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Chapter 4

Organic Farming In Kerala: An Empirical Investigation

4.1. Introduction

Organic farming is gaining gradual momentum across the world. Growing awareness of health and environment issues in agriculture has demanded production of organic food which is emerging as an attractive source of rural health generation. While trends of rising trends of rising consumer demand for organic are becoming discernible. Sustainability in production of crops has become prime concern in agricultural development. The term organic farming is getting popularity in recent times. India being agricultural nations and backed by legacy of organic farming has a tremendous potential to make a mark in the international markets. In view of its unique position the consumers and importers in organic foods in the world over are looking forwards in India. It is due to the potential of the producers and suppliers. It is due to the potential of the producers and suppliers. Therefore development of organic marketing in India offer good opportunities both for domestic use and promotion of international trade in organic products (Ramesh, 2005).

Organic farming is an organic agricultural system that originated early in the twentieth century in response to rapidly evolving agricultural practices, in an effort to improve the environment and prevent against adverse environmental impact. Organic agriculture contributes significantly to the global food supply, through the use non – chemical pesticides and fertilizers. It is also beneficial to the local environment impact. Organic agriculture contributes significantly to the global food supply, through the use of non-Chemical pesticides and fertilizers. It is also beneficial to the local environment by reducing food miles, air pollution, water pollution and greenhouse gases. More than 25% of the world's produce is produced organically, including meat, eggs, dairy products, sugarcane, fruits, vegetables, coffee, tea and coffee. Organic farming is based on the principles of natural agriculture, conservation of soil and biodiversity, respect for human health and the reduction of use of chemical fertilisers and pesticides. This has made organic farming difficult in some parts of the world, especially in terms of access to land and working conditions for the people who work on them. For these, reasons organic farming can be a complex and time-consuming activity, as it requires an appropriate climate, soil structure and management strategies. Organic farming can also be quite expensive due to the labour and equipment involved, but it is generally more-cost effective than conventional

farming. In return, organic farming helps protect the environment and ensure healthier quality foods, as conventional farming uses synthetic chemicals and toxins that may be harmful to the environment (Joshi, 2001)

These are many benefits to organic farming, including a reduction in food waste, lower production costs, better soil and water quality, improved pest control, more organic products, reduced fuel emissions and less food borne diseases. However, one of the most important benefits of organic farming is the assurance of quality produce. Organic food products are usually free form harmful pesticides, herbicides and fertilizers. These chemicals may be dangerous to humans and damage the soil, potentially leading to food insecurity. In addition, the absence of these chemicals means a smaller carbon footprint.

4.2. Organic Farming in India

4.2.1. Principles of Organic Agriculture Practices

Principle of Health

The role of organic agriculture, whether in farming, processing, distributing, or consumption, is to sustain and enhance the health of ecosystems and organisms from the smallest in the soil to human beings. In view of this, it should avoid the use of fertilizers, pesticides, animal drugs and food additives that may have adverse health effects. Modern period people are more health conscious that is the base fact for transforming from conventional method to organic method.

Principle of Ecology

Organic agriculture should be based on living ecological systems and cycles, work with them, emulate them and help sustaining them. Organic management must be adapted to local conditions, ecology, culture and scale. The reduction of inputs by reuse, recycle and the efficient management of materials and energy will contribute to improve environment quality and will conserve resources. Ecological balance is the prime concern for human being and other living organisms. Conventional farming methods slowly kill the environment and breaking the equilibrium of the environment, it has a adverse impact to the human beings.

Principle of Fairness

This principle emphasizes that those involved in organic agriculture should conduct human relationship in a manner that ensures fairness at all levels and to all parties farmers, workers, processors, distributors, traders and consumers. It also insists that animals should be provided with the conditions and opportunities of life according with their physiology, natural behavior and well-being. Natural and environmental resources that are used for production and consumption should be managed in a socially and ecologically fair way and should be held in trust for future generations. Fairness requires systems of production, distribution and trade that are open and equitable and account for real environmental and social costs.

Principle of Care

This principle states that precaution and responsibility are the concerns in management, development and technology choices in organic agriculture. Science is necessary to ensure that organic agriculture is healthy, safe and ecologically sound. However, it must consider valid solutions from practical experiences, accumulated traditional and indigenous knowledge and prevent significant risks by adoption appropriate technologies and rejecting unpredictable ones, such as genetic engineering.

4.2.2. Background of Organic Farming in India

The Indian Agriculture is traditionally organic and farmers were following cultivation till the middle of the last century. During the period the production of food grains has increased four folds from 50.82 mt in 1950-51 to 212.05 mt on 2003-2004. But the indiscriminative and excessive use of chemicals during this period has put forth a question mark on sustainability of agriculture in calling attention for sustainable production which will address soil health and eco-friendly agriculture. Organic farming appears to be one of the options for sustainability. Organic agriculture in India starts in 1900 onwards. The year 2000 is very important year for India on the field of organic farming. There are four major events during the year 2000 (NPOP, 2000)

(1). The planning commission constituted (2000) a steering group on agriculture which identified organic farming as a national challenge and suggested it should be taken in the form of a project as major trust thrust area of 10th plan. The group recommended organic farming in rain fed areas and in the areas where the consumption of agro chemicals is low or negligible.

(2). The National Agriculture policy (2000) recommended promotion of traditional knowledge of agriculture relation to organic farming and scientific up-gradation of organic farming in Kerala.

(3). The Department of Agriculture and co-operation (DAC) and Ministry of agriculture constituted (2000) a task force in organic farming.

(4). The ministry of commerce launched the National Organic Programme in April 2000 and Agricultural and Processed Food Products Export Development Authority (APEDA) is implementing the National Programme for Organic Production (NPOP).

4.2.3. India's Position in Organic Farming

India exported 135 organic products under 18 categories. The total volume of export was 44,476 tons in 2020 but the quantum of export was increased 888187 million tons in 2021. The overall growth of organic food exports was 50.5% over the year 2021. Around 60% of the country's organic products were exported to the Economic Union, 8% to Japan and the rest of Canada, Australia and East Asian countries, India ranked 33rd in terms of total land under organic cultivation, and 88th in terms of ratio of agriculture land under organic crops to total farming areas.

4.2.4. India's Advantages in Organic Farming

India is endowed with various types of naturally available organic cultivation of crops. Indian market shows there is a progressive demand for organic food products. A study was organized by International Competence Centre for Organic Agriculture (ICCOA) in major cities of India it is found that the market potential for organic product in the metros is Rs.1462 crores, out of this 562 is available from modern retail. Market potential for India is estimated at Rs. 2300 crores. Delhi and Bangalore are top two cities in terms of market potential.

Table 4.1
Use of Organic Manures in India (2020)

A.	Crop residue	3.865 million tones
B.	Animal dung	3.854 million tones
C.	Green manure	0.223 million tones
D.	Bio-fertilizer	0.370 million tones

Source: NPOP statistics, 2021

The consumers express very high demand for organic products. It is found that consumer is ready to pay only 57% more for items at a regular consumption, while organic products are available at a premium of 15 to 20%. The market for organic products can be developed at 2 levels. The first one is Niche market which can be developed by creating awareness about certified organic branding and selling through special stores. The second level is mass market. The gain in promoting organic food in mass market is enormous. It is considered that all the consumers want safe healthy products at affordable price. The difficulty in taping this market is also very high, the reason being high cost of certification and quality assurance mechanism.

4.2.5. Relevance of Organic Farming in India

The need for organic farming in India arises from the unsustainability of agriculture production and the damage caused to ecology through the conventional farming practices. But the productivity was very low. Food production was not enough for the population. The green revolution became the Government's most important programme in 1960s, conventional and organic fertilizers replaced by chemical pesticides. Before green revolution it was feared that millions of poor would die of hunger in the mid 1970's. However, the green revolution within few years showed its impact and the country reduced its import. In 1990s, India had surplus food grains and once again became an exporter of food grains. The productivity of Indian agriculture has been boosted by green revolution. In due course of time its harmful effects on eco-system hampered the productivity of soil. The conventional agriculture practices the world over promoted an overriding quest for accumulation of wealth. Therefore, there is a need to have complementarily used of organic farming to sustain and extent the productivity. Now these days the use of organic farming is considered as a crucial parts part of agriculture. Chemical farming products becomes

poison's food. It affects the health with stagnation in its crucial agriculture. They have advocated that "organic farming" initiatives are providing indications on how to reap marginal profits from this sector (Perkins, 1997).

The agriculture and allied sectors in India provide employment to 65% of the workers and accounts for 30% of the national income and India have concerned much more than any other nations of the world as agriculture is the source of livelihood of our people it is the foundation of the economic development of the country .there were times when people lived close to nature, land, water and air. The most fundamental resources supporting the human life have degraded into such an extent that they now constitute a threat to the livelihood of millions of people in the country.

