In India, Agricultural prosperity is one of the key factors for identifying the growth in economy. The development of agricultural sector is felt important in India which has to feed around 121 crores of people,\(^1\) at least three times a day. Agriculture in India is the means of livelihood of almost two thirds of the work force in the country.\(^2\) Almost all the Five year Plans gave more importance to agricultural sector and its development. Several works on this line stressed the need for reorientation of agricultural activities prevalent in India. Production efficiency is dependent upon several factors of which fertilizer management plays a pivotal role in achieving targeted food production.\(^3\)

For well-balanced and normal growth and prosperous development, plants need water, air, light, favourable drainage and plant nutrients. Some of the factors are under the control of man, but others are not so. With air, light and physical support of control over temperature, man has little control. Water comes to the soil as rain and snow, and man may influence in various ways the supply of its availability for crops. Man may plant various crops and sometimes these lead to direct loss of much water and soil as well due to Poor Water Management Practices.

In order to maintain soil fertility, and so to provide a sound basis for continued plant growth the nutrients must be replaced in the soil. Thus, unless the plant nutrient balanced in the soil is adequate for the optimum growth of crops, other factors conducive to increasing agricultural production, such as better seeds,
water and improved land preparation can hardly be of any avail in bringing about
the desired results. Increasing use of chemical fertilizers in agriculture make
country self dependent in food production but it deteriorate environment and cause
harmful impacts on living beings. Due to insufficient uptake of these fertilizers by
plants results, fertilizers reaches into water bodies through rain water, causes
eutrophication in water bodies and affect living beings including growth inhabiting
micro organism. Therefore, it is essential that organic manures and fertilizers
should be regarded as a Prime factor for better crop yields.

1.1 IMPORTANCE OF THE STUDY

Fertilizers are used almost by all the farmers. Chemical fertilizers have now
come to be recognized in the countryside as one of the most important farm inputs.
Although their use had started revolutionizing crop yields in western Europe and the
United States even earlier than World War-I. The artificial fertilizers had passed the
experimental stage around 1875. Two decades later the methods of producing them
had been fully developed. Their application to our agriculture is only of recent
growth. It was in 1942 that the first concerted attempt was made to foster the use of
chemical fertilizers by Indian agriculturists.

‘The Central Fertilizer Pool’ was formed in 1942 to support the ‘Grow More
Food’ campaign, which had become a necessity after the great Bengal famine and
the fall of Burma to the Japanse. The subsequent year 1943 saw the incorporation of
Fertilizers and chemical Tranvancore Ltd. (FACT), which was the first attempt in the
country to Produce chemical Fertilizers on a Commercial Scale. The FACT factory
was set up in 1947. These efforts yielded some modest results. The improved
varieties generally require greater care in production and allow greater intensification, thereby providing a basis for expanded employment of agricultural labour. Additionally, employment opportunities are expanded because the possibilities of double cropping have been made more feasible by the genotypes, which have a shorter growing period than traditional varieties do.

In the interest of rational objectives, there is great need to provide farmers with substantial incentives for using fertilizers. The farmer will not use fertilizers unless he clearly find a positive relation between the cost of this input and the additional return attributable to the fertilizer. There is thus the need to subsidize the use of fertilizers till the production cost is decreased. Fertilizers also play a significant role in deciding the output and financial stability of the farmers. Consumption of fertilizers is one of the important areas where special study is to be made for the purpose of enhancing the agricultural productivity in the region. It is a key to securing the food security of a country.

