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Chapter 2

Review of Theoretical and Empirical Literature

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2.1. Introduction

Theories and models of agricultural development a base upon which the particular study can proceed and gives an idea about the thoughts of traditional and modern economist. These agricultural theories provide valid information about the past as well as present circumstances upon which the theory is built. These Theories can make a strong foundation to the present study.

Agriculture plays a key role in food security and economic development .The most of the population in rural and urban areas depends directly or indirectly on agriculture for their daily needs .There is a positive relation between migration and population, yet as the world's population increases and migration to towns and cities intensifies, so the proportion of people not producing the food will grow. According to Nwachukwu, agricultural development is a multi-sectional activity that support and promote positive change in the rural and urban areas. However, the main objectives of the agricultural development are the improvement of material and social welfare of the people. So the agricultural development is seen as synonymous with rural development (Yadav, 2006).

Agricultural development can also address gender disparities In Sub-Saharan Africa and South Asia, women are vital contributors to farm work, but they have less access to improved seeds, better techniques and technologies, and markets, yields on their plots are typically 20 to 40 percentage lower than on plots farmed by man. Addressing this gap can helps households become more productive and reduce malnutrition with in poor families .Economic growth is seen as a long term rises in the capacity to supply increasingly diverse economic goods to its population. Therefore the role of agriculture in transforming both the social economic framework of an economy cannot be over-emphasized. It has been the source of gainful employment from which the nation can feed its teaming populations, providing the nation's industries with local raw materials and as a reliable source of government revenue.

2.2. Theoretical Literature

Creating a sustainable agricultural development path means improving the quality of life in rural areas ensuring enough food for present and future generations

and generating sufficient income for farmers. Supporting sustainable agricultural development also involves ensuring and maintaining productive capacity for the future and increasing productivity without damaging the environment or natural resources. In addition, it requires respect for and recognition of local knowledge and local management of natural resources, and effort to promote the capabilities of current generations without compromising the prospects of future ones. Consequently, economic and environmental sustainability adequate farmer's income, productive capacity for future, improved food security and social sustainability are important element for developing countries' agricultural development.

The main aim of agricultural development is the improvement of material and social welfare of the people; therefore, it is often seen as integrated approach to improving the environment and wellbeing of the people of the country. The first step in the process of agricultural development is abandoning the view of agriculture in pre-modern or traditional societies as essential static. The problem of agricultural development is not that of transforming a static agricultural sector, but of accelerating the rate of growth of agricultural output and productivity consistent with the growth of the other sectors of a modernizing economy. A theory of agricultural development should provide insights into dynamics of agricultural growth, either into the changing source of growth. In view of the context of organic farming, there are about seven agriculture general models in the literature on agricultural development.

1. The high-pay of input model
2. The urban-industrial impact model
3. The conservation model
4. The Frontier model
- 5 The diffusion Model
6. Theories related to land Use Pattern
7. Schultz theory of Traditional Agriculture
8. Organic Farming and Poor but Efficient Hypothesis
9. Cob-web Theorem and Organic Farming

2.2.1. The High Payoff Input Model

The inadequacy of policies based on the conservation, urban-industrial impact and diffusion model led to a new perspective in the 1960s. The key to transforming traditional agricultural sector into productive source of economic growth is an investment designed to make modern, high pay off inputs available to farmers in poor countries. Peasants, in traditional agricultural systems were viewed as rational, efficient resource allocators. They remained poor because in most poor countries there were only limited technical and economic opportunities to which they could respond.

According to Ruttan, the new high payoff- off inputs were classified into three categories

- a) The capacity of public and private sector research institutions to produce new technical knowledge
- b) The capacity of the industrial sector to develop, produce and market new technical inputs.
- c) The capacity of farmers to acquire new knowledge and use of new inputs effectively.

The enthusiasm with which the high pay off input model has been accepted and translated into economic doctrine has been due in part to the proliferation of studies reporting high rates of returns to public investments in agricultural research. The high return associated with the adoption of new varieties and the associated technical inputs and management practices have led to rapid diffusion of the new varieties among the farmers in several countries. The model remains incomplete as a theory of agricultural development. However the education and research are public goods not traded through the market place. The mechanism by which the resource is allocated among education, research and alternative public and private sector economic activities are not fully incorporated into the model (Schults, 1964).

2.2.2. The Urban-Industrial Impact Model

In the conversion model, location variations in agricultural development were related primarily to differences in environment factors. It stands in sharp contrasts to models which interpret geographical differences in the level and the rate of economic

development primarily in terms of the level and the rate of economic development. Initially, the urban industrial impact model was formulated to explain geographical variations in the intensity of farming system and productivity of labour in an agricultural society. Later this model was expanded to explain the more effective performance of the factor and products markets linking the agricultural and non-agricultural sectors in regions characterized by urban industrial development. The model has been tested extensively in the limited states but has received only limited attention in the less developed world (Club at Rome, 1972).

2.2.3. The Conservation Model

The conservation model of agricultural development evolved from the advances in crop and livestock in crop and livestock husbandry associated with the English agricultural revolution and the concepts of soil exhaustion suggested by the early German chemists and soil scientists. The conservation model emphasized the evolution of a sequence of increasing complex and labour intensive cropping system, the production and use of organic manures and labour intensive capital formation in the form of physical facilities to more effectively use land and water resources. This model was the only approaches to intensification of agricultural development that was available to most of the world's farmers. The agricultural development within the ambit of the conservation model clearly was capable in many areas of the world of sustaining rate of growth in agricultural production around 1.0% year over relatively long periods of time. This rate is not compatible with modern rates of growth in the demand for agricultural output which typically fall between 3-5% in the developing countries (Von Thunen, 1826).

2.2.4. The Frontier Model

The history expansions of area cultivated or grazed in the western countries has represented the main way of increasing agricultural production. However, the most dramatic example in western history was the opening up or creation of the new continents – North and South America and Australia to European settlement during the 18th and 19th centuries. In earlier times, similar processes had proceeded, through at a less dramatic pace, in the peasant and village economies of Europe, Asia and Africa. Intensification of land use in existing villages was followed by pioneer

settlement the establishment of new villages and the opening up of forest or jungle were a series of successive change from Neolithic forest fallow to systems and in recent years to annual cropping. When the soil condition was favourable as in the great river basins and plains new villages are gradually intensified their system of cultivation. While where soil was poor, as in many of the hill and upland areas, new areas were opened up to shifting cultivation to nomadic grazing (Perkins, 1829).

As a result of population growth, the model did not last the main limitation of the Frontier models were quickly reached. Crop yields were typically low measured in terms of output per unit of seeds rather than per unit's crop area. Output per hectare and per man tended to decline except in the Delta areas such as in Egypt and South Asia and wet rice area of the East Asia.