The area under cultivation cannot be increased and the present 140million hectares will have to meet the future increase in such demands. There is a strong reason for decline in cultivated area because of urbanization, which in turn will export much pressure on the existing cropped area. The new technologies he helped men to increase agriculture production. Modernization of Indian agriculture is based on the use of high yielding variety seeds, chemical fertilizers, irrigation and pesticides and also on the adoption of multiple cropping systems with the extension of area under cultivation. It also puts severe pressure on natural like land and water (Das, 2004).

The organic production of meat products like poultry, livestock fisheries are in not satisfactory level in India. The production is not limited to the edible sector but also produce organic products, cosmetics, functional food products body care products etc. there are three types of organic producers in India. Traditional organic traders who flow for subsistent needs, commercial farmers who have surplus and export their produce through different channels and private companies which either have their own farms or organize large conversion programs with growers India of certified organic products. Cotton leads among the products exported (16'503 million tons) India exported 86 items in 2007-2008 with the total volume of 37533 metric tons.

4.2.6. Major Organic Markets in India

The organic products are available in the domestic market are rice, tea, coffee pulses and vegetables. Wholesalers, traders, super markets and own shops are the major channels in the domestic markets which are mainly in the metropolitan cities, and accounts for only 75% of total organic production. The exports of organic products are dealt with by export companies NGO interventions and various types of organic products are provided by the government as the man advantage of Indian organic product markets.

Table 4.2
Major Organic Markets in World (2020)

Place	Market
Asia	Japan, Singapore
Europe	Nether lands, U.K. Germany, Belgium, Sweden, Swifter land, France Italy, Spain, USA and Canada
Middle east	Saudi Arabia and UAE

Source: Department of agriculture and co-operation, ministry of agriculture 2021

4.2.7. Central Government Policies for Organic Agriculture in India

The policy of ministry of Agriculture seeks to promote technically sound economically viable, environmentally Non-degrading and socially acceptance use of natural resources in favor of organic agriculture. The policy seeks to promote organic farming for strengthening rural economy, promoting value addition acceleration growth of Agro business and securing fair standard of living for the farmers and agricultural workers and their families. The 10^{th} five year plan emphasizes encouragement to organic farming with the use of organic waste integrated pest management and integrated in coordination with department of agriculture and cooperation Nutrient management. Even 9^{th} five year plan had emphasized the promotion of organic products with the use of organic and bio inputs for the promotion of sustainable agriculture. Agriculture Ministry is promoting organic farming in the country with the help of various associations such as National Horticulture Mission for North east. Rashtriya Krishivikas Yojana etc. Indian Council of agriculture research has initiated on all India Network projects on organic farming

to ensure the development and promotion of scientifically proven methodologies in organic farming.

4.2.8. Tradeoff between Organic and Sustainable Agriculture

Most of the components of organic agriculture are invariably contained in sustainable agriculture practices. Sustainable practices address the most vital requirements in agriculture, viz the immediate problem of feeding the present population, the long term problem of meeting future food needs and preventing the deterioration of the natural resources that agriculture depends on sustainable agriculture envisages judicious use of present technologies and development of innovations that would enhance productivity and producing without causing irreversible environmental degradation. Good agricultural practice or good agronomy are essential for the success of sustainable agriculture. Agriculture professionals for analyzing the success of sustainable farming systems and to identifying ways of improving the productivity, profitability and resource, efficiency are using by agro-ecological approach. The ultimate goal of agro-ecological design is to integrate farm components. So overall biological efficiency is improved, biodiversity is preserved and agro-eco-system, productivity and its self-regulating capacity are maintained.

4.2.9. Constraints of Organic Farming India

High price expectations, delayed delivery quality restrictions, lack of production, high cost of inputs, lack of certification, huge expense on certification marketing networks are some of the constraints in marketing organic products internationally. In domestic market, market does not provide any incentive to organic production.

Farming policies in India have traditionally not favoured organic agriculture though the country has strong potential for organic farming. The problem is that India is not working to adopt appropriate organic standards and policies like many other countries. However the policy makers are increasingly realizing that fact and are introducing many fiscal and risk reduction strategies to promote organic farming in the country. Organic farmers are still facing some concerns for instance. Most of the organic market oriented programs are an arrangement between trading companies and

farmers in which the companies are clearly dominant which puts farmers at a disadvantage.

Table 4.3

An Overview of Organic Farming India (2020)

Area under certified	4339184 hectare
Total Farm Production	34996800
Number of farmers	1,599010
Total quantity exported	888179 million tones
Value of total export	707849 lakhs

Source: Department of Agriculture and Co-operation, Ministry of agriculture 2021.

Experts say that for the promotion of organic agriculture. Besides, the most efficient way to do this is by inviting the private sector to provide marketing services and even required investment for organic farming.

Table 4.4

Area of Organic Cultivation and Organic Production in Kerala (2020)

Sl.No	Cultivated Area	Hectare
1	Cultivated Area (Organic +In- Conversion)	2657889
2	Wild harvest Collection Area	1681295.61
	Total Area	4339184.61
Organic Production		
1	Farm Production	3468991.98 MT
2	wild harvest production	27808.36 MT
	Total Production	3496800.34 MT

Source: Source: NPOP statistics, 2021

The table 4.1 shows that area of organic cultivation in India in 2020, the total cultivated area is 2657889 hectare and the wild harvest area is 1681295.61 hectare. Organic production includes the total farm production and wild harvest production. The total farm production was 3468991.98 (99.2%) million tonnes in 2020. The total organic production was 3496800.34 million tonnes out of that 27808.36 (.8%) tonnes comes under the wild harvest production. The 99.2% of the organic production was comes from the farms and only 2% of the production was from wild harvest production.

The table 4.2 shows the various operators related to organic farming in India . As per the NPOP statistics 2021 exhibits five group are involved in organic farming and its promotional activities. The main operators of the organic farming are

individual farm producers, ICS groups, and organic processors, traders and wild operators. The total number of operators is 10795. The total number of registered organic farmers is 1599010 in India 2020. To grow organic farming in a widely, policy makers should provide farmer friendly data base that deliver market knowledge. The country should do way with fertilizer subsides which are acting as hindrance and limiting the scope of adoption of organic agriculture in a big way. Organic agriculture in India has made good progress during the last 6 years with a combined effect of farmer's effort, NGO's work, government interventions and market forces. Indian organic agriculture has reached a stage where it can play, a significant role not only in the growing domestic market but also in global organic food trade.

Table 4.5

Operators Statistics of Organic Farming in India (2020)

Sl. No	Category	Number
1	Individual farm producers	3495
2	ICS Groups	4791
3	Total Processors	1703
4	Total Traders	745
5	Wild Operators	71
6	Total Operators	10795
7	Total Farmers	1599010

Source: Source: NPOP statistics, 2021

In fact organic farming in India is experiencing a real boom and the country has tremendous potential to grow crops organically and emerge as a chief provider of organic products in the international market. I India organic farming has a market that is demand oriented. The organic farming is properly planned and executed ;It will become an important foreign exchange earner and money –spinner for the farmers .According to experts for many Indian farmers the approach seems to other a new option for ensuring their livelihood as they can reduce production costs and at the same time ,gain access to markets with better prices for their products while India could have to growing share in supplying export markets , the Indian domestic market for organic farming food appears as a sleeping gland which need to be awakened. Organic farming in India needs to minute attention to market intelligence regarding which crops grows where to sell, destruction channels, competition market access etc. there is also a need to identify and assign ample number of committed service

providers who will act as transfer of technology to identified farmers and connect the certification agencies with the farmers (Reed and Holt, 2006)

Organic farming generally implies to modes of agricultural production which avoids the use of synthetic fertilizers, pesticides and herbicides. It also aims in to recreating a virgin earth and a serene and primitive environment through intelligent selection of production procedures. An organic farming system excludes the use of synthetic inputs such as synthetic

4.3. Organic Farming in Kerala

Agriculture has a good potential in agriculture sector. The organic farming in Kerala shows a increasing trend that is the area of farming and number of registered organic farmers are increasing trend. Kerala Agricultural University has published the adhoc package of practices and recommendations for organic farming in Kerala. Kasaragod district witnessed harshness of chemical pesticides. Kerala organic farming is not limited to crop production alone. Kerala has a rich potential to the production of wide variety of agricultural crops. There are so many initiatives taken by the government and various organizations in promotion of organic farming in Kerala. Government started a state wide intensive programme Jaiva Keralam and formulated new agricultural policy in 2007 to promote organic farming in Kerala.

