ECONOMIC ANALYSIS OF AGRICULTURAL INPUT SUBSIDIES FOR COCONUT CULTIVATION IN KOZHIKODE DISTRICT

by

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(2017-11-118)

THESIS

Submitted in partial fulfilment of the requirements for the degree of

MASTERS OF SCIENCE IN AGRICULTURE

Faculty of Agriculture

Kerala Agricultural University

DEPARTMENT OF AGRICULTURAL ECONOMICS

COLLEGE OF AGRICULTURE

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KERALA, INDIA

2019

DECLARATION

I, hereby declare that this thesis entitled "**ECONOMIC ANALYSIS OF AGRICULTURAL INPUT SUBSIDIES FOR COCONUT CULTIVATION IN KOZHIKODE DISTRICT**" is a bonafide record of research work done by me during the course of research and the thesis has not previously formed the basis for the award to me of any degree, diploma, associateship, fellowship or other similar title, of any other University or Society.

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ACKNOWLEDGEMENT

I pay my obeisance to God Almighty to have bestowed upon me good health, courage, inspiration, zeal at each and every moment without which this study would never seen light.

I would like to express my deep sense of gratitude and indebtedness to Sri. T. Paul Lazarus, Chairperson of the advisory committee, Assistant Professor (SS) and Head, Department of Agricultural Economics, for his timely and valuable guidance, moral support and constant encouragement. I am very thankful for helping me in my academics and also to complete my research work on time.

I am very much grateful to Dr. Santha A. M., Rtd. Associate Professor, Department of Agricultural Economics, for her valuable guidance and noteworthy suggestions during the course of my study and also for my research work.

I am profoundly thankful to Dr. Aswathy Vijayan, member of advisory committee, Assistant Professor, Department of Agricultural Economics, for her encouragement for the new ideas, support for the study in newer areas of the subject and critical valuation of the works and also the research.

I take this opportunity to extend gratitude to Dr. Brigit Joseph, member of advisory committee, Associate Professor and Head, Department of Agricultural Statistics, for her valuable suggestions, timely support in doing statistical analysis and critical evaluation during the course work.

I am very much thankful to Dr. Anil Kumar A. S. ADR, RARS (SZ), Vellayani, member of advisory committee, for his valuable suggestion and critical evaluation of this work.

I accord my sincere thanks to Dr. Durga A. R. Assistant Professor, Department of Agricultural Economics, Smt. Thasnimol, Assistant Professor, Department of Agricultural Economics, for their valuable support and encouragement for successful completion of this work.

I sincerely thankful to Sri. George Alexander, Assistant Director of Agriculture, State Department of Agriculture, Vikas Bhavan, Thiruvanathapuram and Smt. Bindu C. P. Assistant Director of Agriculture, Department of Agriculture, Vikas Bhavan, Thiruvanathapuram, for providing me the necessary secondary data.

I would like to thank Smt. Manjula, Assistant Executive Officer, KSEB, Thiruvanathapuram, for providing me the necessary information regarding the electricity subsidy scheme.

I would also like to thank Mr. Sivadasan, Lead Bank Manager, Kozhikode for providing me the necessary information regarding the agricultural credit and credit subsidy.

I take this opportunity to thank Agricultural officers Mr. Jayes (PAO office, Kozhikode), Mrs. Vidhya (Balussery), Mr. Faisal (Kattipara) and Agricultural Assistants in the selected two panchayats, for providing me with all essential details and data related to my research topic.

I am also thankful to my seniors Mohandas, Kshama A. V., Stephy, M.A. and Abhinav, M.C. and my batch mates Ajmal, S. and Neethu Mol Jacob and my juniors Nithin Raj, Elizebeth Benny, Marupila Supriya for their selfless help, encouragement, moral support and fulfilment of classroom environment during the entire course of study. I also thank all my friends Suresh A, Athulya C. K, Dhanya G., Murugesh, Gayathri Mohan, Bensi, Chandren K., for their support and guidance for completing my M. Sc. programme.

I am most indebted my mother D. Ramani and father D. Vengada Subramania Moorthy and brother V. Mohan Raj for their blessing, constant encouragement, moral support and blessings without which I would not have completed this research work.

I would also like to express my sincere apologies, if I ever failed to mention any names.

Priyanga, V.

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LIST OF ABBREVATIONS

AISP	Agricultural Input Subsidy Programme
ANERT	Agency for Non- Conventional Energy and Rural Technology
B:C	Benefit : Cost ratio
CAGR	Compound Annual Growth Rate
CAP	Common Agricultural Policy
CDB	Coconut Development Board
CPC	Coconut Producer Company
CPS	Coconut Producer Society
CSO	Central Statistical Organisation
DAP	Diammonium Phospahte
DBT	Direct Benefit Transfer
et al	Co worker
FADN	Farm Accountancy Data Network
FAI	Fertilizer Association Of India
FAQ	Fair Average Quality
FBO	Farmer Based Organisation
FISP	Fertilizer Input Subsidy Programme
GDP	Gross Domestic Product
GOK	Government of Kerela
IRR	Internal Rate of Return
KERC	Kerela Electricity Regulatory Commission
KSEB	Kerela State Electricity Board
LT	Low Tension
MAP	Monoammonium Phosphate
MFC	Marginal Factor Cost

mFMS	mobile Fertilizer Management System
MOP	Muriate of Potash
MP/MPP	Marginal Product/ Marginal Physical Product
MSP	Minimum Support Price
MVP	Marginal Value Product
NABARD	National Bank for Agriculture and Rural Development
NBS	Nutrient Based Subsidy
NCDP	National Coconut Development Programme
Nos.	Numbers
NPS	New Pricing Scheme
OLS	Ordinary Least Square
PAO	Principal Agricultural Office
R^2	Coefficient of Multiple Determination
RPS	Retension Price Scheme
RRB	Regional Rural Bank
Rwf	Rwanda Franc
SC/ST	Scheduled Caste/Scheduled Tribes
SCIRS	Subsidized Certified Improved Rice Seed
SEB	State Electricity Board
SLR	Sri Lankan Rupees
SSP	Single Super Phosphate
T×D	Tall ×Dwarf
TGP	Technological Gap Ratio
TSP	Triple Super Phosphate
VIF	Variance Inflation Factor

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LIST OF SYMBOLS

ac	acre
^{0}C	Degree Celsius
>	Greater than
ha	Hectares
kW	Killo watt
kWh	Killo Watt hour
kg	Kilogram
<	Less than
m	metre
mm	Millimeter
m ha	Million hectare
MT	Million tonnes
MU	Million units
%	Per cent
ha^{-1}	Per hectare
kg^{-1}	Per Kilogram
q	Quintal
₹	Rupees
km	Square kilometer

Introduction

INTRODUCTION

Coconut (*Cocos nucifera L.*), the versatile palm popularly known as *'Kalpavriksha'*, 'Tree of Life', as well as 'God's Gift to Humanity' and its fruit is known as Lakshmi Phal, the fruit of wealth. It has been grown in India for the last 3,000 years, which was considered as a traditional plantation crop. Its varied distribution has been favored by its value for human life, along with its adaptability to various ecological conditions.

In India, coconut was cultivated in an area of 2.08 m ha with a production of 23,904.10 m nuts and productivity of 11,481 nuts ha^{-1} in the year 2016-17. The four southern states in particular Kerala, Tamil Nadu, Karnataka, and Andhra Pradesh occupied 89 percent of the coconut area and 91 per cent of coconut production in the country. Among the major coconut producing states in India, Kerala is the leading state in coconut production with about 7,448.65 m nuts in an area of 0.771 m ha. The productivity of coconut in Kerala was 9,664 nuts ha^{-1}. The state, Kerala is known as the "Land of Coconut Trees" (Government of India, 2017). More than 95 per cent of coconut trees have been grown in the front and back yards of homesteads and there are few large coconut plantation in Kerala. Most of the farmers practiced mono cropping models, which do not support their families' livelihood security, so that people are adopting inter-cropping and mixed cropping/ multiple cropping. Coconut cultivation in Kerala is an important source of food component and as a source of income to the people by offering employment opportunities and thereby alleviating poverty.

In Kerala, Kozhikode district stands first in area (1,19,064 ha) and second in production (837 m ha) in the year 2016-17 (Government of Kerala, 2017). Even though Kozhikode district has the largest area under coconut cultivation, the production and productivity are less when compared with that of other district. The production (878 m nuts) was high in Malapuram district and productivity (9,242 nuts ha^{-1}) was high in Kasagod district of Kerala. The district wise area, production and productivity of coconut in Kerala were shown in the table 1.

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Table 1: District wise Area, Production and Productivity of coconut in Kerala (2016-17)

S. No.	District	Area (ha)	Production (m nuts)	Productivity (nuts ha^{-1})
1	Thiruvanathapuram	70467	573	8131
2	Kollam	50938	354	6950
3	Pathanamthitta	15877	89	5606
4	Alappuzha	33670	177	5257
5	Kottayam	25610	127	4959
6	Idukki	16122	63	3908
7	Ernakulam	43079	186	4318
8	Thrissur	80504	500	6211
9	Palakkad	59547	397	6667
10	Malapuram	102836	878	8530
11	Kozhikode	119064	837	7030
12	Wayanad	10322	73	7072
13	Kannur	88217	527	5974
14	Kasargod	65243	603	9242

Source: (Government of Kerala, 2017)

To encourage the production and productivity of coconut, Government of India has declared the Minimum Support Price (MSP) to ensure appropriate minimum prices to the farmers and step up investment in coconut cultivation. The MSP of milling Copra for Fair Average Quality (FAQ) was from ₹ 6,500/-per quintal in the year 2017 and ₹ 7,500/- per quintal in the year 2018. The MSP of ball copra was for FAQ ₹ 67,85/- per quintal in 2017 which increased to ₹ 7,750/- per quintal in 2018.

The copra obtained from the drying of the coconut grain is the richest source of vegetable oil containing 65 to 70 per cent of oil. Coconut oil, also known as "*Velichanna*", is traditionally used for cooking in Kerala, and several studied had

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proved that coconut oil helps in reducing the risk of heart disease due to the presence of healthy saturated fatty acids.

Due to the unprecedented increase in price of coconut oil in the recent period, a shift in the consumption pattern from coconut oil to other vegetable oils such as palm oil, sunflower oil and rice bran oil was observed. Because of low price and large supplies has pushed back coconut oil from the leading position in the domestic market. Most of the edible oils available in the market at a price in the range of ₹ 60-130 per kg while coconut oil fetches a higher at a retail price of around ₹160-200 per kg.

Thus, the coconut sector in the state is confronted with a number of constraints such as low and fluctuating productivity due to old and senile plantations, shortage of quality planting material, incidence of diseases and insect-pests, poor management of the farms, shortage of skilled labour, lack of assured irrigation facilities, poor post-harvest management and infrastructure, lack of access to assured market, and competition from substitute oils. The constraints faced by the coconut sector need to be addressed through focusing on improving productivity in a sustainable manner. Hence, there is the need to provide the input subsidies to coconut cultivation by the Government to increase the production of coconut in Kerala.

1.1 AGRICULTURAL INPUT SUBSIDIES IN INDIA

Indian Government has an important role in agriculture sector development by providing various incentive for accelerating the growth of agricultural production. Among various incentive, the Government of India providing various kinds of agricultural input subsidies such as fertilizer, electricity, credit, irrigation, seeds, machineries, implements and plant protection chemicals.

"Agricultural input subsidies, employed as policy instruments, in the agricultural sectors are most important subsidies in order to lower the prices that farmers pay for their inputs below their market prices."

In India, the agricultural subsidies was originally introduced by the government in the year 1960 to give support for Green Revolution. The expenditure of the government to the agricultural input subsidies was mainly to reduce the price of agricultural inputs, so that farmers can be affordable to buy. The coverage and quantum of input subsidies increased over the years. Among various agricultural input subsidies, Central government is providing the subsidies on fertilizer directly to the farmers whereas the State governments are providing the subsidies on irrigation, electricity, seeds, implements and plant protection chemicals.

1.2 DIFFERENT KINDS OF MAJOR INPUT SUBSIDIES

1.2.1 Fertilizer subsidy

Fertilizer subsidy is the amount to be difference between the price paid to the manufacturer of fertilizer and price received from the farmers. The subsidy to urea was given under the Retention Price Scheme (RPS) till 2003. Later, the New Pricing Scheme (NPS) was introduced to give the subsidy to urea fertilizer. The Government implemented Nutrient Based Subsidy Scheme (NBS) to give subsidies to all fertilizer other than urea such as Di-ammonium Phosphate (DAP), Mono-ammonium phosphate (MAP), Triple Super Phosphate (TSP), Muriate of Potesh (MOP), Single Superphosphate (SSP), Ammonium sulphate and 15 grades of complex fertilizer. Additionally, the subsidy is also provided to the Micronutrients (Boron and Zinc) as per Fertilizer Control Order.

1.2.2 Electricity subsidy

The state government gives electricity subsidy by lowering the rates for the electricity supplied for the agricultural purpose. Electricity subsidy provided by the State Electricity Board (SEBs), is the difference between the cost of generating electricity to farmers and prices received from the farmers.

1.2.3 Irrigation subsidy

Irrigation subsidy is the difference between the operation and maintenance cost of irrigation structure in the state and charges for irrigation recovered from the farmers. It also included the provision for providing the irrigation equipment such as electric pump sets or solar pump sets or diesel pump sets to the farmers at the cheapest rate.

1.2.4 Credit subsidy

Credit availability is the main problem faced by the farmers. The credit subsidy is given to the farmers as lower rate of interest when compared to the market rate prevailing and exemption from collateral security for the loan. It is the difference between the interest charged from farmers and actual cost of providing credit.

1.2.5 Seed subsidy

High yielding variety seeds provided by the government to the farmers at low prices.

1.2.6 Implements and Machinery subsidy

Subsidies are provided on farm implements such as spades, knife and khurpi and similarly farm machinery such as sprayer, power tiller and rotavator.

1.3 COCONUT DEVELOPMENT IN KERALA

The scheme on "Coconut Development" was implemented in the state in the year 2005-06, with the objective to enhance the coconut production and productivity. From 2014-15 onwards, this "*Keragramam*" was included in the Coconut Development, in order to provide the subsidies to the farmers for doing various operations and purchase of inputs and equipment used for coconut cultivation. This scheme was implemented in 26 Keragramams in the year 2014-15 and it was extended to 79 Keragramams in the year 2018-19. The major objectives under this scheme were integrated management of coconut garden, application of organic manure, distribution of climbing devices, establishment of coconut nurseries and irrigation units.

Coconut Development Board (CDB) established by the Government of India for concentrating on increasing productivity and product diversification of coconut.

Coconut Producer Society (CPS), their Federations and Producer Companies are taking more initiatives for value addition by availing the financial assistance of the Board. Combined with Department of Agriculture, GOK, CDB implemented Replanting and Rejuvenation scheme from 2017-18 for giving financial assistance to the farmers for cut and removal of the old palms, replanting of new coconut seedlings and management of coconut orchards

The input subsidies on agriculture contributes in enhancing the agricultural production and productivity through an intensive use of subsidized inputs. Moreover, it helped to induce the farmers to adopt new technology, increased the employment level and helped in attaining the self-sufficiency. However, the beneficial effects of input subsidy has raised, subsidy may also causes the adverse impact on environment due to inefficient or excess utilization of subsidized resources causes over exploitation of ground water, depletion of soil fertility, pollution to environment and water logging.

In the above background, the present study "Economic analysis of agricultural input subsidies for coconut cultivation in Kozhikode district" was taken up with the following objectives.

1. To study the growth of input subsidies for coconut cultivation.
2. To analyze the impact of input subsidies on coconut production.
3. To identify the constraints faced by the farmers in availing the input subsidies.

1.4 SCOPE OF THE STUDY

Coconut is the versatile palm considered as a symbol of rural prosperity. Kerala occupied first in both area and production of coconut in the country over many years. The share in area and production of coconut in the state is declining over the years and the coconut growers are going to the crisis situation and they find it tough to manage the crops as a remunerative basis. To raise the income and profit of coconut farmers and to encourage them to use sufficient amount of inputs, the Government had provided various input subsidy to the coconut growers. Hence, this study was undertaken to know the various input subsidies provided to coconut cultivation in Kerala, its impact on coconut production and also to identify the constraints faced by the farmers in availing the input subsidies. This study can helps the policy makers to know which kind of input subsidies has more influence on coconut production. The input subsidies provided by the Government may causes both positive and negative effect towards environment. So, this study would also help to distinguish the input subsidies as environmentally beneficial and environmentally harmful. This would also help the policy makers to provide the environmental friendly input subsidies for agricultural production to make the environment pollution free and sustainable.

1.5 LIMITATION OF THE STUDY

The non-availability of recorded secondary data in the past was the major limitation for the analysis of growth of input subsidies in Kozhikode district. The data on input subsidies was not getting directly, an indirect method was used for its computation. Moreover, the fertilizer and electricity subsidy cannot be worked out separately for coconut cultivation, as its consumption was low for coconut farming. The analysis of secondary data from ANERT could not be performed as they were not provided any solar subsidies to the farmers in Kozhikode district. In case of primary data collection, the respondents were trying to recall the data on resource used and cost of cultivation, which is also to be constraints. Efforts were taken by researcher to minimize the error and make the study as accurate as possible.

1.6 ORGANIZATION OF THE THESIS

This thesis has been presented in the order as mentioned below:

1. Introduction: This chapter comprises detailed background of the problems, objectives, scope and limitation of the study.
2. Review of literature: This chapter includes the results and findings of the past studies related to the research topics.

3. Materials and methods: This includes the description of study area, source of data, method of data collection and different statistical tools used for the analysis of collected data and different variables.
4. Results and discussion: This chapter contains the results from the analysis and interpretation of the study.
5. Summary: This chapter pointed out the result findings and policy implications.

1.7 FUTURE LINE OF WORK

This study was conducted in Kozhikode district. Similar studies can be extended to other areas to get a clear picture of the Keragramam scheme. A study can also be taken for other input subsidy schemes for different crops to analyse the impact of input subsidies on overall agricultural production. An in-depth study of the impact of agricultural input subsidies on environment will be useful for formulating appropriate policies of environmentally friendly subsidies.

Review of Literature

2. REVIEW OF LITERATURE

A review of the past studies is necessary for undertaking any research work. It provides the basis for preparing the research design of the study. The literature review provides information about the work done related to the present research problem. With this view, the relevant aspects on coconut cultivation, input subsidies and constraints were collected and discussed under the following subheadings.

1. Economics of coconut cultivation
2. Growth of input subsidies
3. Impact of input subsidies on agricultural production
4. Impact of input subsidies on the environment
5. Constraints faced by farmers in availing the agricultural input subsidies

2.1 ECONOMICS OF COCONUT CULTIVATION

Chinnah and Suresh (2013) carried out economic analysis of coconut cultivation in Coimbatore, Thanjavur and Dindigul districts of Tamil Nadu during the year 2012. The analysis showed that the total cost of production for small, medium and large farmers were ₹ 1,03,686 ha^{-1}, ₹ 1,03,170 ha^{-1} and ₹ 97,564 ha^{-1}, respectively. After deducting the cost of production, average net return for these three category of farmers were ₹ 33,474 ha^{-1}, ₹ 39,240 ha^{-1} and ₹ 50,745 ha^{-1}, respectively. The study concluded that coconut cultivation was economically profitable and offers more employment opportunities.

In Tumkur and Hassan districts of Karnataka, the establishment and maintenance cost of coconut cultivation was worked to be about ₹ 63,708 ha^{-1} and ₹ 4,68,750 ha^{-1}, respectively in the year 2015-16. The coconut cultivation had a net present worth of ₹ 3,76,861 ha^{-1} at the end of the life period of coconut *viz,* 50 years. The internal rate of return (IRR), payback period and benefit- cost ratio were found to be 13.3 per cent, 21.8 years and 1.18, respectively (Kishore and Murthy, 2017).

Kolambkar (2017) worked out the marginal productivity and resource use efficiency in coconut cultivation in South-Goa during the period 2013-14. Cobb-Douglas production function showed that the regression coefficient of area under coconut, irrigation, and manure was 0.383, 0.044 and 0.048, respectively and it was statistically significant. The coefficient of hired human labor, nitrogen and family human labor were positive but it was non-significant. The marginal product for area under coconut was 91.77 quintals, followed by machine labor (1.418 quintals), manure (0.178 quintals) and irrigation (0.003). Marginal Value Product (MVP) to price ratio for machine power was found to be 2.65, followed by area (2.24), nitrogen (1.85), irrigation (1.42) and manure (1.24). The results showed that increasing usage of machine power needs to be accorded the highest priority for the coconut cultivation.

The Government had established National Coconut Development Programme (NCDP) in the year 1979-2004 that mainly focused on increasing the production and productivity of coconut in Tanzania by using improved agricultural technologies. Only 22 per cent of farmers were utilizing the improved technologies and the remaining 78 per cent of farmers were utilizing the conventional method of coconut cultivation. To increase the production and productivity of coconut, the study recommended improving extension services for dissemination of improved technologies among the farmers. (Muyengi *et al.* 2015)

Priolkar *et al.* (2017) conducted a study to find the resource use efficiency in coconut production in Ratnagiri district in Maharashtra. The coefficient of multiple determination (R^2) was 0.89. The returns to scale was found to be 0.954. The coefficients for bearing trees, manure and irrigation were positive and statistically significant.

Reddy *et al.* (2017) analyzed the economics of coconut plantation in West Godavari district of Andhra Pradesh. The study observed the cost of production (Cost C) to be ₹ 58,425 ha^{-1} and the B: C ratio to be 1.23. Hence the investment in coconut plantation was economically viable. Net present worth was found to be positive (₹ 47,371) and IRR was 23.25 per cent which was greater than the prevailing rate of interest (12 per cent).

A study by Vinodhini and Deshmukh (2017) on the economics of coconut production in Karur district of Tamil Nadu during 2015 observed that the average land holding of coconut growers was 2.82 ha and the average establishment cost was ₹

2,28,082 ha^{-1}. The maintenance cost of cultivation of coconut was found to be ₹ 92,273 ha^{-1} per year. The benefit- cost ratio was 1.39 which indicated that coconut production was profitable.

2.2 GROWTH OF INPUT SUBSIDIES

Gulati (1989) studied the state- wise analysis of distribution of major input subsidies in India. The study revealed that wide variations existed in the distribution of various inputs across states, which results in differential gain from input subsidies in different region. The results also showed that the developed states get higher input subsidies when compared with others.

Gulati and Sharma (1997) analysed the economy wide impact of input subsidies on agricultural sector. Among various input subsidies, electricity subsidy has exhibited the highest growth rate and also found that the small farmers has appropriated a large share of subsidies.

Sharma and Thaker (2009) examined the trends in fertilizer production and consumption and distribution of subsidies between the farmers and fertilizer industry, among different crops and farm sizes and across different regions. The study revealed that the fertilizer subsidy increased from ₹ 4,389 crores in the year 1990-91 to ₹ 75,849 crores in the year 2008- 09 and about two- third of total fertilizer subsidies were contributed by the crops such as rice, wheat, sugarcane and cotton. The share of fertilizer subsidy for small and marginal farmers was found to be more in comparison with that of share in cultivated land and the study proposed the policy of directly transfer fertilizer subsidy to farmers.

Subsidies were provided on different agricultural inputs such as seeds, fertilizers, electricity and irrigation etc. The aim of this study was to analyse the growth and distribution of fertilizers subsidies in east zone of India. The results showed that fertilizer subsidies has increased both during pre as well as post-liberalization period and the study was concentrated only in few states (Kaur, 2013).

Salunkhe and Deshmush (2013) focused on an outline of agriculture subsidies by the government and criteria for distributing the subsidies in India with the help of allocation of funds for agriculture in five year plans and annual budgets. The Government agricultural subsidies were one of the tools to help the growth of the agricultural sector in India.

Shouraki *et al.* (2013) studied the input subsidies on agricultural production in Iran. A production function was estimated by using the econometric method with time series data. The findings showed that the price was less elastic for all the input. The demand for energy was inelastic. Thus, it causes a reduction in energy consumption as well as energy subsidy for the agricultural purpose. The study suggested to implement the energy policy to cover the benefit over its loss.

Salunkhe and Deshmush (2014) studied contribution of subsidies to the growth of agricultural sectors and its impacts on the agricultural sector in India viz., finance, production, technology, infrastructure and irrigation. It was mentioned that subsidies had some positive and negative effect on agricultural sector. In the last few years, agricultural production was increases with investment whereas percentage of GDP in the agricultural sector was decreases.

Grover *et al.* (2018) studied economics of important crops such as paddy, wheat, sugarcane, and maize. With primary data collected from 180 farmers and also recorded the crop wise input subsidy utilized by the sample farmers. Secondary data illustrated the input subsidy disbursed by Department of Agriculture and Department of Horticulture under various subsidy scheme such as NHMS and RKVY.