2.2.5. Diffusion Model

The diffusion approach to agricultural development rests on the empirical observation to sustainable differences in land and labour productivity among farmers and regions the route to agricultural development in this view is through more effective dissemination of technical knowledge and narrowing of the productivity differences among the farmers and regions. The diffusion of better husbandry practices was a major source of productivity growth even in the pre modern societies. The development of modern agricultural research systems substantial effort was devoted to crop exploration and introduction. Even in nations with well-developed agricultural research systems a significant effort is still devoted to the testing and adaption of exotic crop varieties and animal species. The model was developed emphasizing the relationship between diffusion rates and personality, characteristics and educational accomplishments of farm operators. Diffusion model provides the major intellectual foundation of much of the research and extension effort in farm management and production economics since the emergence in the later of the 19th century of agricultural economics as a separate sub discipline linking the agricultural science and economics. The development that led to the establishment of active programs of farm management research and extension occurred at a time when experiment station research was making only a modest contribution to agricultural productivity growth (Cardo, 2017).

2.2.6. Land Use Pattern and Agricultural Production

The organization of farms varies because of differences in physical, economic and cultural factors though they have something in common as well (Mellor, 1966). The two prominent factor inputs for agricultural production are land and labour and the farmers have an inclination to increase the size of their farm because they can add to their income more than what they will get by applying more labour to the existing farm and the productivity of labour increases. Rent not only varies with its fertility, whatever its produce, but with its situation, whatever be its fertility and it is a residually determined distributive share in terms of most common agricultural produce of the country and levels of rent vary with intensities of Land Use and that both rent and land use varied with distance (Smith,1776).Rent is that portion of the produce of the earth which is paid to the Landlord for the use of the original or indestructible powers of the soil. The definition clarifies that land possesses original permanent powers which are related to the natural ecosystem with a protection of environment. Rent arises from the extensive, intensive cultivation as well as the regionalisation of the existing land. Each increase in population results in increasing demand for land and necessitates cultivation of progressively inferior quality lands (Ricardo, 1817).

2.2.7. Nature of Agriculture and Production

Traditional agriculture occurs if and only if, the state of art of cultivation remains constant and where the farmers use the same factors of production and same procedure of production that their forefathers were doing. Considering the new factors as well as extended factors as constant or given, the farmers, by their experience, can expect an unchanging pattern of net returns which will encourage production and can attain equilibrium where cost of each factor is equal to marginal returns from each factor. If the art of cultivation and motives and preferences to hold the productive assets remain static, then the disequilibrium, if occurred is only temporary. Any permanent deviation towards disequilibrium cannot make agriculture traditional. If equilibrium is disturbed due to price changes, cost reductions, making changes in the costs or the marginal returns, the particular temporary disequilibrium can be restored after sometime at some other level. With the static art of agriculture, there exists neither misallocation of resources nor the existence of unused resources, especially in

agriculture. Since they are utilizing the resources in the proper manner without any misallocation, the farmers can earn their maximum income, but may be a lower or equivalent income when compared with other agriculture progressing countries. The particular concept is called as Efficient but Poor Schultz (Schultz, 1964).

2.2.8. Organic Farming and Poor but Efficient Hypothesis

According to Shultz traditional agriculture is all economic concepts. It implies short run equilibrium when agriculture of a country reaches such equilibrium, it will become an traditional agriculture. The equilibrium can be reached irrespective of the cultural attributes of the society and its institutional arrangement or technical efficiency of its factors. As deduced from the definition of traditional agriculture. Schulz moves on to the description of another hypothesis based upon the perfect allocation of resources which, by now has become quite well known. (Maumdar,1990) The poor but efficient hypothesis implies that people in a traditional agriculture are no doubt efficient so far as the allocation of resources is concerned but still they are poor. According to him optimum allocation of resources fails to ensure a high level income for the farmers. This is because the returns from the resources themselves are quite low or cost of income stream is rather high. Schultz suggests that changes in the nature of from the above implication about the perfect allocation of resources. Schultz suggests changes in the nature of factors of production in order to transform traditional agriculture (Desai and Meller, 1999).

2.2.9. Cob-web Theorem and Organic Farming

The agricultural commodity under consideration is harvest annually, and consumed during two seasons. The production decision is made by the representative farmers/producers in season. The storage decision is made by a representative marketer during both seasons. The quantity planted by the farmer in autumn is available for sale to the marketer. The market is segmented into a local market sells the commodity to the marketer and a central market where the marketer sells the commodity to consumers. This scenario is especially relevant for developing economies. Where production and consumption are geographically dispersed and where transport infrastructure limited. It is also plausible for some regions of developed countries (Bobenenrieth and Wright,2006). In addition, the effects of

storage on price variation are mixed. In the presence of inter annual storage, chaotic price series show less variation compared to a situation without inter annual storage. Storage contributes to the endogenous volatility of prices by making chaotic dynamics more likely. Cobweb theory is the idea that price can lead to changes in supply which causes a cycle of running and falling price in agricultural market where supply can vary due to variable factors (Empler, 1990)

2.3. Empirical Literature

There has been a splurge in organic farming literature in last decade. The literature can be broadly classified as (i) Those dealing with the problems of modern agriculture and suggesting alternative systems such as organic farming (ii) Those expounding the principles and practices of organic farming (iii) Those which study the different elements such as effect of bio-inputs studied on comparative yields. The reconciliatory to me can be understood in the emergence of new terminology and practices like sustainable agriculture.

Organic farming is a gaining momentum due to increasing concerns of global food crisis, global warming and health concerns from Genetically Modified Organisms (GMO). The World Market for organic food has been shown consistent straits for over 15 years.

The article “Two concept of sustainability evolution of organic farming” 2002 by Ki-Huengkim discusses how to evaluate organic farming via two concepts of sustainability namely capability sustainability (which includes environmental, social and human aspects) and economic sustainability by highlighting the experiences of organic farming in Japan, Korea and Thailand. The article also discusses two types of organic farming- large scale and profit or landed and small scale and environmentally aware.

Albert Howard’s *An Agricultural Testament*, first published in 1940, could be said to have marked the origin of modern organic farming in the west. It championed a type of agriculture, which emphasized feeding the soil through compost, the approach is holistic, rather than analytic lands, farmer, food and consumer compose a whole system. It is based on Howard’s experiments while in India 1990’s when he

developed the composting techniques described there in. It is possible that the borrowed the idea from Indian farmers.

Masa noba Fukoka (1985) is the work “One Straw Revolution” indicates four basic principles of natural farming. They are (1) No ploughing, (2) No chemical fertilizers, (3) No weeding,(4) plant protection. In addition, 2000 United Nations Report commonly referred to as the World Agricultural Report, concluded that the world must move away from chemical dependent, industrial agriculture towards sustainable farming.