4.3.1. Organic Farming and Organic Markets in Kerala

The Consolidated organic statistics (2020-2021) by National programme for Organic Production (NPOP), Kerala belongs to the 11th position to compare with other states in India. Kerala has an organic cultivation 48364.18 hectare; it is comparatively low with comparing other states like Maharashtra (371722.62 hectare) and Rajasthan (29686.29 hectare). The table 4.5 shows the area under cultivation of organic farming in Kerala, it shows decreasing and increasing trends in area under cultivation, in 2015-16 the total area under cultivation was 44788.50 ha; and it is decreased in 2016-17 and 2017-18 area under which 43701.88 ha; and 34160.14 ha; respectively. But from the period of 2017-18, it shows an increasing trend in the case of area under organic cultivation. It clearly indicates a positive trend on organic farming. The Table 4.6 shows Kerala's position in organic farming during the period

2020-21, the state belong to the 14th position in the case of area under cultivation. Total area under the organic cultivation was 48364 ha; out of that 45070 ha is farm area and the remaining is organic area under wild cultivation .i.e., (3293 ha). The total farm production is 27850 million tons.

Table 4.6
Area under Organic Cultivation in Kerala (2020)

Period	Area under certified
2015-16	44788.50
2018-19	40911.24
2020-21	48364.18

Source: National Policy for Organic Farming Data 2021

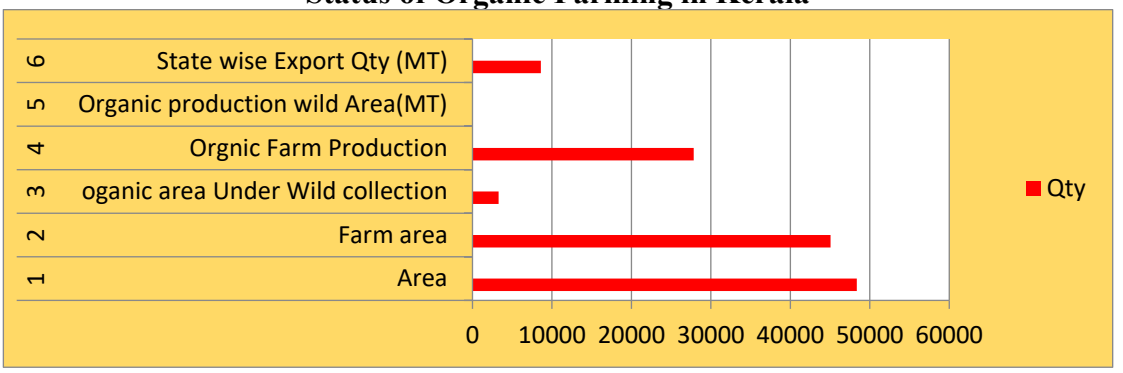
Export is the one of the best indicator to access the economic performance of organic farming Kerala attained 4th position in state wise organic exports with export of 8610.66 million tons.

Table 4.7
Status of Organic Farming in Kerala (2020)

Sl. No	Particulars	Qty	Position
1	Area	48364	14
2	Farm area	45070	11
3	organic area Under Wild collection	3293.8	15
4	Organic Farm Production	27850	10
5	Organic production wild Area(MT)	3.5	14
6	State wise Export Qty (MT)	8610.66	4

Source: NPOP Statistics 2020-21

Figure 4.1
Status of Organic Farming in Kerala



Source: NPOP Statistics 2020-21

4.3.2. Organic Markets in Kerala

The concept of group marketing was developed with focus on empowering and facilitating the farmers to take more effective decisions for marketing of their produce. The concept of group marketing's thereby provides self-help groups,

numbering about 200-300 farmers, come together under the banner of Swasarya Karshaka Samithi (SKS) and trade their produce collectively. This helps the farmers to have volume thereby being a better position to negotiate with the wholesalers in order to optimise their returns and large induces traders to buy from the Swasarya Karshaka Samithi (SKS). It directly helps to reduce the transportation cost and time. The main highlight of this samithi is

1. Production centre oriented marketing system
2. Framers owned markets
3. Expert management committee.
4. Ensure market information and support from VFCK
5. Adopting proper accounting methods and regular auditing
6. Reduced size of marketing chains.

There is a rich potentional for promoting organic farming in Kerala in the intensity of inorganic agriculture is not severe with comparing the neighbouring states in India. While the national average consumption of fertilisers and pesticides during 2020 was 120kg/ha and 340/ha resepectively, It was only 80/Kg and 224kg/ha respectively in Kerala. These points to the positive side of agriculture in Kerala for the consumption of hazardous chemicals and therefore the chances of redeeming farmers to organic agriculture are quite high. By realising these realities Kerala Agricultural Department commenced organic farming promotional activities. Currently there are a number of registered certified farmers in the state, mainly targeting export markets.

Kerala also has accredited organic certifying agencies for providing certification and catering the needs of organic farmers. Pokkali and kaipad cultivation, Cultivation of Jeerakasal and Gandakasala varieties of paddy cultivation in Wayand District and home staed farming systems all over the state are default Organic. The main organic markets in the Kerala

1. KADS Open markets in Thodupuzha

2. Thermal Organic Bazaar Thiruvanathapuram.

3. Eco shops in Thissur and Kozhikode

4. Jaiva krishi Sevena Kendram in Kannur

5. Self-help groups of Women like Kudumbasree and Janasree

These markets are encouraged to undertake organic farming of vegetables and they run organic markets successfully. Understanding the growing demands, private entrepreneurs have also entered into the organic food business.

Organic farming makes agriculture become more rewarding and appreciable, sustainable and respectable, sustains soil fertility by preventing the loss of soil and leaching of minerals protects and enriches bio-diversity microorganisms, soil flora and fauna, plants and animals. Organic farming helps to improves and maintains agro ecosystem and natural landscape for sustainable production. The Organic farmers are mostly on renewable on-farm resources. It encourages consumption of renewable energy resources mechanical and other alternative sources of fuel. It includes domestic animals are an essential part of organic system which helps maintaining soil fertility and also increases the income of farmers.

4.3.3. Role of Kudumbashree to Promote Organic Farming in Kerala

The main vision of the kudumbasree in the field of organic farming is to promote organic farming and agricultural commodities with organic certification. Kudumbasree has ventured into realm of organic cultivation with a missing of bringing 10,000 Hectare under of organic farming in 2020 clusters in all districts. During the current year the mission expects an involvement of around one lakh kudumbasree women farmers in 20000 Joint Liability groups. Joint family groups are group of women farmers comprising of 4 to 10 members Undertaking farm livelihood activities, these groups are the foundation of all agricultural movements in Kudumbasree aiming at social and economic empowerment through sustainable agricultural development. National centre of Organic Farming (NCOF) approved regional council will give necessary support and guidance and training for the smooth function of the organic farming. NCOF has also facilitated the certification process.

4.3.4. Self Helps Groups and Organic farming in Kerala

Self Help Groups are the backbone of Vegetable fruits promotion council of Kerala. Self-help groups are groups of farmers with identified common objectives, task group identities and neighborhood. The council is moulding the self-help groups as the basic local institutional units for introducing innovative interventions in

horticulture. In rural area the farming societies is formed through the creation of small self-help groups. The self-help groups created with to twenty members in each group. The main objectives of these groups are creating employment opportunities among the rural people.

4.3.5 Technology Development for Promoting Organic Farming

Participatory Technology Development (PTD) is an approach which ensures the active involvement of the farmers in technology up gradation and refinement. Farmers playing the key role in technology development and its diffusion. Development in technology in the field of agriculture will leads to scientific development in farming methods government introduces many programmes and measures to strengthen organic agriculture in Kerala.

4.3.6. Extension Programme of Organic Farming in Kerala

The extension approach is marked with features like office-less extension, frequent farm and home visits by professionally qualified extension personnel and massive awareness programmes like campaigns and demonstrations. The extension officers of VFPCK include Managers, Deputy Mangers and Assistant Managers who operate based on a present schedule and are always accessible to the farmers and regular field visits and providing necessary technical advice regularly. This helps farmers to appraise their problems and solve them.

4.3.6.1. Demonstrations in Organic Farming in Kerala

Demonstration is very effective extension method to disseminate new technology. VFPCK demonstrate proven technologies to farmers to convince them about the feasibility and applicability of new practices. Scientifically proven practices such as box method of vermin-composting, preparation of organic pesticides like neem oil emulsion, neem oil-castor oil emulsion, safe handling of pesticides, high yielding varieties, improved production technologies etc are demonstrated to farmers. Self-help groups farmers' visits the demonstration plots to have a firsthand experiences of the techniques.

4.3.6.2. Campaigns

VFPCK organises campaigns to create mass awareness and invoke collective action through campaigns, extension messages reach maximum number of people at the shortest possible time. Need based campaigns are organised on the field of vermin composting, formation of organic manures, usage of organic components, controlling measures of plants diseases.