2.3 IMPACT OF INPUT SUBSIDIES ON AGRICULTURAL PRODUCTION

Spicka *et al.* (2009) examined the relationship between farmers' operating risk and extent subsidies in the Czech Republic. This study mainly focused on the cost and yield of two crops (winter wheat and rapeseed) and two livestock commodities/ activities (cow milk and fattening cattle) during the period 2005-07. It was found that subsidies were one of the complements to manage the risk in the future to reduce the variability of the income among farmers. The results of the study also indicated that the subsidies had an impact on the stability of the famer's income.

The fertilizer subsidy program was introduced in 2005 to provide all the three types of fertilizer, which resulted in financial liability of more than 40 billion rupees to the Government during 2008. It was found that the fertilizer subsidy to the paddy crop had significantly reduced the cost of production, but did not increase the yield. The organic manure use had increased the labor cost by 4 per cent and the yield increased by applying the combination of organic manure and fertilizer (Wijayasena and Thiruchelvam, 2009).

Awotide *et al.* (2011) conducted a study in Nigeria with data from 160 rice farmers to find the impact of Subsidized Certified Improved Rice Seed (SCIRS) on farming households' income. Primary data was collected from the beneficiaries and non- beneficiaries of SCIRS. The results revealed that the average income from rice production increased by 18.5 per cent and per capita household income increased by 2.3 per cent. It was suggested that timely availability of good quality seed could solve the rural poverty to some extent, in the country.

Bardhan and Mookherjee (2011) conducted a study to examine the delivery of subsidized seeds and fertilizer through agricultural mini kits by the local authority in West Bengal using a successive panel period between 1982 and1995. It was found that the mini kit delivered by the local government had a large impact on farm productivity, contributing 17 per cent in 1982-1985, 16 per cent in 1986-1990 and 8 per cent in 1991-1995 and it had no significant effects on cropping pattern, implying that the scheme was meant to raise the crop yield.

Chibwana *et al.* (2011) conducted a study in Kasungu and Machinga districts in central and southern Malawi to investigate the impacts of the Farm Input Subsidy Program (FISP) to influence the farmers for the cropland allocation. Using two-step regression strategy to control for endogenous selection into the program, the study found a positive correlation between farmers' involvement in the program and allocation of land to maize and tobacco. The results suggested that the participating households reduced cultivation by allocating less land to other crops such as groundnuts, soybeans, and dry beans. The findings of the study could be used for formulating policies for the promotion of both food self-sufficiency and crop diversification in low-income settings.

Garg *et al.* (2011) studied the distribution of fertilizer subsidies and its impact on the cost of cultivation of major crops in Punjab state. The study found that the share of fertilizer subsidy on paddy crop was found to be 35 per cent whereas wheat crop was 48 per cent. The removal of fertilizer subsidy had adverse effect on the profit of medium and large size farmers and caused a decline in agricultural production and productivity.

Osorio *et al.* (2011) studied the distribution of the benefits of fertilizer subsidies and their impact on rice production by using the Agricultural census data (2003) and the Rice Household Survey (2008) in Indonesia. This study showed that most of the farmers benefited from the fertilizer subsidies and nearly 40 per cent of the large size farmers were utilizing 60 per cent of the subsidy. It was also found that the use of fertilizer in sufficient quantity had a positive and significant impact on rice production and the excess utilization led to an adverse impact on rice yield.

Manafi *et al.* (2011) conducted a study with the objectives of identifying impacts of agricultural credit, subsidy and extension on dairy sector sustainability in Iran. The data were collected from 119 respondents and showed that 72 per cent of farmers had received subsidies to develop their dairy production. Around 97 per cent of farmers were connected with the extension facility, but only 45 per cent of them underwent training. The results suggested that the credit and subsidy to the dairy sector to reduce the poverty and also increase the income of the farmers from high milk yield led to attaining the sustainability in the dairy sector.

Ciaian *et al.* (2012) studied the impact of agricultural credit subsidies under the European Union's Common Agricultural Policy (CAP) on a bank loan. Secondary data was collected from the Farm Accountancy Data Network (FADN) from the panel year during 1995-2007. The impact of credit subsidies were found to be low in long term credit when compared with that of short term credit. The result also suggested that the use of subsidies by the large farm to increase long- term loans and a small farm to obtain short term loans and subsidies tends to crowd out short- term loans for large farms and long- term loans for small farms.

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Kaur and Sharma (2012) analyzed the electricity subsidy in Punjab during the 1996-97 to 2011-12 based on both primary and secondary data. The electricity subsidy has benefited the large farmers than the small and medium farmers because of more use of land, electric load, new model pump sets and use of more than one electricity connections. It was suggested to impose the flat rate on electricity supply to the agricultural purpose.

Semasinghe (2012) studied the effectiveness of fertilizer subsidy on paddy cultivation in Sri Lanka and found that there was a positive relationship between the fertilizer subsidy and average yield of paddy. Though the fertilizer subsidy had a positive effect, it also encouraged the farmers to use more fertilizer. In an economic point of view, the use of fertilizer was inefficient i.e., the fertilizer usage was more than the optimum level.

Shamsuddin *et al.* (2012; 2015) studied the impact of fertilizer subsidy on Malaysian Paddy/ Rice Industry by using the system dynamic model. The results showed that the fertilizer subsidy had a positive impact on both yields of the Malaysian paddy and rice industry. This study indicated that the removal of fertilizer subsidy would have a negative impact on rice production and make it unsustainable.

The share of fertilizer subsidy in total agricultural subsidies had increased from 37 per cent in 2003-04 to 560 per cent in 2010-11 during the 2003-04 to 2010-11. The removal of fertilizer subsidy will lead to non- profitable agricultural production, particularly for small and marginal farmers in many states. The study suggested that fertilizer subsidy should continue with better targeting and rationing to achieve the socio- economic objectives of national food security, poverty alleviation, farmers' welfare as well as subsidy reduction (Sharma, 2012)

A study by Thangam (2012) reported the impact of subsidies on Paddy and Banana production in Kanyakumari district of Tamil Nadu. It was found that the estimated regression was significant for the dummy variables in both rice and banana production. It concluded that the beneficiary farmers had utilized the input subsidies mainly to increase the production of paddy and banana in Kanyakumari district.

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Ekise *et al.* (2013) analyzed the impact of agricultural input subsidies on maize production of small scale producers in Kirehe district at Eastern Rwanda. The study found that the Government of Rwanda supplied the major inputs such as fertilizer, maize seeds at the subsidized rate (50 per cent) for maize cultivation under Agricultural Input Subsidies Programme (AISP) implemented in 2007. The results showed that the AISP programme had significantly increased the maize production from 280 kg to 1760 kg and income of the farmers from 39,215 Rwf. to 158,746 Rwf. Hence, it was concluded that the AISP had a major contribution to the maize production as well as the farmer's welfare.

The Government of Serbia had provided the input subsidies to field crops and vegetable production since 2007 mainly to increase the production and productivity of the crops. The study analyzed the effects of input subsidies on the economic position of production of major field crops (wheat, corn, sunflower, soybean, sugar beet) during 2007-2011. The input subsidies for the crop production was found to be stimulative to the farmers to use the optimum quantity of agricultural inputs such as mineral fertilizer and declared seeds etc. (Muncan and Bozic, 2013)

Zhong *et al.* (2013) studied the effectiveness of agricultural subsidies policies in Huangpi district in Wuhah, Hubai Province in China. The results showed that the agricultural subsidies increased the welfare of the farmers by increasing the agricultural income of the households but was not significantly increased agricultural production. The study suggested that objectives of each agricultural subsidy policies should likely to promote the agricultural production and should also to improve the standard of living of the farmers.

Chibwana (2014) measured the farm level impacts of Malawi's Farm Input Subsidy Programme (FISP) on fertilizer use and maize yield in central and southern Malawi. The result of instrumental variable regression using panel data revealed that statistically significant correlation between the participation in the FISP and fertilizer use intensity. The results for a linear- log production function for maize found that significantly positive correlation between the fertilizer used and maize yield, but diminishing return to fertilizer use.

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Hosseingholizadeh *et al.* (2014) studied the impact of government subsidy policies on maize production in Iran by using the panel data during the period 1999-2007. The production function was estimated with the input data information of chemical fertilizer, seeds, labor, water and pesticides and calculated the partial elasticity of inputs and found the effect of production change on the price of the inputs. The results revealed that the government subsidy to chemical fertilizer decreased the maize production by 0.412 per cent because of less demand elasticity of fertilizer whereas subsidy to seeds increases the production by 0.478 per cent.

A study by Kiratu *et al.* (2014) examined the perception of smallholder farmers towards a fertilizer and certified seed subsidy program in Nakuru North district of Kenya. The data was collected with 52 respondents with a structured questionnaire and analyzed using mean, median and mode. The results showed that the farmers having positive perception towards the *Kilimo Plus* program and it also had a positive effect on the use of fertilizer and certified seeds.

The input subsidies and farm technology are two major significant factors for agricultural development in India. The study dealt with the impact of input subsidies and farm technology on output supply, factor demand, agricultural price and farmer income using two major cereals wheat and maize for the analysis. The study revealed that farm technology was the most powerful instrument for neutralizing the price inflation and it also maintained the interest of the producer and consumer, but input subsidies had a weak influence on supply. Investment in irrigation, rural literacy, research and extension policies were the key to increase its supply at a higher growth rate. (Kumar and Joshi, 2014)

Chen *et al.* (2015) studied the agricultural subsidies viz. area subsidy and price subsidy by considering the two crops namely Chinese rice and cotton to find the effects with farmland constraints and demand elasticity. The study showed that subsidies had both stimulating and inhibiting effects *i.e.* subsidies has positive effects on increasing the total cultivated area of the crops selected and vice- versa for the other crops. Furthermore, the study showed that the output efficiency of farmland and demand elasticity had a significant impact on government subsidies.

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Howale *et al.* (2015) analyzed the awareness and utilization of government subsidies by the farmers in Kolhapur, Sangli, Satara, Pune and Solapur district of Western Maharashtra with pre- structured interview schedule with 300 respondents. The results showed that 73 per cent of farmers were aware of government subsidies but only 67 per cent of farmers were benefitted from the government subsidies.

Imoru and Ayamga (2015) conducted the study to examine the farm yield response to fertilizer subsidy among the maize farmers in the Northern region of Ghana and also accessing the fertilizer subsidy program. The study used the probit model to examine the factors that influenced the participation in the subsidy programme and use the Tobit model to examine the effect of participation on the fertilizer application rate. The results of both the models showed that farm size, subsidized fertilizer price, distance to input dealers, amount of credit borrowed and off-farm income were significant determinants of farmer's decision to participate in the subsidy program.

In order to increase the productivity of the agricultural sector and to improve food sufficiency, the Government of Ethiopia had constantly given the subsidy program and accorded prime importance to fertilizer subsidy. This study analyzed the impact of fertilizer subsidy on farmers' productivity by using two methodologies. First, using data envelopment analysis to find the efficiency score and latter using endogenous treatment- regression model to account for the potential endogeneity and self – selectivity issues. The result indicated that the fertilizer subsidy was a good programme to increase agricultural productivity and it was also associated with increased efficiency (Seck, 2016).

The use of electricity subsidy for irrigation doubled the food grains production and productivity in Punjab within 40 years and the country maintained the buffer stock of 45 per cent in wheat and 27 per cent in rice. The subsidies also encouraged the farmers to adopt modern technologies such as diesel or electric motor pump sets for irrigation to promote the Green revolution. The study analyzed the electricity subsidy, electricity consumption and public sector investment during 1990-91 to 2012-13 in Punjab and examined the changes in consumption pattern of electricity due to subsidy

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and also found the impact on the profitability of rice and wheat and also in public investment (Shoor, 2016).

Abadi (2017) reviewed the impact of targeting subsidy plan on the input use of the farmers in Iran. The study indicated that the input subsidies had an impact on the input use of the farmers, thus resulted in increasing the agricultural input prices so that, farmers should concentrate on the decision to use the resources effectively.

Keneri *et al.* (2017) analyzed the technical efficiency and technology gap ratio (TGR) in greenhouse cucumber in the year 2010-11 at Fars province, Iran. Frontier models were used for the analysis and the results showed that elimination of energy input subsidies leads to decline in production efficiency from 98 per cent to 67 per cent during 2010-11 and also declined on the technology gap ratio from 0.92 to 0.87.

Praveen *et al.* (2017) studied the impact of the Nutrient Based Subsidy schemes and nutrient use ratio in India. The main reason for the implementation of the Nutrient based subsidy scheme was to control the soil nutrient imbalance. The analysis indicated that inequity distribution of the subsidy across some crops and states, contrary to the unbiased degree of equity that existed in inter-class distribution. The study could help in suggesting the re-targeting of subsidies to the deserving crops, regions and farm categories.

Sisman (2017) considered an industry model to analyze the economic welfare of agricultural subsidies and inventory holdings by using equilibrium displacement modeling. The objectives of the study were to improve the welfare of the producers and reduce the government inventories. The analysis was done using the Monte Carlo Simulation model. The results indicated that there was an increase in price to the licensed producers and decreased market price to unlicensed producers at 5 per cent and 95 per cent confidence limit.

Agricultural subsidies were paid to the farmers and agribusiness by the government to increase their income and to influence the cost and supply of the agricultural commodities. The survey showed that nearly 54 per cent of wheat cultivators and 50 per cent of sugarcane cultivators who were poor were not getting the subsidies because of the inefficiency in the distribution system. In order to overcome this situation, the study suggested to frame rational policy for the non-beneficiary who were mostly small size category farmers. It could be achieved by implanting the various strategies like JAM trinity, investing in agriculture rather than subsidizing agriculture, direct transfer of subsidy to farmers, targeting and rationing of subsidies, step up domestic production capacity, effective extension services to promote balanced use of nutrients by farmers etc (Raja and Ramya, 2017).

A study by Venkatesh *et al.* (2017) about the benefits of agricultural input subsidies to farmers in South India suggested that the government should deliver information about the benefits of agricultural input subsidies among the farmers and made useful to them. They also recommended distribution of agricultural input subsidies to farmers either through Farmers Based Organization (FBO) or Direct Benefits Transfer (DBT) schemes.

Wijetunga and Saito (2017) analyzed the changes in fertilizer subsidy policy in Sri Lanka with a view to understand its impact on national rice production, demand/supply of inputs, farm profit and government budget. The results indicated that the fertilizer subsidy cut led to 4 per cent reduction in rice production, 36 per cent decline in fertilizer demand for paddy cultivation, 40 per cent reduction in farm profit Furthermore, fertilizer subsidy would make the government to spend 1.38 to 1.91 Sri Lankan Rupees (SLRs.) to increase farm profit by one rupee.

2.4 IMPACT OF INPUT SUBSIDIES ON THE ENVIRONMENT

The input subsidies has been accused of causing most harmful effect in terms of reduced public investment in agriculture on account of the erosion of investible resources, and wasteful use of scarce resources like water and power. Further, apart from causing unsustainable fiscal deficits, these subsidies by encouraging the intensive use of inputs in limited pockets have led to lowering the productivity of inputs, reducing employment elasticity of output through the substitution of capital for labour and environmental degradation such as lowering of water tables (Gulati and Narayanan, 2003).

Sami (2006) presented brief information on agricultural input subsidies and evaluated the negative effects of subsidies on environment. The negative effects of the agricultural input use such as water pollution, land pollution, air pollution, water

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logging and salinization and so on. The study suggested the reduction and removal of agricultural input subsidies through Government policies to improve the environment. But reducing agricultural input subsidies caused the reduction in output, thereby increasing the food imports and weaken the balance of payments by decreasing the export of the food products.

The removal of agricultural subsidies in the mid-1980s in New Zealand has led to effect on environment such as improving water quality, reducing methane emission and reduces the soil erosion. The other effects such as increase in allied sector activities such as dairy and deer sector, plantation of more forest trees, and effective utilization of fertilizer and pesticides were also found. The environmentally harmful effects of subsidies could make the improvement on policy reforms in wider international efforts (Vitalis, 2007).

Murthy and Raju (2009) conducted the study to identify inter - linkage between agriculture and electricity in Vijayaranagaram, Visakhapatnam and East Godavari district of Andhra Pradesh. The growth of agriculture has mainly based on the timely and adequate supply of irrigation water. The study showed that the groundwater irrigation was more important when compared with canal irrigation, so the farmers had the control over the utilization of groundwater for irrigation purpose. It was recommended to measures to bridge the gap between the energy requirement and its consumption for the optimum utilization of electrical energy.

Kannan (2013) conducted a survey in two states of Southern India viz., Karnataka and Tamil Nadu to study the farmer's perception of free supply of power to the agricultural purpose. The sample farmers followed different cropping pattern in which paddy, cotton, sugarcane and coconut had more area of using groundwater irrigation. Nearly 91 per cent and 58 per cent of sample farmers in Karnataka and Tamil Nadu had the right to use to groundwater resources. Majority of the farmers wanted the government to stop the free electricity supply because of the decline in water table due to the excess use of groundwater in the study area and the farmers were also willing to pay for its usage.

Electricity subsidy is one of the important component in the state budget and it gives the effect of increasing agricultural production and groundwater extraction. This has resulted in overutilization of groundwater and environmental degradation. The study found that the increasing subsidy percentage resulting in the negative gap between the revenue and cost in the power sector. The study suggested that electricity subsidies should be given only to those who were paying the regular tariff and only to potential beneficiaries (Bhargava, 2015).

2.5 CONSTRAINTS FACED BY FARMERS IN AVAILING THE INPUT SUBSIDIES

Gulati, (2007) reviewed the trends in Government subsidies and investment in and for Indian agriculture. The author suggested that to sustain long-term growth in agricultural production and therefore provide a long-term solution to poverty reduction, the Government should cut subsidies of fertilizer, irrigation, power and credit and increase investments in agricultural research and development, rural infrastructure and education.

Singh, (2013) studied the basic overview of the fertilizer sector and its challenges. The major challenging issue under the fertilizer sector included that the timely availability of fertilizer at an affordable price and fertilizer subsidy reduction without affecting the growth rate of fertilizer consumption. Other issues such as increasing the investment in domestic capacity with limited feedstock and raw material and maintaining the nutrient balance in the soil through appropriate price policy.

Swarnkar and Singh (2013) studied the gap between total electricity requirement and total electricity consumed in agriculture in the period of three years, namely 2001-02, 2006-07 and 2007-08 in Uttarakhand state. The suggested measures for the effective utilization of energy such as improving the quality of the power supply, providing electricity subsidies, improving irrigation techniques and providing timely credit.

SC/ ST farmers are an economically weaker category and get affected by the shortage of agricultural subsidies. The distribution of subsidy based on economic level

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and size of holdings brought the small and marginal farmers as a neglected section of the society. The fund for the agricultural subsidies was also lacking in case of poor farmers, so they were incapacitated to use the power subsidy for pump sets (Sivashankar and Uma, 2014)

Electricity subsidy for agriculture has contributed significantly high for the irrigation purpose which depends on groundwater supply. The power service was not properly utilized by the farmers which resulted in declining in groundwater level and agricultural productivity. The study also proposed a scheme which directly delivering the subsidy to farmers in cost-effective, transparent mechanism to reduce the inefficiencies in the existing system and also offer the minimum energy and better power supply to the farmers (Gulati and Pahuja, 2014).

The subsidy policies of the Republic of Moldova was different from the European Union, because of the detrimental factor such as lack of consistency of subsidy policies, insufficiency of necessary financial resources in the country. The subsidy policies were not clear to the farmers, so it may create difficulties for them to access. In this context, Golban and Gorgos (2016) analyzed the effectiveness of subsidy allocation on the beneficiaries and non-beneficiaries different horticultural enterprises during the period 2009-12. The result revealed that the average TFP (Total Factor Productivity) of the beneficiary enterprises were very low when compared with that of Non- beneficiary enterprises. It reflected the inefficiency of the subsidy policies in the country where there was a need for the improvement in the subsidy system.

Anand and Kaur (2017) conducted a survey with 180 farmers, 20 economists and 20 extension personnel to study the perception of the positive and negative impact of agricultural input subsidies in Punjab. This analysis was used to encourage the farmers to remain in this sector by resolving the existing different input subsidy policies and to enhance their socio-economic conditions than supporting their livelihoods.

Kanimozhi, (2017) studied the awareness and utilization of agricultural subsidies by the farmers in Palladam areas of Coimbatore district with 150

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respondents. The agricultural subsidies ware mainly intended to reduce the cost of production and promote the use of modern inputs. The results revealed that most of the respondents were more satisfied with the utilization of government agricultural subsidies. Most of the farmers were also facing the problems in getting the agricultural subsidies because of an ineffective source of information as well as complex procedure in availing the subsidies.

Liyun and Guanqiao (2017) measured the change in the production performance of rice in China before and after the implementation of direct grain subsidy policy in the panel year between 2002 and 2014 by using data envelopment analysis method. The results showed that the direct grain subsidy promoting the production performance of rice was declining over the year, because of series of problems such as improper resource allocation, redundancy in agricultural subsidy resulted to lower rice production.

Salunkhe (2017) found that subsidies had a positive impact on agricultural sector in Jalgaon district by reducing their cost of production. The major problem was that the farmers did not receive the subsidies on required time. The study suggested that the Government should provide the subsidies to the farmers on the correct time and each subsidy programme should be aimed to reduce the cost of production and raise the profit of farmers.

Anand and Kaur (2018) studied the awareness, satisfaction and problems of agricultural subsidies on the perception of farmers, extension personnel and economists in Punjab. The study showed that the level of satisfaction of beneficiaries' farmers were found to be low and they faced many problems in availing the subsidies such as lengthy documentation procedure, lesser quantity, sub- standard quantity of subsidized inputs, timeliness of subsidy and its misallocation. Lack of proper infrastructure, lack of staff, lack of funds and information facilities were the major problem found by the extension personnel in the disbursement of subsidies.

Materials and Methods

3. MATERIALS AND METHODS

Selection of apt methodology is essential to bring out a suitable result for a research study. Based on the review of literature given in the previous chapter an appropriate methodology was selected for each aspect of the study. This chapter discusses the methods of data collection, different statistical tools used for analysis of collected data and described under the following headings.

3.1 Description of the study area

3.2 Source of data

3.3 Method of data collection

3.4 Analytical Framework

3.5 Tools for analysis

3.1 DESCRIPTION OF THE STUDY AREA

A brief description of study area is most essential to understand the physical, economic and environmental condition in the selected area for the research work. In this view, different characters like topography, climate, soil types, land utilization pattern, land holding pattern, agriculture, demography, occupation and administrative set up are discussed in the following sub-sections.

3.1.1. Location

3.1.1.1 Kerala

Kerala is a state located on the southwestern Malabar Coast of India and is surrounded by Arabian Sea to the West, Karnataka to the North and Northeast, Tamil Nadu to the East and South. It is situated between 10.00^0 North latitude and 76.25^0 East longitude. Kerala receives heavy rainfall through southwest monsoon which prevails during June to September and it also receives the rainfall from northeast monsoon during October and December. The average rainfall received was 2,923 mm per annum with 120-140 rainy days per year. The average maximum daily temperature is around 37 ^{0}C and the minimum temperature is around 19.8^0C. The major crops cultivated in Kerala are paddy, pulses, pepper, ginger, turmeric, rubber, cardamom, arecanut, banana, coconut, coffee, tea and tapioca. There are 14 districts in Kerala. Among these, Kozhikode district has the highest area under coconut cultivation and hence was selected for the study. Political map of Kerala is given in Figure 1.

3.1.2 Kozhikode – topography

The district Kozhikode is bordered by Kannur to the North, Wayanad to the East, Malappuram to the South and Arabian Sea to the West. It lies between 11.08^0 and 11.50^0 North latitudes and between 75.30^0 and 76.8^0 East longitude. Kozhikode has 3 taluks such as Kozhikode, Vadakara and Koyilandy. The total area of the district is 2,345 km^2 which highland region accounts for 26.80 per cent and low land region accounts for 15.55 per cent of the district. Political map of Kozhikode is given in fig 2.

3.1.3 Climate and rainfall

The district has generally a humid climate with hot season from March to May and rainy season from first week of June to September during southwest monsoon and it also receive the rainfall from northeast monsoon from third week of October to November. The average minimum and maximum temperatures were 14^0C and 39.4^0C with the average rainfall is 3266 mm. The annual average precipitation was 3,284 mm for every year.

3.1.4 Soil types

The district has three types of soils such as alluvial soil, lateritic soil and forest loam soil. Alluvial soil is mostly seen in the coastal plains and valley. The major part of the district is covered by the lateritic soil except coastal strips where rich in sandy soil.

