests and diseases, absence of seed storage and processing.

Table 4.27. Constraints faced by cowpea seed production farmers

S.No	Constraints	Garrett's score	Rank
1	Pests and diseases attack	29.7	4
2	Availability of required seed in quantity	29.6	5
3	Limited quantity of inputs	28.5	6
4	High cost of input seed	50.6	1
5	Availability of seed in time	28.0	7
6	Limited returns of vegetable cowpea	37.8	2
7	High wages to labour	32.6	3

4.9.2. Constraints faced by institutional agencies during cowpea seed production

Institutional agencies identified were KAU research stations and Agricultural universities. There were no major constraints noticed in the institutional agencies during the cowpea seed production of varieties Lola and Anaswara.

Summary

SUMMARY

The present study entitled “Economic analysis of cowpea seed production in Palakkad district” was carried out with the objectives of working out the comparative economics of costs and returns of cowpea seed production with vegetable cowpea, to study the efficiency in cowpea seed production, to analyze the factors affecting availability of quality seeds, finding out the constraints and opportunities for seed production by public agencies and under farmer participatory mode of cowpea seed production.

Palakkad district was purposively selected for study since the district had maximum area under cowpea compared to other districts. The study was based on both primary and secondary data. The study was conducted in Palakkad district and primary data was collected by means of interview from farmers. The primary data was obtained from 80 cowpea farmers who are both vegetable and seed growers. The two blocks selected for the study were Nenmara and Chittur because these blocks had maximum number of registered farmers from VFPCK. From the list of registered farmers, the farmers growing both vegetable and seed cowpea with at least 50 cents area were selected at random for the study. Twenty farmers were selected from Nenmara block and 60 farmers were selected from Chittoor block in proportion to the area of seed production undertaken by VFPCK in the respective blocks. The varieties selected for study were Anaswara and Vellayani Jyothika for seed production and Arka Mangala for vegetable production.

The socio-economic characteristics of the respondent farmers with respect to age, education, family size, income, land holding and experience were categorised among the farmers. The distribution of respondents based on age showed that majority of cowpea seed farmers fall under 50-60 years age group. It was observed that majority of farmers are with secondary school education. Majority of the respondents were in the medium-sized family category (4-6 members) in their family. The findings support the fact that joint families are on a decline. It was observed that respondents had about 25-30 years’

experience in seed production of cowpea. The results showed that there were mostly small holding farmers (1-2 ha) who are involved in cowpea seed production.

Compound growth rate analysis of area, production and productivity of vegetables in Kerala from 1991-2018 revealed that the growth rate for area was negative (-0.26) and was found to be non-significant. The growth rate for production was negative (-0.14) and was found to be non-significant. The growth rate for productivity was positive (0.85) and was found to be significant. This indicates that there has been a significant increase in the productivity of vegetables in Kerala due to the introduction of HYVs during this period (1991-2018). The increase in productivity further led to an increase in production though the area under cultivation showed a negative growth rate.

Costs and returns structure was worked out both for cowpea seed production and vegetable production using percentage analysis and cost concepts. The cost of cultivation for seed production was highest in case of Anaswara variety in Chittur (₹ 148386.8 ha^{-1}) and for Vellayani Jyothika variety cost of cultivation (₹ 164065.4 ha^{-1}) was high in Chittur. Gross returns obtained during seed production were highest for Vellayani Jyothika variety (₹ 383925 ha^{-1}) and Anaswara variety (₹ 235015 ha^{-1}) in Chittur. The cost of cultivation for vegetable purpose was high for Arka Mangala variety (₹ 119991 ha^{-1}) in Nenmara. Gross returns for Arka Mangala variety was highest (Rs. 192500 ha^{-1}) in Nenmara. Benefit Cost ratio for the Vellayani Jyothika variety in Chittur (2.36) was highest compared to Anaswara and Arka Mangala.

Cobb-Douglas production function was fitted to estimate the resource use efficiency in Cowpea and it was found that quantity of labour contributed significantly towards the increase in the yield at one per cent level of significance. From the regression analysis, the total sum of coefficients was 1.29 per cent, which means that one per cent increase in all the independent variables will increase the yield. Since, the value was greater than one, it showed increasing returns to scale.