The curtain raised article “Overview of organic agriculture (2006) by Paul Krishansen Arcan Tari and John Reganold provides a culture of the history and development of the organic movement from its roots in the early 1900s to its current position is global agriculture. The article answers questions related to sustainability and productivity of organic agriculture and whether organic agriculture can feed the world.

Bill Mollison’s An Introduction to permaculture (1991) and permaculture – A Designer’s Manual 1990 detail the permaculture way of system that ecologically sound and economically viable. A location specific system permaculture is based on a philosophy of working with nature and not against it. The most widely quoted book on sustainable agriculture is Miguel. A Altieri’s Agriecology : The Science of sustainable agriculture (1987) The classic work emphasizes the importance of agro ecology as the discipline that provides the basic ecological principles of house to study design and manage eco-systems that are both productive and natural source conserving and are also culturally sensitive.

Martha Kiley-Warthington’s Eco-Agriculture food first faming (1993) is another of the no-nonsense, down to earth books which gives a pragmatic view of eco-friendly agriculture, The brilliant exposition of the pit falls of modern agriculture, description of alternatives and finally evolving a set of principles of eco-friendly agriculture based on her own experience gives the reader clarify of whole philosophy of Judious exploitation of natural resources.

Jules N. Pretty’s regenerating agriculture and policies and practices for sustainability and self-reliance (1995). It looks at the scale of challenges facing

agriculture today and details the concept and characteristics of alternatives, sustainable agriculture practices. Return to the Good Earth. 'Damaging effects of modern agriculture and the case of for ecological farming (1993) is a collection of articles and excerpts from many sources published by the Third world network. The dangers of pesticide over use, the green revolution and its disastrous effects in the third world', the bio-technology threat, indifferences and natural farming methods that are productive and ecologically sound etc are some aspects covered in these dossier.

Robert C. Oelhalf's organic agriculture (1978) is a watershed in the history of organic farming because it is one of the earliest works that has analyzed organic farming using the conventional scientific methodology.

Francis Blake's organic farming and growing (1987) is a comprehensive hand book on organic husbandry outlying principles of organic agriculture, giving advice to those considering going organic and step by step guide to conversion.

The last two decades of 20th century witnessed an over whelming popularity and scientific acceptance of organic farming in the western world. especially USA, Germany and the Scandinavian countries. In depth research has gone into different aspects, stages and shades of organic agriculture.

There is no doubt that organic forming has been established in the west. Natural fallout is the interest shown by MNCs who sent a huge killing in a new area. The prime motive organ becomes generation of easy money and opening at new markets. Organically grown food produce is already being exported in the West from Latin America and Asia under the supervision and certification of inspectors from the West. The whole idea of food export from Kerala is cashew nut and seafood.

Organic agriculture is new practiced in almost all countries of the world and it is the share of agriculture land and forms is growing the total organically managed area is more than 22 million hectares worldwide. The market of organic products is growing not only in Europe and North America but also in many other countries including many developing countries official interest in organic agriculture is emerging in many countries (Yusseli and Mitscke, 2003).

2.3.1. Sustainability and Organic Farming

India produces primary organic products; processed foods are limited organic products grow in various agro-climatic zones are coffee, tea, spices, fruits vegetables and cereals as well as honey and cotton. Organic animal husbandry, poultry and fisheries do not exist. Domestic organic market and consumer awareness are under developed in India but interest is usually sold directly by the farmers or through specialized shops and restaurants.

External certification bodies introduced inspection and certification programmes in 1987 in June 2001. The government of India announced the national programmes for organic production (NPOP), which aims to promote.

Organic farming is mainly for export markets, has made significant progress in many part of India, However, this ecological form of agriculture face, several obstacles. Institutional support by the government can help overcome the hurdles and promote faster growth of this sector. Organic agriculture is penetrating the farm lands of India slowly but surely. It is in deeded remarkable that the organic model in its modern form (Le central organic”) has found acceptance among the divers categories of agriculturists operating in different parts of India under varied agro ecological and financial condition and often with divine objects

In India organic food is usually sold directly by the farmers or through specialized shops and restaurants. At present, a price premium of about 20-30% over conventional; products can be received (FAO, 2002). India is an exporting country and does not import any organic products. However in recent times a number of studies on related aspects of organic farming have been fourth coming line the effect of organic and inorganic manures, chemical and bio pesticides comparative yield studies on integrated pest nutrient management.

“Tending the Earth” Traditional, sustainable agriculture in India, summarizes a wealth of information and ideas from a voluminous documentation collected over more than 21 years. It dents how the traditional agricultural system in India was so developed in terms of productivity, self-reliance, diversity and sustainability (Winin Pereria, 2003).

The organic farming source Book is the first document of the organic farming scene in India. It also contains brief but very interactive reviews on the publications on organic farming in India. It gives an ample information about various eco-friendly farming practices prevalent in the world (Claude Alvarez, 1996).

The organic farming reader includes different sections such as the “philosophy and ethics of organic farming; soil fertility management and land generation’, “seeds-Genetic sources and food security” problems in plant-animal relationships and “Economic and special aspects of organic farming’ cover almost the entire spectrum of organic farming” (Alvarez, 1999).

“Agrarian Crisis”, Analysing the failures and strategies for sustainable Development emphasizes the adverse impacts of green revolution. The country is passing through the agrarian unrest. Food production has shrunk over the last decade. According to the author population is increasing by 2% every year and projected to reach 130 crore by 2010 and may require 300 million tones of food grains to feed the population (Agarwal, 2003).

Institutionalized sustainable agriculture in India towards as a response to climate change” is a study published in 2009 This study examined the nature of threats faced by the Indian agriculture sector from the impending change in agriculture and climate. The study also emphasizes the importance of organic farming in improving crops and animal productivity under low-external inputs and selecting varieties and breed that are fit under local conditions in the spirit of organic farming (Milindo, 2009).

The national seminar on National Farming (1992) in Rajasthan brought the first comprehensive collection of papers on organic farming in India. The National symposium on organic farming (1996) held in Chennai, congress on traditional sciences and technologies of India (1993, 1995, and 1997) held at Mumbai, Chennai and Varanasi, respectively. The workshop on tropical organic farming (1995) and seminar on sustainable farming and the environment (1993) held at Kottayam and Kochi respectively are some of the major events in the course of development of organic farming in the country. It also discusses major issues and suggests remedial measures needed for the popularizing of organic agriculture (Jhnaadhan, 2009).

Air quest for green revolution and food security, we have completely ignored soil. As organic farming is the need of the time the research work has been projected to explore the possibilities and feasibility of organic matter, recycling and enrichment of using cheap non- traditional organic waste available.