3.1.5 Land utilization pattern

The total geographical area of the district is 2,345 km^2. The gross cropped area contributes 85 per cent, net sown area contributes 63 per cent and area sown more than once contributes 22 per cent of the total geographical area in the district. Forest land occupies 17.63 per cent of the total geographical area (GOK, 2018).

3.1.6 Agriculture

Agriculture plays a major role in the districts' economy. The major crops grown in the districts are coconut, rice, banana, rubber, sugarcane, pepper, tapioca, arecanut, cashewnut and vegetables. The district has the largest area under coconut cultivation in the state which accounts for about 60 per cent of the total cropped area of the district.

3.1.7 Demography

According to the 2011 census, the population of the district was 30.86 lakhs which contributes 9.25 per cent of the total population of Kerala. Out of the total population, male and female population constitutes 47.7 per cent and 52.3 per cent, respectively. Sex ratio is 1,097 females for every 1,000 males. The population density is 1,316. The district has the average literacy rate of 95.36 per cent which is more than the national average of 74.85 per cent. The male average literacy rate is 97.57 per cent and female literacy rate is 93.16 per cent (GOK, 2018)

3.1.8 Occupation

Kozhikode district itself contributes 12 per cent to the gross state domestic product. Most of the people in the district depends on agriculture and it plays a major role in the district economy. In the coastal belts, large number of people are involved in fishing and shrimp farming and considered as their main occupation. The allied industries provide the employment to more than 5,000 people in the district.

3.1.9 Administration

The city of Kozhikode is the district headquarters itself. It comprises of 2 revenue divisions (Vadakara and Kozhikode), 3 taluks, (Kozhikode, Vadakara, and Koyilandy) and the taluks are subdivided into 12 block panchayats such as Kunnumal, Thuneri, Balussery, Perambra, Kunnamangalam, Thodannur, Koduvally, Meladi, Vadakara, Panthalayani, Chelannur and Kozhikode. The district also has total of 117 revenue villages.

3.2 SOURCE OF DATA

The study was conducted in Kozhikode district using both primary and secondary data. This district was purposively selected because it has the maximum area under coconut cultivation in Kerala. Two blocks in the district with maximum area under coconut cultivation namely Balussery and Koduvelly were selected purposively (GOK, 2017). From each of the selected blocks, two panchayats Balussery and Kattipara were selected purposively as they had maximum area under coconut. These panchayats were also having the Coconut Development Scheme "Keragramam" being implemented by the Department of Agriculture Development and Farmers' Welfare, Government of Kerala during the survey period 2018-19 for the integrated management of coconut garden.

3.2.1 Primary Data

For primary data collection, the list of small and large coconut growers were collected from the respective Krishi Bhavans. From the selected 2 village panchayats, 20 each of small and large farmers were selected randomly, making a total sample size of 80 (figure 3).

The small farmers who own less than or equal to 2 hectares (5 acres) of land are the beneficiaries of input subsidy scheme "Keragramam" along with general agricultural subsidies such as electricity and credit. The large farmers who own more than 2 hectares (5 acres) of land are the non- beneficiaries of input subsidy scheme "Keragramam" but they were availing the general agricultural subsidies i.e., electricity and credit. The farmers those who received the subsidies from "Keragramam" scheme are not eligible for "Replanting and Rejuvenation" scheme from Coconut Development Board, Government of India. The basic details about the selected panchayats are described below.

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Fig 2. Political map of Kozhikode district

Fig 1. Political map of Kerala state

3.2.1.1. Balussery

Balussery is the small developing block in Kozhikode district with the total area of 278.54 km^2. It is located between 11.45^0 North latitudes and 75.83^0 East longitude with an average elevation of 42 mts. The total population of the block is 2,12,592 as per 2011 census. The block have eight grama panchayat such as Atholi, Balussery, Kottur, Koorachundu, Panangad, Naduvannur, Unnikulam and Ulliyeri.

3.2.4.2. Koduvally

Koduvally is also known as the golden city. It gives its name to the Koduvally river which flows west into the sea. The population of Koduvally is 2,91,622 as per 2011 census. It consists of seven village panchayats namely Kozhakkoth, Madavoor, Omaseery, Kattipara, Narikkuni, Koduvally and Thamarassery. The literacy rate of Koduvelly block is 83 per cent.

3.2.2 Sampling frame

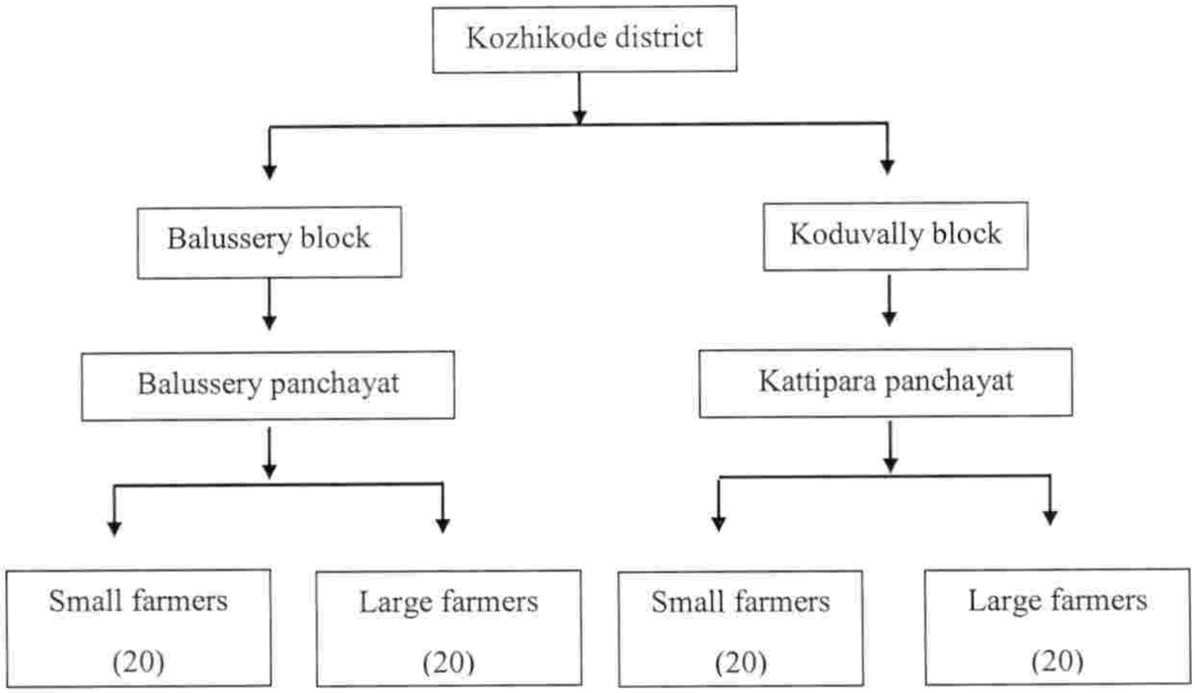

Figure 3. Sampling frame work for the study

3.2.3 Secondary Data

Secondary data included physical and financial achievements of subsidy schemes implemented by the Department of Agriculture Development and Farmers' Welfare, GOK and Coconut Development Board (CDB), GOI. These data were collected from the Principal Agricultural Office (PAO), Kozhikode and the annual reports of CDB, Cochin. Electricity consumption and subsidy data for Kozhikode district were collected from the Kerala State Electricity Board (KSEB), Trivandrum. Data on the consumption of fertilizer were collected from the website of Mobile Fertilizer Management System (mFMS.nic.in) and various nutrient based subsidy were collected from the websites of Fertilizer Association of India (FAI). Agency wise credit flow to agriculture were compiled from the reports of District credit plan of Canara Bank (Lead bank), Kozhikode district and Potential linked credit plan of NABARD, Malappuram and Kozhikode district.

3.3 METHODS OF DATA COLLECTION

Primary data were collected from the coconut growers by using a pretested structured interview schedule. The survey was conducted during February 2019 to March 2019. The information related to annual maintenance cost of coconut cultivation, yield details of coconut farming and different input subsidies received from different institution such as Department of Agriculture, CDB, KSEB and Banking institution were collected.

3.4 ANALYTICAL FRAMEWORK

The data pertaining to the study were collected under the following headings and anlaysed using various tools.

3.4.1 Socio economic status of the farmers

Socio- economic characteristics of the farmers such as sex, age, education, occupation, farming experience and annual income were collected and categorized into various group.

3.4.2 Quantity of inputs

Quantity of inputs such as quantity of fertilizers, bio fertilizers, organic manures, soil ameliorants and plant protection chemicals were collected and used for the analysis of resource use efficiency.

3.4.3 Cost of inputs

3.4.3.1 Cost of seedlings

The seedlings used for the coconut cultivation were purchased from the local nurseries at the prevailing market price.

3.4.3.2 Cost of manures and fertilizers

This includes cost of organic manure and chemical fertilizers purchased by the farmers from the local dealers. Imputed value were used for valuing the manures produced in farmer's field.

3.4.3.3 Cost of soil ameliorants

Soil ameliorant used for the coconut cultivation is lime or dolomite. The purchase price of lime or dolomite were also used for the analysis of cost of inputs.

3.4.3.4 Cost of plant protection chemical

The different pesticides, fungicides and insecticides were used by the farmers in order to reduce the risk from pest and diseases. The cost of these inputs are valued at their market price. No respondent in the study area used any plant protection chemical for coconut farming, hence the cost of plant protection chemical were not included in the study.

3.4.3.4 Cost of machinery and implements

The implements such as pump set for irrigation, weed cutter for weeding and climbing machine for harvesting were used for coconut farming. The cost incurred for purchase of these implements were evaluated at the market price.

3.4.4 Cost of labour

3.4.4.1 Cost of family labour

The cost incurred for family members involved in farming operation were evaluated at the wage rate paid to the hired labour in that locality.

3.4.4.2 Cost of hired labour

It is the actual wage rate that is paid to the hired labour for their work done in the farm. The wage rate for men in that locality was in the range between ₹ 700 – 800 and for women is ₹ 450 - 550.

3.4.4.3 Cost of machine labour

The maintenance cost of pumpset such as cost incurred for fuel or power, repair and other expenses used were included for the analysis. Some farmers made use of hired machine for doing the intercultural operation such as weeding. The cost incurred for hired machine labour was ₹ 250 per hour which was the rent paid for the machine involved in weeding operation. Climbing machine was also used for harvesting of coconut and the cost for harvesting a single palm in that locality was ₹ 30-35.

3.4.5 Land Revenue

The farmers have to pay the tax to revenue department for the land they possess. The actual rate paid by them was ₹ 200 per acre per year in that locality.

3.4.6 Interest on working capital

Farmers avail the short term loan from the banks to pay for the working capital especially for the annual maintenance of coconut cultivation. The banking institution provided the short term credit to the farmers at the rate of 7 per cent. Hence, the interest on working capital can be worked out with 7 per cent per annum.

3.4.7 Interest on fixed capital

Fixed capital refers to the values of the assets and equipment except land. The farmers borrow long term loan from the banking institution at the rate of 11 per cent per annum. So, the interest on fixed capital can be worked out with 11 per cent per annum.

3.4.8 Rental value of leased in land

The rent for the leased in land is given as per the number of palms under the land area. The lending rate for the single palm is ₹ 200 per palm per year in that locality.

3.4.9 Rental value of owned land

It is actually the rental value of land prevailed in that locality.

3.4.10 Depreciation

Depreciation means declining in the value of the asset over the period of time, due to the wear and tear. Annual depreciation on individual items of fixed capital can be worked out by using straight line method and then aggregated to get the total annual depreciation.

$$Amount\ of\ depreciation = \frac{(Original\ cost\ of\ the\ asset - Junk\ value)}{Useful\ life\ of\ the\ asset}$$

(Reddy *et al.*, 2016)

3.4.11 Miscellaneous expenses

This included the expenses incurred for cutting and removing of damaged or disease affected palms, post- harvest operation and transportation charge to market.

3.4.12 Quantity of outputs

Quantity of coconut is given as kg/ha.

3.5 TOOLS FOR ANALYSIS

Statistical tools are employed for the analysis of collected data to get the meaningful conclusions. Different tools used in the present study are given below:

3.5.1 Compound Annual Growth Rate (CAGR)

It was used for the analysis of secondary data to measure the growth of different agricultural input subsidies for coconut cultivation in Kozhikode district. The exponential trend growth rate was calculated by using this following formula:

$$Y = ab^t e_t$$ (Gujarati *et al.*, 2012)

The estimated form of the equation is

$$\ln Y_t = \ln a + t \ln b + \varepsilon$$

where,

Y = growth rate in the different input subsidies

a = intercept

b = regression coefficient

t = time variable

ε = error term

3.5.2 Percentage and Average

Socio- economic characteristics of the respondents such as age, education, gender, family size, income, land holdings and cropping pattern can be examined by using percentage and averages.

Percentage analysis was also used to know about perception of farmers on the impact of input subsidies on environment.

3.5.3 Annual maintenance cost

Annual maintenance cost of coconut farming can be worked out by the sum total of the various inputs cost used in the production activity. Cost of cultivation of coconut for the year 2018-19 was worked out by using cost concepts.

3.5.3.1 Cost concepts

Cost A_1 includes

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1. Cost of hired labour
2. Cost of machine labour
3. Cost of manures and fertilizers
4. Cost of soil ameliorants
5. Land revenue
6. Depreciation on machineries and implements
7. Interest on working capital
8. Miscellaneous expenses

Cost A_2: Cost A_1 + Rental value of leased in land

Cost B: Cost A_2 + Interest on the fixed capital excluding land + rental value of owned land

Cost C: Cost B + Imputed value of family labour (Raju and Rao, 2015)

3.5.4 Returns

3.5.4.1 Gross return

It can be worked out as the product of total quantity of coconut per year with the unit price. The market price of coconut during the study period ranged between ₹ 30-35 per kg.

3.5.4.2 Net return

Net return was worked out by deducting the annual maintenance cost from the gross return.

3.5.5 Benefit- cost ratio

It is the ratio between gross return and total annual expenses incurred for the coconut farming.

3.5.6 Resource use efficiency

Cobb- Douglas production function was used to determine how efficiently the farmers were allocating their scarce resources in the production process. This production function gives the relationship between the output and various inputs used in the coconut cultivation. To evaluate the factors that influence the coconut production, the Ordinary Least Square (OLS) method was used by taking yield as dependent variable and different resources as independent variables. The function was fitted separately for small and large farmers.

The Cobb- Douglas production function is given by:

$$Y = aX_1^{b1}X_2^{b2}X_3^{b3}X_4^{b4}X_5^{b5}e^{u_i} \qquad \text{(Gujarati } et\ al.\text{, 2012)}$$

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

$$\ln Y = \ln a + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 + b_5 \ln X_5 + u_i$$

Where,

Y = Yield of coconut (kg)	a = Intercept
X_1 = Quantity of hired labour (man days)	b_1 = Regression coefficient of hired labour
X_2 = Quantity of family labour (man days)	b_2 = Regression coefficient of family labour
X_3 = Quantity of manures and fertilizers (kg)	b_3 = Regression coefficient of manures and fertilizers
X_4 = Quantity of soil ameliorants (kg)	b_4 = Regression coefficient of soil ameliorants
X_5 = Quantity of machine power (hours)	b_5 = Regression coefficient of machine labour
e = base of natural logarithm	u = stochastic disturbance term

3.5.7 Estimation of Marginal Products (MP) and Marginal Value Products (MVP)

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

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

$$MP = b_i \times \frac{\bar{Y}}{\bar{X}_i}$$

Where

$\bar{Y}$ = Geometric mean of output

$\bar{X}_i$= Geometric mean of i^{th} independent variable

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

MVP can be calculated by using the formula

$$MVP = P_y \times MP_i$$

Where P_y= Price of coconuts (₹/kg)

The efficiency can be judged using following criteria or this is based on k values ($MVP_i/MFC_i = k_i$). k_i value refers to the ratio of marginal variable cost and marginal factor cost.

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

3.5.8 Chow test

Chow test was done to estimate the significant difference between the regression coefficients of small and large farmers. It can be performed by using the F test.

$$F^* = \frac{[\sum e_p^2 - (\sum e_1^2 + \sum e_2^2)]/K}{(\sum e_1^2 + \sum e_2^2)/(n_1 + n_2 - 2K)}$$

Where,

$\sum e_p^2$ = Sum of square of error term of pooled regression function of small and large farmers with $(n_1 + n_2 - 2K)$ degrees of freedom

$\sum e_1^2$= Sum of square of error term of regression function of small farmers with $(n_1 - K)$ degrees of freedom

$\sum e_2^2$= Sum of square of error term of regression function of large farmers with $(n_2 - K)$ degrees of freedom

n_1= Number of small farmers

n_2= Number of large farmers

K = Number of regression coefficients including constant

The null hypothesis assumed is that there is no significant difference between the coefficients of two groups tested against the alternate hypothesis that two groups differ significantly. Compare the observed F^* with the theoretical value of $F_{0.05}$ with $v_1 = K$ and $v_2 = (n_1 + n_2 - 2K)$ degrees of freedom. If $F^* > F_{0.05}$, we reject null hypothesis otherwise accept null hypothesis. (Chow, 1960)

3.5.9 Impact of input subsidies for coconut production

To study the impact of different input subsidies for coconut production, the ordinary least square regression (OLS) model was used. This was carried out by keeping yield as a dependent variable and different amount of subsidy as independent variable. The functional form of regression is as follows.

$$Y = f(X_1, X_2, X_3, X_4)$$

The above function can be modified as log- log model,

$$\log Y = b_o + b_1 \log X_1 + b_2 \log X_2 + b_3 \log X_3 + b_4 \log x_4 + u$$

Where

Y = Yield (kg)

a = Intercept

X_1= Amount of subsidies on organic manures (₹)

b_1 = Regression coefficient of organic manures subsidy

X_2= Amount of subsidies on soil ameliorants (₹)

b_2 = Regression coefficient of soil ameliorants subsidy

X_3= Amount of credit subsidy (₹)

b_3 = Regression coefficient of credit subsidy

X_4= Amount of electricity subsidy (₹)

b_4 = Regression coefficient of electricity subsidy

u = Error term

3.5.10 Constraint analysis- Garrett's Ranking Technique

Garrett's ranking techniques were adopted to identify the constraints faced by the farmers in availing input subsidies. The respondents were asked to rank the different aspects of constraints in availing input subsidies and the ranks were converted into percent position by using the following formula.

$$Percent\ position = \frac{100\ (R_{ij} - 0.5)}{N_j}$$

Where R_{ij} = Rank given for i^{th} constraint by j^{th} farmer.

N_j = Number of constraints ranked by the j^{th} farmer (Garrett, 1969)

The per cent position of each rank was converted to the Garrett score. The score of the individual respondent for each constraints were added. The sum value of scores and the mean values of score is calculated. The mean score for all the constraints were arranged in ascending order and the constraints having highest mean value is considered to be the most important constraints.

Results and Discussion

4. RESULTS AND DISCUSSION

In the previous chapter, we discussed the review of previous studies, the description of the study area and the methodology used to analyze the data. The data collected for the study was aimed to draw meaningful conclusions based on the objectives. Primary and secondary data were analyzed separately with different statistical tools and the results are presented in this chapter under the following sections.

4.1 Growth of different input subsidies for coconut cultivation

4.2 Socio- economic status of respondents

4.3 Economics of coconut cultivation

4.4 Resource use efficiency

4.5 Input subsidies in coconut cultivation

4.6 Impact of input subsidies on coconut production

4.7 Impact of agricultural input subsidies on environment

4.8 Constraints faced by the farmers in availing agricultural input subsidies

4.1 GROWTH OF DIFFERENT INPUT SUBSIDIES FOR COCONUT CULTIVATION

4.1.1 Basic information about input subsidies for coconut cultivation

In Kerala, at present both central and state governments are providing the subsidies on different inputs such as fertilizers, electricity, implements and credit to farmers for the development of coconut cultivation. Out of the different input subsidies, the Department of Agriculture Development and Farmers' Welfare, Government of Kerala is providing subsidy directly to the farmers on different components such as intercultural operations, soil ameliorants, fertilizers, irrigation components, climbing machine, cut and removal of old palms and replanting with new seedlings and intercropping in coconut gardens. The central government provides indirect subsidy to farmers on the purchase of fertilizers since 1977 (Sharma and Thaker, 2009). In addition, commercial banks, co-operative societies and regional rural banks are also providing credit to the farmers for agricultural purposes below the market rate of interest under the Interest Subvention scheme since 2006-07 (NABARD, 2018-19).

4.1.2 Subsidies from the Department of Agriculture Development and Farmers' Welfare

4.1.2.1 Coconut Development Scheme

In 2018-19, the Coconut Development Scheme "*Keragramam*" was implemented in 79 panchayats in Kerala to provide physical and financial assistance directly to the farmers. Out of 79 Keragramams, Kozhikode district itself covers 12 Keragramams of the state. The scheme "Keragramam" comprises of various components. The eligibility criterian for farmers to obtain these subsidies was that they should have land holdings of less than or equal to 5 acres. The rate of subsidies on each component during 2018-19 are given in table 2.

Table 2. Rate of subsidies on each components under Keragramam scheme (2018-19)

S. No.	Component	Rate of subsidy
1	Integrated management of coconut garden	
a	Intercultural operation- opening of coconut basins, weeding, mulching etc.	50 per cent subsidy @ ₹ 35/palm
b	Coconut husk burial for moisture conservation	50 per cent subsidy @ ₹ 50/palm
c	Application of soil ameliorants (Lime/Dolomite)	75 per cent subsidy @ ₹ 9/palm/kg
d	Application of fertilizer	50 per cent subsidy @ ₹ 20/ palm
e	Application of magnesium sulphate	50 per cent subsidy @ ₹ 3.75/ palm

f	Application of organic manure	50 per cent subsidy @ ₹ 25/palm
g	Application of plant protection chemicals	50 per cent subsidy @ ₹ 10/palm
h	Application of bio-fertilizer/ bio-pesticides and bio-control agents.	50 per cent subsidy @ ₹ 25/ palm and ₹ 50/palm as labour charge
i	Cut and removal of disease affected old and senile palms	₹ 1,000/palm limited to ₹ 10,000/ha
j	Replanting with good quality coconut seedlings	50 per cent subsidy limited to ₹ 60/seedling for 7 palms/ha
k	Intercropping in coconut garden	50 per cent subsidy @ ₹ 6,000/ha
2	Installation of irrigation components including micro irrigation	50 per cent subsidy limited to ₹ 25,000/ha @ 20 ha/ Keragramam
3	Coconut climbing equipment	₹ 2,000/unit @ 61 units/ Keragramam
4	Establishment of organic manure production units	₹ 10,000/ units @ 8 units/ Keragramam

Source: Government of Kerala, 2018-19.

4.1.2.2 Progress of Coconut Development Schemes in Kozhikode district during 2010-19

The Coconut Development Scheme was implemented in the year 2005-06 and the scheme "Keragramam" was introduced under the coconut development scheme from 2014-15. In order to understand the progress of coconut development scheme and Keragramam scheme in Kozhikode district, the annual growth rate was calculated for the number of clusters, area under single cluster, total area covered and total amount spent under the scheme from 2010 to 2019. The results are presented in table 3.

It was observed that the number of clusters before the introduction of Keragramam was more when compared with after the introduction of the scheme. CAGR of the total area covered under the scheme during 2010-19 was found to be increasing with 1.50 per cent per annum. In case of total expenditure of the scheme, an increasing trend of 9.92 per cent per annum was observed and the maximum expenditure was incurred in the year 2018-19.

CAGR was also calculated separately for both Coconut Development Scheme (2010-14) and Keragramam (2015-19). CAGR on the total area covered was found to be in increasing trend both in coconut development scheme as well as Keragramam and it was about 5.78 and 23.48 per cent per annum, respectively. The maximum area achieved under the scheme was reported in the year 2018-19 (2558.46 ha). In case of total expenditure of the scheme, an increasing trend of 11.75 per cent per annum under Coconut Development scheme which is low when compared with that of Keragramam scheme (14.66 per cent per annum). The maximum expenditure was incurred in the year 2018-2019 (₹ 545.48 lakhs).

The average value of number of cluster in coconut development scheme (60) was found to be more than the Keragramam (5.4). In case of average area under each cluster, it was found to be large for Keragramam (400 ha) when compared with that of coconut development scheme (25 ha). The total area achieved was more for the coconut development scheme with the average of 1,585 ha and the total expenditure was found to be comparatively more for Keragramam with the average of ₹ 380.07 lakhs.