4.3.6.3. Supply of Seeds

Vegetable seeds of 19 different types of High Yielding Crops suitable to the Agro Climatic conditions of the State are produced by 104 trained Seed Growers under the technical guidance of the Seed Technologist. This is a shining example of how Public-Private Participatory (P.P.P) models can attain excellent results. These units have nurtured and developed a harmonious and long standing relationship with the farmers of Chittur taluk of Palakkad over the past 14 years to achieve what many thought impossible till recently. This unit is today widely acknowledged as the only centre capable of engaging in the commercial production of vegetable seeds in Kerala and operating in an economically viable manner.

4.3.6.4. Uniqueness of VFPCK Seed Production Programme

1. Seed Production without formal contract
2. Commercial seed producer in Kerala
3. Lion share of vegetable seed production in public sector
4. Competitive price when compared to other PSU's in Kerala
5. Exclusive fully fledged Seed Testing Lab for Vegetables
6. Well trained trustworthy and efficient seed growers
7. Plays vital role in promoting high yielding varieties
8. In VFPCK Seeds are produced by farmers for the farmers
9. VFPCK acts as a facilitator to maintain genetic and physical purity of seed

4.3.7. Pest and Disease Surveillance and Early Warning System

Pest and disease surveillance and forecasting system provides advanced information on the possible occurrences of pest and diseases so that the farmers can take adequate precautionary measures against pest and disease attack. Plots of major crops will be selected for pest and disease surveillance in each district. The professionally qualified field staff will regularly monitor the plot and the information will be recorded in the observation cards regularly. Accordingly, the message including pest and disease management practices will be communicated to the farmers.

4.4. Comparison of Organic and Conventional Farming in India

Agriculture is the prime sector for employment generation and food in many developing countries like India. The green revolution in India resulted in yield enhancement. The emergence of the green revolution in India had intensified the chemical fertilisers used in farming practices. This movement was a short run remedy for food production and food security. The use of heavy and improper chemical fertilisers degraded the soil fertility and raised the cost of organic production. The chemical intensification has also poised the environmental degradation as well as the fertility level of the soil at present the desire for sustainable agriculture is a global need, but how to do so is remain elusive (Rigby, 2001).

According Ikerd (1993), Sustainable agriculture can define as asystem that at can maintain and keep usefulness in the long run for society. The various alternative farming systems are proposed to solve agriculture sustainability problems led by the conventional agriculture system (Bowler, 2002). Today organic farming has become one of the most prominent alternative farming systems that can improve soil fertility, reduce production costs, improve plant nutrients, assure health benefits, and transform overall agriculture into sustainable agriculture. However the relative yields from both farming systems differ across the regions (Ponti et.al, 2012). The world has been witnessed a movement towards organic agricultural production and transformation in recent decades. India has the maximum number of organic farmers worldwide but contain only 1% total organic land it is very challenging for the Indian farming system to cope with comparatively diverse production output either in the short-run or long run.

The essential difference between organic and conventional farming is that conventional farming is that conventional farming relies on chemical intervention to fight pests and weeds and provide plant nutrition. That means synthetics pesticides, herbicides, and fertilisers. Organic farming relies on natural principles like bio-diversity and composting instead to produce healthy and abundant food. Importantly, organic production is not simply the avoidance of conventional chemical inputs, nor is it the substitution of natural inputs for synthetic ones. Crop rotations and the use of composted animal manures and green manure crops, in ways that are economically sustainable in today's world. In organic production overall system health is emphasized and the interaction of management practices is the primary concern. Organic farmers implement a wide range of strategies to develop and maintain biological diversity and replenish soil fertility (USDA, 2007). The conventional and organic farming methods have different consequences on the environment and people. The conventional and organic farming methods have different consequences on the environment and people. Conventional agriculture causes negative impact to the soil and society it increase greenhouse gas emissions, soil erosion, water pollution, and threatens organic farming has a smaller carbon footprint.

4.5. Conversion of Conventional Farmland into Organic Land

The conversion from a conventional to an organic system requires a transitory period, where the organic practices are applied progressively following an organized plan. During this period it is important to analyse carefully the actual situation of the farm and identify the actions to be taken (Florez, 2003). Features of farm, Soil analysis, climate, organic matter are the indicators used to analyse the farm.

4.5.1. Farm with High External Input

The majority of intensively managed farms in Africa, Latin America and Asia that strongly rely on external inputs are larger farms. Such farms mostly grow a few annual or perennial cash crops relying heavily on the use of fertilizers for plant nutrition and pesticides and herbicides for pest, diseases and weed control. On such farms crops are often grown without a planned rotation and farm animals are not integrated into the nutrient cycle. Diversification is usually low on these farms: Trees and brushes are mostly removed to facilitate extensive mechanization, and crops are

mostly grown alone. Potential challenges in conversion of such farms, establishing a divers and balanced farming system with a natural ability to regulate itself usually takes several years. Major efforts may be necessary to be store natural soil fertility is re-established and yields rises again. New approaches and practices usually involve a lot of learning and intensive observation of crop development, and dynamics of pests, diseases and natural enemies (Gavrilov,1962).

However, the conversion process can be achieved, if the following practices are implemented: Diversify the farming system: Select appropriate annual crops for the area and rotate them in a planned sequence. Include legume crops such as beans or leguminous feed crops in the rotation to provide nitrogen to the subsequent crops. Plant hedges and flower strips to encourage natural enemies and to control pests. Start recycling valuable farm by-products. Establish on-farm compost production based on harvest residues and manure, if available, and mix the compost with the topsoil. This will bring stable organic matter into the soil and improve its structure and its capacity to feed the plants and store water. Green manures can provide plenty of plant material to feed soil organisms and build up soil fertility. Introduce farm animals into the system. Farm animals provide valuable manure and diversify farm income through additional animal products. Grow cover crops. Cover crops or lay out mulches in perennial crops provide protection to the soil.

4.5.2 Farm with Low External Input

Farmers working with little external inputs based on traditional practices may grow many different crops in a densely mixed system on the same piece of land changing crops randomly. A few livestock such as chickens, pigs, cattle and /or goats may be kept, which scatter the manure in their feeding places, hence providing very little manure for the gardens. The trees may be extensively cut for firewood and charcoal burning. Brush and trash burning may be a common practice especially during land preparation. Harvests are probably low and increasingly becoming difficult due to unreliable and insufficient rains.

The harvests may just be sufficient for feeding the family and little may be left to sell for income Traditional farmers fulfill some principle of organic farming already by relying on farm-own resources, growing different crops simultaneously

and raising livestock. However, there are still practices, which clearly distinguish such farms from organic farms. The following challengers need to be addressed for conversion: Avoid burning of crop residues after harvest as this is, in most cases, not a viable solution, since it destroys valuable organic material and damages soil organisms. Establish a well-organized diversification systems including a 'planned' crop rotation and intercropping systems.

Accumulate knowledge and practice regarding efficient use of farm own resources, especially for compost production to manage and improve soil fertility. Avoid indiscriminate tree cutting for firewood and charcoal burning Establish a system to collect the animal manure for composing. Apply measures to prevent loss of soil through erosion and protect it from drying out. Pay special attention to satisfy feed and health requirements of the farm animals. Avoid infection of seeds with diseases, gain knowledge on disease cycles and preventive measures. Avoid harvest and storage losses. Some practices for conversion in this system are implement planned crop rotation and intercropping system. A combination of annual and perennial crops including leguminous green manure cover is needed. Combined with 15 properly selected or improved crop varieties with good resistance to plant pests and diseases, will facilities the crop and soil management. Proper integration of animals into the farming regularly collected for compose making. Growing nitrogen fixing legumes between annual crops is another possibility to feed the soil and the crops. Additional measures to control soil erosion such as digging trenches and planting trees along the hillside, and covering the soil with living or dead plant material should be implemented.

4.5.3 Creation of Mixed Farm

Mixed farms, crops and farm animals may be integrated, whereby the animal manure is collected and used in the gardens after having kept it for a few weeks to root. Some soil conversation measures may be implemented, such as mulching in perennial crops and trenches to reduce erosion. Occasionally herbicides, pesticides and treated seeds may be used to control weeds in fruit and vegetable production. Farmers of such mixed farms are obviously familiar with some of the organic farming practices. Such farmers will find it easy to learn new methods from other farmers or

from a trainer and to implement organic practices throughout the farm. Implement organic practices to manage the soil and to control weeds instead of using herbicides.