Another important article on organic farming is “study of Awareness and adoption of organic farming among the cultivators in Maharashtra” say that the concept of organic farming is not well popularized in addition; certification procedure is also very complicated. The study is based on the primary data collected from 306 organic farmers from the selected counties. The study suggest that the government should take steps to minimize the constraints in adoption of organic farming add to popularize organic farming (Kasar, 2004).

The article “organic farming solution to starvation” authorized by C.S. Murthy (2009) explains the bio-technology that has the potential to increase agricultural productivity through intensification rather than exploitation of additional resources.

An important article “organic farming” authorized empowering farmers by Rao (2009) high light that organic farming has the potential to create job opportunities for rural people and sybolises a novel opportunity for small farmers who lack the resources (Fertilizers and pesticides) to do conventional farming India has a tremendous potential to flow crops organically and emerge as a chief of organic products in international market.

One of the most significant studies that have a strong relevance is the one on the “organic farming in Pudukkotai, Tamil Nadu”. The study on the cost-benefit analysis, impact of organic farming an yield, soil, income and expenditure Ecology, debt, health etc, of the 300 organic farmers of Pudukkotai district. Tamil Nadu reveals despite the infancy stage of organic farming, the results are very encouraging. The cost benefits ratio of some crops is already higher for organic farming (Norman, 1997). The growth of organic farming mainly for export markets, which makes a significant progress in many parts of India. It also discusses the convention period from conventional farming into organic which may turn cut to be a difficult phase for farmers owing to direct and indirect costs involved in the process (Kasturidas,2009).

Another article titled “Issues and Challenges in Financing organic agriculture” emphasizes that banks need to prepare for the emerging business opportunities and funding of large amount for commodities it also discusses that organic agriculture is going to benefit the farmers by security him a surplus and this, in turn would help de-risk the agricultural portfolio of the bank (Murray,2009).

Another important study is “Ecological Agriculture in South India” describes two research programmes carried out on ecological agriculture. The duration of the transition period is directly related to previous farming systems. An average transition takes 3 to 5 years, consisting of one ecological and one conventional relevance farm is analysed in relation agro-economic and economic performance. Ecological farms achieve similar economic performance. Ecological farms (Evender Werf, 1992).

The two works that appeared recent times are organic farming for sustainable agriculture (Dharma, 1999) in a bleak scenario where there are hardly any books on the Indian context of organic farming. The four important factors of sustainable agriculture are balanced fertilization integrated plant nutrient system (Prasad, 1996).

The quality of the crops produced by a mixture of organic matter and phosphate is better than the produced in control soil or that fertilized by the application of inorganic fertilizers. The protein vitamins and minerals are appreciably greater in the organically produced crops (Srivasthava et al., 1982).

To sum up the greatest challenge for the coming decades lie in the fact that the production environments are unstable and degrading and the balance between intensive and extensive agriculture is precious. Experience over the past 20 years has shown that mismatch between crop production methods and resources characteristics has led to a decline in soil Fertility increased soil losses disturbed hydrological balance and a buildup of pests and diseases (Ahrol, 1994).

2.3.2 Environmental Impact of Organic Farming

Agriculture in Kerala is at the cross roads. Hundreds of farmers who had learnt the bitter lessons of chemical farming and mono cropping practiced hitherto in the name of ‘scientific agriculture’ are making come back to organic multiple crop learning more importantly from the farmers initiative the state department of

agriculture has made a significant turnaround to promote the production and marketing of organic food by launching a programme and policy for “organic sustainability of Kerala” named Jaiva Keralam.

The most revealing statement on the agricultural situation in Kerala in recent times is in the Kerala State Resource based Perspective Plan 2020 AD Giving a bird’s eye-view of agriculture in Kerala, it strongly recommends the adoption of sustainable agricultural practices at the earliest. It is one of the most precise indictments on the state’s sorry state of agricultural affairs. Detailed data on Kerala’s agriculture, on the basis of agro-climatic zones are given in the book.

First major coverage on organic farming by a popular periodical was in “Karshakashree. The article by Mini George contained the principles of organic farming, sustainable farming and examples of organic farmers in the state. The periodical “Jaiva Karshaka Prakriti” published by the Jaiva Karshaka Samiti (Kerala Association of organic farmers) carries articles on organic farming and environment conservation. Two books named “Oorvathayude Sangeetham” by Dayal and Krishni Malayalam by Sujith Sankar (1996), while the former services as excellent introduction to organic farming, the latter deals with the history and culture of agriculture in Kerala.

Another significant study from the 1980s is the Report of the One-Man Commission on the problems of Paddy cultivators in Kerala (1981). Though restricted to the problems of paddy cultivation, the recommendations of the study are valid for the entire agriculture sector. Noteworthy among the observations are those on decreasing use of organic manures in the fields and the negative impacts of chemical pesticides. The Report recommends popularisation of bio-fertilisers and green manures; to initiate a ‘Green manure perennial planting Programme mechanical plants for manufacture of compost in Corporations and Municipalities, minimization of use of insecticides; and to take up biological and mechanical control of rodents. Enquiry into the available literature on organic farming in Kerala revealed a void. Here again, there are quite a number of studies on organic manures, natural pesticides, integrated pest and nutrient management but organic farming as a system seems to have been left out. This gap is filled to a certain extent by the few studies on homestead gardens and farms of Kerala.

“Organic farming the cluster-Approach” talks about the need for organic farming policy which advocates for a cluster approach for organic farming. According to him organic farming can be introduced in art of the selected villages and sale of pesticides and their use would be banned in such villages. According to the author, much of crop loss and farmers suicide happen only in the areas where the mono cropping and excess chemical fertilizer usage. The recent realization of the ill effects of chemical fertilizers and pesticides that personal the environment and food crops has forced the rethinking on going back to the organic farming which is eco-friendly and free from health hazards (Baby, 2010).

Sreekumar Chatopadhyay, Richard W Frantise (2006) in their book striving, for sustainability environmental stress and Democratic initiatives in Kerala” take stocks of Kerala’s environmental decline as well as the people’s response towards possible alternatives that meet the basic criteria for sustainability. In this book the author discusses the changes in agriculture inorganic fertilizers have been substituted for livestock manure, compost and nitrogen fixing crops. Machines have replaced labour and fossils fuels have been substituted for local energy suppliers. External inputs as the means to increase food production have made the whole agricultural system more vulnerable to sudden failures.