Table 3. Progress of coconut development scheme and Keragramam in Kozhikode district during 2010-19

Year	Number of clusters/ Keragramams	Area under single cluster (ha)	Total area achieved under the scheme (ha)	Total expenditure of the scheme (₹ lakhs)
Coconut Development Scheme				
2009-10	40	25	1,000	174.99
2010-11	80	25	2,000	202.09
2011-12	80	25	2,000	349.93
2012-13	50	25	1,250	218.70
2013-14	50	25	1,675	293.12
Average	60	25	1,585	247.78
CAGR (2010-14)	-	-	5.78	11.75
Keragramam				
2014-15	4	500	752	246.49
2015-16	3	500	1,528	426.29
2016-17	3	500	1,469.5	340.10
2017-18	5	250	1,088	341.96
2018-19	12	250	2,558.46	545.48
Average	5.4	400	1,479.19	380.07
CAGR (2015-19)	-	-	23.48	14.66
CAGR (Entire period)	-	-	1.50	9.92

Source: Records from Principal Agricultural Office, Kozhikode district, 2019

Table 4 provides the component wise physical and financial growth of Keragramam scheme. The different components under the Keragramam scheme were integrated management of coconut garden, installation of irrigation components, coconut climbing equipment, organic manure production units and establishment of coconut nurseries. The physical and financial growth of integrated management of coconut garden was observed to be 23.48 and 13.72 per cent per annum, respectively. The maximum area covered and maximum expenditure for this component was achieved in the year 2018-19. In case of installation of irrigation components, CAGR for number of irrigation components was having a decreasing trend with the negative growth rate of -6.05 per cent per annum and the rate of growth for financial expenditure was 20.55 per cent per annum. The number of coconut climbing equipment was found to be increasing over the years with the positive growth rate of 29.43 per cent per annum and the growth rate for the expenditure spent on the climbing equipment was 23.80 per cent per annum. The number of organic manure production units was also found to be increasing with a growth rate of 18.58 per cent per annum and 8.71 per cent for the financial expenditure. In the year 2018-19, the establishment of coconut nurseries was not achieved and the physical and financial growth rate during 2015-18 was found to be 23.11 and 23.11 per cent per annum.

A similar results were also found in a study done by Grover *et al.* (2018) on different subsidy schemes of Directorate of Agriculture and Directorate of Horticulture, Government of Punjab during 2003-15.

Table 4. Component wise progress of Keragramam scheme in Kozhikode district during 2015-19

Year	Intergrated management of coconut garden		Installation of irrigation components		Coconut climbing equipment		Organic manure production units		Establishment of coconut nurseries	
	Physical (ha)	Financial (₹ lakh)	Physical (Nos.)	Financial (₹ lakh)	Physical (Nos.)	Financial (₹ lakh)	Physical (Nos.)	Financial (₹ lakh)	Physical (Nos.)	Financial (₹ lakh)
2014-15	752	219.11	301	19.09	197	3.94	14	1.40	1	0.5
2015-16	1528	363.44	85	18.32	425	8.5	24	2.4	2	1
2016-17	1,469.50	288.71	103	25.35	282	5.64	14	1.26	2	1
2017-18	1088	272.23	119	29.94	581	11.62	17	1.68	2	1
2018-19	2,558.46	481.50	186	38.01	612	9.8	39	2.54	-	-
CAGR (per cent per year)	23.48	13.72	-6.05	20.55	29.43	23.80	18.58	8.71	23.11	23.11

Source: Records from Principal Agricultural Office, Kozhikode district, 2019.

4.1.3 Subsidies from Coconut Development Board (CDB)

The scheme "Replanting and Rejuvenation" was implemented by the CDB in Kozhikode district through the State Department of Agriculture from 2017-18 onwards. Before 2017-18, the scheme was implemented by CDB through Coconut Producer Companies (CPC). The main objective of the scheme was to enhance the production and productivity of coconut by the cut and removal of disease advanced, old, senile and unproductive palms and replanting with good quality seedlings. It also includes rejuvenation of the existing coconut gardens. Under this scheme, the subsidies were given directly to the farmers for each component. Table 5 shows the performance of each component under replanting and rejuvenation schemes for 2018 and 2019. The physical and financial achievement of the scheme was 586.91 ha and ₹ 109.14 lakhs in 2017-18 and 138.45 ha and ₹ 18.75 lakhs in 2018-19, respectively. The physical and financial achievement in the year 2018-19 was found to be less when compared with last year (2017-18).

Table 5. Progress of Replanting and Rejuvenation scheme (CDB) in Kozhikode district during 2017-19

S.No.	Components	2017-18		2018-19	
		Physical (ha)	Financial (₹ lakhs)	Physical (ha)	Financial (₹ lakhs)
1	Cutting & removal of disease advanced, old, senile and unproductive palms	260.16	83.25	62.15	13.97
2	Assistance for replanting	63.70	2.87	26.99	1.08
3	Rejuvenation of the existing coconut palms	263.05	23.02	49.31	3.70
	Total	586.91	109.14	138.45	18.75

Source: Records from Principal Agricultural Office, Kozhikode district, 2019.

4.1.4 Subsidies from Kerala State Electricity Board (KSEB)

Electricity is one of the major inputs in agricultural activities. Kerala Electricity Regulatory Commission (KERC) introduced a new tariff order on electricity supplied for agricultural purpose in 2012-13. The electricity connection used for major activities such as pumping, dewatering and lift irrigation for the cultivation of different crops. The fixed charges for low tension (LT) was ₹ 8 per kW and the energy charges was ₹ 2 per kWh under the new tariff system in the year 2017-18. Electricity subsidy was not paid directly to the individual consumers. The state government directly compensate the concerned KSEBs to supply electricity at a lower rate to the farmers than that of other consumers.

The growth of electricity subsidy in Kozhikode district can be clearly understood by calculating the CAGR for the period of 2013-18. Kozhikode district has two circles *viz.*, Kozhikode circle and Vadakara circle. Kozhikode circle has three subdivisions namely Kozhikode, Feroke and Balussery whereas Vadakara circle has Vadakara and Nadapuram subdivisions. The results of the growth rate of circle wise electricity consumed for agricultural purpose and the electricity subsidy receivable from the state government are presented in table 6.

The electricity consumed for agriculture in Kozhikode district has increased from 2.79 MU in 2012-13 to 3.61 MU in 2017-18. CAGR of electricity consumption at Kozhikode district was found to have an increasing trend with 4.35 per cent per annum during 2013-18. The growth rate of electricity consumed separately in Kozhikode and Vadakara circles were 6.35 and -0.91 per cent per annum, respectively.

The growth rate of amount of electricity subsidy was found to have decreasing trend in Kozhikode circle with -1.68 per cent per annum and increased trend in Vadakara circle with 4.83 per cent per annum. The maximum amount of electricity subsidy was found in the year 2013-14 (₹ 16,78,364). The growth rate of total amount of electricity subsidy during 2013-18 in Kozhikode district was found to be 0.48 per cent per annum.

Table 6. Consumption of electricity and electricity subsidy for agricultural purpose in Kozhikode district during 2013-18

Year	Agricultural consumption (MU)		Agri. consumption in Kozhikode (MU)	Amount of electricity subsidy (₹)		Total amount of electricity subsidy (₹)
	Kozhikode circle	Vadakara circle		Kozhikode circle	Vadakara circle	
2012-13	1.96	0.82	2.79	8,66,439	3,57,297	12,23,736
2013-14	2.22	0.85	3.07	10,88,529	5,89,835	16,78,364
2014-15	2.28	0.86	3.14	9,70,219	5,48,186	15,18,406
2015-16	2.16	0.76	2.93	7,25,636	4,71,715	11,97,351
2016-17	2.59	0.78	3.36	9,56,378	5,51,930	15,08,308
2017-18	2.78	0.83	3.61	8,81,608	5,33,227	14,14,835
CAGR (per cent per year)	6.35	-0.91	4.35	-1.68	4.83	0.48

Note: MU- Million units

Source: Kerala State Electricity Board, Trivandrum, 2018.

Similar results were observed in the studies conducted by Thangam (2012) and Bhargava (2015). The amount of subsidies in Kanyakumari district of Tamil Nadu was found to be 12.98 crores in 2001, which was increased upto 27.20 crores in 2010.

4.1.5 Agricultural credit subsidy in Kozhikode district

Credit is the most important component for the growth of agricultural production. Institutional credit sources such as Co-operative bank, Commercial banks and Regional Rural Banks (RRB) provide crop loans to agricultural sector. Since 2006-07, the Government of India decided to provide the short term credit by the different institutions at 7 per cent rate of interest with an upper limit of ₹ 3 lakh. The rate of interest subvention was 2 per cent in the year 2007-08 and it has continued in subsequent years with certain modifications. During 2009-10, Government of India introduced additional incentive of 1 per cent for the farmers who promptly repay the loans on or before the due date or the date fixed by the bank, subject to a maximum period of one year.

Table 7 shows the agency wise flow of agricultural credit (crop loan and term loan) in Kozhikode district from the year 2007-08 to 2017-18. The amount of agricultural credit has increased over the years with a growth rate of 22.23 per cent per annum for commercial banks, 9.21 per cent per annum for co-operative banks and 11.94 per cent per annum for regional rural banks. As the data on credit subsidy was not available directly from the bank, it was obtained by multiplying the total agricultural credit flow of each institution with interest rate subvention in each year. So, the results of agency wise amount of agricultural credit subsidy in Kozhikode district are presented in table 8.

The growth rate of agricultural credit subsidy by the total banking sector from 2008-18 was 14.15 per cent per annum whereas the CAGR for commercial banks was 21.07 per cent, 8.18 per cent for cooperative banks and 10.88 per cent for regional rural banks. The annual growth rate of credit subsidies for cooperative banks was lower than that of the commercial banks and regional rural banks.

Table 7. Amount of agricultural credit (crop loan + term loan) disbursed in Kozhikode district (₹ lakhs) during 2008-18- Agency wise

Year	Commercial banks (₹ lakhs)	Cooperative banks (₹ lakhs)	RRBs (₹ lakhs)	Total (₹ lakhs)
2007-08	46,341	48,816	46,307	1,41,464
2008-09	40,705	66,084	50,442	1,57,231
2009-10	57,781	69,374	68,393	1,95,549
2010-11	91,522	71,867	51,811	2,15,199
2011-12	1,59,266	1,05,163	46,038	3,10,467
2012-13	1,46,798	91,150	54,408	2,92,355
2013-14	1,86,175	98,989	68,963	3,54,127
2014-15	2,11,983	1,54,056	1,01,032	4,67,071
2015-16	2,32,735	2,03,022	97,404	5,33,160
2016-17	2,18,113	72,693	1,24,439	4,15,245
2017-18	3,00,489	1,23,103	1,53,685	5,77,277
CAGR (per cent per year)	22.23	9.21	11.94	15.24

Source:

1. Reports of District Credit Plan Report, Canara bank, Kozhikode district, 2008-18
2. Reports of Potential Linked Credit Plan report, NABARD, Malappuram district, 2008-18

Table 8. Amount of agricultural credit subsidy in Kozhikode district (₹ lakhs) during 2008-18 - Agency wise

Year	Rate of interest subvention (per cent per annum)	Commercial banks (₹ lakhs)	Co-operative banks (₹ lakhs)	Regional Rural Banks (₹ lakhs)	Total (₹ lakhs)
2007-08	2	927 (32.76)	976 (34.51)	926 (32.73)	2,829 (100)
2008-09	3	1,221 (25.89)	1,983 (42.03)	1,513 (32.08)	4,717 (100)
2009-10	2	1,156 (29.55)	1,387 (35.48)	1,369 (34.96)	3,911 (100)
2010-11	1.5	1,373 (42.53)	1,077 (33.40)	777 (24.08)	3,228 (100)
2011-12	2	3,185 (51.30)	2,103 (33.87)	921 (14.83)	6,209 (100)
2012-13	2	2,936 (50.21)	1,822 (31.18)	1,088 (18.61)	5,847 (100)
2013-14	2	3,724 (52.57)	1,980 (27.95)	1,379 (19.47)	7,083 (100)
2014-15	2	4,240 (45.36)	3,081 (32.98)	2,021 (21.63)	9,341 (100)
2015-16	2	4,655 (43.66)	4,060 (38.09)	1,948 (18.27)	10,663 (100)
2016-17	2	4,362 (52.53)	1,454 (17.51)	2,489 (29.97)	8,305 (100)
2017-18	2	6,010 (52.05)	2,462 (21.32)	3,074 (26.62)	11,546 (100)
CAGR (per cent per year)		21.07	8.18	10.88	14.15

Note: Calculated by the author

Number in parentheses indicate percentage to total

4.1.6 Fertilizer subsidy in Kozhikode district

Since, the data on district wise fertilizer subsidy was not directly available, an indirect method was used to compute the district level fertilizer subsidy. In order to compute the amount of fertilizer subsidy in Kozhikode district, the rate of subsidy (₹/ tonne) for different fertilizers at all India level was multiplied with the fertilizer consumption (in MT) in the district. Major fertilizers consumed in Kozhikode district were Urea, DAP, MOP, NPKs (complex fertilizer) and SSP. The data on different fertilizers consumed in Kozhikode district from 2013-19 is presented in table 9.

The growth rate of different fertilizers consumed such as urea, MOP and complex NPK fertilizers were found to have negative values of -2.39, -1.53 and -10.29 per cent per annum, respectively whereas growth rate of DAP and SSP fertilizer were 7.88 and 29.07 per cent per annum during 2014-18. The total fertilizer consumed in Kozhikode district was 13,079 MT in 2013-14, 24,297 MT in 2014-15, 12,411 MT in 2015-16, 12,487 MT in 2016-17, 15,247 MT in 2017-18 and 529 MT in 2018-19. CAGR of total fertilizer consumption in the district was calculated as -3.53 per cent per annum. During 2017-18, Direct Benefit Transfer (DBT) project was introduced to improve the fertilizer service delivery to the farmers and the sale of fertilizer was done by retailers only through PoS devices. Data on fertilizer consumption in 2018-19 were recorded on the website only through the PoS device transaction. The sale of fertilizer was also happened separately other than PoS device, but was not recorded on the websites. So, data on 2018-19 was not included while calculating CAGR.

The amount of fertilizer subsidy in Kozhikode district from 2014-19 is presented in table 10. The per cent share of different fertilizer subsidies in the total amount of fertilizer subsidy are also given in table 10. The share of subsidy on complex fertilizer was more (40.26 per cent) in 2013-14, followed by urea (38.75 per cent), DAP (10.73 per cent). From 2014-15 onwards, the share of subsidy on urea was increased, followed by complex fertilizers, DAP and MOP. CAGR of the amount of different fertilizer subsidy was -6.81 for urea, -1.13 for DAP, -0.79 for MOP, -16.69 for complex fertilizer and 16.01 for SSP. The growth rate of total fertilizer subsidies in Kozhikode district was found to be negative, -8.80 per cent per annum.

Thangam (2012) computed that the growth rate of amount of fertilizer subsidy and it was found to be have an increasing trend from ₹ 791.27 crores in 2001 to ₹ 3,434.27 crores in 2010.

Table 9. Fertilizer consumption in Kozhikode district during 2014-19 (in MT)

Year	Urea (MT)	DAP (MT)	MOP (MT)	Complex (MT)	SSP (MT)	Total (MT)
2013-14	3,968 (30.34)	883 (6.75)	3,895 (29.78)	4,301 (32.88)	32 (0.24)	13,079 (100)
2014-15	5,922 (24.37)	3,799 (15.64)	9,927 (40.85)	4,648 (19.13)	0	24,297 (100)
2015-16	3,807 (30.67)	1,643 (13.24)	3,717 (29.95)	3,223 (25.97)	22 (0.07)	12,411 (100)
2016-17	3,743 (29.97)	1,896 (15.18)	4,077 (32.65)	2,737 (21.92)	34 (0.27)	12,487 (100)
2017-18	4,426 (29.03)	1,826 (11.98)	5,626 (36.90)	3,257 (21.36)	111 (0.73)	15,247 (100)
2018-19*	186 (35.09)	1 (0.19)	201 (37.89)	142 (26.83)	0	529 (100)
CAGR (per cent per year)	-2.38	7.88	-1.53	-10.29	29.07	-3.53

Source: Mobile Fertilizer Management System (www.mFMS.nic.in)

Note: Numbers in parentheses show the percentage share to total

*Fertilizer consumption only through PoS device

Table 10. Amount of fertilizer subsidy in Kozhikode district during 2014-19 (₹)

Year	Urea* (₹)	DAP*(₹)	MOP* (₹)	NPKs* (₹)	SSP* (₹)	Total (₹)
2013-14	3,81,05,601 (38.75)	1,05,53,433 (10.73)	99,75,640 (10.15)	3,95,85,292 (40.26)	1,01,536 (0.10)	9,83,21,502 (100)
2014-15	5,68,67,926 (31.52)	4,54,17,536 (25.17)	3,53,32,560 (19.59)	4,27,84,164 (23.72)	0	18,04,02,188 (100)
2015-16	3,65,54,221 (38.36)	2,02,86,728 (21.29)	1,52,76,645 (16.03)	2,31,03,554 (24.24)	69,806 (0.07)	9,52,90,954 (100)
2016-17	2,72,95,642 (33.46)	1,69,57,484 (20.79)	1,75,96,352 (21.57)	1,96,46,303 (24.08)	79,662 (0.10)	8,15,75,443 (100)
2017-18	3,86,56,914 (41.91)	1,63,19,409 (17.69)	1,35,80,334 (14.72)	2,34,38,764 (25.41)	2,40,859 (0.26)	9,22,36,280 (100)
2018-19	16,14,561 (59.12)	10,402 (0.38)	6,674 (0.24)	10,99,107 (40.25)	0	27,30,744 (100)
CAGR (per cent per year)	-6.81	-1.13	-0.79	-16.69	16.01	-8.80

*Computed by the author

Note: Numbers in parentheses show the percentage share to total

4.2 SOCIO ECONOMIC CHARACTERISTICS OF SAMPLE FARMERS

The primary data were obtained from 80 coconut growers and were divided into two categories as small and large farmers. Small farmers who take advantage of input subsidies have been considered as beneficiaries of Keragramam scheme and large farmers who are the non- beneficiaries of Keragramam. The primary socio-economic characteristics such as age, sex, education, family size, occupation and family income were tabulated and analyzed with percentage analysis. The results of the analysis are presented below.

4.2.1 Age

The distribution of respondents on the basis of age was classified into five groups such as less than 30, 31-40, 41-50, 51-60 and over 61 years of age and presented in table 11. The average age of small farmers was 56.23 years and for large farmers was 55.7 years. The average age of total respondents was 55.96 years. Up to 35 per cent of small farmers fell in the age group of between 51 and 60, followed by 32.50 per cent of small farmers under the age group of more than 61. In the case of large farmers, 40 per cent of respondents in the age group between 51 and 60 were followed by respondents in the age group from 41 to 50 (35 per cent).

Table 11. Distribution of respondents based on age

Particular	Below 30	31 – 40	41 – 50	51 – 60	Above 61	Total	Mean age
Small farmers	1 (2.50)	-	12 (30)	14 (35)	13 (32.5)	40 (100)	56.23
Large farmers	-	1 (2.50)	14 (35)	16 (40)	9 (22.50)	40 (100)	55.7
Total	1 (1.25)	1 (1.25)	26 (32.50)	30 (37.50)	22 (27.50)	80 (100)	55.96

Note: Figures in parentheses indicate percentage to total.

In a study by Vinodhini and Deshmukh (2017) on coconut growers, majority of the coconut growers were in the middle age group and the average age of the respondents was found as 52.82 years.

4.2.2 Gender

The gender distribution of respondents is presented in table 12. It was found that 68 respondents were male and made up about 85 per cent and the remaining 12 respondents were female around 15 per cent. In the case of small farmers, 33 of the respondents were male and constitute about 82.50 per cent while only 7 were female (17.50 per cent). In the case of large farmers, 35 farmers were male (87.50) and 5 female (12.50).

Table 12. Distribution of respondents based on gender

Gender	Small farmers	Large farmers	Overall
Male	33 (82.50)	35 (87.50)	68 (85)
Female	7 (17.50)	5 (12.50)	12 (15)
Total	40 (100)	40 (100)	80 (100)

Note: Figures in parentheses indicate percentage to total.

4.2.3 Education

The educational level of the farmers and the adoption of modern cultivation practices are known to be positively related. The educational status of the respondents is classified into four categories, such as no-formal education, lower and upper primary education, high school and higher secondary education and graduation. The results are presented in table 13. In the case of small farmers, 52.50 per cent of respondents completed high school education and 32.50 per cent were graduated. In the case of large farmers, 60 per cent of respondents completed high school education, followed by 27.50 per cent graduates. Finally, it was evident that almost 45 respondents completed high school education, 24 were graduates and 11 respondents completed only lower and upper primary education.

Table 13. Distribution of respondents based on educational status

Educational status	Small farmers	Large farmers	Overall
No formal education	-	-	-
Lower and upper primary	6 (15)	5 (12.50)	11 (13.75)
High school and higher secondary	21 (52.50)	24 (60)	45 (56.25)
Graduation	13 (32.50)	11 (27.50)	24 (30)
Total	40 (100)	40 (100)	80 (100)

Note: Figures in parentheses indicate percentage to total.

4.2.4 Family size

Farming is labour intensive and hence involvement of family labour is significant. The distribution of selected farmers based on family size is presented in table 14. The family size was classified into three categories i.e., less than four members, four to six members and more than six members. Nearly 65 respondents were in the medium-sized category with 4-6 members in their family representing about 81.25 per cent. In the case of small farmers, 72.50 per cent of farmers were in the medium-sized category, while in large farmers, 90 per cent belong to the medium-sized group. The average family size of the respondents was 5.

Table 14. Distribution of respondents based on family size

Size of the family	Small farmers	Large farmers	Overall
Small (<4)	2 (5)	3 (7.50)	5 (6.25)
Medium (4-6)	29 (72.50)	36 (90)	65 (81.25)
Large (>6)	9 (22.50)	1 (2.50)	10 (12.50)
Total	40 (100)	40 (100)	80 (100)
Average size	5.4	4.75	5.08

Note: Figures in parentheses indicate percentage to total.

A similar results reported by Vinodhini and Deshmukh (2017) also revealed that most of the coconut growers had a family size between 4 and 6.

4.2.5 Occupation

The occupational status of the respondents is classified into two: agriculture as the main occupation and the other that considered agriculture as a secondary source of income. The results are presented in table 15. Considering the total number of respondents, almost 85 per cent depent on agriculture as the main source of income and the remaining 15 per cent was considered agriculture as a secondary source. They were doing their own business, government teacher, engineer, postmaster, lawyer, etc. Nearly 35 small farmers and 33 large farmers were considered agriculture as a major occupation.

Table 15. Distribution of respondents based on occupational status

Particular	Small farmers	Large farmers	Total
Agriculture as a main	35 (87.50)	33 (82.50)	68 (85)
Agriculture as subsidiary	5 (12.50)	7 (17.50)	12 (15)
Total	40 (100)	40 (100)	80 (100)

Note: Figures in parentheses indicate percentage to total.

4.2.6 Annual gross income

The total annual gross income of respondents was calculated as the aggregation of income from agriculture and also from other source. The results of the distribution of farmers based on annual gross income are presented in table 16. The annual gross income of the farmers has been classified into five categories such as less than ₹ 1 lakh, ₹ 1 to 2 lakh, ₹ 2 to 4 lakh, ₹ 4 to 6 lakh and above ₹ 6 lakh. Almost 33 per cent of small farmers belong to the category of ₹ 1 lakh to 2 lakh followed by the category of less than ₹ 1 lakh (30 per cent). In case of large farmers, 50 per cent of large farmers belong to the category of ₹ 2 lakh to ₹ 4 lakh annual gross income followed by the category of ₹ 4 lakh to 6 lakh (22.50). It was understood that the income of the large farmers was relatively more when compared to that of small farmers. The average annual gross income of the small farmers was found to be ₹ 2,48,725 and that of the large farmers was ₹ 3,96,875. The average annual gross income of the respondents was ₹ 3,22,800.

Table 16. Distribution of respondents based on annual gross income

Annual gross income (₹/year)	Small farmers	Large farmers	Total
< 1,00,000	12 (30)	0 (0)	12 (15)
1,00,000- 2,00,000	13 (32.50)	5 (12.50)	19 (23.75)
2,00,000- 4,00,000	8 (20)	20 (50)	28 (35)
4,00,000- 6,00,000	3 (7.50)	9 (22.50)	11 (13.75)
> 6,00,000	4 (10)	6 (15)	10 (12.50)
Total	40 (100)	40 (100)	80 (100)
Average	2,48,725	3,96,875	3,22,800

Note: Figures in parentheses indicate percentage to total.