Marginal productivity analysis was carried out and allocative efficiency was worked out to detect how the farm efficiently utilizing the resources. It was found that k ratio (MVP/MFC) for the resources, quantity of labour and quantity of manures and fertilizers were found to be greater than one. This indicated sub-optimal utilization of these

resources. The k-value for rouging (man days/ha) and quantity of plant protection chemicals were found to be less than one, which indicates excess utilization of the above resources.

Linear regression analysis was carried out to understand the factors affecting availability of seed to vegetable farmers by analysing different independent variables such as cost of seed, pests and diseases attack, distance to source of seed and cost of production for different varieties. The results indicate that the coefficient of pests and diseases attack was negative and it does not significantly influenced the yield. The coefficient of costs of production of different cowpea varieties was positive and it significantly influences the yield.

Various constraints in cowpea seed production were identified and ranked using Garrett's ranking technique. Among the various constraints faced by farmers, high cost of input seed and limited returns of vegetable cowpea were the major constraints faced by the cowpea farmers. Since the procurement prices of seeds have been recently revised, it can be concluded that seed production in cowpea is highly remunerative, given the increasing demand for quality seeds in vegetables. Thus cowpea seed production can be seen as a profitable venture in order to proceed towards the path to self-sufficiency in vegetables in our state.

References

Ahmad, B., Hassan, S. and Bakhsh, K. H. U. D. A. 2005. Factors affecting yield and profitability of carrot in two districts of Punjab. *Intl. J. Agril. Bio.* 7(5): 794-798.

Aji, J. M., Rola-Rubzen, M. F. and Batt, P. J. 2001. Factors influencing a farmer's decision to purchase seed potatoes in East Java. Paper: 45th Annual Conference of the Australian Agricultural and Resource Economics Society, January 23 to 25, 2001, Adelaide, South Australia. (No. 412-2016-25854)

Amiruddin, A. and Uma, K. 2019. Farm level study of paddy seed production in Madurai district. *Intl. J. Agrl. Sci. and Res*. 9(4): 47-52.

Amrutha, D. 2011. Constraints and techniques for improving pulses production in Tamil Nadu, India. *Intl. J Bio- Res. and stress Manag*. 2(2): 159-162.

Babu, N. K. and Rana, B. S. 2003. The economics of sorghum hybrid seed production. *Seed Res.* 31(1): 1-7.

Balaji, P. Kumaresan, S. Sivakumar, S. D. 2016. Economic analysis of pandal vegetables cultivation in Coimbatore district of Tamil Nadu. *Intl. Res. J. Agrl. Econ. And Stat.* 7(1): 56-62.

Chandrasekhar, K. S. and Srinivasa Gowda, M. V. 1996. Resource use efficiency in groundnut production under rainfed conditions - A study in Challakere taluk of Karnataka. *Agric. Situation in India.* 28(2): 387-390.

Chapke, R. R., Mondal, B. and Mishra, J. S., 2011. Resource-use efficiency of sorghum (Sorghum bicolor) production in rice (Oryza sativa)-fallows in Andhra Pradesh, India. *J. Human Ecol.*, 34(2): 87-90.

Chattopadhyay, C. and Mohapatra, S. D., 2015. Perception of constraints in chickpea production in India. *Indian J. Agric. Sci*, *85*: 287-289.

CIAT (International Center for Tropical Agriculture), 2008. Farm level impact of improved bean varieties and agronomic technologies in Rwanda [online] Available at http://www.webapp.ciat.cgiar.org. [Accessed 15th December 2010].

Deshmukh, D. S., Pawar, B. R., Landge, V. V. and Yeware, P. P. 2010. Resource productivity and resource use efficiency in pearl millet production. *Intel. J. Commerce and Business Management*. 3(1): 117-119.

FAO (Food and Agriculture Organization of the United Nations), 2004. Seed multiplication by resource-limited farmers. Rome: FAO, Plant Production and protection paper.

FAOSTAT, F.A.O., 2017. Available online: http://www. fao. org /faostat/en/# data. *QC (accessed on January 2018)*.