The proceedings of the two major seminars and workshop held at Kochi and Kottayam organized by the united planters association of South India brought out a number of works of farm-level experiences of organic farmers. Cultivation practices of various field crops as well as plantation crops. Enquiry into the available literature on organic farming in Kerala revealed a void. Here again, there are quite number of studies on organic manures, natural pesticides. Integrated pest and nutrient management but organic farming a system seems to have been left out. This gap is held to a certain extent by few studies on homestead gardens and farms of Kerala are by, Thampan of Kochi, in this book (organic agriculture) 1995 he has compiled articles on organic agriculture. Verms culture, traditional Indian agriculture, some case studies of organic farmers from the different parts of India. It provides data on yield returns techniques used for maintaining soil fertility etc.

Diverse agricultural systems had evolved in Kerala, as diverse as its landscapes. But in the last few decades, traditional agriculture was rejected in favour

of the modern, intensive kind. This had a negative impact not only on agriculture but also on the economy, environment, culture and social life of the people. The transformation of 'agriculture' to 'agri-business' is most evident in Kerala. Oilseeds, rubber, tea, coffee, cashew, spices, sugarcane, horticulture, and floriculture have relegated food crops to the background (Madhusudanan, 1995).

Decreasing share of agriculture in the total domestic production and individual earnings from agriculture, diminishing importance of agriculture as a source of livelihood, shift from short term annual crops to long term cash crops and tree crops which have a lesser potential for employment, decrease in the area under paddy cultivation mainly due to conversion of paddy lands to coconut plantations, brick kilns and construction of residential houses, acute shortage of farm workers, fragmentation of land, pollution due to chemical pesticides and fertilizers, are some of the major problems faced by agriculture in Kerala (Varghese, 1995).

“The current farming systems lay emphasis on high yields which are achieved by intensive use of fertilizers, pesticides and other off-farm inputs. Alternate farming systems range from systems which follow only slightly reduced use of these inputs through the better use of soil tests, cultivation of crops only on soils best suited to them and integrated use of pest management. to those that seek to minimize their use through appropriate crop rotations, integration of livestock with crop husbandry, mechanical or biological control of weeds and less costly buildings and equipment. So for agriculture to be sustainable, it should include a spectrum of farming systems ranging from organic systems that greatly reduce or eliminate use of chemical inputs to those involving the prudent use of antibiotics to control specific pests and diseases’ (Kerala Land Use Board, 1997)

In Kerala, organic agriculture has been showing a rising trend. So the conventional farming will directly or indirectly effects the environment as well as the human beings also here we produce organic products many for exports: domestic consumption of the organic products in Kerala is very low. Organic agriculture is a way of forming that avoids the use of synthetic chemicals and genetically modified organisms and usually subscribes to the principles of sustainable agriculture. Its theoretical basic puts an emphasis on soil health. It proponents believe that healthy soil maintained without the use of man-made fertilizers and pesticides and live stocks

raised without drugs and yields higher quality food than conventional based agriculture.

The term 'organic' was first used in relation to farming in the book "Look to the land" the farmer itself must have a biological completeness. It must be a living entity; it must be a unit which has within itself a balanced organic life (Boune, 1940).

The origin of modern organic agriculture is intertwined with the birth of today's "industrially based organic agriculture" Before the introduction of chemical fertilizers, eco-friendly agriculture was the only optics for farmers. But those days production yield was very low. This led to the invention of chemically synthesized fertilizers and pesticides. Like a can has two sides, one side it leads to enormous increase in production on the other side, it becomes a threat to our health, climate etc. The negative effects of industrially based agriculture force the farmers to rethink and how they are moving back to eco-friendly and poison free agriculture i.e. organic agriculture.

Rice ecosystem in the sandy soils of Onattukara as influenced by organic manures and in organic fertilizers Symposium "Rice in Wetland Ecosystem" December 1990, Kottayam. Results of the Permanent Manurial trials at the KAU Rice Research Station at Kayamkulam show that organic manure is essential for rice production in Onattukara tract. Cattle manure acts as a buffer and helps to maintain soil PH. The water holding capacity, percentage pore space and absolute specific gravity are increased by cattle manure (Abraham Varghese, 1990).

Farmers' character and preference among rice cultivars- a group participatory analysis. Proc. IX Kerala Science Congress, January 1997, Thiruvananthapuram. It shows the preferences of attributes of rice seeds of the rice farmers of the small production system. Stability of yield, grain quality, good taste, high protein content, quick cooking quality, low input and cultivation cost, adaptability to less intensive management, adaptability to inferior fertile soil, etc., were the higher ranked preferences of the farmers. Interestingly, these qualities are inherent in the indigenous varieties rather than the HYVs (Ramesan, 1997).

The study shows that recommending chemical Weedicides for controlling weeds based on their weed killing property is not scientific and correct as it has got

specific effect on plant. Judicious experimentation of these chemicals is essential before recommending them in order to ensure that they do not have a toxic effect (Neelakantan, 1991).

Trends in the use of ecologically hazardous inputs for rice in wetland ecosystem: a 10 year case study. The data on usage of chemical fertilizers and pesticides among the farmers of two villages in Kuttanad show a high percentage of overdoses. Nitrogen, phosphorus and potassium were being applied at levels 50-60% higher than the recommended levels. Fungicides were used in overdoses. The gravity of this problem is enhanced by the fact that 95 % of the farmers used lower than recommended volume of spray fluid. The paper states: “Now that we realize that chemical pesticides are not essential for crop production and that they may be dangerous both to health and the environment, we have the responsibility to determine better way to use these materials. Research ought to be intensified to develop bio-pesticides as substitutes for chemicals” (Krishanakumari, 1990).

A conceptual overview of resource use systems with special reference to the agricultural production system of Kerala. Given the complexity of our eco system any attempt to manipulate natural resources must take into account the entire systems or run the risk of breakdown in the not-so-long-run (Shanmugaratnam, 1993).

“Alternative fertilizer use behaviour of rice farmers in Thrissur district.” The study was conducted to identify the alternatives to chemical fertilizers by the rice farmers to overcome the recent price hike of chemical fertilizers and also to compare the constraints in the use of fertilizers before and after the price hike. The choices were: apply more organic manures and reduce the quantity of chemical fertilizers (97.5%) grow green manure crops during the third crop season (49.58%) skip application of fertilizers (30.42%) ranked high among them. Majority of the farmers had adapted themselves to the situation by increasing the use of organic manures and reducing the quantity of chemical fertilizers to the extent possible. This projects the need for self-reliance on the part of farmers as in the past, when they were utilizing cattle manure, green leaf manure, FYM, ash, etc. from their homestead as the nutrients for their crops without wasting them (Geethakutty,1994).

“Cost-benefits analysis of rice cultivation in Kerala”. Proc, III “Kerala Science Congress .Kozhikode.” Cost and returns and factors affecting yield of rice crop were analysed. Cost of cultivation of local varieties was found to be less than that of HYVs. Due to the higher yield, the HYVs were found to be profitable. The benefit: cost ratio for local varieties and HYVs were found to be 1.28 and 1.31 for the Virippu season and 1.31 and 1.42 for the Mundakan respectively. The method of cultivation, details on the application of fertilisers and chemicals etc., for local varieties and HYVs in comparison are not available in the paper (Prakash, 1991).