The proper use of Fertilizer on soils of low natural fertility makes it possible to grow a wider variety of crops, ensures greater efficiency in the utilization of land, labour and water. Organic manures and bio-fertilizers also play an important role in improving the fertility of the soil. It adds humus, cannot possibly meet the entire requirements for reenergizing the soil fertility due to improved cultivation methods. The rational approach under the present circumstances would be that the farmer is to be taught to plan his farming practices to produce the maximum output through the optimal use of fertilizers, may be chemical or bio-fertilizers. There is also a mention about the use of chemical fertilizer for achieving higher levels of
production in Indian context. Farmers for boosting agricultural output the chemical fertilizers Indian soil is deficient in nitrogen and phosphorus, the two plant nutrients, which together with organic manures influence crop output. In the recent past, there is an increased awareness among planners, administrators and farmers about the use of required fertilizers for their soil.7

The Present level of three nutrient components that is Nitrogen, Potassium and Phosphate seems to be not fully balanced. The imbalance is due to problems such as all the Nitrogen is being used and lower use of Phosphates and Potash by the soil. Many states are taking measures to correct the imbalances. There is also a concern that the fertilizers are not used to the targeted levels by the farmers

Indian Agricultural Ministry follows a Ten Point Programme to stimulate fertilizer consumption. The Ten-Point Programme includes massive demonstration on Package of approach for specific commodities like cotton, oilseeds, jute, cereals, sugarcane, fruits, vegetables and plantation crops. Indian farmers are also trying to use biological fertilizers, to increase the production of pulses. For instance, Rhizobium bacteria is used for extracting Nitrogen from the air, which in turn rationalize the use of Nitrogen fertilizer. Hence a study on the economics of fertilizer consumption acquires a special mention at present.

1.2 CONSUMPTION OF CHEMICAL FERTILIZERS AND YIELD

Government of India, Ministry of Agricultural8 stated that “plants like all living things, require adequate nutrition for their proper development. The main nutrients which must be added to the soil in the form of fertilizers are Nitrogen, Phosphorus and Potassium. Sometimes micro-nutrients such as calcium,
magnesium, manganese, boron, etc. would also be required. UN Manual defines fertilizer as “any material organic or inorganic natural or synthetic that furnishes to plants one or more of the chemical elements necessary for normal growth”.9

Teakle and Boyle10 found that fertilizer plays an important role in the growing of larger and better quality crops so urgently needed to-day. Fertilizer is needed to improve the yield and prevent the deterioration of good land. It is essential in the conversion of low productive and waste land into valuable and fertile farms. They suggest that the ideal fertilizer programme is one that promotes the most satisfactory production at the least cost. A veritable miracle is observed when high-yielding variety seeds and fertilizers are combined in real farm situations in most of the countries, they add.

The National Commission on Agriculture has laid down the ambit of fertilizer use in India as “addition of Plant nutrients in the form of Fertilizers constitute an essential step in agricultural production. Because of narrow land man ratio which would get still narrower in coming years, the hopeful means of supplying needs of agricultural produce would be the fertilizers”11

Fertilizer is one of the powerful resources to the man who wrests his living from the soil. The economic development of the nation also depends on its agricultural productivity. The study tries to provide ways and means to increase the net income of the farmers, which is the goal of production. There must be realistic and pragmatic approach for attaining the goal of profitability in agriculture. Agricultural scientists and social scientists have developed many useful and precise tools for computing the profitability in farming activities. The study aims in
providing pragmatic environmental situation prevailing in the selected sample block with regard to fertilizer consumption.

The study focuses on the economic implications of reducing fertilizer consumption. The factors influencing the income of the farmers are analysed. The cost effectiveness of the use of fertilizers is also studied. Analysis is done based on the calculations of returns along with simulations of net returns considering alternative yields and prices. The comparisons about the use of chemical and bio-fertilizers and manures are done in this study for practical utility.

Many states in India have helped to promote the use of fertilizers through various methods. The progressive technology and infrastructural developments also have significant effect on the use of fertilizers The institutional factors, tenancy and the farm size have attracted a great deal of attention. The impact of method of land holdings such as tenancy, contracts etc. also have impact on fertilizers consumption pattern. Normally the quantity given by the tenant may be lesser than that of the owner of the land. However, this may not be generalized in the case of some existing practices in tenancy system. As regards farm size, the small farmers may tend to use lower fertilizers and the large farmers may use more. Financial powers of the farmers can also influence the fertilizer consumption pattern. Further the cropping pattern followed by the farmers may have significant impact on the consumption pattern of fertilizers Some cost variables such as cost of fertilizer, transportation, and use of application methods may also influence the Production Plan of the farmers The actual incremental agricultural output may differ from place to place and crop to crop. For example, the high yielding variety crops are known to
be both more fertilizer response as compared to the conventional or traditional varieties. Some varieties are capable of absorbing a larger volume of nitrogen and other nutrients. It is to be noted that the consumption pattern primarily depends on the output and the profitability and hence the study of consumption pattern of fertilizer is highly needed at present.12