Farrell, M. J., 1957. The measurement of productive efficiency. *J. the Royal Statistical Society: Series A (General)*, 120(3): 253-281

Garrett, H. E and Woodsworth, R. S. 1969. Statistics in psychology and education. Vakils, Peffer and Simons Pvt. Ltd, Bombay, India, 329p.

Gopikrishna. 1999. An economic analysis of production and marketing of pulses in Kurnool district of Andhra Pradesh. M.Sc. (Ag) Thesis. Acharya N. G. Ranga Agricultural University, Hyderabad.

Gujarati, D. 2004. *Basic Econometrics* (4th Ed.). The McGraw Hill Companies, 1003p.

Hedgire, D. N. 1993. Production, Marketing and Processing of groundnut in marathwada - An economic analysis. *Indian J. Agric. Econ.* 48(3): 426-428.

Welfare, F., 2016. Horticultural statistics at a glance 2018. *OUP Catalogue*.

Hugar, L. B., Amrutha, C. P. and Patil, B. V. 2009. Productivity difference between Bt and non Bt cotton farms in Karnataka state, India-An econometric evidence. *Karnataka J. Agric. Sci.* 22(2): 349-352.

Jat, S., Dangi, K. L. and Kumhar, B. L. 2017. Constraints in Adoption of Improved Cultivation Practices of Black Gram. *Int. J. Curr. Microbiol. App. Sci*, 6(5):1820-1824.

Kahair, S. M., Ali, A. and Salam, A., 2003. Production constraints of soybean in upland Balochistan. *Asian J. Pl. Sci*, 2: 388-391.

Kumar, A., Rohila, A. K. and Pal, V. K., 2018. Profitability and resource use efficiency in vegetable cultivation in Haryana: Application of Cobb-Douglas production model. *Indian J. Agric. Sci.* 88(7): 1137-1141.

Kumar, A., Sumit, Yadav, M. K. and Rohila, A. K. 2019. Constraints faced by the farmers in production and marketing of vegetables in Haryana. *Indian J. Agric. Sci.*, 89(1): 153-160.

Kumar, K., Bhatia, J. and Kumar, M. (2018). Constraints in the Production and Marketing of Pulses in Haryana, *Int. J. Pure App. Biosci.* 6(2): 1309-1313.

Kumar, P., Peshin, R., Nain, M. S. and Manhas, J. S. 2010. Constraints in pulses cultivation as perceived by the farmers. *Rajasthan J. Ext. Edu.*: 33-6.

Kumar, R., Bhatia, A. K. and Davinder, S. 2017. Present status of vegetable production and their impact in human nutrition. *Intl. J. Agrl. Sci.* 9(5): 4945-4949.

Kumar, S. and Bourai, V. A. 2012. Economic analysis of pulses production their benefits and constraints (A case study of sample villages of Assan valley of Uttarakhand, India). *J. Humanities and Soc. Sci.* 1(40): 41-53.

Kumar, G. 2013. An economic evaluation of seed business of pulses in Kurnool district of Andhra Pradesh. (*Acharya N. G. Ranga Agricultural University Rajendranagar, Hyderabad*).

Kumar, V. 2017. An economic analysis of seed production of paddy and chickpea in mungeli district of Chhattisgarh. *Doct. Disser.* Indira Gandhi Krishi Vishwavidhyalaya, Raipur.

Kumar, V. and Singh, M. 2017. An Economic Evaluation of quality seed production of an important leguminous fodder crop- Cowpea in Bundelkhand region, U.P., India. Plant Archives. 17(1): 527-531.

Kumar, V., Bahukhandi, D., Wasnik, V. K. and Suman, M. 2017. Economics of fodder and seed production of important leguminous cowpea crop. *Intl. J. Agric. Sci. Res. (IJASR).* 7(4): 83-88.

Kutty, C. N., Devi, P. I. and Kumaran, U. J. 1998. Economics of vegetable seed production in Kerala State. *A case study seed res.* 26(1): 47-52.

Langyintuo, A. S., Lowenberg - DeBoer J, Faye, M., Lamber, D. and Ibro G. *et al*. 2003. Cowpea supply and demand in West Africa. *Field Crops Res.* 82(1): 215–231.