4.2.7 Experience in farming

Based on experience in farming, farmers were classified into five categories, less than 20 years, 21 to 30 years, 31 to 40 years, 41 to 50 years and more than 50 years. The results are presented in table 17. In case of small farmers, almost 35 per cent of farmers had experience between 21 and 30 years followed by farmers had experience less than 20 years (30 per cent). Most of the large farmers were in the category of 21 to 30 years of experience (37.5 per cent) followed by the category of less than 20 years (27.50). Both small and large farmers have a similar range of experience in farming. It was found that the average farming experience was similar in case of both small and large farmers i.e., 30 years and 31 years, respectively. The average farming experience of respondents was 30.37 years.

Table 17. Distribution of respondents based on experience in farming

Experience (years)	Small farmers	Large farmers	Total
Less than 20	12 (30)	11 (27.50)	23 (28.75)
21-30	14 (35)	15 (37.5)	29 (36.25)
31-40	9 (22.50)	8 (20)	17 (21.25)
41-50	3 (7.50)	5 (12.5)	8 (10)
More than 50	2 (5)	1 (2.5)	3 (3.75)
Total	40 (100)	40 (100)	80 (100)
Average	30.25	30.50	30.37

Note: Figures in parentheses indicate percentage to total.

4.2.8 Details of coconut cultivation

Most of the selected respondents cultivated coconut in their own land, either as a single crop or as a mixed with other crop such as arecanut, nutmeg, cocoa, banana, pepper and vegetables. They were mostly cultivating the local variety with spacing of 7.5×7.5 m. Only a very few number of farmers have started growing T×D hybrids which come to bear in three years. They put manures and fertilizer once in a year and frequency of harvest is four to six times a year. Traditionally, majority of the farmers were cultivating coconut under rainfed condition. Only few of the farmers having irrigation system and well, that are connected with electric pumpset or some with micro irrigation (Drip irrigation). The major problems faced by the farmers were shortage of labour for basin opening, weeding and harvesting of coconut. The other problem faced by the farmers was low yield of the crop because of less productive, old and senile palms.

4.2.9 Land holding

The respondents were classified as small and large farmers based on the total land holding pattern. The land holding size of the small farmers was less than or equal to 5 acres (≤ 2 ha) and large farmers had more than five acres (> 2 ha). It was found that the average farm size was 2.86 acres for small farmers and 6.72 acres for large farmers (Table 18). The result also showed that the average size of the land holdings was 4.79 acres.

Table 18. Distribution of respondents based on land holding

Size of land holding (acres)	Total number of farmers	Average size of holding (acres)
Small farmers (≤ 5 acres)	40 (50)	2.86
Large farmers (> 5 acres)	40 (50)	6.72
Total	80 (100)	4.79

Note: Figures in parentheses indicate percentage to total.

4.2.10 Area under coconut cultivation

As the farmers in the study area were growing different crops in separate or in the same piece of land as intercrop. The area under coconut cultivation of the respondents were distributed under six categories as less than 2 acre, 2.1-4 acres, 4.1-5 acres, 5.1- 6 acres, 6.1-8 acres and more than 8 acres. The results are presented in table 19. Majority of the small farmers belongs to the category of less than 2 acres (47.50 per cent), followed by the category of 2.1 - 4 acres (37.50). In case of large farmers, almost 32.50 per cent corresponds to 4.1 - 5 acres, followed by 5.1 - 6 acres (27.50 per cent) and 6.1 – 8 acres (17.50 per cent). From this, we can understood that some of the large farmers were cultivating various crops as separate sole crops. The average area of coconut was found to be 2.47 acres for small farmers and 5.61 acres for large farmers. The average area under the coconut cultivation was found to be 4.04 acres.

Table 19. Distribution of respondents based on area under coconut cultivation

Area (acres)	Small farmers	Large farmers	Total
< 2	19 (47.50)	1 (2.50)	20 (25)
2.1- 4	15 (37.50)	6 (15)	21 (26.25)
4.1- 5	6 (15)	13 (32.50)	19 (23.75)
5.1-6	-	11 (27.50)	11 (13.75)
6.1- 8	-	7 (17.50)	7 (8.75)
>8	-	2 (5)	2 (2.5)
Total	40 (100)	40 (100)	80 (100)
Average	2.49	5.61	4.04

Note: Figures in parentheses indicate percentage to total.

4.2.11 Cropping pattern

Table 20 shows the type of multiple cropping followed in coconut garden. Arecanut + banana, banana + arecanut, pepper + arecanut, pepper + banana + arecanut, banana + arecanut + cocoa/nutmeg + vegetable, pepper + arecanut + cocoa/nutmeg + vegetables were grown as multiple crop along with coconut. Arecanut was the major intercrop along with coconut plantation which was grown by 25 per cent of the respondents, followed by banana to the extent of 21.50 per cent and followed by Banana+ Arecanut multiple crop of 15 per cent.

4.2.12 Mode of irrigation

Table 21 represents the area under various modes of irrigation for coconut farming. The mode of irrigation for coconut in the study area were well irrigation connected with pumpset, bore well and micro irrigation. The total area of the selected respondents was 323.74 acres, in which 99.47 acres were occupied by small farmers and 224.27 acres by large farmers. Nearly 73.80 and 80.44 per cent of the area of small and large farmers, respectively were under rainfed cultivation. 78.40 per cent of total area were under the rainfed condition, followed by well irrigation with pumpset (10.72 per cent) and well with micro irrigation (9.64 per cent). Only 1.24 per cent of the total area were under the bore well irrigation condition

Table 20. Distribution of respondents based on cropping pattern

Cropping pattern	Small farmers	Large farmers	Total
Arecanut	8 (20)	12 (30)	20 (25)
Banana	11 (27.5)	6 (15)	17 (21.5)
Banana + Arecanut	5 (12.5)	7 (17.5)	12 (15)
Pepper + Banana	6 (15)	2 (5)	8 (10)
Pepper + Banana + Arecanut	3 (7.5)	1 (2.5)	4 (5)
Banana + Arecanut + Cocoa/Nutmeg + Vegetable	1 (2.5)	5 (12.5)	6 (7.5)
Pepper + Arecanut + Cocoa/Nutmeg + Vegetables	6 (15)	7 (17.5)	13 (16.25)

Note: Figures in parentheses indicate percentage to total.

Table 21. Area under various modes of irrigation for coconut farming

S. No.	Mode of irrigation	Area under irrigation (acres)		
		Small farmer	Large farmer	Total area
1	Rainfed	73.41 (73.80)	180.4 (80.44)	253.81 (78.40)
2	Well irrigation with pumpset	14.56 (14.64)	20.16 (8.99)	34.72 (10.72)
3	Borewell with pumpset	4 (4.02)	0	4 (1.24)
4	Well with Micro irrigation	7.5 (7.54)	23.71 (10.57)	31.21 (9.64)
	Total	99.47 (100)	224.27 (100)	323.74 (100)

Note: Figures in parentheses indicate percentage to total.

4.3 ECONOMICS OF COCONUT CULTIVATION

Economics of coconut cultivation is used to compare the relative performance of small and large farmers and it is also important in making proper decision in farming. The cost of cultivation refers to the total expenses incurred by the farmer per unit area. Annual maintenance cost of coconut cultivation per hectare was calculated separately for small and large farmers using cost concepts and the results are presented in tables 22 and 23, respectively.

4.3.1 Annual maintenance cost of coconut cultivation

The total cost of cultivation of small farmers at cost C was found to be ₹ 1,23,462 ha^{-1}. Cost A_1 of the small farmers was ₹ 81,295 ha^{-1}, of which cost of machine power contributed highest of about 30.16 per cent, which includes the weeding, climbing machine used for harvesting and maintenance cost of pumpset. It was followed by manures and fertilizers which contributed to 24.81 per cent, hired labour (16.87 per cent) and miscellaneous expenses (13.42 per cent) of cost A_1. Interest on working capital, depreciation on machinery and implements and cost of soil ameliorants shared about 6.08, 4.21 and 3.82 per cent of cost A_1, respectively. The land revenue were very meagre which was 0.62 per cent. The pictorial representation of cost A_1 of the small farmers is given in figure 4. As none of the small farmers had leased in land, the rental value of leased in land was found to be zero. Hence cost A_2 was same as Cost A_1 of ₹ 81,295 ha^{-1}. Cost B was found to be ₹ 1,17,965 ha^{-1}. The results are presented in table 22.

The annual maintenance cost of cultivation for large farmers is presented in table 23. Cost A_1, Cost A_2, Cost B and Cost C (total cost of cultivation) were 72,223, 72,479, 1,03,687 and ₹ 1,06,897 ha^{-1}, respectively. Out of cost A_1, cost of machine power contributed to 30.69 per cent, followed by manures and fertilizers (22.53 per cent) and hired labour (18.43 per cent). The miscellaneous expenses, interest on working capital, and cost of soil ameliorants contributed to 15.23, 5.60 and 4.28 per cent, respectively. The rest was shared by depreciation (2.56 per cent) and land revenue (0.69 per cent). The rental value of leased in land for large farmers was found to be ₹ 256.39 ha^{-1}. The share of different costs in cost A_1 is shown in figure 5.

Cost A_1, Cost A_2, Cost B and Cost C were larger for small farmers when compared with that of large farmers. The cost of hired labour and family labour was found to be more for small farmers. The cost of manures, fertilizers and soil ameliorants were found to be more for small farmers when compared with that of large farmers. Machine power was contributing highest share in the cost of cultivation of both small and large farmers which includes the cost for weeding, climbing machine used for harvesting and annual maintenance cost of pumpset. This shows that both small and large farmers incurred high amount for cost of harvesting operation. The miscellaneous cost included the cost incurred for post- harvest operations, transportation cost and cut and removal of old and disease affected palms. The miscellaneous expenses of small farmers was ₹ 10,906 ha^{-1} and that of large farmers was ₹ 11,002 ha^{-1}. It was found to be more, which increased the total cost of cultivation. The comparison of cost A_1, cost A_2, cost B and cost C of small and large farmers are presented in figure 6.

A similar results by Government of Kerala (2017) were in conformity with the present study stating cost C of coconut for the large farmers (₹ 2,93,068 ha^{-1}) was more when compared with that of small farmers (₹ 4,04,019 ha^{-1}) and medium farmers (₹ 5,03,268 ha^{-1}).

Table 22. Annual maintenance cost of coconut cultivation for small farmers

S. No.	Item	Cost (₹/ha)	Percentage to cost A_1
1	Hired labour	13,718	16.87
2	Machine power	24,518	30.16
3	Manures and fertilizers	20,172	24.81
4	Soil ameliorants	3,108	3.82
5	Land revenue	506.43	0.62
6	Depreciation	3,423	4.21
7	Interest on working capital	4,944	6.08
8	Miscellaneous expenses	10,906	13.42
	Cost A_1	81,295	100.00
9	Rental value of leased in land	0	
	Cost A_2	81,295	
10	Interest on owned fixed capital excluding land	6,772	
11	Rental value of owned land	29,898	
	Cost B	1,17,966	
12	Imputed value of family labour	5,497	
	Cost C	1,23,462	

Table 23. Annual maintenance cost of coconut cultivation for large farmers

S. No.	Item	Cost (₹/ha)	Percentage to cost A_1
1	Hired labour	13,308	18.43
2	Machine power	22,164	30.69
3	Manures and fertilizers	16,271	22.53
4	Soil ameliorants	3,089	4.28
5	Land revenue	500	0.69
6	Depreciation	1,845	2.56
7	Interest on working capital	4,045	5.60
8	Miscellaneous expenses	11,002	15.23
	Cost A_1	72,223	100.00
9	Rental value of leased in land	256	
	Cost A_2	72,479	
10	Interest on owned fixed capital excluding land	3,317	
11	Rental value of owned land	27,890	
	Cost B	1,03,687	
12	Imputed value of family labour	3,210	
	Cost C	1,06,897	

Figure 4. Per cent share of components at Cost A_1 of small farmers

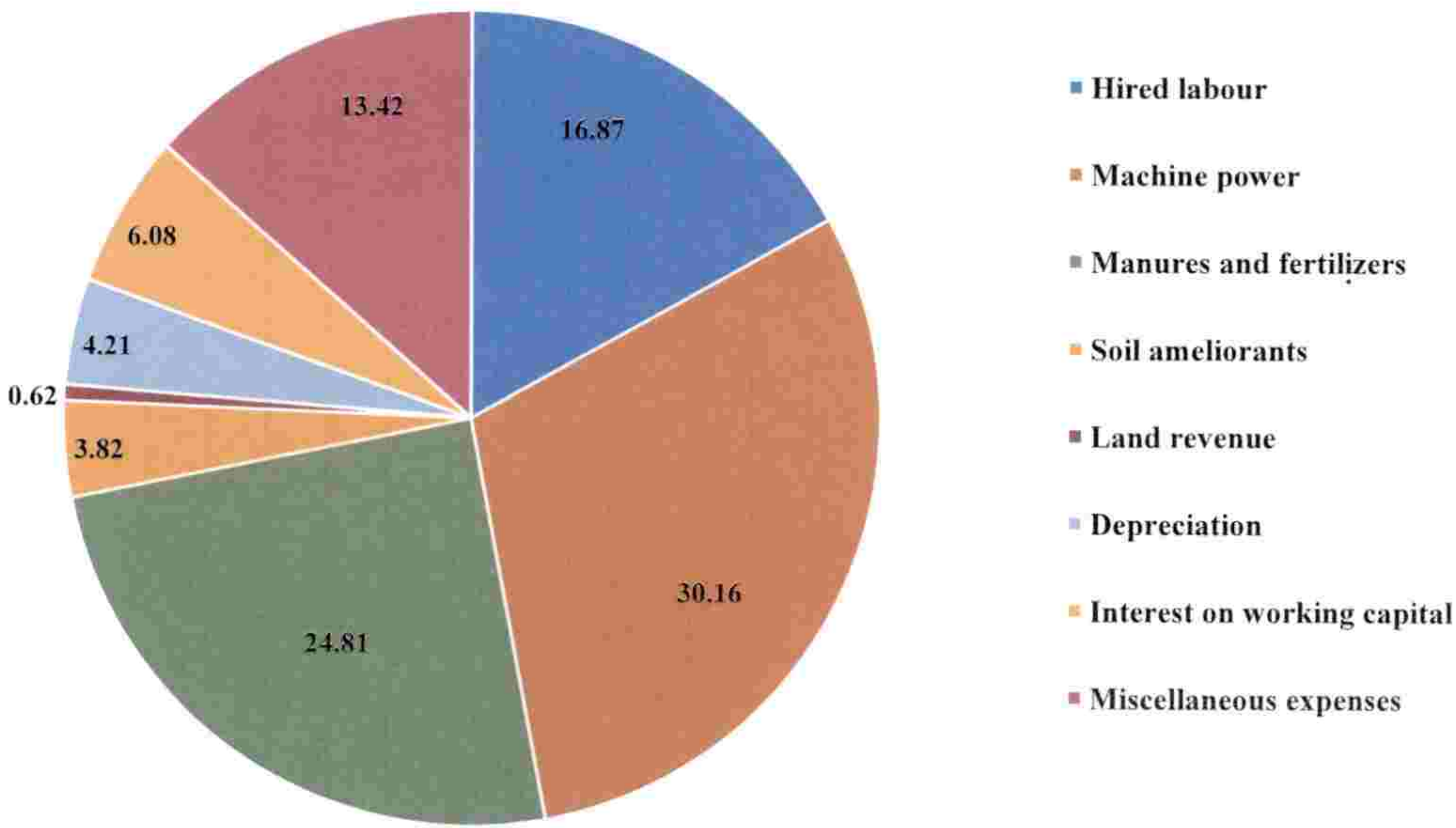


Figure 5. Per cent share of components at Cost A_1 of large farmers

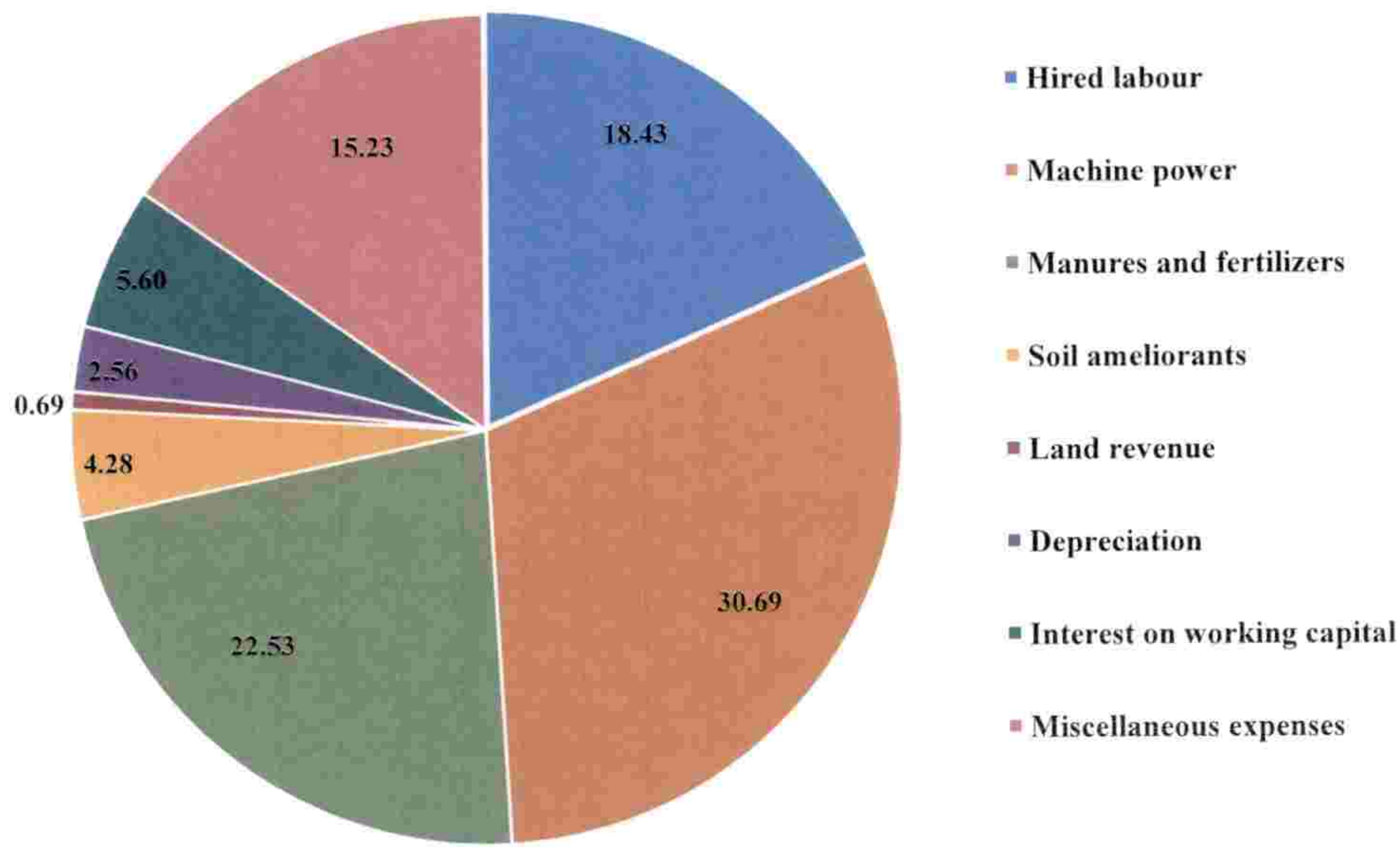
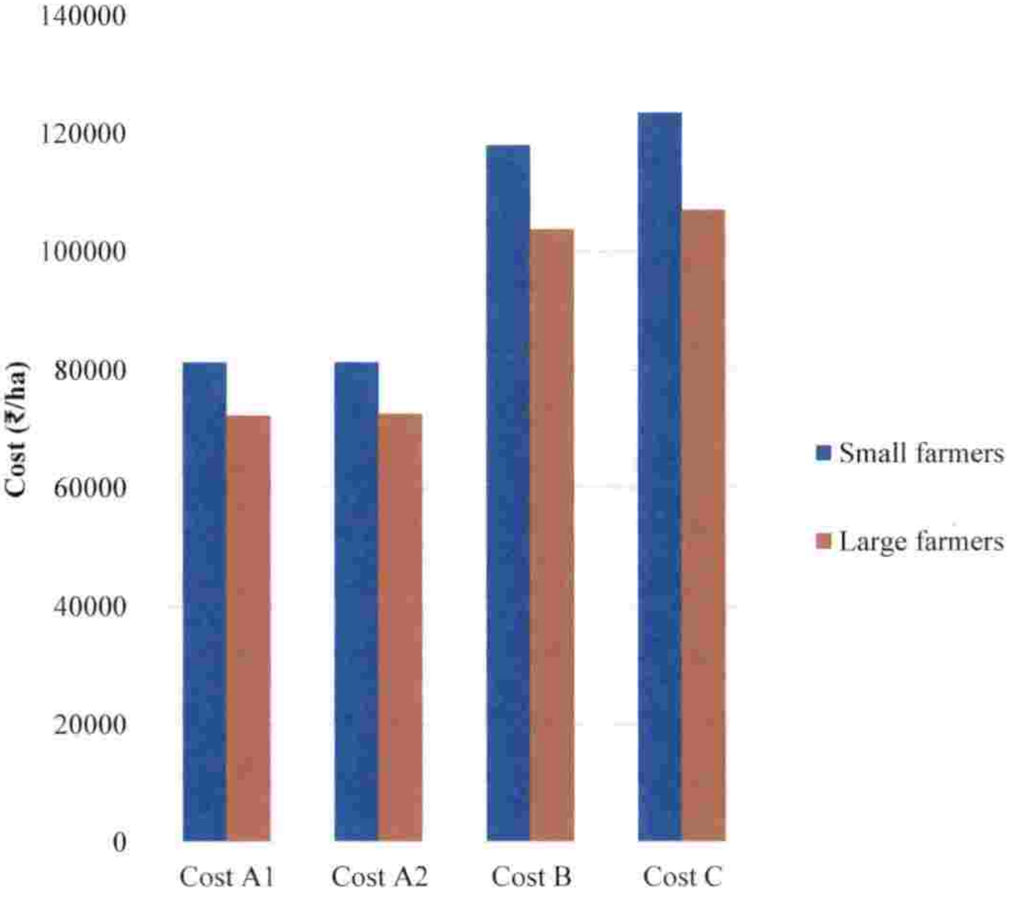


Figure 6. Comparison of costs of small farmers and large farmers



4.3.2 Returns from coconut cultivation

The average weight of a single nut after removing the husk from the coconut was 0.45 kg. The yield obtained by the small farmers was 9,359 nuts ha^{-1} or 4,211 kg ha^{-1}. In the case of large farmers, the yield obtained was 9,276 nuts ha^{-1} or 4,174 kg ha^{-1}. The average price of coconut during February and March 2019 was ₹ 34 per kg for small farmers and ₹ 35 per kg for large farmers.

The gross returns of ₹ 1,44,304 ha^{-1} was obtained by small farmers. The net returns at cost A_1 and cost A_2 were found to have same (₹ 63,009 ha^{-1}), since the rental value of leased in land was zero for the small farmers. The net return at cost B and cost C were ₹ 26,338 ha^{-1} and ₹ 20,842 ha^{-1}, respectively.

In case of large farmers, the gross returns obtained was ₹ 1,45,119 ha^{-1} and net returns at cost A_1, cost A_2, cost B and cost C were 72,896, 72,639, 41,432 and ₹ 38,222 ha^{-1}, respectively. All these results are given in table 24.

Table 24. Returns from coconut cultivation

S. No.	Parameters	Small farmers	Large farmers
1	Yield (nuts/ha)	9,359	9,276
	Yield (kg/ ha)	4,211	4,174
2	Price (₹/kg)	34	35
3	Gross return (₹/ha)	1,44,304	1,45,119
4	Net return at cost A_1 (₹/ha)	63,009	72,896
5	Net return at cost A_2 (₹/ha)	63,009	72,639
6	Net return at cost B (₹/ha)	26,338	41,432
7	Net return at cost C (₹/ha)	20,842	38,222

A similar result was also found in the study done by Chinnaih and Suresh (2013) which highlighted the net return received by the coconut growers was found to be more for large farmers when compared with that of small and marginal farmers.

4.3.3 Benefit- Cost ratio

The B:C ratio for both small and large farmers was calculated separately and presented in table 25. B:C ratio is a concept of profitability, in which higher value indicates more profit. Large farmers were found to have more profit when compared with that of small farmers at various costs. The B:C ratio of small farmers at cost A_1, cost A_2, cost B and cost C was found to be 1.76, 1.76, 1.22 and 1.17, respectively. In case of large farmers, the B: C ratio at these costs were found to be 2.00, 2.00, 1.40 and 1.36, respectively.