4.5.4 Degraded Land

Land may be degraded due to shifting cultivation, overgrazing, over-cultivation or deforestation, salinity after years of intensive irrigation with ground water, or water logging and flooding. Such land may take more efforts and patience to establish good growing conditions. At the same time, organic practices are an excellent approach to recover such soils. It may require specific practices to stop soil degradation and to re-establish soil fertility. Such practices include digging of terraces or sowing an intensive fallow with a leguminous green manure crop that grows well on poor soils.

4.5.5. Conversion of Degraded land

Many experience show that organic farming is promising approach to improve degrade land and bring it back into production. In most cases, the increase of organic matter plays a key role to improve the quality of degraded soils, excessive use of irrigation water, especially in arid and semi-arid climates. These salts can be reduced slowly by ensuring proper irrigation an building up the structure of the soil with compost to allow natural drainage of the excess salts. In a first period salt tolerant crops may be grown. Acid soils can be reclaimed by adding lime and well-made compost. Flooded soils can be improved by creating drainage channels to drain off the excess water. Converting a farm to organic farming in an area with very little rainfall and high temperatures or strong winds will be more challenging than converting a farm located in an area with well distributed rainfall and favourable temperatures. At the same time, the improvements that follow implementation of organic practices will be more obvious under arid conditions than under ideal humid conditions. For example, compost application into topsoil or into planting holes will increase the soils water retention capacity and the crop's tolerance to water scarcity (Tybrik,2004)

In very warm and dry climate, losses of water through transpiration from plants and evaporation from soils are high. These losses may be further encouraged by strong winds, enhancing, soil erosion. The soils' organic matter content is generally

low, as biomass production is low, implying that the availability of nutrients to the plants is highly reduced. Under such conditions, the key to increasing crop productivity lies in protecting the soil from strong sun and wind and increasing the supply of organic matter and water to the soil. Soil organic matter can either be increased through compost or through cultivation of green manure crops. In the case of compose production the challenge is to increase production of plant biomass, which is, needed for compost production.

4.5.6. Conversion of Dry Climate

In warm and humid climate, high above ground biomass production and rapid decomposition of soil organic matter imply that the nutrients are easily made available to the plants. But it also involves a high risk that the nutrients are easily washed out and lost. Under such conditions a balance between production and decomposition of organic matter is important to avoid depletion of soil. Combining different practices to protect the soil and feed it with organic matter proved to be the most effective approach to choose. These practices include creating a divers and multi-layer cropping system ideally including trees, growing nitrogen-fixing cover crops in orchards and applying compost to enrich the soil with organic matter and in this way increase its capacity to retain water and nutrients (Ismail,197)

4.5.7. Step by Step Conversion of Organic Faming

The procedure of conversion of a farm commonly consists of three steps. In a first step it is recommended to collect information on appropriate organic farming practices. In a second step, the most promising organic practices should be implemented in the entire farm. Support from an experienced extension officer or farmer is usually very helpful to give guidance in the process. Successful organic farming requires considerable knowledge on the functioning and the possibilities of management of natural processes. Interest in learning about the possibilities to support natural processes to sustain and improve harvests is essential for successful organic farming. Farmers who are interested in adopting organic farming practices are recommended to get in contact with farmers in the area, who already practice organic farming to learn from them. Some farmers may be good at making compost, some at growing green manures, and some at making plant or manure tea. Learning from

experienced farmers allows to get firsthand experience under local conditions, and thus to learn about the advantages and potential challenges related to implementing organic methods. Basically, farmers who are interested in converting their farm to organic agriculture are confused with the following questions.

1. How to improve soil fertility

2. How to keep crops healthy

3. How to best increase diversity in the farm

4. How to keep livestock healthy

5. How to determine price to organic products and how to sale them.

After having collected information about the requirements, the potentials and the main practices related to conversion, farmers should start to learn from, their own experience on their farms. To minimize risks of crop failure and losses of animals, and avoid frustrating overload, farmers are recommended to implement organic practices step-by-step to a limited extent, selecting specific practices at a time and testing them on selected plots or selected animals only. But which practices should one choose to start with? As would seem natural, farmers should start by applying practices that are of low risk and investment, require little specific knowledge, limited additional labour, and with high short term impact. Mulching - Covering the soil with dead plant material is an easy way to control weeds and protect the soil in annual crops. This practice can be implemented into most existing cropping systems.

The main question may be, however, where to get appropriate plant material from. Intercropping-Growing two annual crops together, commonly a leguminous crop like beans or a green manure crop in alternating rows with maize or another cereal crop or vegetable is a common practice in organic farming to diversify production and maximize benefits from the land. In inter-cropping, special attention must be paid to avoid competition between the crops for light, nutrients and water. This requires knowledge on arrangements, which promote growth of at least one of the crops. Composting is an application of compost to the fields can have a major

impact on crop growth and yields. To start compost production, farmers will need enough plant materials and animal manures, if such are available.

In case such materials are scarce, farmers would first have to start producing plant materials on the farm by sowing fast growing leguminous plants that build a lot of biomass, and by introducing some livestock on the farm for manure production, if this proves appropriate. To get familiar with the process of making compost, farmers should be instructed by an experienced person. Proper compost production requires some knowledge and experience and additional labour, but is low in investments. Green manuring-The practice of growing a leguminous plant species for biomass and incorporation into the soil may be new to most farmers. Nevertheless, this practice can greatly contribute to improvement of soil fertility. Green manures can be grown as improved fallows, as seasonal green manures in rotation with other crops, or in strips between crops. Proper green manuring first requires information on appropriate species. Initially, bio-control agents may be applied but organic pest management is best achieved through ecological approaches that establish a pest/predator balance. While the choice of resistant varieties of crops is paramount, other prevention methods include: choosing sowing times that prevent pest outbreaks; improving soil health to resist soil pathologies; rotating crops; rotating crops; encouraging natural biological agents for control of disease, insects and weeds; using physical barriers for protection from insects, birds and animals; modifying habitat to encourage pollinators and natural enemies; and trapping pests in pheromone attractants. Appropriate seeds and planting material, use of healthy seeds and planting materials, and robust and/or improved cultivars can make a big change in crop production. The practice may require some information's on selection of seeds and planting materials including availability of improved varieties and seed treatments. Generally, locality-adapted seeds are proffered because of their resistance to local conditions.

4.5.8 Implementation of Organic Farming Practices

Looking at the organic farm as being 'one organism', the focus does not lie on cultivating specific crops only, Rather, the focus is on choosing crops that can easily be integrated into the existing farming system and will contribute to its improvement. But the choice also depends on the farmer's knowledge on the right management of the crops, their contribution to a diverse family diet or their

demand in the market. Besides growing crops for food, farmers may need to grow leguminous cover crops to provide high-protein feed for livestock and to be used as green manures to feed the soil. Planting trees for shade, as windbreak, for firewood, feed, mulching material or for other uses, can be recommended in most situations.

a) In the first place, organic farmers should grow enough food for the family. But they may also want to grow crops for the market to get money for other family needs. The farmers should also grow crops that contribute to improvement of soil fertility. Farmers who keep livestock need to grow pasture grass and legumes.

b) Basically, farmers should select crops with low risk of failure. Cereals and legumes such as maize, sorghum, millet, beans and peas are especially suitable for conversion, since they cost little to produce, generally have moderate nutrient demands and are robust against pests and diseases. In addition, many of the traditional crops can be stored and sold in domestic markets. High-value short term crops, such as most vegetables, are more delicate to grow and highly susceptible to pest and disease attack. Therefore, they should not be grown on a larger scale, unless the farmer can sustain some losses in harvest.

c) The crops to grow for sale should include crops that can be sold at the farm gate, at the roadside market or can be transported directly to nearby markets in urban centres. Choosing the right crop to sell on the market may require some market information. Decision making for crops for local or export markets requires detailed information from traders or exporters on the crops, requested varieties, quantities, qualities, regularity and season.

d) High-value perennial crops such as fruit trees take at least 3 years until the first harvest from the date of planting. This makes them appropriate crops for the conversion period. For 24 new plantations, species and varieties must be carefully selected to suit the organic market and production requirements. For conversion of an existing orchard, it might be necessary

to replace old existing varieties, if they are very susceptible to diseases and the product quality does not match with the market requirements.

e) The success of a crop will also depend on provision of favourable growing conditions. The better a crop variety matches local soil and climate conditions. andis tolerant or resistant to common pests and diseases, the better it will grow.

f) Planting of hedges other crops and/or ago forestry trees can be valuable to help establish a diverse farming system

g) Growing leguminous green manures provides nutrients to the soil. Green manures do not provide immediate income, but in the long-term, they make the soil fertile and productive for the future.