Manjunatha, B. L., Rao, D. U. M., Sharma, J. P., Burman, R. R., Hajong Dipika, D. M. and Kumar, S. V. 2015. Factors affecting accessibility, use and performance of quality seeds in Andhra Pradesh and Bihar: Farmers' experiences. *J. Community Mobilization and Sustainable Devel.* 10(1): 130-45.

Mani, R. and Singh, A. N., 2007. Water use efficiency under different water availability conditions in Eastern Uttar Pradesh, India - A case study. *Water and Energy Intl.*, *64*(3): 47-52.

Mbah, E. N. and Nwunuji, R. 2016. Factors Limiting Adaptation to Climate Change among Farmers in Taraba State, Nigeria. *Agril. Devel.* 1: 1-5.

Njonjo, M. W., Muthomi, J. W., and Mwang'ombe, A. W. 2019. Production Practices, Postharvest Handling, and Quality of Cowpea Seed Used by Farmers in Makueni and Taita Taveta Counties in Kenya. *Intl. J. Agron.*, *2019*.

Naik, B. K., Shastry, R. and Hosmani, S. B. 1996. Economics of tomato seed production in Dharwad district. *Karntaka J. Agric. Sci.* 9(2): 369-371.

Nufaisa, P. F., Market access to quality paddy seed in Kerala. M.Sc Thesis. Department of Agricultural Economics, College of Horticulture, Vellanikkara).

Omonona, T. B. O. L. A. R. I. N. 2006. Cost and returns to contract seed production in Nigeria: Evidence from Osun State. *J. Central European Agril.* 7(3): 475-478.

Pal, G., Radhika, C., Singh, R. K., Bhaskar, K. U., Ram, H. and Prasad, S. R. 2016. Comparative economics of seed production vis - à - vis grain production of pigeon pea in Karnataka, India. *Legume Res. - An Intl. J.* 39(5): 806-809.

Pandit, J. C. and Basak, N. C. 2013. Constraints faced by the farmers in commercial cultivation of vegetables. J. Bangladesh Agrl. Univ. 11(2): 193-198.

Pant, B. and Nagar, M. 2005. Resource Use Efficiency in Punjab agriculture. *Agric. Situation in India.* 62 (5): 312-315.

Prapoorna. 2000. Economics of production, marketing and processing of groundnut in Kalyandurg mandal of Anantapur district. M.Sc. (Ag) Thesis. Acharya N. G. Ranga Agricultural University, Hyderabad.

Prasad, V. R. and Prasad, Y. E. 2009. Study of economics of cotton and its competing crops in Guntur district of Andhra Pradesh. *Mysore J. Agric. Sci*. 43: 234-238.

Raghuwanshi, R. S., Awasthi, P. K. and Sharma, P. 1999. Resource use efficiency in wheat cultivation. *Indian J. Agric. Res.* 33(1): 67-71.

Ranganath, P. D. and Reddy, B. P. 2005. Comparative economics of seed and Non-seed production of Jowar in Kurnool district of Andhra Pradesh. *The Andhra Agric. J.* 52 (4): 553-556.

Reddy, T. N. V., Reddy, G. P., Reddy, B. V. C. and Siddappa, B. 1990. An economic analysis of breeder seed production of cowpea. *Agric. Situation in India*, 45(8): 533-536.

Rohit, J. Dubey, S. K. Singh, P. Singh, B. K. and Kumbhare, N. V. 2017. An Assessment of Constarints faced by the farmers in Peri- Urban Vegetable Cultivation. *Intl. J. Curr. Microbiol. App. Sci*. 6(10): 2245-2251.

Sahu, R. P. Sachan, V. K. and Singh, R. J. 2013. Constraints in adoption of Vegetables production technology in Uttarakhand Hills, *J. Mutidisciplinary Adv. Re*s. 2(2): 31-34.

Sairam, N. 2011. An economic study of seed and commercial production of paddy in Chittoor district of Andhra Pradesh. Doctoral dissertation, Acharya N. G. Agricultural University.