1.2.1 Issues in the use of chemical fertilizers

The use of fertilizer is determined by the presence or absence of number of constraints. Such constraints may either reduce the profitability of the farmer by using more fertilizer, or prohibit him from obtaining, or make it unattractive for him to seek such potential profits. The type of constraints and their relative impact on fertilizer use vary among geographical regions and among farm groups within regions. In general, small farmers tend to be faced with more severe constraints than large farmers, for a number of reasons to be further discussed.

While the presence and impact of individual constraints are location specific, a number of constraints appear to be present in most developing countries. These include unavailability of fertilizers where and when needed; lack of knowledge, risk and uncertainty, lack of credit, land tenure and lack of the most appropriate complementary inputs.

Indian agriculture has reached the stage of development and maturity much before some advanced countries in the world due to intense cultivation measures as given in historical books. However, food problems commenced in the 18th century and the magnitude of the problem intensified during the 20th century. But at present due to the pragmatic steps followed by the Government such as Green Revolution,
the intensity of food problem has decreased. However, the problems faced by the farmers seem to continuing due to various reasons. Farmers face diversity in landholdings, pattern of crop, usage, lack of capital, rural indebtedness, marketing problems and other economic problems.

One of the major problems in the use of fertilizer to their crops at the optimum level of usage is yet to be identified. Outmoded farming techniques, fluctuations and inelasticity of crop output, more dependence on natural resources such as rain, temperature *etc.*, also cause maximum fluctuations in the agricultural sector. Further India is a country having substantial diversities. Different regions exhibit entirely different characteristics so that not a single plan can be conceived for all agricultural regions of the nation. The nature of soil, the magnitude, availability of water in time, cost of farming, availability of power, cost of fertilizers and pesticides differ considerably between various regions. The existing regional imbalances also create considerable problems in generalizing the plans for use of fertilizers and cropping pattern.

Productivity in agriculture depends on social, technological and economical factors. The consumption pattern of fertilizers also varies due to local and environmental factors. The social environmental of villages is a reason for changes in consumption pattern. Most of the Indian farmers are illiterates, superstitious, conservative and unresponsive to new agricultural techniques in relation to fertilizers.

Land tenure system is also identified as one of the factors affecting fertilizer consumption. Regulation of rent, security of tenure, ownership rights for tenants
etc., did not make the position of the tenants better. Tenancy of most of the tenants continues to be insecure and they have to pay exorbitant rates of rent. In the land tenure system, it is difficult to increase productivity through various technological means. Unless land reforms precede technological advancements, developments in agricultural sector cannot be seen.

The use of fertilizer also depends upon the tenancy system. If the period is short duration, the level of applying fertilizer may come down. Lack of credit and marketing facilities with regard to produce is also considered as a factor influencing fertilizer consumption.

Subsidy provided by the Government has significant influence on the consumption pattern of fertilizers. Availability of required quantity, storage facility for fertilizers, cost of applying fertilizers, chemical combination required, water and irrigation facilities available at the time of applying, type of crop etc., may influence fertilizer consumption pattern. Fertilizer use efficiency can be determined by complex of factors including agro-climatic conditions, the quality of soil, water management, the level and nutrient composition of fertilizer applied, quality of seed and the standard of weed and pest management.

The socio economic status of the farmers may also have impact on the consumption pattern. The present call for increased use of biological fertilizers may also divert the attention of the farmers to new – untouched areas. Some consumer organizations are also opposing the use of chemicals as fertilizers and wide propaganda is being made for use manure and bio-fertilizers. A single window system has not so far been developed to minimize the problem of farmers,
especially in the case of fertilizer consumption. This study is aimed to identify the fertilizer consumption pattern in the study area and tries to find out the relationship between factors affecting fertilizer consumption.