Many farmers want to see quick results and often ask how long it takes for organic crops to grow. Organic farming does not aim to make crops grow faster. Crops will grow faster and larger when they have better growing conditions than before. Although conventionally grow crops can be made to grow faster by intensive use of synthetic fertilizers and sprays. Organic crops are nurtured to grow at their normal, natural rate in order to be less susceptible to pests and diseases and build up good physical and nutritional structure. However organic farmers do a lot to make their crops grow healthy and to produce good yields. In a third step, implementation of organic practices throughout the entire farm should be considered, once sufficient experience with different practices has been gained. As soon as organic practices are implemented throughout the entire farm a farmer can claim to be an organic farmer. 25 Commonly, consistent application of organic practices marks the beginning of a long process of improving the production system:

1. Improving soil fertility based on the recycling of farm own organic materials and enhancement of farm own biomass production.
2. Encouraging positive interactions between all parts of the production system (the farm ecosystem) to enhance self-regulation of pests and diseases.
3. Optimizing the balance between feed production and livestock. Farming organically also means continuously learning from personal observation, from outside experiences, sharing experiences with other organic farmers and

implementing new information on the your farm, making it increasingly more sustainable.

4.5.9. Mulching in Organic Agriculture

Mulching is the process of converting the topsoil with plant material such as leaves, grass, twigs, crop residues, straw etc. A mulch cover enhances the activity of soil organisms such as earthworms. They help to create a soil structure with plenty of smaller and larger pores through which rainwater can easily infiltrate into the soil, thus reducing surface runoff. As the mulch material decomposes, it increases the content of organic matter in the soil. Soil organic matter helps to create a good soil with stable crumb structure. Thus the soil particles will not be easily carried away by water. Therefore, mulching plays a crucial role in preventing soil erosion. In some places, materials such as plastic sheets or even stones are used for covering the soil. However, in organic agriculture the term 'mulching' refers only to the use of organic, degradable plant materials. Protecting the soil from wind and water erosion soil particles cannot be washed or blown away.

Improving the infiltration of rain and irrigation water by maintaining a good soil structure no crust is formed, the pores are kept open Keeping the soil moist by reducing evaporation: plants need less irrigation or can use the available rain more efficiently in dry areas or seasons Feeding and protecting soil organisms, organic mulch material is an excellent food for soil organisms and provides suitable conditions for their growth Suppressing weed growth: with a sufficient mulch layer, weeds will find it difficult to grow through it. Preventing the soil from heating up too much: mulch provides shade to the soil and the retained moisture keeps it cool. Providing nutrients to the crops: while decomposing, organic mulch material continuously releases its nutrients, thus fertilizing the soil.

The kind of material used for mulching will greatly influence its effect. Material which easily decomposes will protect hardy materials will decomposes will protect the soil only for a rather short time but will provide nutrients to the crops while decomposing. Hardy materials will decompose more slowly and therefore cover the soil for a longer time. If the decomposition of the mulch material should be accelerated, organic manures such as animal dung may be spread on top of the mulch,

thus increasing the nitrogen content. Where soil erosion is a problem, slowly decomposing mulch material (low nitrogen content, high C/N) will provide a long-term protection compared to quickly decomposing material. 30 Weeds or cover crops, Crop residues, Grass, Pruning material from trees, Cuttings from hedges, Wastes from agricultural processing or from forestry, while mulching has a lot of advantages, it can also cause problems in specific situations. Some organisms can proliferate too much in the moist and protected conditions of the mulch layer. Slugs and snails can multiply very quickly under a mulch layer. Ants or termites which may cause damage to the crops also may find ideal conditions for living.

When crop residues are used for mulching, in some cases there is an increased risk of sustaining pests and diseases. Damaging organisms such as stem borers may survice in the stalks of crops like cotton, corn or sugar cane. Plant material infected with viral or fungal diseases should not be used if there is a risk that the disease might spread to the next crop. Crop rotation is very important to overcome these risks. Water management in organic practices: Practices Scarcity of water for agriculture is a common phenomenon in many countries. In some regions it is almost impossible to grow crops without irrigation. Even in areas with large amounts of rainfall in the rainy season, crops may get short of water during dry periods.

Organic farming aims at optimizing the use of on-farm resources and at a sustainable use of natural resources. Active water retention, water harvesting and storing of water are important practices, especially for organic farmers. Organic farmers know that it is more important to first improve the water retention and the infiltration of water into the soil. Keep soil moisture, during dry periods, some soils are more and some are less in a position to supply crops with water. The ability of a soil to absorb and store water largely depends on the soil composition and on the content of organic matter. Soils rich in clay can store up to three times more water than sandy soils. Soil organic matter acts as storage of water, just like a sponge. Therefore, crop residue or a cover crop protects the soil, prevents crusting on the surface, and slows runoff. Roots, earthworms and other soil life maintain cracks and pores in the soil. Less water runs off, and more sinks into the soil. Reduce evaporation: A thin layer of mulch can considerably reduce the evaporation of water from the soil. It shades the soil from direct sunlight and prevents the soil from getting

too warm. Shallow digging of the dry top soil can help to reduce the drying up of the soil layers beneath (it breaks the capillary vessels). A better retention of water within the soil saves costs on irrigation. Better use of season's rainfall: Ripping during the dry season allows farmers to plant earlier right at the start of the rains.

4.5.10. Water Conservation and Organic Farming

A green manure or cover crop is not always a suitable way of reducing evaporation from the soil, due that they also use water. In dry areas, you should consider using other types of mulch, such as crop residues or plant remain brought in from outside the field. That will help conserve moisture in the soil where it can be used by the crop. During strong rains, only a part of the water infiltrates into the soil. A considerable part flows away as surface runoff, thus being lost for the crop. In order to get as much of the available rainwater into the soil, the infiltration of rainwater needs to be increased. The most important for achieving a high infiltration is to maintain a topsoil with a good soil structure containing many cavities and pores (e.g. from earthworms). Cover crops and mulch application are suitable to create such a favorable top soil structure. Further, they help to slow down the flow of water, thus allowing more time for the infiltration. Some techniques to harvest water include: Planting pits are hand-dug circular holes which collect water and store it for use by the crop. Each pit is about 20 cm across and 20 cm deep. After planting, the holes are left partly open so they collect water. Planting pits take a lot of work to dig when the soil is dry. But they produce good yields in areas where otherwise crops might die because of a lack of water. Once made, the pits can be used again, season after season. Leave the soil covered, and add compost or fertilizer to the pits to increase their fertility. Upper: Sketches of trenches and semi-circular bunds, lower: photos of a circular bund around a coconut palm and beans with mulch in plant pits

In areas with low rainfall, there may not be enough water to grow a crop over the whole area. On gentle slopes (less than 3%), one possibility is to use contour bunds and catchment strips. Catchment strips are areas where no crops are planted. When rain falls on this ground, it runs down slope and is trapped by the contour bund. Plant rows of crops behind the bund to use this water. This can produce a good yield even with very little rain. Mulch the cultivated areas with crop residues to prevent erosion, help water sink in, and slow evaporation.

4.5.11. Crop Planning and Management in Organic Farming

In many traditional agricultural systems a diversity of crops in time or space can be found. Knowing that different plants have different requirements for nutrients, a good crop planning and management is required in order to optimize the use of nutrient in the soil. Crop rotation, intercropping, cover crops and green manures represent the main alternatives to the farmers to manage soil health and fertility. The first three practices will be described in this section. Crop rotation means changing the type of crops grown in the field each season or each year (IIRR and ACT 2005). It is a critical feature of all organic cropping system. because it provides the principal mechanisms for building healthy soils, a major way to control pests, weeds and to maintain soil organic matter (Mohler and Johnson 2009). It increases soil fertility: legumes (such as groundnuts and beans) fix nitrogen in the soil. When their green parts and roots rot, this nitrogen can be used by other crops such as maize. The result is higher, more stable yields, without the need to apply expensive inorganic fertilizer. It helps control weeds, pests and diseases: planting the same crop season after season encourages certain weeds, insects and diseases. Planting different crops breaks their life cycle and prevents them from multiplying.

It produces different types of output: growing a mix of grain, beans, vegetables and fodder means a more varied diet and more types of produce to sell. In some ways, crop rotation takes the place of ploughing the soil: it helps aerate the soil, recycles nutrients, and helps control weeds, pests and diseases. Intercropping, strip cropping and relay cropping bring many of the same advantages as rotation. a) Crop selection Crops produce many different things: food, fodder, firewood, fence poles, thatch and medicines. Farmers grow some crops (such as cotton) only for cash. For other crops, such as cereals or vegetables, you may be able to sell what you do not use yourself. If your objective is marketing, make sure that there is a market of your main output or rotation crop. This depends on many factors: the amount of rain or moisture in the soil, the season (some crops and varieties do not grow well at certain times of year), and the soil fertility, among others. What are the roots like? Tall cereals (millet, maize, sorghum, etc.), finger millets and some legumes (e.g., pigeon pea and sunn hemp) have strong roots that penetrate deep into the soil-up to 1, 2 m for tall cereals.