Sandhya, M. Das. 2000. Economics of vegetable seed production in Chittur taluk of Palakkad district. M.Sc. (Ag) Thesis. Acharya N. G. Ranga Agricultural University, Hyderabad.

Satpute, T. G., More, S. S. and Sanap, D. J. 2009. Costs, returns and resource use efficiency of organic and inorganic soybean farming in Parbhani, India *Agric. Update.* 4 (2): 189-193.

Sharma, S. 2017. An economic analysis of seed production of soybean in kabirdham district of Chhattisgarh. (Doctoral dissertation)

Sharma, A., Kachroo, J., Bhat, A., Kachroo, D. and Peer, Q. J. A., 2016. Resource use efficiency of maize production in Jammu Region of J & K State. *J. Applied and Natural Sci.*, *8*(2): 691-700.

Shashikant, V. G., Prabhakar, I. and Manjunatha, B. L. 2011. Constraints in Production and Marketing of Redgram in Gulbarga District of Karnataka. *J. Community Mobilization and Sustainable Devel.* 6(2): 202-204.

Singh, B. B., Mohan, D., Raj, R., Dashiell, K. E., Jackai, L. E. N. 2002. Co-publication of *Intl Institute Tropical Agril*. (IITA) and *Japan Intl. Res. Centre for Agril. Sci*. (JIRCAS0.IITA, Ibadan, Nigeria TropicallegumesII/pdfs/BTL16-20122712.

Singh, P., Shahi, B. and Singh, K. M., 2017. Enhancing Pulses Production in Bihar: Constraints and Strategies for Sustainable Growth. *J Agrl. Search.* 3(3): 178-184.

Singh, S. N. Singh, V. K. Singh, R. K. and Singh, R. K. 2016. Adoption constraints of Pigeonpea cultivation in Lucknow district of Central Uttar Pradesh. *Indian Res. J. Ext. Edu.* 7(1): 34-35.

Soman, S. K. 2012. A comparative performance appraisal of VFPCK and Kudumbashree beneficiaries in Thiruvananthapuram district. M.Sc. Thesis. Kerala Agricultural University.

Tiwari, A. K. and Tiwari, J. K. 2018. Constarints in adoption of modern vegetable cultivation practices in Bastar plateau. *Intl. J. Current Microbiol. Applied Sci*. 7(1): 820-826.

Tripathi, R. S. 1992. An Economic analysis of French bean (*Phaseolus vulgare*) cultivation in the rain fed conditions of UP hills. *Legume Res.* 15(1): 45-50.

Usman, I., Taiwo, A. B., Haratu, D. and Abubakar, M. A. 2013. Socio-economic factors affecting groundnut production in Sabongari local government of Kaduna state, Nigeria. *Intl. J. Food and Agril. Econ.* (IJFAEC), 1: 41-48.

Wannur and Nagapp, A. K. 2015. Farmers participatory groundnut seed production programme (FPSPP) of UAS Dharwad - an Economic analysis. M.Sc Thesis. University of Agricultural Sciences, Dharwad.

Warade, Sangita, Deshmukh, Rajendra, Tiwari, Vijay, Alexander and Shubhangi 2010. Yield gap analysis in cotton of Akola district. *J. Social and Econ. Devel*. Jan. 1. 2010.

Appendices

Appendix -1

Questionnaire for cowpea seed farmers

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……

Family details:

Sl No.	Name	Relation with respondent	Age	Education	Occupation

III. 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 :

Crop details

Year	Season	Variety & type	Area		Yield/ha		Total returns
				Costs	Pod yield & Selling price	Fodder yield&Selling price	
2017-18	Virippu	Semi trailing					
		Trailing					
		Bushy					
	Mundakan	Semi trailing					
		Trailing					
		Bushy					

IV. Cropping Systems :

YEAR	Monocropping	Dual-cropping	MIXED CROPPING
2017-18			

COSTS & RETURNS FOR SEED GROWERS

Cost of cowpea seed and vegetable 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								
Land preparation								
Soil amelioration								
Basal dose application								
Irrigation								
Weeding								
Plant protection								
Manures and fertilizers								
Harvesting								
Threshing								
Transportation								
Loading and unloading charges								
Storage cost								
Specify if any								

Quality of cowpea seed produced:

1. Do you know the class of cowpea 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 cowpea 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

If yes, what is the isolation distance?