The comparative yields of vegetable in different organic plots with that of conventional plots were studied. The results showed that, even though the yield in the first season was only 1/7th of that of conventional plot, in the subsequent years the yield increased and it is expected that yield equalization can be achieved within 5-6 years (Gopimony, 1996).

The split between organic agriculture and industrial agriculture dates back to the start of the 19th century when it was discovered that it was the mineral salt of the 19th century contained in human and manure that plants absorbed and not organic matter. Sir Humphery Davy and Justus Von Liebig were the key founders of this theory and published their ideas in elements of agriculture chemistry and organic chemistry and organic chemistry in its application to Agriculture and physiology. Their argument was that inorganic mineral fertilizers could replace manures and bring agriculture into scientific fold with resulting increase in the production and efficiency (Davy, 1813).

The first organic certification and labeling system “Demetes” was created in 1924. During this time Robert Mccarison a distinguished scientist, was researching the vitality of the fighting men of India and why lacked diseases common in the west. Mccarison followed up his observations with dietary experiments on rats, feeding one group the diet of the Indian and other of the British poor. The rats on Indian diet flourished while the others suffered a range of diseases and negative sociological effects. This led Maccarison to expand the importance of wholesome diet grown on soil fertilized with manures and other organic matter (Rundgren, 2002).

The formation of a thermal global network is one of the land marks for the organic movements this was the founding of international federation of organic agriculture movement (IFOAM) in 1972, which to this day remains the only global organic non-governmental association.

UDOAN's mission is leading, uniting and assisting the organic movement in it's fully diversity (Woodward and Voytman 2004). The main aims of the organization are:

1. Providing authoritative information about organic agriculture
2. Promoting world wide application.
3. Marking the agreed international guarantee of organic quality.
4. Building a common agenda for all the stake holders in the organic sector.

Explosive growth in organic agriculture occurred in the 1980's beyond the industrialized countries of the Western Europe and Northern America a large growth in organic agriculture occurred in the 1980's in part of Oceania, central and South America has three million hectares of land under organic production (Yusseli, 2004)

Cuba developed several programmes to promote organic agriculture including biological control agents, restricting state farms and developing training and certified frame works. During the latter Vedic period of India, a system of eco-friendly agriculture practices prevailed in India. This indigenous knowledge still applied today in many parts of India acts as an aid for farmers converting to organic agriculture organic agriculture has been adopted in a few countries like Kenya. Australia has largest (10 million hectares) and Argentina the second largest (3 million hectare) are of the world (Yusseli, 2004).

Trends that began in the 1970's and accelerated through the 1980s continued to flourish during the 1990s and into the new millennium. Demand and production of organic products continued to grow exponentially around the world often at 20 to 30% per year organic agriculture is now widely recognized by the public and governments as a valid alternative to conventional agriculture and is a source of ideas

and approaches that conventional agriculture can adopt to make more it more sustainable.

2.3.3. Organic Farming Practices and Fertility of Soil

Since soil is known as the soul of infinite life, continued maintenance of good soil health is vital to agricultural production and nation economy. Amongst the various attributes, organic matters content is the most important determinant of soil quality including its fertility and productivity. Since it serves as a primary sources and temporary sink for plant nutrients, influence water air regime, minimizes degradation process and aids in sustaining soil health Bagwu (1989) reported that application of organic wastes like poultry manure, compost, sawdust, rice shavings and cashew leaves improved the soil structure, water retention property, total porosity, macro porosity and saturated hydraulic conductivity, but in decreased the bulk density of tropical ullisol. A decrease in bulk density by the addition of organic matter residues over long time was observed by Rasmussen and Collins (1991) in temperate and semi-and regions.

Organic matter is an important determinant of available water content and it increased the available water content in sandy texture soils only. As the organic matter increased the volume of ware held at field capacity increased at a greater rate than held at permanent Wilting point. Organic matter addition increased the ability of soils to hold moisture, expanded the available water capacity and decreased the modulus of rapture of compacted soils (Nidal, 2003).

The study conducted on topic soil showed that macro pots were more and continuous to a greater depth (75 cm layer) in the plots receiving liquid diary sludge than in the fertilized plots due to the presence of earthworms. In another experiment to study the water retention characteristics under soybean – wheat cropping sequence, it was observed that in farm yard manure treated, plots, soil water retention was significantly higher in all the depths compared with fertilized plots. This is because water retention at lower tension depends primarily upon the pore size distribution (Mayunkui, 1994).

According to Senthilkumar (2002), vermin compost influenced the physical, chemical and biological properties of the soil. They also opined that it improved the water holding capacity of soil and acted as a mine for various plant essential nutrients.

Lee (1985) observed that the applications of vermin compost raised the pH of the soil. Worm casts have a pH near to neutral change than the surrounding soil and the possible factors that act on soil pH may be excretions of NH_4^+ from Calci Ferass glands of the earth worms.

Agriculture based economic development ideas and the trend of new technology implementation received tremendous attention in developing countries. However, the growth in agriculture, which ultimately drives economic development, is governed by technology and optimal resource utilization. This optimal resource utilization is called efficiency, which has a functional relationship with the resource and the performing units of production. The optimization of resources has a significant role in agricultural sustainability (Johnston and Mellor, 1961; Singer, 1971; Kawagoe et al., 1985).

The growth of agricultural productivity is the key concern of many developing countries, but also it should have the power to maintain sustainability. Agricultural sustainability needs to adopt such a technique that would trade-off crop yields and maintain soil health for future viewpoints. Today agriculture productivity is under the pressure of sustainable agro activity development. In the Indian context, the agriculture sector plays a significant role in fostering economic development and providing livelihood to a large population. The per capital food grain consumption has been declined while the total food grain production increased with the population growth. The food grains are the primary source of diet for India's population share, which is also essential for food security (Reddy, 2010).

Traditionally, economic development has widely affected the agriculture sector, especially after India's independence. Still, in India, agriculture and allied activity provide livelihood but have a stagnant growth rate over the past few decades. The major reason behind the slow pace of agricultural growth in developing countries is related to agricultural transformation. The Indian agricultural system is the provider of allied activities, which must be transformed with time (Mellor, 2017).

Agriculture was considered the main source of national income for independent India (Tripathi and Prasad, 2009). The immediate productivity booster by Green Revolution in the early 1960s had prolonged India's institutional strategy and supported the livelihood. In the late twentieth century, the Green Revolution movement enforced many developing countries towards 'productivism', including India (Bowler, 2002).