Table 25. B:C ratio of small farmers and large farmers

Particular	Small farmers	Large farmers
Cost A_1	1.76	2.00
Cost A_2	1.76	2.00
Cost B	1.22	1.40
Cost C	1.17	1.36

4.4.1 RESOURCE USE EFFICIENCY

The Cobb- Douglas production function was used to find the resource use efficiency for coconut cultivation. It can be fitted separately for small and large farmers by using the below function.

$$Y = aX_1^{b1}X_2^{b2}X_3^{b3}X_4^{b4}X_5^{b5}e^{u_i}$$

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

$$\ln Y = \ln a + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 + b_5 \ln X_5 + u_i$$

Where,

Y = Yield of coconut (kg)

a = Intercept

X_1 = Quantity of hired labour (man days)

b_1 = Regression coefficient of hired labour

X_2 = Quantity of family labour (man days)	b_2 = Regression coefficient of family labour
X_3 = Quantity of manures and fertilizers (kg)	b_3 = Regression coefficient of manures and fertilizers
X_4 = Quantity of soil ameliorants (kg)	b_4 = Regression coefficient of soil ameliorants
X_5 = Quantity of machine power (hours)	b_5 = Regression coefficient of machine power
e = base of natural logarithm	u = stochastic disturbance term

The co-efficient of determination (R^2) explained 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 (b_i) of respective inputs (X_i). The regression coefficient (b_i) indicates the percentage change in the yield (Y) if the input quantities (X_i) changes by one unit while all other factors remain constant at their geometric mean levels. Variance Inflation Factors (VIF) was also calculated to check the existence of multicollinearity between the independent variables involved in the analysis. The manures used by the respondents includes farm yard manure, poultry manure and neem cake whereas fertilizer includes urea, muriate of potash and super phosphate.

The estimated Cobb-Douglas production function for small farmers was presented in table 26. The coefficient of determination (R^2) for small farmers was 0.71 which indicated that 71 per cent of variation in yield was explained by the independent variables involved in the function such as quantity of hired labour, family labour, manures and fertilizers, soil ameliorants and machine power.

Among the different independent variables, the quantity of hired labour and manures and fertilizers significantly influencing the yield at one per cent level of significance. A one per cent increase in the use of hired labour and manures and fertilizers were found to increase the yield by 0.45 and 0.31 per cent, respectively. The coefficient of family labour were found to be positive and it significantly influencing the yield at 5 per cent level of significance. A one per cent increase in use of family labour can causes 0.21 per cent increase in yield. The coefficient of machine power were found to be significant at 10 per cent level, in which one per cent increase in use of machine power can causes 0.12 per cent increase in yield. The $\sum b_i$ value refers to returns to scale. It's value was found to be 1.15, which means a simultaneous increase in all the independent variables by one per cent will increase the yield by 1.15 per cent which in turns shows increasing return to scale. The VIF (Variance Inflation factor) value was found to between 1 and 2, hence there was no multicollinearity problem among the independent variables.

Table 26. Estimated production function for small farmers

S. No.	Particular	Coefficient	Standard error	P value	VIF
1	Intercept	3.229	0.558	0.000	-
2	Quantity of hired labour (man days)	0.457***	0.161	0.008	1.54
3	Quantity of family labour (man days)	0.214**	0.085	0.017	1.35
4	Quantity of manures and fertilizers (kg)	0.306***	0.089	0.002	1.64
5	Quantity of soil ameliorants (kg)	0.053	0.042	0.222	1.33
6	Quantity of machine power (hours)	0.125*	0.063	0.053	1.84
7	R^2	0.71			
8	$\overline{R^2}$	0.67			
9	Calculated F	16.84			
10	$\sum b_i$	1.15			
11	No. of observations	40			

* Significant at 10 per cent level

** Significant at 5 per cent level

*** Significant at 1 per cent level

Note: The coefficients were obtained with log value

In case of large farmers, the quantity of manures and fertilizer was found to be significantly influencing the yield at one per cent level of significance. A one per cent increase in the use of manures and fertilizers can cause 0.64 per cent increase in yield. The quantity of family labour has the negative coefficient and it was significantly influencing the yield at 10 per cent level of significance, which means that one per cent increase in use of family labour can cause 0.16 per cent decreases in yield. A one per cent increase in the use of soil ameliorants can cause increasing the yield by 0.05 per cent and it was significantly influencing the yield at 5 per cent level of significance.

Table 27. Estimated production function for large farmers

S. No	Particular	Coefficient	Standard error	P value	VIF
1	Intercept	3.831	0.822	0.000	-
2	Quantity of hired labour (man days)	-0.037	0.146	0.803	1.49
3	Quantity of family labour (man days)	-0.161*	0.084	0.064	1.84
4	Quantity of manures and fertilizers (kg)	0.636***	0.111	0.000	1.54
5	Quantity of soil ameliorants (kg)	0.046**	0.021	0.036	1.19
6	Quantity of machine power (hours)	-0.0002	0.040	0.996	1.67
7	R^2	0.59			
8	$\overline{R^2}$	0.53			
9	Calculated F	9.90			
10	$\sum b_i$	0.78			
11	No. of observations	40			

* Significant at 10 per cent level

** Significant at 5 per cent level

*** Significant at 1 per cent level

Note: The coefficients were obtained with log value

The R^2 value was found to be 0.59, which means 59 per cent of the variation in the yield was explained by the independent variables included in the model. The $\sum b_i$ was found to be 0.78, which means that one per cent increase in all the independent variable will increase the yield by 0.78 per cent. Since, the value was less than one, it shows decreasing returns to scale. The VIF value of all the independent variable ranges between 1 and 2 indicated that there was no multicollinearity in the selected variables. This results are presented in table 27.

The null hypothesis of the chow test is that there is no difference in the coefficients of small and large farmers testing against the alternate hypothesis that there is a difference in the coefficients of the small and large farmers.

Compare the F* with the critical value of $F_{0.05}$ with $v_1 = K$ and $v_2 = (n_1 + n_2 - 2K)$ degrees of freedom. If $F^* > F_{0.05}$, we reject null hypothesis, that there was a significant difference between the two groups. In this study, F* value was found to be 1.89 and $F_{0.05}$ was 2.17 at $v_1 = 6$ and $v_2 = 68$ degrees of freedom, hence the null hypothesis was not rejected and resulted that there was no significant difference in the coefficients between the small and large farmers.

4.4.2 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 resource use efficiency of coconut. The results are presented in table 28 and 29.

The allocative efficiency for the small farmers is presented in table 28. The k ratio for all the resources such as quantity of hired labour, family labour, manures and fertilizers, soil ameliorants and machine power were found to be greater than one, which indicates that underutilization or suboptimal utilization of resources.

The marginal productivity analysis of coconut for large farmers were shown in table 29. The k ratio for quantity of manures and fertilizers and soil ameliorants were found to be greater than one indicating the sub optimal utilization of resources. In case of hired labour, family labour and machine power, the allocative efficiency was found to be less than one, which indicates the excess utilization of resources.

Table 28. Marginal value product (MVP) and Marginal factor cost (MFC) for small farmers

S. No.	Particular	Geometric mean	MVP	MFC	MVP/ MFC = K
1	Yield	4,075.65	-	-	-
2	Quantity of hired labour	24.13	2,603.60	633.91	4.11
3	Quantity of family labour	2.72	10,824.29	660.72	16.38
4	Quantity of manures and fertilizers	2,010.52	20.92	8.51	2.46
5	Quantity of soil ameliorants	21.79	334.40	24.40	13.70
6	Quantity of machine power	314.79	54.89	21.87	2.50

Table 29. Marginal value product (MVP) and Marginal factor cost (MFC) for large farmers

S. No.	Particular	Geometric mean	MVP	MFC	MVP/ MFC = K
1	Yield	3,902.99	-	-	-
2	Quantity of hired labour	18.80	-7.68	684.13	-0.38
3	Quantity of family labour	2.51	-250.39	658.92	-12.82
4	Quantity of manures and fertilizers	2,565.69	0.97	5.60	5.83
5	Quantity of soil ameliorants	6.24	28.76	20.93	46.36
6	Quantity of machine power	767.02	-0.0010	10.02	-0.0034

A study by Kolambkar (2017) on resource use efficiency in coconut production was revealed that hired human labour, machine power and manures and fertilizers were excessively utilized whereas plant protection chemical was found to be underutilized. A similar study was also done by Priolkar *et al.* (2017).

4.5 INPUT SUBSIDIES IN COCONUT CULTIVATION

4.5.1 Input subsidies under Keragramam

For the selected panchayat, the total physical and financial achievements of Keragramam scheme under each components during 2018-19 are given in table 30. The total area covered under keragramam scheme was 256.3 ha in Baluserry panchayat and in Kattipara panchayat, it was 265.5 ha. From the total area covered in Balussery and Kattipara panchayat, the input subsidies were given to 44,852 palms and 46,473 palms, respectively. The total financial achievement of the scheme in both Baluserry and Kattipara panchayat was ₹ 95,19,000.

Table 30. Physical and financial achievements of Keragramam scheme in selected panchayats during 2018-19

S. No.	Components	Balussery panchayat		Kattipara panchayat	
		Physical	Financial (₹)	Physical	Financial (₹)
1	Area covered	256.3 ha	-	265.5 ha	-
2	Number of palms	44,852 palms	-	46,473 palms	-
3	Intercultural operation	39,415 palms	13,79,525	39,814 palms	13,93,490
4	Soil ameliorants	-	-	38,869 palms	3,49,821
5	Organic manure	39,415 palms	9,85,375	38,869 palms	9,71,725
6	Plant protection chemicals	-	-	465 palms	999
7	Application of bio-fertilizer/bio-pesticides and bio-control agents	-	-	465 palms	23,250
8	Cut and removal of disease affected palms	855 palms	8,55,000	270 palms	2,70,000
9	Replanting with good quality seedlings	600 seedlings	22,500	-	-
10	Intercropping in coconut garden	256.3 ha	8,58,345	265.56 ha	12,39,520
11	Installation of irrigation components	67 units	5,01,255	53 units	3,31,195
12	Coconut climbing equipment for clusters	50 units	1,00,000	61 units	1,22,000
Total			95,19,000		95,19,000

Source: Krishi Bhavan, Balussery and Kattipara panchayat, 2019

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4.5.2 Input subsidies under CDB scheme

The input subsidy scheme of CDB was "Replanting and Rejuvenation". It was implemented in Balussery panchayat in the year 2017-18. This scheme was not implemented in the Kattipara panchayat. Under this scheme, the subsidy amount was given to the farmers for three components such as cut and removal of disease advanced, old, senile and unproductive palms, replanting of new seedlings and rejuvenation of existing coconut orchards. The achievements of the scheme in Balussery panchayat are given in table 31.

Table 31. Achievements of Replanting and Rejuvenation scheme in Balussery panchayat during 2018-19

S. No.	Components	2017-18			
		Area	No. of palms	No. of beneficiaries	Financial achievement (₹)
1	Cut and removal of disease advanced, old, senile and unproductive palms	5 ha	160	50	1.6 lakhs
2	Replanting of new seedlings	5 ha	320	50	0.12 lakhs
3	Rejuvenation of existing coconut garden	5 ha	875	50	0.44 lakhs
Total					2.16 lakhs

Source: Krishi Bhavan, Balussery

4.5.3.1 Awareness about various input subsidy

The analysis on the awareness regarding various areas of input subsidy are given in table 32. All the small farmers were availing input subsidies under Keragramam whereas almost 57.50 per cent of large farmers were aware about that scheme. Nearly, 47.5 per cent of small farmers and 32.5 per cent of large farmers were aware about the schemes of CDB, GOI. Only 20 per cent of small farmers and 50 per cent of large farmers were aware about the fertilizer subsidy given by GOI. Mostly 95 per cent and 97.5 per cent of small and large farmers were aware about the electricity subsidy whereas all the respondents were aware about credit subsidy.

Table 32. Distribution of respondents based on their awareness about various input subsidies

S. No.	Particular	Small farmers	Large farmers	Total
1	Coconut Development scheme "Keragramam"	40 (100)	23 (57.50)	63 (78.75)
2	Coconut Development Board schemes	19 (47.5)	13 (32.5)	32 (40)
3	NPK fertilizer	8 (20)	20 (50)	28 (35)
4	Credit subsidy	40 (100)	40 (100)	80 (100)
5	Electricity subsidy	38 (95)	39 (97.5)	77 (96.25)

Note: Figures in parentheses indicate percentage to total

4.5.3.2 Source of information about input subsidies

Source of information about the different input subsidies to the farmers are presented in table 33. The different sources of information was Krishi Bhavan, social media, fellow farmers, friends and relatives. Almost 53.75 per cent of respondents received the information from Krishi Bhavan, followed by fellow farmers (25 per cent), social media (15 per cent) and friends and relatives (6.25 per cent). Most of the small farmers obtained information from Krishi Bhavan (65 per cent), followed by fellow farmers (27.5 per cent) and social media (7.5 per cent). In case of large farmers, almost 42.5 per cent obtained information from Krishi Bhavan, followed by both social media and fellow farmers by 22.5 per cent and friends and relatives by 12.5 per cent.

Table 33. Distribution of farmers based on source of information about input subsidies

S. No.	Particular	Small farmers	Large farmers	Total
1	Krishi Bhavan	26 (65)	17 (42.5)	43 (53.75)
2	Social media	3 (7.5)	9 (22.5)	12 (15)
3	Fellow farmers	11 (27.5)	9 (22.5)	20 (25)
4	Friends and relatives	-	5 (12.5)	5 (6.25)
Total		40 (100)	40 (100)	80 (100)

Note: Figures in parentheses indicate percentage to total

Kanimozhi *et al.* (2017) reported that 34.7 per cent of the respondents were aware of subsidies for agriculture from agro centers and 23.3 per cent from the Government officials.

4.5.3.3 Source of input subsidies

The distribution of respondents based on source of input subsidies are shown in table 34. All the small farmers were availing input subsidies from Keragramam scheme, under Department of Agriculture Development & Farmers' Welfare, GOK where as large farmers were not eligible for the scheme. The CDB schemes were also available only to the small farmers. The farmers those who were getting the subsidies from Keragramam scheme were not eligible to get the subsidies from CDB scheme. 25 per cent of small farmers and 30 per cent of large farmers were getting the electricity subsidy. Overall, 27.5 per cent of the total farmers were getting the electricity subsidy. Nearly 36.25 per cent of the total farmers were availing credit subsidies under interest subvention scheme, GOI, of which 25 per cent of small farmers and 27.50 per cent of large farmers.

Table 34. Distribution of respondents based on source of input subsidies

S. No.	Particular	Small farmers	Large farmers	Total
1	State department of agriculture (Keragramam)	40 (100)	-	40 (100)
2	Coconut Development Board	-	-	-
3	Kerala State Electricity Board	10 (25)	12 (30)	22 (27.5)
4	Banking Institution	18 (45)	11 (27.5)	29 (36.25)

Note: Figures in parentheses indicate percentage to total

4.5.3.4 Amount of input subsidies availed under Keragramam scheme

Under Keragramam scheme, the Department of Agriculture, GOK provided input subsidies on various components such as intercultural operation, soil ameliorants, organic manure, cut and removal of disease affected palms, replanting with good quality seedlings, intercropping in coconut garden, installation of irrigation components and coconut climbing equipment. The total area covered by the sample small farmers in Balussery panchayat was 34.44 acres with the total number of 1,887 palms. In case of Kattipara panchayat, the total area covered was 65.03 acres with 3,250 palms. The amount of subsidies availed by the small farmers was worked out for selected panchayat during 2018-19 and presented in table 35. The total amount of subsidies availed by the sample farmers in Balussery panchayat was ₹ 2,46,536 and in Kattipara panchayat was ₹ 4,15,153.

The pictorial representation of amount of input subsidies availed by the small farmers is represented in the figure 7. Almost 27.17 per cent of the total amount of subsidies was availed for doing the intercultural operation like basin opening/ weeding, followed by intercropping in coconut garden (25.17), organic manure (19.41 per cent), cut and removal of old palms (12.54 per cent). For the installation of irrigation components, 8.99 per cent of total input subsidy was availed, 4.42 per cent for soil ameliorants, 2.12 per cent for the purchase of coconut climbing equipment and 0.18 per cent for replanting new seedlings.

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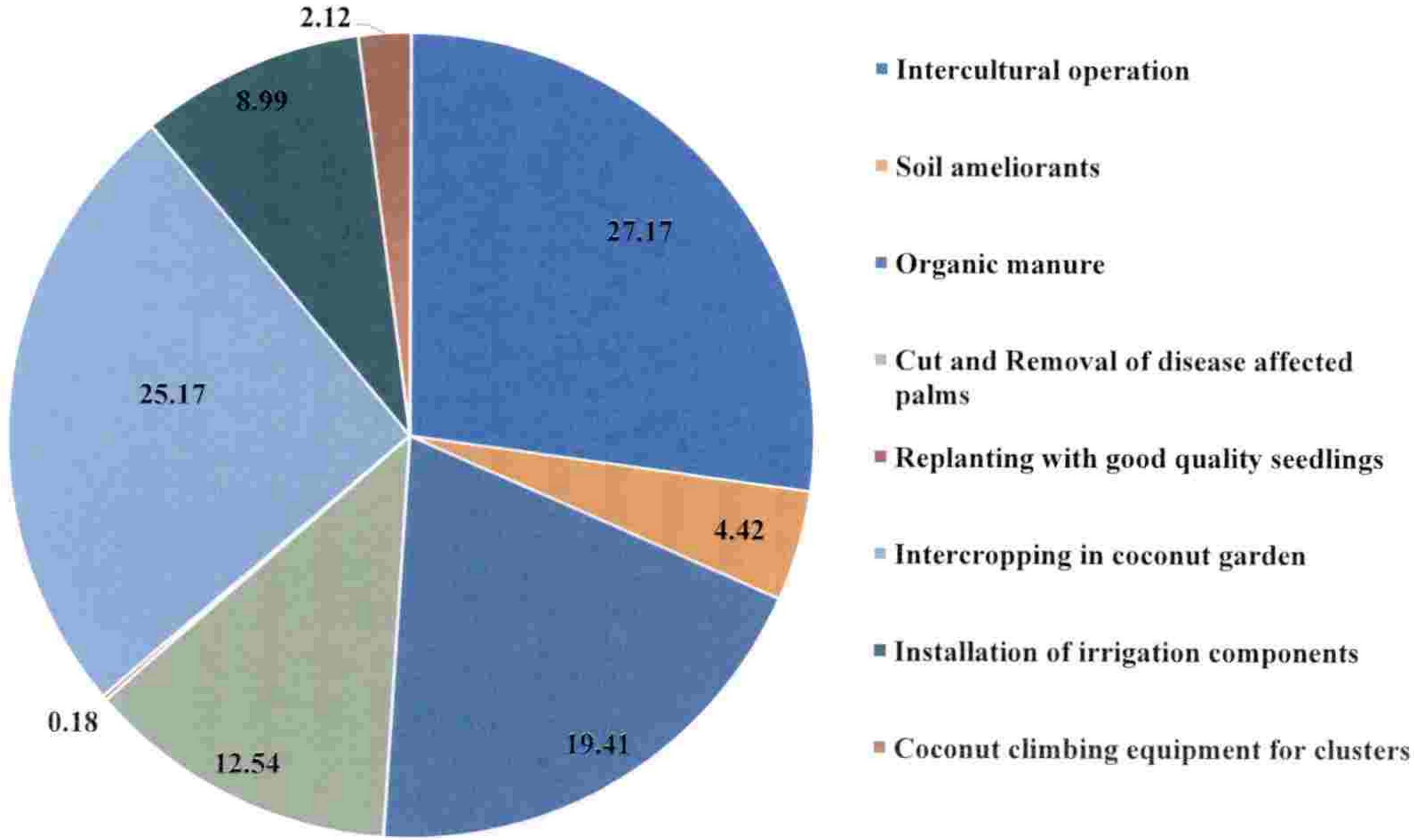
Table 35. Amount of input subsidies availed by the small farmers under Keragramam scheme

S. No.	Components	Balussery panchayat		Kattipara panchayat		Total	
		Physical	Financial (₹)	Physical	Financial (₹)	Physical	Financial (₹)
1	Area covered	34.44 acres	-	65.03 acres	-	99.47	-
2	Number of palms	1,887 palms	-	3,250 palms	-	5,137	-
3	Intercultural operation	1,887 palms	66,045	3,250 palms	1,13,750	5,137	1,79,795
4	Soil ameliorants	-	-	3,250 palms	29,250	3,250	29,250
5	Organic manure	1,887 palms	47,175	3,250 palms	81,250	5,137	1,28,425
6	Cut and Removal of disease affected palms	39 palms	39,000	44 palms	44,000	83	83,000
7	Replanting with good quality seedlings	24 seedlings	1,200	-	-	24	1,200
8	Intercropping in coconut garden	34.44 acres	45,116	65.03 acres	1,21,403	99.47	1,66,519
9	Installation of irrigation components	5 units	46,000	2 units	13,500	7 units	59,500
10	Coconut climbing equipment for clusters	1 units	2,000	6 units	12,000	7 units	14,000
Total			2,46,536		4,15,153		6,61,689

Figure 7. Amount of input subsidies availed by the small farmers under Keragramam scheme (per cent)



4.5.3.5 Impact perceived under Keragramam scheme

Small farmers have reported different types of impact as they have perceived under the Keragramam scheme and results are presented in table 36. The major impact perceived was that the subsidy scheme ensured cheap inputs to coconut farming which was reported by 67.5 per cent of the respondents. The second most important impact was that the subsidy scheme reducing the cost of cultivation which was reported by 60 per cent of the respondents. Because of providing good quality inputs under the scheme, there was considerable increase in the yield of the coconut and also increase in the income of the farmers. This was reported by 52.5 per cent and 47.5 per cent of small farmers, respectively. Nearly 42.5 per cent of the farmers has reduced their borrowing from the others and only few farmers have reported that this subsidy scheme provided security to them (12.5 per cent).

Table 36. Distribution of respondents based on impact perceived under Keragramam scheme

S. No.	Statement	Small farmers	Per cent
1	Ensure cheap input to agriculture	27	67.5
2	Reduce the cost of cultivation	24	60
3	Reduce the need to borrow	17	42.5
4	Provide security to the farmers	5	12.5
5	Increase the yield of the crops	21	52.5
6	Increase the income of the farmers	19	47.5

These results were also found in the research study of Venkatesh *et al.* (2017) on the benefits of agricultural input subsidies for farmers in South India. It was reported that, subsidies were given to the farmers as means to ensure cheap inputs to agriculture and it also reduced the need to borrow, which has been agreed by more farmers.

4.5.3.6 Farmers' perception on the sufficiency of keragramam scheme

Farmers' perception on the sufficiency of input subsidies provided by the Department of agriculture is presented in the table 37. The results showed than 55 per cent of the small farmers were satisfied about the input subsidy given by the Department of Agriculture and 45 per cent of the farmers were not satisfied about the subsidy scheme.

Table 37. Distribution of respondents based on farmers' perception on the sufficiency of input subsidies

S. No.	Particular	Small farmers	Per cent
1	Sufficient	22	55
2	Not sufficient	18	45
Total		40	100

4.5.4 Farm credit

Table 38 presents the average amount of farm credit availed by the farmers. It was found that the farmers applied for agricultural credit both in commercial banks and regional rural banks for the purpose of coconut cultivation. Out of 29 farmers availing the credit subsidies, only 5 small farmers and 6 large farmers received credit from commercial banks whereas 13 small farmers and 5 large farmers were received credit from regional rural banks. The average amount of farm credit taken by the sample respondent was ₹ 2,48,793. The average amount of farm credit taken by the small farmers was ₹ 2,36,944, of which average of ₹ 2,90,000 from commercial bank and ₹ 2,16,538 from regional rural bank. In case of large farmers, the average of ₹ 2,66,667 taken from commercial bank and ₹ 2,70,000 was taken from regional rural bank. The average amount of farm credit by the large farmers was ₹ 2,68,182. None of the small and large farmers had taken loan from cooperative bank.

Table 38. Average amount of farm credit availed by the farmers

S. No.	Source	Commercial banks	Regional Rural banks	Total
1	Small farmers	2,90,000 (5)	2,16,538 (13)	2,36,944 (18)
2	Large farmers	2,66,667 (6)	2,70,000 (5)	2,68,182 (11)
Overall		2,77,273 (11)	2,30,294 (18)	2,48,793 (29)

Note: Figures in parentheses indicate number of farmers

4.5.4.1 Amount of credit subsidy availed by the respondents

Table 39 shows the details of amount of credit subsidy from each institution availed by the respondents. The total amount of credit subsidies availed by the farmers was ₹ 2,16,450, of which ₹ 91,500 from commercial bank and ₹ 1,24,950 from regional rural bank. The amount of credit subsidies availed by the small farmers was ₹ 1,27,950 (59.11 per cent). It was found to be more when compared with that of large farmers with the amount ₹ 88,500 (40.88 per cent).