Their roots improve the soil structure and porosity, so are a good choice if the soil is compacted (Reganold, 1989).

4.5.12. Steps for Using Green Manures

In order to ensure a permanent plant cover it is important to consider the following aspects: o Timing of soil cultivation o Timing of planting or sowing o Producing seedlings and transplanting them o Mixed cultivation o Intercropping o Cover crops o Mulching o Timing of weeding o Sowing of a green manure crop in the off-season Expected effect on yields o Availability of suitable species o Costs of seeds o Availability of water o Availability of labour o Additional use of side-crops o Reduction of the risk o Food security. A well-kept field record book is a great help in remembering which crop has in the past been grown in a particular plot within the field or farm. This is useful especially if the records also show past incidents of plant pests or diseases in each plot in the farm. For example, soil diseases and pests can build up during the life of a susceptible crop. If the same crop or a similar type belonging to the same family is grown in the same field, it will suffer from the accumulated pests and diseases from the previous crop (s) and may not grow well. This can be avoided if the soil is left fallow (not cropped) for a while, or a different crop is planted which is tolerant or resistant to the particular pest or disease. Better still is to plant a crop from a different family which will not share a same complex of pests and diseases. This will result in decline of soil problems and the original crop can be grown successfully again.

4.5.13. Nutrient Management in Organic Agriculture

Soil is a living system and soil identify is the key to agricultural productivity. The maintenance of the fertility of the soil is the primary step in any agricultural system. The plethora of microorganism inherent in any soil system ensures that nutrient cycle is in place and the large substrate is broken down to minute particles that can be easy assimilated by the plant's root system. Therefore farmers should maintain the inherent soil fertility by replacing the nutrients removed by the crops or livestock grazing by using green manures, animal manures (raw or composted) and other natural fertilizers (e.g. rock phosphate).

The input and output of plant nutrients must be monitored through a soil testing program, to ensure that nutrient depletion does not take place. Soils deficient in nutrient cannot support either crop production or active populations of beneficial microorganisms, which are essential for a productive soil. Improvement in agricultural sustainability requires, alongside effective water and crop management, the optimal use and management of soil fertility and soil physical properties Both rely on soil biological process and soil biodiversity. This requires the adoption of management practices that enhance soil biological activity and build-up long term soil productivity and health; the main practices to enhance soil fertility include the use of organic fertilizers such as,

1) Compost and vermin-compost

2) Green manures

3) Animal manure

4) Microbial fertilizer

5) Mineral fertilizers

The Composting is the process of transforming organic materials of plant or animal origin into humus in heaps or pits. Compared with uncontrolled decomposition of organic material, decomposition in the composting process occurs at a faster rate, reaches higher-temperatures and results in a product of higher quality. Within the process of composting, three main phases can be distinguished: the heating phase, the cooling phase and the maturing phase.These systems do not heat-up during the composting process. They are handy if there is a continuous supply of wastes (e.g. kitchen waste). However, they lack the advantages of the heating phase. Batch-fed systems (all material is composted at once): These systems lead to a hot composting process. They offer the advantages of reduced nutrient loss death of weed seeds and diseases as a result of the high temperature of composting, the process is fast (within a few weeks) and it results in a compost of superior quality. If little water is available, composting in pits may be more appropriate since humidity is conserved better in pits than in heaps. Vermi composting: is a method of composting using earthworms. Earthworms speed up the composting process, aerate the organic material and enhance the finished compost with nutrients and enzymes from their digestive tracts.

Vermi composting allows you to create compost round the year, indoor during the winter and outdoor during the summer.

Green manures are plants grown to accumulate nutrients for the main crop. When they have built up maximum biomass, they are worked into the surface soil. As they are usually cut before flowering, growing a green manure is thus different from growing a legume crop in the rotation. Once worked into the soil the fresh plant material releases nutrients quickly and will be fully decomposed within a short period of time. Old or coarse material (e.g. straw, twigs, etc.) will decompose at a slower rate than fine material and will therefore contribute more to the build-up of soil organic matter than to fertilizing the crop. An alternative to sowing a green manure crop in the field is to collect fresh plant material from elsewhere and work it into the soil. They penetrate the soil with their roots, make it more friable and bind nutrients, which would otherwise be washed away. They suppress weeds and protect the soil from erosion and direct sunlight. If legume plants are used, nitrogen is fixed from the air into the soil. Some green manures can be used as fodder plants or even to provide food for human consumption (e.g. beans and peas). By decomposing, green manures release all kinds of nutrients in the correct mixture for the main crops to utilize thus improving their yield. The incorporated plant material encourages the activity of soil organisms, and builds up organic matter in the soil. This improves soil structure and water holding capacity. Green manuring is thus an inexpensive way to improve soil fertility and the nutrition of the main crops grown.

Labour is required for tillage, sowing, cutting and incorporation of plants into the soil, and is most intensive where the amount of helpful equipment available is small. If green manures are intercropped with the main crops, they compete for nutrients, water and light. When old or coarse plant material is incorporated into the soil, nitrogen may be temporarily immobilized and therefore unavailable for plant growth. If food and space are in short supply it may be more appropriate to grow a food crop rather than a green manure and recycle the crop residues, or to intercrop a green manure crop with the main crop. The benefits of green manures occur over the long term and are not always visible immediately.

The green manure is using following manner

a) Sowing the green manure, if grown within a crop rotation, the time of sowing must be chosen such that the green manure can be cut down and worked into the soil before the next crop is sown. Green manures need water for germination and growth. The ideal seed density must be tested for each individual situation. It depends on the species chosen. In general no additional fertilization is necessary. If legumes are grown in a field for the first time, inoculation of the seeds with the specific rhizobia may be necessary to profit from nitrogen fixation of the legume.

b) Working the green manure into the soil. The time gap between digging in the green manure and planting the next crop should not be longer than 2 to 3 weeks, so as to prevent nutrient losses from the decomposing green manure. Crushing: Green manures are worked in most easily when the plants are still young and fresh. If the green manure plants are tall or contain bulky and hard plant parts, it is preferable to chop the plants into pieces to allow easier decomposition. The older the plants, the longer decomposition will take. The best time to dig in green manure plants is just before flowering. Depth of incorporation: Green manures should not be ploughed deeply into the soil. Instead they should only be worked in to the surface soil (in heavy soils only 5 to 15 cm deep, in light soils 10 to maximum 20 cm deep). In warm and humid climates the material can also be left on the soil surface as a mulch layer.

4.5.14. Microbial Fertilizers

The microbial fertilizers mostly consist of organic material and some source of sugar or starch, which are fermented together with specific species of microorganisms. The products are living organisms and need to be applied cautiously. They should not be used when expired, since the organisms may be dead. Although some research has been done on the use of microorganisms and positive effects may be proven, there is still little experience with such products. To find out the effect of a certain product, it is recommended to test them in small scale and compare with an untreated plot. Remember though: microbial fertilizers cannot substitute an appropriate humus management in the farm. Most of the bacteria and fungi present in the purchased

products are generally present in soil. Microbial inocula, therefore, enhance the presence of the specific organisms. Some farmers make their own microbial fertilizers to save on costs .Some microbes add nutrients to the soil through mineralisation. Others add nitrogen by fixing it from the atmosphere. These include Rhizobium and Azotobacter. Other microbes, such as Mycorrhizal fungi, help to supply plants with phosphorus. Azospirillum and Azotobacter are bacteria that can fix nitrogen. Pseudomonas species are a diverse group of bacteria that can use a wide range of compounds that plants give off when their roots leak or die. They are able to solubilize phosphorus and may help to suppress soil borne plant diseases (Sharma, 2005)

The mineral fertilizers, which are allowed in organic agriculture, are based on ground natural rock. However, they may only be used as a supplement to organic manures. If they contain easily soluble nutrients, they can disturb soil life and result in unbalanced plant nutrition. In some cases, mineral fertilizers are ecologically questionable as their collection and transport is energy consuming and in some cases natural habitats are being destroyed.

4.5.15. Basics of Organic-Pest and Disease Management

Knowledge about plant health and pest and disease ecology helps the farmer to choose effective preventive crop protection measures. As many factors influence the development of pest and disease, it's crucial to step in at the most sensitive points. This can be accomplished through the right timing of management practices, a suitable combination of different methods, or the choice of a selective method. Some important preventive crop protection measures are the following ones.

1. Selection of adapted and resistant varieties: Choose varieties which are well adapted to the local environmental conditions (temperature, nutrient supply, pests and disease pressure), as it allows them to grow healthy and makes them stronger against infections of pests and diseases.
2. Selection of clean seed and planting material Use safe seeds which have been inspected for pathogens and weeds at all stages of production. ? Use planting material from safe sources.