The intensification of agricultural inputs has benefited a minimal extent of small and marginal farmers. They did not have the necessary capital to acquire this new intensification-based technology on marginal lands. As a result, Indian smallholding farmers are still in poor conditions and away from product market gains. Intensification of fertilizers for enhancing crop production would not solve future food demands in India, and it continuously degraded the crop yield level (Smith et al., 2020).

The main aim of the Green Revolution was to make agriculture self-sufficient and resolve the food security issue. Using high yield variety seeds and chemical fertilizers, some states like Punjab, Uttar Pradesh made a drastic change in food grain production but with a high environmental cost. Today, India is placed at second position after China in most land degraded areas, and these rapid changes would have a severe effect in the long run. The green revolution movement in India was quite successful in northern states. However, the large agricultural holding got shrieked with time, and also the heavy fertilizers and pesticides worsen the soil health. Another challenge is decreasing water levels in arid and semi-arid regions of India, where 70% of arable land is primarily rain fed (Harish, 2020).

Sustainable production with a near stagnant area of cultivation becomes a vital debate by economists and policy makers. The demand for agriculture shifted from high production yield to sustainable production, fulfilling the current production demands without harming future demands. Ainsworth writes, "What is sustainable agriculture after all? The only sustainable agriculture is profitable agriculture. Short and sweet" The policymakers realized that input intensification in agriculture is a widening issue for soil yield sustainability, and we need an alternative method to resolve it. To resolve crop yield and upcoming food demand, organic farming can become an alternative method that has been growing faster in India.

2.3.4. Organic Farming Practices

The concept of organic farming in India is not new. Traditionally, Indian farmers used to do organic farming (e.g., formally a practice without chemical uses). The practice has the inherent trait and natural for Indian farmers and has a potential agro-climatic feature for organic production (Amarnath, 2012). The roots of organic inputs used in India are briefly visible in literature like Ramayana, Mahabharata, Rig Veda and Kautilya's Arthashastra (Behera et al., 2012).

The modernization and surge for high agricultural yield somehow change the practice, and today this conventional method of farming is rare in practice. So we can say, the conventional farming technique in India was pure organic. Therefore this study writes non-organic practice instead of writing conventional farming and tries to avoid vagueness to readers, especially from India. The idea and fundamental characteristics of organic farming are not clear to many people. Sometimes people believe that traditional agriculture means organic agriculture (Bhattacharyya, 2005).

It should be clear that organic farming is not the traditional farming that we have commonly known. Instead, it is a modern agro-based technique based on traditional farming. Organic farming is a method of farming that does not use any chemical fertilizer and pesticides. Organic farming is a method of farming in which the use of chemical fertilizers, pesticides is avoided, and beneficial microbes like bio fertilizers, manure, and compost are used in agricultural production. This method is based on intimate natural role in farming that produces crops to keep the soil alive (Yadava, 2017).

It uses beneficial microbes, organic wastage, and biological materialism farming practice. In other words, the organic farming method avoids the use of the genetically modified entity, synthetic fertilizers, and chemical during production and makes it more viable for the environment.

International Federation of Organic Agriculture Movements (IFOAM) defines "Organic Agriculture is a production system that sustains the health of soils, eco systems and people. It relies on ecological processes, biodiversity and cycles adapted to local conditions, rather than the use of inputs with adverse effects. Organic

agriculture combines tradition, innovation and science to benefit the shared environment and promote fair relationships and a good quality of life for all involved.”

The modern organic agriculture practice had initiated by two scientists Sir Albert Howards and Rudolf Steiner, in their speech in 1924. In 1972, the organic movement got boost-up by establishing IFOAM. Germany was the first country who adopted organic agriculture more scientifically. Later, many other countries participated in this movement (Nielsen, 2018).

There are many scientific terminologies available in organic farming, and without going into detail about all of them, we only focus on those terms which are essential for this study. As mentioned above, the organic farming practice involves bio-fertilizers and bio-pesticides in the production process. The land which is non-organic need to be transformed to grow organic production but this transformation takes some time, two to three year. This period is called the transformation period, and the products grown during this period are partially organic, or we can say production during the transformation period.

After the transformation period, the pure organic products need to be tagged that excludes them from the non-organic products in the market. Any private or government institution commonly does this tagging or labeling. By labeling the products, a producer gets a higher price for her products, called premium price for the product. The labeling of organic products is a major challenge in developing countries like India. In 2001, the Ministry of Commerce and Industries launched the National Program for Organic Production (NPOP) in India. Organic Farming Policy was introduced in India. The NPOP program is responsible for organic certification, product promotion, standard monitoring, and marketing of organic products. The certified organic products by NPOP have also been renowned by the United States Department of Agriculture (USDA) and European Commission. This international recognition makes Indian organic products exportable in the international markets.

The certification of NPOP based third parties are monitored and regulated by the Agricultural and Processed Food Products Export Development Authority (APEDA). Currently, India has 2.78 million hectares of organic land, which is almost

2% of the total irrigated land size, and out of this, 1.94 million hectares are under the NPOP scheme. Despite the area under NPOP, 0.59 million hectares area is under Parampragat Krishi Vikas Yojana (PKVY) scheme, 0.07 million hectares are under Mission Organic Value Chain Development North Eastern Region (MOVCDNER) scheme and 0.17million hectares belongs to non-schemes. The PKVY and MOVCDNER schemes were launched in 2015 by Government of India (GoI).

Another major and institution-based certification in India has been provided under Public Guarantee System (PGS) India scheme. The PGS India is a participatory approach-based initiative that substantiates the goals of the National Project on Organic Farming (NPOF). The PGS system is a pooled group system of organic farming and covers PKVY and MOVCDNER schemes. In the PGS system, farmers collaborate and monitor farming activities of each other. These farmers or groups of farmers get the organic certificate with direct institutional support from the Ministry of Agriculture and Farmers Welfare, Government of India (GoI). Whether in the PGS India scheme, the institutions are directly involved in certification, while in the NPOP scheme, a third party, mainly private institutions, is involved in the certification process.

India has the largest number of organic producers (approx. 1.4 million organic producers) and at sixth place in organic land. In the past few years, organic farming has emerged as an alternative and sustainable farming method which ultimately enhances the soil yield in the long run and reduces the cost of production in India. The practice has been adopted by many counties worldwide. The growth of organic land share with overall irrigated land size worldwide. A significant organic land size increment has been recorded in the Oceania region, followed by Europe, Asia, North America, and Africa.

2.3.5. Non-organic Farming Practices and Sustainability

The non-organic or the agriculture practice, which is in common practice, is the main livelihood source in India. The study defines the non-organic farming practice, which uses synthetic or chemical fertilizers, pesticides, and any synthetic inputs in farming. The non-organic practice may use bio-fertilizers, manure, and other organic material with chemical fertilizers and pesticides.