6. Do you follow rouging? Yes/ No
7. How rouging is being done? Who? When? How frequently?
8. Draining before harvest for uniform maturity? Yes/No
9. Harvesting at 80% maturity?Yes/No
10. How harvesting is being done? Labour harvest/ Machine harvest
11. If labour harvest, Do you thresh it just after harvesting?
12. If machine harvest, Does it affect the quality of seeds ? Yes/No
13. What is the moisture per cent needed for seeds?
14. How it is checked while drying?
15. Where so you store seeds until procurement? Is it in sacks? Yes/No
16. If yes, how many sacks are piled one above other?
17. Do you check seed quality yourself? How? What are the parameters?
18. Is there any seed quality test by authority before procurement? Yes/No
19. If yes, How many samples?
20. How samples are being taken?
21. What are all the parameters of seed quality?
22. Was there any instances of problem due to insufficient quality seeds? Yes/No
23. If yes, How many times? Why? How did you cope up?
24. Do you get support from krishibhavan or any other government institution? Yes/No
25. If yes, how?
26. How frequently officials/AO visit the field?

27. Who bear the cost of such visits

V. Procurement details:

Do they procure cowpea 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 cowpea 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?

Is it sufficient? Yes/No

How do you rise crop? Sowing in all seasons
Sowing in virippu
Sowing in mundakan
Specify if any other……

Seed rate followed: Sowing-

How frequently you replace cowpea 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)?

Constraints in access to quality cowpea seed:

(Rank the below given constraints accordingly)

Problem	**Occurrence of problem(Yes/No)**	**Ranking of problem (on a 5 point scale)**
Pests and diseases attack		
Availability of required seed in quantity		
Limited quantity of inputs		
High price of seed		
Availability of seed in time		
Limited returns of vegetable cowpea		
High wages to labour		

VI. Suggestions to overcome these shortcomings

……
……
……
……

Questionnaire for officials in research farms

1. Name of the institution
2. Name and designation of the respondent:
3. Which are all the varieties of cowpea handled?
4. Constraints faced during the cowpea seed production by the agricultural institutions?

   (Rank the below given constraints accordingly)

Problem	**Occurrence of problem(Yes/No)**	**Ranking of problem (on a 5 point scale)**
Pests and diseases attack		
Availability of required seed in quantity		
Limited quantity of inputs		
High price of seed		
Availability of seed in time		
Limited returns of vegetable cowpea		
High wages to labour		

Appendix-2

GARRETT RANKING CONVERSION TABLE

The conversion of orders of merits into units of amount of "socres"

Percent	Score	Percent	Score	Percent	Score
0.09	99	22.32	65	83.31	31
0.20	98	23.88	64	84.56	30
0.32	97	25.48	63	85.75	29
0.45	96	27.15	62	86.89	28
0.61	95	28.86	61	87.96	27
0.78	94	30.61	60	88.97	26
0.97	93	32.42	59	89.94	25
1.18	92	34.25	58	90.83	24
1.42	91	36.15	57	91.67	23
1.68	90	38.06	56	92.45	22
1.96	89	40.01	55	93.19	21
2.28	88	41.97	54	93.86	20
2.69	87	43.97	53	94.49	19
3.01	86	45.97	52	95.08	18
3.43	85	47.98	51	95.62	17
3.89	84	50.00	50	96.11	16
4.38	83	52.02	49	96.57	15
4.92	82	54.03	48	96.99	14
5.51	81	56.03	47	97.37	13
6.14	80	58.03	46	97.72	12
6.81	79	59.99	45	98.04	11
7.55	78	61.94	44	98.32	10
8.33	77	63.85	43	98.58	9
9.17	76	65.75	42	98.82	8
10.06	75	67.48	41	99.03	7
11.03	74	69.39	40	99.22	6
12.04	73	71.14	39	99.39	5
13.11	72	72.85	38	99.55	4
14.25	71	74.52	37	99.68	3
15.44	70	76.12	36	99.80	2
16.69	69	77.68	35	99.91	1
18.01	68	79.17	34	100.00	0
19.39	67	80.61	33		
20.93	66	81.99	32		