1.3 THE PROBLEM

The success of Green Revolution has been the result of the combination of High Yielding Variety (HYV) seeds, adequate and timely application of chemical fertilizers and use of water. The agricultural prosperity generally said that it depends on inputs, incentives, infrastructure, institution and information.

Many research studies have proved that application of chemical fertilizers is the dominant variable in determining output. Because of genetic revolution, high yielding seeds of most of the crops have now become available. Adoption of HYV means adoption of the ‘New Input Basket’ which consists of HYV Seed, Fertilizer, Pesticide, irrigation and better farm management practices.

Tiruchirappalli is one of the major agricultural districts in Tamil Nadu, where important food crop like Paddy and cash crop like Banana and sugar cane are cultivated. Studies reveal that a complex set up factors affect fertilizer consumption in India. Major determinants are agro-climatic factors, high yielding variety of seeds, irrigation, farm size, cropping pattern and socio-economic character of the farmers. With all these consideration in mind, the study proposes to examine the impact of fertilizers consumption in the cultivation of Paddy and Banana in Lalgudi Block of Tiruchirappalli District” for a detailed investigation.
1.4 **OBJECTIVES**

The objectives of the present study are:

✧ To find out the quantum of chemical and bio-fertilizers used by the sample respondents in the study area.

✧ To examine the effect of chemical and bio-fertilizers between paddy and banana.

✧ To study the impact of fertilizers in the cultivation of paddy and banana.

✧ To examine the size and pattern of fertilizer consumption across various farm sizes.

✧ To identify the relationship of fertilizer utilisation with the cropping pattern of the various farmers.

✧ To probe the participation in farmers awareness programme of the sample respondents.

1.5 **HYPOTHESES**

Based on the above objectives the following hypotheses have been enunciated to be tested in this study:

✧ The consumption pattern of fertilizers does not significantly differ among size of the farm.

✧ Age of the sample respondents has no significant effect on the consumption pattern of fertilizers.

✧ Educational qualification has no significant relationship between the uses of different types of fertilizers.

✧ Crop wise cost of fertilizer does not vary for different categories of farmers.
1.6 LIMITATIONS OF THE STUDY

The farmers in this area are not keeping proper records of accounts with them. The data relating to inputs, quantity, cost, etc. are as per the data provided by the respondents. Exact nature of expenses could not be ascertained. Many farmers gave the data relating to input and output in quantity and they were to be converted into money worth only after getting data from other farmers. The quantum of fertilizer used by the farmers is given as per the data provided and they have given data from their memory.

Another limitation is that the small cultivators are reluctant to part with some data relating to income, quantity of output in certain cases. Some farmers are not using standard measure for applying fertilizers. Further some farmers are using both chemical and bio-fertilizers in their cropping area. The farmers are following their own practices in combining various fertilizers for their crops.

It may be pointed out that the quantitative magnitude given are relevant only to these areas, which were selected for the study and cannot be used as dependable index for the country as a whole, the reason for these limitations are evident from the country as a whole, some broad generalization are, however, possible.

1.7 SCOPE OF THE PRESENT STUDY

Economics of fertilizers has several dimensions, viz. production, marketing, pricing, distribution, consumption and imports. Since it is not possible for an individual researcher to make an attempt to study all these dimensions, the present research is delimited to the study of economics of fertilizer consumption in one
predominantly agricultural block, namely Lalgudi, in Tiruchirappalli District. We believe that the present study is also significant from the broader perspective of regional and national policy making. Fertilizer consumption is the prime factor for higher yields. The results of this research would help in formulating government policies regarding to protect the soil from fertilizer. Balanced fertilization means application of essential plant nutrients particularly the major nutrients, Nitrogen, Phosphoric, Potassic and Calcium in optimum quantity through correct method and time of application in right proportion. It is essential to encourage the use of Nitrogen, Phosphoric and Potassic fertilizers, so as to achieve the desirable consumption ratio of 4:2:1 to maintain the soil health and sustain the crop productivity. The loss of soil fertility in many developing countries poses an immediate threat to food production. Plant nutrient exhaustion a real and immediate threat of food security and to the lives and livelihood of millions of people. So steps must be taken to protect soil fertility.