Table 39. Amount of credit subsidy availed by the beneficiaries

S. No.	Farmers	Commercial banks (₹)	Regional Rural banks(₹)	Total amount (₹)
1	Small farmers	43,500 (47.54)	84,450 (67.58)	1,27,950 (59.11)
2	Large farmers	48,000 (52.45)	40,500 (32.01)	88,500 (40.88)
Overall		91,500 (100)	1,24,950 (100)	2,16,450 (100)

Note: Figures in parentheses indicate percentage to total

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4.5.4.2 Reason for not availing the agricultural credit

Some farmers had not availed agricultural credit because of the several reasons such as lack of knowledge, high interest rate, complicated procedure, farmers can use their own money for farming and has a burden to repay the loan. The distribution of non- beneficiaries of credit subsidies based on the reason for not availed agricultural credit is presented in the table 40. Out of 22 small farmers, almost 50 per cent have the reason that they had a burden to repay the loan, followed by 40.91 per cent have their own fund and 9.10 per cent feels that credit was given at high interest rate. Out of 29 large farmers, 79.31 per cent has their own fund for farming, followed by 20.69 per cent feels the complex procedure.

Table 40. Distribution of respondents based on the reason for not taking agricultural credit

S. No.	Reason	Small farmers	Large farmers	Total
1	Lack of knowledge	-	-	-
2	High interest rate	2 (9.10)	-	2 (3.92)
3	Complex procedure	-	6 (20.69)	6 (11.76)
4	Own funds	9 (40.91)	23 (79.31)	32 (62.75)
5	Burden to repay the loan	11 (50)	-	11 (21.57)
	Total	22 (100)	29 (100)	51 (100)

Note: Figures in parentheses indicate percentage to total

4.5.5.1 Amount of electricity subsidy availed by the respondents

The total amount of electricity subsidy availed by the selected respondent is shown in table 41. The amount of electricity subsidies availed by the small farmers was ₹ 14,100 with 38.81 per cent of total electricity subsidy. In case of large farmers, amount of the electricity subsidy was ₹ 22,230 with 61.19 per cent. The total amount of electricity subsidy availed by the farmers was ₹ 36,330.

Table 41. Amount of electricity subsidy availed by the beneficiaries

S. No.	Farmers	Number of farmers	Amount of electricity subsidy availed (₹)
1	Small farmers	10	14,100 (38.81)
2	Large farmers	12	22,230 (61.19)
Total		22	36,330 (100)

Note: Figures in parentheses indicate percentage to total

4.5.5.2 Reason for not availing electricity subsidy

The non-beneficiaries have several reason for not taking the electricity subsidy. The distribution of non- beneficiaries based on the reason for not availing electricity subsidy are presented in table 42. A total of 58 farmers had not availed electricity subsidy. Out of 58 farmers, 30 were small farmers and 28 were large farmers. Almost 66.67 per cent and 64.29 per cent of small and large farmers, respectively were fully dependent on rainfed condition for coconut farming, followed by 23.33 per cent and 32.14 per cent felt that there was a complex procedure to get the electricity subsidy. The lack of knowledge and irregular electricity supply were also the reasons for the farmers for not taking the electricity subsidy.

Table 42. Distribution of respondents based on the reason for not taking electricity subsidy

S. No.	Reason	Small farmers	Large farmers	Total
1	Lack of knowledge	2 (6.67)	1 (3.57)	3 (5.17)
2	Complex procedure	7 (23.33)	9 (32.14)	16 (27.59)
3	Fully depends on rain	20 (66.67)	18 (64.29)	38 (65.52)
4	Irregular electricity supply	1 (3.33)	-	1 (1.72)
Total		30 (100)	28 (100)	58 (100)

Note: Figures in parentheses indicate percentage to total

4.6 IMPACT OF INPUT SUBSIDIES ON COCONUT PRODUCTION

To know the impact of agricultural input subsidies on coconut production, ordinary least square estimates was performed by keeping yield as a dependent variable and different amount of subsidies as independent variable. Among various input subsidies, organic manure, soil ameliorants, electricity and credit were included as the independent variables in this analysis. Large farmers were not eligible to receive organic manure and soil ameliorant subsidies, so they were not included for the analysis. The results of the impact of these input subsidies are presented in table 43.

Table 43. Impact of input subsidies on coconut production

S.No.	Variables	Coefficient	Standard error	P value	VIF
1	Intercept	-0.319	0.411	0.443	-
2	Amount of subsidy on organic manure (₹)	1.053***	0.055	0.000	1.41
3	Amount of subsidy on soil ameliorants (₹)	0.019	0.013	0.148	1.76
4	Amount of credit subsidy (₹)	-0.007	0.009	0.478	1.38
5	Amount of electricity subsidy (₹)	0.033**	0.119	0.010	1.07
6	R^2	0.94			

** Significant at 5 per cent level

*** Significant at 1 per cent level

From the table, it is evident that the amount of organic manure subsidy was found to be significant at 1 per cent level of significance and the amount of subsidy has a positive influence on yield. A one per cent increase in amount of organic manure subsidy can causes increase in yield by 1.05 per cent. The amount of electricity subsidy has influenced the yield positively and it was found to be significant at 5 per cent level. A one per cent increase in amount of credit subsidy can causes increase in yield by 0.03 per cent. The coefficient of multiple determination (R^2) was found to be 0.94, which means that 94 per cent of the yield was explained by the independent variables included in this model. Hence, it was found that amount of organic manure subsidy and amount of electricity subsidy were found to have more influence on the coconut production.

A related study conducted by Chibwana (2014) in central and southern Malawi. The results for a linear- log production function for the impact of the FISP on maize yield found that significantly positive correlation between the fertilizer used and maize yield, but diminishing return to fertilizer use.

4.7 IMPACT OF AGRICULTURAL INPUT SUBSIDIES ON ENVIRONMENT

Agricultural input subsidies that encourage the use of inputs inevitably results in adverse effects on the environment. Some adverse effect from the agricultural input use on environment was water logging, air pollution, water pollution, soil degradation and so on. This section will discussed about the environmental impact of different input subsidies as perceived by the respondents.

Table 44 shows the distribution of small and large farmers based on the impact perceived on chemical fertilizer subsidy. Most of the farmers perceived that the fertilizer subsidy was the major reason of its overuse because it was available to the farmers at cheaper rate. 92.5 per cent and 97.5 per cent of the small and large farmers agreed that more use of fertilizer under subsidy can cause the contamination to soil and water and 83.75 per cent of the total respondents agreed that fertilizer subsidy may cause the depletion of soil fertility. 48.75 per cent of the farmers perceived that the fertilizer subsidy can cause the contamination to ground water that may affect the water quality. The other impact that farmers perceived was the overuse of fertilizer decreases the response of crop to the fertilizer and also increases the pest attack.

The free supply of electricity or electricity subsidy was responsible for the different impact and are presented in table 45. 43.75 per cent of the farmers perceived that the electricity subsidy causes over exploitation of ground water and 31.25 per cent of farmers said that irregular supply of power increased the maintenance cost of pumpset. The free supply of electricity has increased the fiscal burden to government and also increased the use of electric pumpset comparative to diesel pumpset, and it was perceived by 35 per cent and 33.75 per cent of total farmers, respectively.

Table 44. Distribution of respondents based on the perceived impact on chemical fertilizer subsidy

S. No.	Particular	Small farmers	Large farmers	Overall
1	Contamination of environment (soil & water)	37 (92.5)	39 (97.5)	76(95)
2	Depletion of soil fertility	35 (87.5)	32 (80)	67 (83.75)
3	Groundwater contamination affecting water quality	21 (52.5)	18 (45)	39 (48.75)
4	Decrease the response of the crop to fertilizer	14 (35)	20 (50)	34 (42.5)
5	Insect pest attack increases	10 (25)	19 (47.5)	29 (36.25)

Note: Figures in parentheses indicate percentage to total

Table 45. Distribution of respondents based on the perceived impact on electricity subsidy

S. No.	Particular	Small farmers	Large farmers	Overall
1	Over exploitation of ground water	9 (22.5)	26 (65)	35 (43.75)
2	Irregular supply of subsidized electricity	10 (25)	15 (37.5)	25 (31.25)
3	Fiscal burden to government	5 (12.5)	23 (57.5)	28 (35)
4	Increased use of electric pump set compared with diesel pump set	15 (37.5)	12 (30)	27 (33.75)

Note: Figures in parentheses indicate percentage to total

The data presented in table 46 revealed that 88.75 per cent of the respondents perceived that providing subsidies on organic fertilizer would help to increase the soil fertility. 85 per cent of the total respondents said that organic fertilizer subsidy can minimize the negative consequence of chemical fertilizer. The reason given by them was that subsidies for organic fertilizer was welcomed by the farmers but more than the inorganic fertilizer. 97.5 per cent of the farmers also mentioned that increasing the organic fertilizer subsidy can cause decreases in the use of chemical fertilizer.

Table 46. Distribution of respondents based on the perceived impact on organic manure subsidy

S. No.	Particular	Small farmers	Large farmers	Overall
1	Helps to increase the soil fertility	33 (82.5)	38 (95)	71 (88.75)
2	Minimize the negative consequences of chemical fertilizer	29 (72.5)	39 (97.5)	68 (85)
3	Decreases the use of chemical fertilizer	19 (47.5)	28 (70)	78 (97.5)

Note: Figures in parentheses indicate percentage to total

Regarding micro irrigation subsidy, nearly 63.75 per cent of the respondents perceived that the subsidies provided on drip or sprinkler irrigation would help in reducing the ground water depletion. All the small and large farmers believed that subsidy for installation of micro- irrigation components can helps in increasing the water use efficiency by reducing the over usage of water. The results are presented in table 47.

Majority of the small farmers (82.5 per cent) and large farmers (100 per cent) perceived that unabated use of plant protection chemicals under subsidies would result in causing pollution to environment. 80 per cent of small farmers and 92.5 per cent of large farmers have agreed that chemicals used under the cheaper rate caused toxicity to soil and resulted in declining soil fertility. The other impact of plant protection chemicals under subsidy was that it killed the non- target species, killed soil microorganism and also were harmful to animals and human. This results are given in Table 48.

Table 47. Distribution of respondents based on the perceived impact on micro irrigation subsidy

S. No.	Particular	Small farmers	Large farmers	Overall
1	Helps in reducing ground water depletion	19 (47.5)	32 (80)	51 (63.75)
2	Helps in increasing the water use efficiency by reducing the usage of water	40 (100)	40 (100)	80 (100)

Note: Figures in parentheses indicate percentage to total

Table 48. Distribution of respondents based on the perceived impact on plant protection chemical subsidy

S. No.	Particular	Small farmers	Large farmers	Overall
1	Chemical causing pollution to environment (air and water)	33 (82.5)	40 (100)	73 (91.25)
2	Soil gets toxic and decline in soil fertility	32 (80)	37 (92.5)	69 (86.25)
3	Chemical kills the non- target species	15 (37.5)	21 (55)	36 (45)
4	Chemical kills soil micro-organisms	15 (37.5)	17 (42.5)	32 (40)
5	Harmful to animals and humans	31 (77.5)	35 (87.5)	66 (82.5)

Note: Figures in parentheses indicate percentage to total

The data presented in table 49 revealed that 23.75 per cent and 25 per cent of total respondents perceived that providing seed/ seedling subsidies would encourage the need for inputs that negatively impact soil and need for inputs that negatively impact water quality respectively. Nearly 55 per cent of small farmers and 17.5 per cent of the large farmers perceived that seed subsidy would increases the plant density.

Table 49. Distribution of respondents based on the perceived impact on seeds/seedling subsidy

S. No.	Particular	Small farmers	Large farmers	Overall
1	Increase the need for inputs that negatively impact soil	7 (17.5)	12 (30)	19 (23.75)
2	Increase the need for inputs that negatively impact water quality	8 (20)	12 (30)	20 (25)
3	Increase planting density	22 (55)	7 (17.5)	29 (36.25)

Note: Figures in parentheses indicate percentage to total

Table 50. Distribution of respondents based on the perceived impact on machinery and implement subsidy

S. No.	Particular	Small farmers	Large farmers	Overall
1	Destroying earthworm and beneficiary insects	5 (12.5)	17 (42.5)	22 (27.5)
2	Animal draft power decreases	7 (17.5)	30 (75)	37 (46.25)
3	Increase the jobless problem	19 (47.5)	11 (27.5)	30 (37.5)
4	Soil compaction	5 (12.5)	16 (40)	21 (26.25)

Note: Figures in parentheses indicate percentage to total

Farmers' perception on the impact of machineries and implement subsidies on farmers' perception are furnished in table 50. Overuse of machinery and implements caused the impact such as destroying earthworm and beneficial insects in the soil that has resulted in decline in soil fertility was perceived by 27.5 per cent of the total respondents. The other impact perceived by them was that it decreased the animal draft power (46.25 per cent), increased the job less problem to the daily wage labour (37.5 per cent) and soil compaction (26.25 per cent).

Almost 75 per cent of small farmers and 90 per cent of large farmers perceived that the credit subsidy reduced the credit intake from money lenders. 17.5 per cent of small farmers and 40 per cent of large farmers believed that providing credit at the subsidized interest rate could make them to use that credit for some other purpose. This results are shown in table 51.

Table 51. Distribution of respondents based on the perceived impact on credit subsidy

S. No.	Particular	Small farmers	Large farmers	Overall
1	Reduce the credit intake from money lender	30 (75)	36 (90)	66 (82.5)
2	Use of credit for the some other purposes	7 (17.5)	16 (40)	23 (28.75)

Note: Figures in parentheses indicate percentage to total

The agricultural production depends on the judicial use of agricultural inputs. But the over use of these inputs were causing stagnation in the overall production. More amount of subsidies to the chemical fertilizer would cause more negative effect to the environment where as subsidies to organic manure causes the minimization of its negative effect. The subsidies for organic fertilizer was welcomed by the farmers to reduce the adverse environmental effect. The respondents also suggested for the recommended use of chemical fertilizer or the government should provide the fertilizer subsidies based on soil fertility.

The subsidies on plant protection chemicals also caused pollution to the environment and harmful to microorganism, human and animals. This can be reduced by the use of bio-control agents as suggested by the farmers.

In case of electricity subsidies, the farmers have less awareness on its impact on environment, it can be suggested that electricity charges for agricultural purpose should be imposed on the large farmers who actually have the capacity to pay the bills.

This would help in reducing the environmental adverse impact and also reduce the fiscal burden to the government. The subsidies to micro irrigation components can reduce the usage of water, thus can increases the water use efficiency as suggested by the farmers. This would also help in reducing the ground water depletion. Subsidies given for seeds/ seedling could encouraged the need for other input in subsidized rate which could causes the negative impact on environment.

A study was conducted by Anand and Kaur (2017) regarding the impact of agricultural subsidies in Punjab during 2016. This study reported the perception of both farmers and extension agents regarding the positive and negative impact of different agricultural subsidies.

4.8 CONSTRAINTS FACED BY FARMERS IN AVAILING AGRICULTURAL INPUT SUBSIDIES

4.8.1 Constraints in availing input subsidies under Keragramam scheme

It was reported that the farmers were facing a number of problems in availing all kind of input subsidies provided by both state and central government. A proper understanding of the constraints faced by the beneficiaries of each subsidies helps in taking the appropriate policy measures to overcome such constraints.

In the present study, the small farmers who were the beneficiaries of Coconut development scheme "Keragramam", GOK have faced the number of constraints in availing the input subsidies. The results are given in table 52. Untimely availability of subsidy inputs was the major constraints faced by the beneficiaries with the Garrett's score of 71.05, followed by limited quantity of inputs (58.43), lowest amount of subsidies (53.88), delay in release of subsidy amount (49.78) and complex procedure to avail (48.65). The other constraints faced by the small farmers were low capacity to buy (48.60), non- viability of subsidy scheme (47.85), lack of information (42.73), no fixed place of sale of subsidized inputs (39.55) and improper quality of inputs (38.05).

Table 52. Constraints in availing input subsidies under "Keragramam" scheme

S. No.	Constraint	Garrett's score	Rank
1	Lack of information	42.73	8
2	Limited quantity of inputs	58.43	2
3	Lowest amount of subsidies	53.88	3
4	Low capacity to buy	48.60	6
5	Untimely availability of subsidized inputs	71.05	1
6	Complex procedure to avail	48.65	5
7	Improper quality of input	38.05	10
8	Delay in release of subsidy	49.78	4
9	Non- viability of subsidy scheme	47.85	7
10	No fixed place for sale of subsidized inputs	39.55	9

The constraints faced by the beneficiaries in availing the credit subsidies under the Interest subvention scheme are presented in table 53. Complex procedure was the most important constraint faced by the beneficiaries with the Garrett's score of 57.30, followed by timeliness of credit (53.69), limitation of credit (52.28) and duration of credit (50.52). Repayment procedure and rate of interest were the least important constraints faced by the beneficiaries of credit subsidy.

Table 53. Constraints in availing credit subsidy

S. No.	Constraint	Garret's score	Rank
1	Complex procedure	57.30	1
2	Rate of interest	37.31	6
3	Credit limit	52.28	3
4	Timeliness of credit	53.69	2
5	Duration of credit	50.52	4
6	Repayment procedure	47.90	5

The constraints of the farmers in availing the electricity subsidies are furnished in table 54. Complex procedure was the most important constraint faced by the respondents in availing electricity subsidy. The Garret's score obtained was 63.82. Followed by the irregular supply of electricity (50.86) and poor quality electricity (35.32) were the second and third constraint as ranked by the beneficiaries of electricity subsidies.

Table 54. Constraints in availing electricity subsidy

S. No.	Constraint	Garret's score	Rank
1	Complex procedure	63.82	1
2	Irregular supply of electricity	50.86	2
3	Poor quality electricity	35.32	3

4.8.2 Suggestions to improve the subsidy scheme

The various suggestion were asked from the respondents about the Coconut development scheme "Keragramam" to make the scheme more effective. The results are presented in table 55. The results revealed that 85 per cent of the respondents suggested that the inputs should be given to farmers at the required time. Nearly 40 per cent of the farmers suggested to increase the amount of subsidy, followed by 32.5 per cent of farmers suggested to make the simple documentation procedure, 27.5 per cent of the farmers suggested to change the criteria for giving the subsidies. A small portion of respondents suggested to make a transparent procedure for the distribution of subsidies to the farmers and gives quality inputs.

Table 55. Suggestions to improve the subsidy scheme

S. No.	Suggestions	Number	Percentage
1	Make simple documentation process for farmer	13	32.5
2	Transparent procedure for distribution agricultural subsidies to farmers	7	17.5
3	Gives quality inputs	8	20
4	Inputs given at the time of need	34	85
5	Amount of subsidies should be more	16	40
6	Criteria for giving subsidies	11	27.5

Summary

5. Summary

Coconut is a plantation crop cultivated in Kerala with maximum area but its production and productivity are less than that of other major coconut producing states such as Tamil Nadu, Karnataka and Andhra Pradesh. Input subsidy in agriculture is an attempt to make the inputs available to farmers below market costs as a way to increase agricultural productivity with wider benefits. In this context, the study entitled "Economic analysis of agricultural input subsidies for coconut cultivation in Kozhikode district" was carried out with the objectives to study the growth of input subsidies for coconut cultivation, to analyse the impact of input subsidies on coconut production and also to identify the constraints faced by the farmers in availing the input subsidies.

The study was based on both primary and secondary data. Kozhikode district was purposively selected for the study. Secondary data on various area of input subsidies were obtained from the Department of Agriculture Development and Farmers' Welfare (GOK), Coconut Development Board (CDB), Principal Agricultural Office (PAO), Kozhikode, Kerala State Electricity Board (KSEB), Trivandrum, websites of Fertilizer Association of India (FAI), Mobile Fertilizer Management System (mFMS), reports of District credit plan of Canara Bank (Lead bank), Kozhikode district and Potential linked credit plan of NABARD, Malappuram and Kozhikode district. Primary data were collected for the agricultural year during 2018-19 from the Balussery and Kattipara panchayat of Kozhikode district. The total sample size was 80, out of which 40 were small farmers (≤ 2 ha land) and 40 were large farmers (>2 ha of land).

In order to know the progress of agricultural input subsidies at Kozhikode district, the growth rate were estimated separately for the various input subsidies. Compound Annual Growth Rate (CAGR) was calculated separately for both Coconut Development Scheme (2010-14) and Keragramam scheme (2015-19). CAGR on total area covered under coconut development scheme as well as Keragramam was found to be positive about 5.78 and 23.48 per cent per annum, respectively. In case of total expenditure spent on both Coconut Development and Keragramam scheme, it was found to be an increasing trend with the positive growth rate of 11.75 and 14.66 per cent per annum, respectively. The total expenditure spent on the different components of Keragramam scheme was also found to be increasing trend with positive growth rate during 2015-19. The scheme "Replanting and Rejuvenation" implemented by Coconut Development Board (CDB), has the physical and financial achievement of 586.91 ha and 109.14 lakhs, respectively in the year 2017-18.

The growth rate of amount of electricity subsidy in Kozhikode and Vadakara circle during 2013-19 was -1.68 and 4.83 per cent per annum and the total growth rate for Kozhikode district was 0.48 per cent per annum, which was low.

The agricultural credit subsidy by the total banking sector from 2008-18 was 14.15 per cent per annum whereas the CAGR was calculated separately for commercial banks, cooperative banks and regional rural banks to the extent of 21.07, 8.18 and 10.88 per cent per annum.

The CAGR of different fertilizer subsidy such as urea, DAP, MOP, and complex fertilizer was found to have negative growth rate of -6.81, -1.13, -0.79 and -16.69 per cent per annum, respectively whereas SSP has the positive growth rate of 16.01 per cent per annum during 2014-18. The total fertilizer subsidies in Kozhikode district was found to have negative growth rate of -8.80 per cent per annum during 2014-18.

The annual maintenance cost of coconut cultivation was carried out using cost concepts. The total cost of cultivation (Cost C) incurred by the small farmers was ₹ 1.23 lakh ha^{-1} and large farmers was ₹ 1.07 lakh ha^{-1}. Small farmers has incurred more cost when compared with that of large farmers. In both the case of small and large farmers, the share of cost A_1 for the machine power was highest, followed by manures and fertilizer and hired labour. Net return at cost C for small farmers was ₹ 20,842 ha^{-1} and for large farmers was ₹ 38,222 ha^{-1}. B. C ratio at cost C for small farmers was 1.17 which was low when compared with that of large farmers, who has 1.36.

To calculate the resource use efficiency of coconut cultivation, Cobb Douglas production function was fitted separately for small and large farmers. In case of small farmers, quantity of hired labour, family labour, manures and fertilizers and machine power were found to be positively significant. The R^2 value for small farmers was

0.71 which indicated that 71 per cent of variation in yield was explained by the independent variables involved in the function. In case of large farmers, quantity of manures and fertilizers and soil ameliorants were found to be positively significant on yield whereas quantity of family labour has negatively significant. The R^2 value was found to be 0.59, which means 59 per cent of the variation in yield was explained by the independent variables included in the model. The result of allocative efficiency for the small farmers revealed that all the resources such as quantity of hired labour, family labour, manures and fertilizers, soil ameliorants and machine power were found to be underutilized. In case of large farmers, quantity of manures and fertilizers and soil ameliorants were underutilized whereas hired labour, family labour and machine power were over utilized.

Around 53.75 per cent of respondent were obtained the information about input subsidies from Krishi Bhavan, followed by 25 per cent from fellow farmers, 15 per cent from social media and 6.25 per cent from friends and relatives. All the small farmers were received the input subsidies from Keragramam scheme implemented by the State department of Agriculture wherease large farmers are not eligible to receive. A total of 22 farmers (27 per cent) were the beneficiaries of electricity subsidy and 29 farmers (36 per cent) were the beneficiaries of credit subsidies. The farmers who received the subsidies from Keragramam scheme were not eligible to receive any subsidies under CDB schemes.

The input subsidies availed by the sample respondents under Keragramam scheme were calculated. The total area covered by the sample farmers under Keragramam scheme in both Balussery and Kattipara panchayat were 99.47 acres and the total amount of ₹ 6,61,689 were availed. The results also revealed that, almost 27.17 per cent of the total amount of subsidies was utilized for doing the intercultural operation like basin opening/ weeding, followed by 25.17 for intercropping in coconut garden, 19.41 per cent for organic manure, 12.54 per cent for cut and removal of old palms. For the installation of irrigation components, 8.99 per cent of total input subsidies were utilized, 4.42 per cent for soil ameliorants, 2.12 per cent for the purchase of coconut climbing equipment and 0.18 per cent for replanting new seedlings. The major impact perceived by the farmers under Keragramam scheme was that it ensured cheap inputs to coconut farming, which was reported by 67.5 per cent of the respondents. Almost 55 per cent of beneficiaries perceived that input subsidies were sufficient under Keragramam scheme.