3. Use of suitable cropping systems Mixed cropping systems: can limit pest and disease pressure as the pest has less host plants to feed on and more beneficial insect life in a diverse system. Crop rotation: reduces the chances of soil borne diseases and increases soil fertility. Green manuring and cover crops: increases the biological activity in the soil and can enhance the presence of beneficial organisms (but also of pests; therefore a careful selection of the proper species is needed).

4. Use of balanced nutrient management: Moderate fertilization: steady growth makes a plant less vulnerable to infection. Too much fertilization may result in salt damage to roots, opening the way for secondary infections. Balanced potassium supply contributes to the prevention of fungi and bacterial infections.

5. Input of organic matter: Increase micro-organism density and activity in the soil, thus decreasing population densities of pathogenic and soil borne fungi. Stabilises soil structure and thus improves aeration and infiltration of water. Supplies substances which strengthen the plant's own protection mechanisms.

6. Application of suitable soil cultivation methods facilities the decomposition of infected plant parts. Regulates weeds which serve as hosts for pests and diseases. Protects the micro-organisms which regulate soil borne diseases.

7. Use of good water management: No water logging: causes stress to the plant, which encourages pathogens infections. Avoid water on the foliage, as water borne disease spread with droplets and fungal diseases germinate in water.

8. Conversation and promotion of natural enemies provide an ideal habitat for natural enemies to grow and reproduce. Avoid using products which harm natural enemies.

9. Selection of optimum planting time and spacing most pests or diseases attack the plant only in a certain life stage; therefore it's crucial that this vulnerable life stage doesn't correspond with the period of high pest density and thus that the optimal planting time is chosen. Sufficient distance between the plants reduces the spread of diseases. Good aeration of the plants allows leaves to dry off faster, which hinders pathogen development and infection.

10. Use of proper sanitation measures: Remove infected plant parts (leaves, fruits) from the ground to prevent the disease from spreading. Eliminate resides of infected plants after harvesting.

Weed management in Organic Agriculture: Organic farmers give first priority prevention of the introduction and multiplication of weeds. The management practices aim at keeping the weed population at a level that does not result in economic loss of the crop cultivation or harm its quality. The goal is not to completely eradicate all weeds, as they also have a role to play on the farm. For example, weeds provide cover that reduces soil erosion. In addition, most of the biological diversity in our fields comes from the presence of weeds.

They provide habitat for both beneficial bio-control insects and mycorrhiza fungi. Because weeds offer pollen and nectar they allow bio-control insects to maintain their populations and therefore, serve as a valuable instrument in controlling pests. However, weeds may also alter reduced between the crop plants. In this darker and more humid environment, diseases find ideal conditions in which to spread and infect plants. As we have seen many times up to this point, a basic working principle in organic farming is to prevent problems, rather than to cure them. This applies equally to weed management. Good weed management in organic farming includes creating conditions which hinder weeds from growing at the wrong time and in the wrong place and then become a serious problem for the crop cultivation. Competition by weeds doesn't harm the crop throughout the whole cultivation period in the same way.

The most sensitive phase of a crop to weed competition is in its early growth stage. A young plant is vulnerable and depends highly on an ideal nutrient, light and water supply for a good development. If ii has to complete with weeds at this stage, the crop may grow weak, which also makes it more vulnerable to pest and disease infections. Weed competition later in the cultivation period is less harmful. However, some weeds may cause harvesting problems and reduce the crop yield in that way. Therefore, weeds should not be completely ignored after the most critical growth period of the crop, but in general, they become less important. These considerations should influence the selection and timing of weed management measures. In general, such measures aim at keeping the weed population at a level which doesn't result in

economic loss of the crop cultivation or harm its quality. Several preventive measures may be applied at the same time. The importance and effectiveness of the different methods depend to a large extent on the weed species and the environmental conditions.

4.5.16. Soil Fertility

Any soil cultivation has a more or less destructive impact on soil structure. in tropical soils, regular tillage accelerates the decomposition of organic matter which can lead to nutrient losses. The mixing of soil layers can severely harm certain soil organisms. Soil after tillage is very prone to soil erosion if left uncovered before the onset of heavy rains. Minimum tillage systems on the other side help to build up a natural soil structure soil structure with crumbly top soil rich in organic matter and full of soil organisms. Nutrient losses are reduced to minimum as there is no sudden decomposition of organic matter and nutrients are caught by a dense network of plant roots. Soil erosion won't be a problem as long as there is a permanent plant cover or sufficient input of organic material

4.5.17. Animal Husbandry in Organic Farming

Integrating animal husbandry into crop producing farms is one of the principles of organic farming. In temperate and arid zones, animal husbandry plays an important role in the recycling of nutrients, while it is less emphasized in the humid tropics. The caring, training and nurturing of animals is considered an art in many farming communities. Integrating animals into a farm help creating a closed or semi-closed system where energy and nutrients are recycle. Animals can convert non-edible biomass into food, while increasing soil fertility with their manure. Many farm animals have a multi-functional role, for example produce dung which is of great importance for soil fertility. yield products such as milk or eggs for sale or own consumption continuously. Recycle by-products such as straw or kitchen waste. Serve as draught animals for tillage or transport. Produce meat, hides, feathers, horns etc. Serve as an investment or a bank. Help in pest control (e.g. dugs) and weed management (Lotter, 2003)

The significant of each role will vary from animal to animal and form farm to farm. It will also depend on the individual objectives of the farmer. There are several reasons for taking up animal husbandry as a part of your farming activities or even as the main one. In most smallholder farms, fodder cultivation will compete for space with the cultivation or crops. Fodder cultivation is economically more beneficial compared with crop production must be assessed case by case. However, there are some options for integrating fodder crops in farms without sacrificing much land. Below are some examples Grass or leguminous cover crops in tree plantations. Hedges of suitable shrubs, shade or support trees, Grass on bunds against soil erosion, Grass fallows or green manures in the crop rotation, Crops with by-products such as paddy straw or pea leaves 97. The management of pastures is crucial for a good herd management. It is also important to practice appropriate management throughout the year.

4.6. Modern Agriculture and Organic Farming

"The side-effects of the modern agricultural chemicals and machines raise serious questions about the overall benefits of the new technology. Chemical fertilisers and pesticides pollute our air and water. Agricultural chemicals, including hormones and antibiotics leave residue in food that may cause cancer or genetic damage. Soil and energy resources are being depleted. Instead of recycling our wastes back onto land as fertilizer, we allow them to pollute our water. We use non-renewable energy resources to produce artificial fertilizer. In the future we may be forced to make radical adjustments on such agricultural practices" (Oelhaf, 1978).

The adverse environmental and social impacts of modern agriculture are universal. Pretty (1995) summarized them as follows. 'contamination of water by pesticides, nitrates, soil and livestock wastes, causing harm to wildlife, disruption of ecosystems and possible health problems in drinking water. Contamination of food and fodder by residues of pesticides, nitrates and antibiotics, damage to farm and natural resource by pesticides, causing harm to farm workers and public, disruption of ecosystems and harm to wildlife. Contamination of the atmosphere by ammonia, nitrous oxide, methane and the products of burning, which play a role in ozone depletion, global warming and atmospheric pollution; overuse of natural resources, causing depletion of groundwater and loss of wild foods and habits and their capacity

to absorb wastes causing water-logging and increased salinity. The tendency in agriculture to standardize and specialize by focusing on modern varieties, causing the displacement of traditional varieties and breeds new health hazards for workers in the agrochemical and food processing industries(Wander 2004).

There is an alarming reduction in agricultural production during the last three decades, the factors which contribute to reduction in the agricultural output is scarcity of labour, very high wage rates compared to neighbouring state etc. Agriculture is not main occupation of the people only 17% of the populations are real farmers fully dependent on agriculture. Many of the farm land are not cultivated treated as plain land. On this background, the policy makers in Kerala think about alternative farming system change from systems which follow only non-conventional farming methods by avoiding the use of harmful materials in agricultural practices through the better cultivation of crops on soils best suited to them. Currently about 7000 farmers practices organic farming in the state as NPOP (National Programme for Organic Production) standards, covering a total area of 5750 hectare. But non-certified organic cultivation which has not been done is expected to much more than conventional farming.

Kerala has increasing the momentum of organic farming to comparing to the other states. Government of Kerala introduces many measures to enrich the organic farming and reducing the problems faced by the organic farmers. There are two types of organic agriculture in Kerala one is focused for export (certified process) and another is domestic consumption of the state. At present, the market price of conventional products and demand for the products are comparatively high, because of lack of awareness non-affordability of price of organic products are still in dilemma by the consumers.