Abstract

ECONOMIC ANALYSIS OF COWPEA SEED PRODUCTION IN PALAKKAD DISTRICT

by

Vechalapu Lakshmi Sindhuja

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ABSTRACT OF THESIS

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ABSTRACT

Cowpea [*Vigna unguiculata* (L.) Walp.] is one of the most essential food which is extensively adapted, stress tolerant grain legume, vegetable, and fodder crop. Kerala is striving to move towards self-sufficiency in vegetables and in this context, the timely availability of quality seed is gaining importance. Plant types are often categorized as trailing and semi trailing varieties. The varieties selected for the study were Vellayani Jyothika which is of trailing type, Anaswara, which is a semi-trailing variety (both for seed purpose) and Arka Mangala which is of trailing type was selected for comparison between seed and vegetable production.

The two blocks selected for the study were Nenmara and Chittur because these blocks had maximum number of registered farmers. The registered farmers under VFPCK's seed production of cowpea were selected for the study. From the list of registered farmers, farmers growing both vegetable and seed cowpea with at least 50 cents area were selected at random. Twenty farmers were selected from Nenmara block and 60 farmers were selected from Chittur block in proportion to the area of seed production undertaken by VFPCK in the respective blocks.

The results of the study are as follows. The distribution of respondents based on age showed that majority of cowpea seed farmers fall under 50-60 years age group. It was observed that the farmers who had secondary school education fell in this category. Majority of the respondents were in the medium-sized family category (4-6 members). The findings support the fact that joint families are on a decline. It was observed that respondents had about 25-30 years' experience in seed production of cowpea. The results showed that they were mostly small holding farmers (1-2 ha) who are involved in cow pea seed production.

The growth rate of area and production for vegetables in Kerala were negative -0.26 per cent and -0.14 per cent respectively, while the growth rate for productivity was positive (0.85%) and was found to be significant. This indicates that there has been a significant increase in the productivity of vegetables in Kerala due to the introduction of HYVs during this period (1991-2018).

It was found that the cost of cultivation for Anaswara (Rs.148386.8 ha^{-1}), Vellayani Jyothika (Rs. 164065.4 ha^{-1}) were high in Chittur and for Arka Mangala varieties (Rs.119991 ha^{-1}) was high in Nenmara. The reason was a marginal increase in the wage rate in Chittur compared to Nenmara. Anaswara (Rs. 235015 ha^{-1}) and Vellayani Jyothika (Rs. 383925 ha^{-1}) yielded higher in Chittur compared to Nenmara. The B:C ratio for the varieties were Vellayani Jyothika (2.36) which is high in Chittur, followed by Anaswara (1.58), it was high in Nenmara and for Arka Mangala it was 1.60, which were same in both the blocks. The findings indicate that Vellayani Jyothika variety had high procurement price of seed, high returns and higher B:C ratio. The returns to scale was also greater than one *i.e.* 1.29, indicating increasing returns to scale in cowpea.

Cobb-Douglas production function was fitted to estimate the resource use efficiency in Cowpea and it was found that quantity of labour contributed significantly towards the increase in the yield. Marginal productivity analysis was carried out and it was found that the k ratio (MVP/MFC) for the resources, quantity of labour and quantity of manures and fertilizers were found to be greater than one. This indicated sub-optimal utilization of these resources. The k-value for rouging (man days/ha) and quantity of plant protection chemicals were found to be less than one, which indicates excess utilization of the above resources.

The results of linear regression to understand the factors affecting availability of seed to vegetable farmers in general are pests and diseases attack and costs of production of different cowpea varieties. High cost of input seed and limited returns from vegetable cowpea are the major constraints faced by the cowpea farmers. Since the procurement prices of seeds have been recently revised, it can be concluded that seed production in cowpea is highly remunerative, given the increasing demand for quality seeds in vegetables. Thus cowpea seed production can be seen as a profitable venture in order to proceed towards the path to self-sufficiency in vegetables in our state.


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