The total amount of credit subsidies availed by the beneficiaries were ₹ 2,16,450, of which ₹1,27,950 was availed by small farmers with the share of 59.11 per cent and ₹ 88,500 was availed by large farmers with the share 40.88 per cent of total credit subsidy. The non- beneficiaries has several reason for not taking the agricultural credit. Majority of the non- beneficiaries had their own fund for coconut farming, which was reported by 62.75 per cent respondents, followed by 21.57 per cent has the burden to repay the loan.

The amount of electricity subsidies availed by the small farmers was ₹ 14,100 with the share of 38.81 per cent of total amount of electricity subsidy. In case of large farmers, amount of electricity subsidy was ₹ 22,230 with 61.19 per cent share. The total amount of electricity subsidy utilized by the total beneficiary farmers was ₹ 36,330. Most of the non- beneficiaries (65.52 per cent) has depends fully on the rainfall for coconut plantation, followed by 27.59 per cent of farmers had a problem on complex procedure for availing the electricity subsidy.

To know the impact of agricultural input subsidies on coconut production, ordinary least square estimates (log-log model) was performed. The result revealed that amount of organic manure subsidy and amount of electricity subsidy was positively significant at 1 per cent and 5 per cent level of significance, respectively. The coefficient of multiple determination (R^2) was found to be 0.94, which means that 94 per cent of the yield variation was explained by the independent variables such as amount of subsidies on organic manure, soil ameliorants, credit subsidy and electricity subsidy.

Percentage analysis was used to know the perception of farmers on the impact of input subsidies on environment. More amount of subsidies to the chemical fertilizers would causes the more negative effect to the environment where as subsidies to organic manure causes the minimization of its negative effect. The subsidies for organic fertilizers were welcomed by the farmers to reduce the adverse

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environmental effect. The respondents also suggested for the recommended use of chemical fertilizers or the government should provide the fertilizer subsidy based on land fertility. Is subsidies provided for plant protection chemical, it causes the pollution to environment and harmful to microorganism, human and animals. This could be reduced by the use of bio-control agents as suggested by the farmers. In case of electricity subsidies, the farmers has less awareness on its impact on environment. But the subsidies to micro irrigation components can reduce the usage of water, thus can increases the water use efficiency as suggested by the farmers.

To know the major constraints faced by the farmers in availing the input subsidies, Garrett's ranking technique was used. Constraints faced by the beneficiaries were analysed separately for different input subsidies. Timely availability and limited quantity of subsidized inputs were the major constraints faced by the farmers under Keragramam scheme. In case of credit subsidy and electricity subsidy, complex procedure was the major constraints faced by the farmers. The suggestion were given by the farmers to improve the various areas of subsidy scheme. The suggestions included that the subsidized inputs should to distribute to the farmers required time, increase the amount of subsidy and also make the simple and transparent procedure to receive the subsidies.

5.1 Suggestions

The primary objectives of agricultural input subsidies by the Government is to involve income support to farmers and price stabilization of inputs. However, by reducing the costs of production, agricultural input subsidies encourage inefficient utilization of materials, energy and natural resources.

The subsidies given for chemical fertilizer, can alleviate unintended environmental problems such as contamination to environment and depletion of soil fertility. If more amount of subsidy were given to environmentally sustainable components such as organic manures and bio-fertilizer, it could enhance the use of these components by the farmers. This will considerably reduce the externalities caused due to chemical fertilizers.

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Subsidies given to electricity and irrigation water, encourage over-use of scarce water, and hence, water logging and soil salinization. In contrast, a subsidy to encourage micro irrigation components and solar pumpsets, may be environmentally beneficial, if it reduces the ground water depletion, increase the water use efficiency and enhance the conjunctive use of water. Conjunctive use of water comprises of harmoniously combining the use of both surface and groundwater in order to minimize the undesirable physical, environmental and economical effects of each solution and to optimize the water demand/supply balance.

Agricultural input subsidies could encourage the production of environmentally harmful pollution, lead to the excessive use of natural resources and often impose high costs on consumers, taxpayers and government budgets. The reduction/removal of environmentally harmful subsidies would increase economic efficiency, lessen government expenditure as well as improve environmental quality.

Large farmers were not eligible to receive the subsidy under Keragramam scheme. As the study indicated better utilization of available resources by the large farmers, it is recommended to follow fair degree of equity in the distribution of subsidy to all farm- size categories.

The input subsidy provided under the Keragramam scheme must continue during consecutive years, as suggested by farmers, as this scheme has been implemented in many panchayats for a year only.

Efforts should be taken to simplify the procedure to avail the electricity and credit subsidies by the farmers.

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Appendix I

APPENDIX – I

KERALA AGRICULTURAL UNIVERSITY

DEPARTMENT OF AGRICULTURAL ECONOMICS

COLLEGE OF AGRICULTURE, VELLAYANI

Schedule for primary data

ECONOMIC ANALYSIS OF AGRICULTURAL INPUT SUBSIDIES FOR COCONUT CULTIVATION IN KOZHIKODE DISTRICT

I. General Information:

1. Name of the Krishi Bhavan:
2. Name of the farmer:
3. Address:

4. Village panchayat:
5. Block:
6. Phone number:
7. Farming experience:
8. Family details:

S.No.	Relation with head	Sex	Age	Education	Occupation		Income (₹)	
					Main	Subsidiary	Main	Subsidiary
1								
2								
3								
4								
5								

Relation with head:

1. Head, 2. Wife, 3. Son, 4. Daughter, 5. Son in law, 6. Daughter in law, 7. Sister, 8. Brother, 9. Grandchild 10. Others

Sex: 1. Male 2. Female

Education: 1. No formal education 2. Lower and upper primary, 3. High school and higher secondary, 4. Graduation

Occupation: 1. Agriculture only, 2. Govt. Service 3. Private Job, 4. Own business, 5. Agricultural labour, 6. House wife

II. Size of Holding

a) Small farmers ($\leq$ 2 ha/ 5 acres) b) Large farmers (> 2 ha/ 5 acres)

III. Land particulars:

S. No	Particulars	Wetland (acres)	Garden land (acres)		Total (acres)
			Rainfed land	Irrigated land	
1	Area owned				
2	Area leased in				
3	Area leased out				
4	Net cropped area				
5	Area under coconut				
6	Land revenue (₹)				

IV. Assets Position

S. No.	Particulars	Number	Value (₹)	Year of construction/ purchased	Present value (₹)	Subsidy (₹)	Depreciation (₹)	Maintenance cost (₹)
a.	Farm building							
1.	Farm house							
2.	Cattle shed							
3.	Poultry house							
4.	Pumpset house							
b.	Farm Machinery							
1.	Tractor							
2.	Power tiller							
3.	Bullock cart							
4.	Pumpsets							
5.	Climbing machine							
6.	Dryer							

IV. Farm Implements:

S. No	Particulars	Numb er.	Year of purchase	Value (₹)	Subsidy (₹)	Expected life (years)	Depreciat ion (₹)
1.	Spade						
2.	Handhow						
3.	Pickaxe						
4.	Sprayer						
5.	Vaakathi/ knife						
6.	Ladders						

V. Livestock

S. No.	Types of animal	Total Number	Total Expenditure (₹)	Annual income (₹)	Net Return (₹)
1.	Cow				
2.	Goat				
3.	Sheep				
4.	Pig				
5.	Poultry				

VI. Family Expenditure pattern

S. No	Particulars	Expenditure (per month)
1.	Food Expenditure	
2.	Education expenses	
3.	Medical expenses	
4.	Recreation	
5.	Transportation	

VII. Particulars of Coconut cultivation

S. No.	Particulars	
1.	Total area under coconut	
2.	Variety	
3.	No. of palms in the area	
4.	Age of the garden	
5. .	Irrigated/ Rainfed	
6.	Spacing adopted	
7. .	No. of bearing palms	
8.	Harvest	
	Main product (nuts/palms/harvest)	
	No. of harvesting per year	
	Price/nut	

VIII. Method of irrigation

S. No.	Source	Area irrigated for coconut
1.	Canal	
2.	Tanks/ Ponds	
3.	Wells/ Bore wells	
4.	Pump set (Electric/ Diesel/ Solar)	
5.	Micro irrigation (Sprinkler/ Drip)	
6.	Others	

IX. Cropping pattern (Sole cropping/ intercropping)

S. No.	Crops	Area (cents)	No. of plants	Crop expenditure (₹)	Yield (in kg)	Price of the product (₹/kg)	Net Return (₹)
1							
2							
3							
4							
5							

X. **Input cost:**

S.No	Particulars	Quantity applied		₹/unit	Total expenses(₹)
		Unit	Quantity		
1.	Seedlings				
2.	Fertilizer application 1. Urea 2. DAP 3. MOP 4. SSP 5.Complex 6. Other fertilizer				
3.	Bio-fertilizer				
4.	Manures 1. Cow dung 2. Green manure 3. Sheep manure 4. Poultry manure				
5.	Soil ameliorants 1. Lime 2. Others				
6.	Herbicides 1. 2.				
7.	Pesticides 1. 2.				
8.	Fungicide 1. 2.				
9.	Total				

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XI. Labour cost:

Wage rate:

Male (₹/day):

Women (₹/ day):

Machinery rent (₹/ hours):

S. No.	Particulars		Family labour (man days)		Hired labour (man days)		Machine power (hours)
			Men	Women	Men	Women	
1	Digging pits and planting the seedlings						
2	Organic manure						
3	Fertilizer application						
4	Liming material						
5	Plant protection operation	Bio control					
		Chemical					
6	Weeding						
7	Irrigation						
8	Intercultural operation						
9	Harvesting						
10	Collection and handling						
11	Post-harvest operation						

XII. Agricultural input subsidies on coconut cultivation:

1. Awareness among the farmers regarding various input subsidies for coconut cultivation

S. No	Input	Aware	Not aware
1.	Coconut development "Keragramam"		
2.	Coconut Development Board schemes		
3.	NPK fertilizer		
4.	Electricity		
5.	Credit		
6.	Insurance premium subsidy		

2. Source of information about agricultural input subsidies
   a) Krishi bhavan
   b) Social media
   c) Fellow friend
   d) Relatives/ Friends
   e) Others

3. Source of availing subsidies

S. No.	Sources	Yes	No
1	State Department of Agriculture		
2	Coconut Development Board		
3	Kerala State Electricity Board		
4	Banking institution		
	Commercial Bank		
	Cooperative Banks		
	Regional Rural Banks		
5	ANERT (for Solar pump sets)		

4. Farm Credit:

S. No	Types of credit	Source	Purpose	Amount taken (₹)	Interest rate (%)	Repaid (₹)	Outstanding (₹)

5. Reason for not taking credit from bank:
   a) Interest rate on loans is high
   b) Complicated and time consuming procedure
   c) Own funds
   d) Not needed
   e) Burden to repay the loan

6. Reason for not taking electricity subsidy:
   a) Lack of knowledge
   b) Complex procedure
   c) Fully depends on rainfed
   d) Irregular electricity supply

7. Utilization of subsidies

S. No.	Activities	Amount of subsidy (₹)
1.	Nursery preparation (₹/cent)	
2.	Seedlings (₹/ seedling)	
3.	Soil ameliorants (₹/palm)	
4.	Fertilizer (₹/palm)	
	1. Organic	
	2. Inorganic	
	3. Bio fertilizer	
5.	Plant protection (₹/palm)	
	1. Chemicals	
	2. Bio control agents	
6.	Irrigation (Micro irrigation) (₹/unit)	
7.	Pump set (₹/unit)	
8.	Climbing machine and other implements (₹/unit)	
9.	Intercultural operation (₹/palm)	
10.	Intercropping (₹/ha)	
11.	Premium rate for insurance (₹/palm)	
12.	Electricity (₹/ha)	
13.	Credit (₹/palm)	

8. Opinion of farmers regarding the Keragramam scheme

S. No.	Statements	Agree	Disagree
1	Subsidies ensure cheap input to agriculture		
2	Subsidies reduce the cost of production		
3	Subsidies reduce the need to borrow		
4	Subsidies provide security to the farmers		
5	Increase the yield of the crops		
6	Increase the income of the farmers		

9. Which institute is providing more input subsidies?

   a) Krishi bhavan

   b) Coconut Development Board

   c) Banks

   d) Kerala State electricity Board

   e) ANERT

10. Do you feel that the input subsidies given by the Government is sufficient?

    Yes/ No

11. Constraints faced by the farmers in availing subsidies

S. No	Constraints	Rank
	Keragramam	
1	Lack of information	
2	Limited quantity of inputs	
3	Lowest amount of subsidies	
4	Low capacity to buy	
5	Availability in time	
6	Complex procedure to avail	
7	Improper quality of input	
8	Delay in release of subsidy	
9	Viability of subsidy scheme	
10	No fixed place of sale of subsidized inputs	
	Credit subsidy	
1	Complex procedure	
2	High rate of interest	
3	Credit limit	
4	Timeliness of credit	
5	Duration of credit	
6	Repayment procedure	
	Electricity subsidy	
1	Complex procedure	
2	Poor quality electricity	
3	Irregular Supply/ Frequent power cut	

12. Suggest the measures should be taken by government

- **a)** Amount of subsides directly transfer to farmers account
- **b)** Make simple documentation process for farmer
- **c)** Transparent procedure for distribution agricultural subsidies to farmers
- **d)** Gives quality inputs
- **e)** Given at the time of need
- **f)** Amount of subsidies
- **g)** Criteria for giving subsidies
- **h)** Others

Other information

Impact of agricultural input subsidies as perceived by the farmers

1. Is there any impact on the coconut farming due to the input subsidies?

   If yes, then mention

2. Do you feel that increasing input subsidies leads to the overutilization / mis utilization of inputs? Yes/ No

3. **Impact of fertilizer subsidy**

   Excess use of fertilizer due to the subsidized rate: Yes/ No

S. No.	Particulars	Yes	No	Can't say
1.	Contamination of environment (soil & water)			
2.	Depletion of soil fertility			
3.	Groundwater contamination affecting water quality			
4.	Decrease the response of the crop to fertilizer			
5.	Insect pest attack increases			
6.	Other (specify)			

Alternatives for fertilizer subsidy

1. Government should provide the subsidies based on land fertility
2. Use of bio fertilizer and organic fertilizer instead of chemical fertilizer
3. Application of recommended dose of fertilizer

4. **Impact of electricity subsidy**

Excess use of electricity leads to environmental problems: Yes/ No

S. No.	Particulars	Yes	No	Can't say
1.	Over exploitation of ground water			
2.	Irregular supply of subsidized electricity increase the maintenance cost of pump set			
3.	Fiscal burden to government			
4.	Increased use of electric pump set compared with diesel pump set			
5.	Other (specify)			

Alternatives for electricity subsidy

1. Pricing of electricity to farm sector
2. Solar power energy subsidy along with drip irrigation to reduce the overuse of water
3. Farmers willing to pay to get the good quality power? Yes/ No
   If yes, then how much amount willing to pay (₹/ unit)?

4. **Impact of organic fertilizer subsidy**

S. No.	Particulars	Yes	No	Can't say
1.	Helps to increase the soil fertility			
2.	Minimize the negative consequences of chemical fertilizer			
3.	Decreases the use of chemical fertilizer			
4.	Others (specify)			

5. Impact of micro irrigation subsidy

S. No.	Particulars	Yes	No	Can't say
1.	Helps in reducing the ground water depletion			
2.	Helps in increasing the water use efficiency by reducing the usage of water			
3.	Other (specify)			

6. Impact of plant protection chemical subsidy

Excess use of chemicals: Yes/ No

S. No.	Particulars	Yes	No	Can't say
1.	Chemical causing pollution to environment (air and water)			
2.	Soil gets toxic and decline in soil fertility			
3.	Chemical kills the non- target species			
4.	Chemical kills soil micro- organisms			
5.	Harmful to animal and human by accumulating in soil and leaching into water bodies			
6.	Other (specify)			

Alternatives for plant protection chemical subsidy

1. Use of bio control agents
2. Integrated pest management

7. Impact of credit subsidy

S. No.	Particulars	Yes	No	Can't say
1.	Reduce the credit intake from money lender			
2.	Use of credit for the some other purposes			
3.	Other impact (specify)			

8. Impact of machinery and implements subsidy

S. No.	Particulars	Yes	No	Can't say
1.	Destroying earthworm and beneficiary insects			
2.	Animal draft power decreases			
3.	Increase the jobless problem			
4.	Soil compaction			
5.	Other impacts (specify)			

9. Impact of seedling subsidy

S. No.	Particulars	Yes	No	Can't say
1.	May increase the need for inputs that negatively impact soil			
2.	May increase the need for inputs that negatively impact water quality/ quantity			
3.	Increase planting density			
4.	Other impacts (specify)			

Appendix II

Appendix II

Schedule for secondary data

Data from Department of Agriculture

1. Name of the Agriculture officer:
2. Phone number:
3. Address:

4. Block:
5. District:
6. Schemes on Coconut Development upto 2014-15:

   Major Objectives of the scheme:

   a)

   b)

   c)

   d)
7. Schemes for Coconut Development after 2014-15(KERA GRAMAM):

   Major Objectives of the scheme:

   a)

   b)

   c)

8. Fund allotted for the scheme:

	Year	Fund allotted (₹)
Upto 2014-15 (Coconut Development Scheme)		
After 2014-15 (Keragramam)		

9. Subsidies for each component of the schemes at present year:

S. No.	Components	Amount (₹/palm)	Rate of subsidies

10. Number of kera gramam under the schemes at present:
11. Area under one kera gramam:
12. Number of palms under per kera gramam (175 palms/ ha):
13. Total area covered and expenditure for each components under the schemes

S. No.	Components	Target		Achievement		No. of beneficiaries
		Physical	Financial (₹)	Physical	Financial (₹)	

Data from Banking Institution

1. Name of the Bank:
2. Name of the Bank manager:
3. Phone number:
4. Address:

5. Amount of agricultural credit given to the farmers in Kozhikode district:

S. No.	Year	Total Amount (₹)

6. What is the subsidized rate of credit to the farmers?

S. No.	Year	Rate of interest without subsidy (%)	Subsidized rate of interest (%)

7. Amount of credit subsidy availed by the farmers in Kozhikode district

S. No.	Year	Amount (₹)	Number of farmers

8. Is there any interest free loan to the farmers? Yes/ No If Yes, then
9. How much amount of interest free loan was given to the farmers?
10. How many number of farmers are benefited from interest free loans?

Data from Kerala State Electricity Board

1. Name of the chairman:
2. Phone number:
3. Address of the office:

4. District:
5. Power sold in Kozhikode district:

S. No.	Year	Total power consumed	Power consumed by agricultural sector

6. Per unit cost of power supplied

S. No.	Year	Cost (₹/unit of power)	Amount of subsidy (₹/unit)

7. Amount of electricity subsidies given for agricultural purpose:

S. No.	Year	Amount of subsidies	Number of farmer benefitted

Data from ANERT

1. Name of the officer:
2. Phone number:
3. Address of the office:

4. District:
5. Functions of ANERT:
    a)
    b)
    c)
    d)
    e)
6. Is there any scheme available for solar subsidy for agricultural purpose:
   If yes, then give the below information requires:
7.

S. No	Name of the scheme	Implemented year
1.		
2.		
3.		

8. Procedure to get the solar pump set subsidy
9. How much amount of solar subsidy for single solar pump set?
10. What is the percentage rate of subsidy for the individual solar pump set?
11. How many solar pump sets installed in Kerala through ANERT and in which district?
12. How many number of farmers were benefitted under ANERT (year wise)?

Appendix III

APPENDIX- III

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 AGRICULTURAL INPUT SUBSIDIES FOR COCONUT CULTIVATION IN KOZHIKODE DISTRICT

by

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(2017-11-118)

Abstract of the thesis

Submitted in partial fulfilment of the

requirements for the degree of

MASTERS OF SCIENCE IN AGRICULTURE

Faculty of Agriculture

Kerala Agricultural University

DEPARTMENT OF AGRICULTURAL ECONOMICS

COLLEGE OF AGRICULTURE

VELLAYANI, THIRUVANANTHAPURAM – 695522

KERALA, INDIA

2019

ABSTRACT

The study entitled "Economic analysis of agricultural input subsidies for coconut cultivation in Kozhikode district" was carried out with the objectives of analyzing the growth of input subsidies for coconut cultivation, to analyse the impact of input subsidies on coconut production and also to identify the constraints faced by the farmers in availing the input subsidies. The relevant secondary data regarding the progress of Coconut Development Scheme and other areas of input subsidies such as fertilizer, credit and electricity in Kozhikode district were collected from the concerned institutions. Primary data were collected from Balussery and Kattipara panchayat of Kozhikode district for the agricultural year 2018-19. Random sampling technique was adopted and the total sample size was 80, out of which 40 were small farmers (≤ 2 ha of land) and 40 were large farmers (>2 ha of land).

The results of Compound Annual Growth Rate revealed that the total expenditure of Coconut Development Scheme (2009-14) was much lower (11.75 per cent per annum) when compared to that of Keragramam scheme (14.66 per cent per annum) by the Government of Kerala (2015-19). The total amount of electricity subsidy (2013-18) was recorded to have slow growth rate (0.48 per cent per annum) whereas credit subsidy (2008-18) was found to have faster rate (14.15 per cent per annum). The growth rate of total amount of fertilizer subsidy was found to be negative (-8.80 per cent).

Cost of cultivation was worked out using the ABC cost concept. The total cost of coconut cultivation (Cost C) incurred by the small farmers was ₹ 1.23 lakh ha^{-1} which was more than that of large farmers (₹ 1.07 lakh ha^{-1}). It was found that profitability was more for large farmers with a B:C ratio of 1.36 while small farmers had a comparatively smaller B:C ratio of 1.17.

The results of Cobb-Douglas production function revealed that the R^2 value for small farmers and large farmers was 0.71 and 0.59 respectively which indicated a good fit. The analysis of allocative efficiency for small farmers and large farmers revealed that only two components *viz.*, quantity of manures and fertilizers and soil ameliorants were underutilized. While small farmers had underutilized quantity of

hired labour, family labour and machine power, the large farmers had overutilized these resources.

Almost 54 per cent of respondents obtained the information about input subsidies from Krishi Bhavan. All the respondent small farmers were beneficiaries of Keragramam scheme implemented by the State Department of Agriculture, while large farmers were not eligible. A total of 29 farmers (27 per cent) and 22 farmers (36 per cent) were beneficiaries of electricity and credit subsidy respectively.

The total area covered by the sample farmers of Balussery and Kattipara panchayat was 99.47 acres and a total amount of ₹ 6.61 lakhs was availed under Keragramam scheme. The input subsidy under Keragramam scheme ensured cheap inputs for coconut farming as perceived by 67.5 per cent of the respondents. Nearly 55 per cent of beneficiaries perceived that input subsidies were sufficient under Keragramam scheme. The total amount of credit subsidies availed by the beneficiaries was ₹ 2.16 lakh, of which 59 per cent was availed by small farmers and 41 per cent by large farmers. The total amount of electricity subsidy availed by the beneficiaries was ₹ 36,330 of which 39 per cent was availed by small farmers and 61 per cent by large farmers.

The statistical analysis of the impact of agricultural input subsidies in coconut production revealed that the amount of subsidy for organic manure and electricity significantly increased the yield at 1 per cent and 5 per cent level of significance, respectively. The coefficient of multiple determination (R^2) was 0.94, which indicated that 94 per cent of the variation in yield was explained by the independent variables such as amount of subsidies for organic manure, soil ameliorants, credit subsidy and electricity subsidy.

The timely availability and limited quantity of subsidized input were the major constraints faced by the beneficiaries under Keragramam scheme whereas complex administrative procedure was the major constraint faced by the beneficiaries of both electricity and credit subsidy.

Large farmers were not eligible to receive the subsidy under Keragramam scheme. As the study indicated better utilization of available resources by the large farmers, it is recommended to follow fair degree of equity in the distribution of subsidy to all farm- size categories. If more amount of subsidy were given to environmentally sustainable components such as organic manures and bio-fertilizer, it could enhance the use of these components by the farmers. This will considerably reduce the externalities due to chemical fertilizers. If more amount of subsidies were given to solar pumpset and micro-irrigation components, it will reduce the externalities from electric pumpset and enhance the conjunctive use of scarce resources such as water. Conjunctive use of water comprises of harmoniously combining the use of both surface and groundwater in order to minimize the undesirable physical, environmental and economic effects of each solution and to optimize the water demand/supply balance. Thus the study can be a guide for planners and policy makers.