1.8 OUTLINE OF THE THESIS

The present study on economics of fertilizer consumption in Lalgudi Block in Tiruchirappalli District is divided in six chapters.

✶ Importance of the study, consumption and issues in the use of chemical fertilizers, the problem, objectives, Hypotheses and limitations and the scope of the present study are given in the first chapter.

✶ The second chapter deals with the survey of related literature on the methodological issues, dimensions and use of fertilizers.
The third chapter reveals the use of fertilizers on agriculture - a frame work of the study.

The fourth chapter presents a brief account of the choice of the study area, the period of study, the data, methodology \textit{viz.}, the sample, measurement of variable, tools of analysis and statistical test used followed by a brief description of the study area.

In the fifth chapter, the results of the analyses are presented and discussed.

The sixth chapter presents the summary of the thesis findings, policy recommendations and conclusion.
Chapter-I
Notes

1. Census of India (Provisional) 2011.
10. L. J. H. Teakle and R. A. Boyle, Fertilizer for the farm and Garden, Angus and Robertson, 1958, p. 322.
An adequate knowledge of the use and consumption of fertilizers in agricultural productivity is vital to any attempt to determine the role played by it in the development of food production of the area.

Various studies in relation to the use and consumption of fertilizer done in the past, and most of which are scientific in nature. Agricultural scientists do research on the impact of fertilizer on plants at various levels. Some economists have also analyzed the pattern of use of fertilizers at different areas. Some studies relating to fertilizer are reviewed in this chapter for the purpose of understanding the concepts of pattern of use. The use of fertilizers has been considered as an essential input in the study area and fertilizer consumption stresses higher yields and profits to farmers is the subject of the present study.

Bansil in his book on ‘Agricultural Problems of India” finds out that organic manures cannot possibly meet that full requirements for replenishing the soils at higher levels of production envisaged by the new technology. He says that chemical fertilizers play an important role in any scheme for boosting agricultural output. He found out that the present level of nutrient components is not fully balanced. He concluded that due to various plan programmes undertaken by both central and state governments, the farming community is increasingly becoming aware of the value of applying fertilizers.
Anderson\(^2\) in his work ‘The Role of Fertilizers’ analyzed the factors expected to restrict the contribution of fertilizers to food production to an accelerated rate of increase in food production and to remove the factors with emphasis on the role of public policy measures. He found out that unavailability of fertilizers, lack of Knowledge, risk and uncertainty, lack of credit, land tenure and lack of complimentary inputs are the impediments to overcome.

Deepak Kher and Bhat\(^3\) in their article ‘Economics of Fertilization in Maize and wheat: A study of Himachal Pradesh’ has analyzed the use of fertilizer and the relationship between fertilizer inputs and yield outputs with regard to maize and wheat in Himachal Pradesh. They have found out that the coefficient determination \(R^2\) is significantly high for both the crops.

Mohanam\(^4\) in an article “Determinants of fertilizers use in Tamil Nadu” attempted to study the factors determining the fertilizers use in Tamil Nadu by choosing three groups factors, viz. Technological, Economic and Institutional and analyzed their relative importance on fertilizer use with the help of a simple regression model and found out that the proportion of area under heavy yielding varieties and more dominantly influencing the fertilizer use.

Swaminathan\(^5\) in his article ‘Synergetic Effects of the Coordinated use of Fertilizers and other Inputs’ studied the fertilizer response function of local and high yielding varieties of rice and wheat. He mentioned that the test conducted on the Nitrogen responsiveness at the Indian Agricultural Research Institute on these crops (Rice and Wheat) responded well to all the three major nutrients.
Biswa et al.\textsuperscript{6} in their article on ‘Fertilizer use in some selected Agro-Ecological Zones of India’ attempted to examine their fertilizer use pattern of some selected agro-ecological zones and also indicated the fertilizer use pattern for the future taking into account their compound growth of fertilizer consumption. They found out that fertilizer consumption varies widely in different agro-ecological zones in India.