It is expected that the global food demand in 2050 will touch 9.1 billion, which is double comparatively the current production level of food grains. However, global agricultural production only increased by 28% from 1985 to 2005 (Ray et al., 2012). By the century, to maintain this required demand, it is necessary to focus upon agricultural productivity with sustainability. India has tremendous agro-climatic advantages to produce different crops across different regions. The agriculture sector in India is important for resolving food security issues and gives lively hood to a significant part of the population. These features make agriculture the primary source of employment in India. The growth rate of Indian agriculture was about 1% per annum before the independence and improved to 2.6% per annum after the independence.

This agricultural growth had resulted from increasing agricultural land size in the fifties and sixties. This growth rate was almost stagnant for a long time. Based on institutional policy options adopted from the independence, we can divide the growth of Indian agriculture into four phases. The first phase started in 1947 and ended in the mid-sixties. This phase is known for institutional land reforms, removal of intermediaries, agricultural credit reforms, etc. The second phase started in the mid-sixties when a new agricultural policy was adopted. This period is known for adopting a new strategy for high yield growth in the Indian agricultural system. This was the golden time for Indians because India stood on its bare feet and become self-sufficient for food security. The main strategy was to build a long-term policy for agricultural performance.

The third phase originated in the early 1980s which recorded a drastic change in non-food grain items. The institutional subsidy played a massive role in record growth in fisheries, milk production, and poultry. The fourth phase begins with the new economic policy of 1992. The growth of Indian agriculture mainly declined in this post liberalization period. Despite no policy changes for agriculture in 1991, changes in other sectors indirectly affected agriculture growth. After 1991, the growth rate of crops declined to 1.57 from 2.93. Even for some specific crops, the growth turned negative (e.g., the growth rate of pulses became negative). The policymakers argued that the failure was related to improper or incompetent agricultural policy. The continuous decline of agriculture raised concern for policymakers, and in the

year 2000, the new agriculture policy was adopted with the aim of annual growth of 4% per annum. However, the target of the new agriculture policy seems complicated to obtain specifically without any significant technological change in the Indian agriculture system. In the year 2004, the National Commission on Farmers was set up to provide a comprehensive study of the food situation in India. The committee's concern was primarily related to production and productivity in the agricultural system. The committee placed several recommendations to reform agriculture, and those were mainly related to land reforms, public investment in agricultural infrastructure, and enhancement in productivity.

The sectoral growth rates of different sectors in India. The growth rates of this table are average growth rates over different periods or long-term growth. The growth of the agriculture sector has recorded 3.4% annually during 2004-05 to 2016-17, which was better than the previous decade rate of 2.3% annual (during the year 1995-96 to 2004-2005). However, this growth rate is still below the target of the new agriculture policy. During this period, the growth rate of livestock and sub-sectors was remarkable. The livestock sub-sectors have not recorded negative growth in the last 34 years, and it can minimize risk in farming and mitigate the farmers' loss.

Appendix 1 shows that the growth of agriculture and agriculture allied activities is comparatively lower than to industry and services in India. The gap between agricultural growth and the overall economy has constantly been widening. Even with the five-year plans, the performance of Indian agriculture gives a mixed phenomenon over time. One major reason behind this slow pace and continuous agricultural growth decline is the decline in productivity time due to intensified agricultural practice. The past thirty years have seen the contribution of agricultural land to the growth has declined, and agricultural productivity concerns have become the new driver for agricultural growth in India.

The food grain production in India accounts for nearly 90% to 95% of total agricultural production, and total food grain production recorded 130 million tons in 1980-81. India has currently recorded 296.65 million tons of food grain production in 2019-20 (Economic Survey, 2019). Also, the agriculture and allied sector contributed 17.2% in Gross Value Added (GVA) at the current price into the national income of India in the year 2019-20. A snapshot of major food grain production in India from

2012-13 to 2017-18 is presented in figure 1.3. In total food grain production; an exciting increase appeared in the case of coarse cereals. The coarse cereals production was 30 million tons in the mid-1990s, increasing to 44 million tons in 2016-17. Oilseeds also recorded a surge in production. During this period, the production of pulses remained stagnant and created demand for imports. A drastic change has been recorded in recent years in food grain production but with prolonged growth rates.

The food grain production in India has been recorded a plodding pace of growth or stagnant growth in the past year. A detailed crop-wise production, yield, and growth of major food grain production working group report by NITI Aayog show how agricultural performance in the last 35 years. It documents that growth in agriculture production in the 1980s was mainly improved by increasing areas that became negative in the 1990s and the negligible amount recorded in the 2000s. The production growth trends of major cereals, especially rice, have declined over the past three decades. These trends are stagnant for wheat and even negative for some Kharif crops.

In recent years, researchers and policymakers have shown an increased curiosity in sustainable agricultural practice. This is the only solution to boost productivity levels in the long run. Issue of low yield and future demands are in policy debates. Kesavan and Swaminathan, (2008) argued that without care of the soil and long-run effects of intensified agricultural practice induced into traditional practice will ultimately drive into agricultural disaster. Also, the yield gap through imbalance agricultural practice in major crops is the critical issue of debate for doubling the farmers' income in India. There is an urgent need to adopt an alternative farming practice that would be more viable for current agriculture conditions in India.

Organic agriculture is an integrated production management system which promotes and enhances agro-ecosystem health, including biodiversity, biological cycles and soil biological activity. It emphasizes the use of natural inputs (i.e. mineral and products derived from plants) and the renunciation of synthetic fertilizers and pesticides. Organic agriculture follows the principles and logic of a living organism, in which all elements (soil, plant, farm animals, insects, the farmer and local conditions) are closely linked to each other. Organic agriculture shares many techniques used by other sustainable agricultural approaches (e.g. intercropping, crop

rotation, mulching, integration of crops and livestock). However, the use of natural inputs (non-synthetic), the improvement of soil structure and fertility and the use of a crop rotation plan represent the basic rules that make organic agriculture a unique agricultural management system (WHO, 2007).

According with the Guidelines of Organically Food Produce of the Codex Alimentarius (2007), an organic production system is designed to: Enhance biological diversity within the whole system Increase soil biological activity, Maintain long-term soil fertility; Recycle wastes of plant and animal origin in order to return nutrients to the soil, thus minimizing the use of non-renewable resources; Rely on renewable resources in locally organized agricultural systems, Promote the healthy use of soil, water and air as well as minimize all forms of pollution that may result from agricultural practices; Promote the careful processing methods agricultural products in order to maintain the organic integrity and vital qualities of the product at all stages; Become established on any existing farm through a period of conversion, the appropriate length of which is determined by site-specific factors such as the history of the land, and type of crops and livestock to be produced