Nelson Paul\textsuperscript{7} In his work on ‘Fertilization’ said that a plant is composed of about 90 per cent water and 10 per cent of dry weight. This 10 per cent consists of 14 essential elements. He also discussed about their Fertilization programmes. Among the 14 essential elements there are Macro nutrients and Micro nutrients.

Singh and Jose Baelo Baleka\textsuperscript{8} in their study, ‘Factors Affecting fertilizers consumption in the Western Maharashtra’ identified important determinants of fertilizer consumption in different districts of western in Maharashtra. They stressed that fertilizer consumption is one of the important elements of agricultural growth strategy. It is influenced by certain regional factors relating to natural endowments like different types of soils, amount of participation, river basins \textit{etc.}, and sociological variations such as attitudes towards work and progress, spending habits, social restrictions, \textit{etc.}, These influence fertilizer consumption.

Ramalingaswamy \textit{et al.}\textsuperscript{9} in their article ‘Effects of Integrated Use of Fertilizers and Organic Manures on Soil and Crop Productivity Under Sugarcane Based Cropping Systems’, studied the effect of integrated use of organic manures and fertilizers on soil fertility and found out that available Nitrogen, Phosphorus and
Potassium at the beginning and close of crops cycle were having significant effect by the integrated use of manures and fertilizers.

Bhattacharyya and Mishra\(^\text{10}\) in their article ‘Status of Bio-fertilizer Use in Andhra Pradesh-Scope and Limitation’ studied the scope of applying Bio-fertilizer and said that Bio-fertilizer plays a significant role as one of the components of Integrated Plant Nutrient Supply systems. They studied the potential demand in Andhra Pradesh and stressed the need for the combined efforts of Centre and State Government to meet the demand.

Robinson\(^\text{11}\) in his Book on “Bananas and Plantations”, discussed about fertilization and said that fertilization practices vary widely according to climate, cultivars, yield level, soil fertility and management expertise of the grower. He felt that in addition to nitrogen, potassium, Phosphorus, the use of calcium and zinc are also essential. Organic fertilization is another option for supplying nutrient elements to bananas.

Rajendra Prasad \textit{et al.}\(^\text{12}\) in their article on “Interrelationships of Fertilizer Use and Other Agricultural Inputs for Higher Crop Yields”, analysed briefly the interaction effect of various components of agronomic package and organic manures. They indicated that integrated plant nutrient system coupled with recommended agronomic practices are the key to the successful agriculture.

Pradhan \textit{et al.}\(^\text{13}\) in their article “Growth of Fertilizer Consumption in Orissa – A District-wise Analysis” found out that during post-Green Revolution the fertilizer consumption had increased when HYV seeds were introduced. They held
the view that the growth rate of fertilizer consumption in Orissa was 9.45 per cent where as in India it was 9.40 per cent during the period 1968-1992.

**Raguram and Chowdry**\(^{14}\) in their article, ‘Factors Influencing Fertilizer Consumption in Andhra Pradesh: A Micro-Macro Analysis’ realized that the application of fertilizers was a pre-requisite for the realization of expected level of output on the farm. They had analyzed the factors influencing fertilizer consumption at the Micro and Macro levels. At the micro level quantitative factors like area under HYV seed, irrigated, *etc.*, and qualitative factors *viz.* literacy, social status of the farmers *etc.*, were analyzed to study the influence of fertilizers in three districts of Andhra Pradesh.

**Mohanam**\(^{15}\) in his article on ‘Growth Rates of Fertilizer Consumption - A district-wise analysis in Tamil Nadu’ analyzed the growth rate and found out that the growth rate of fertilizer consumption in India was nearly 18 per cent during the Post-Green Revolution Period (1966-1985). According to him the growth rate of fertilizer consumption in Tamil Nadu, during the same periods, were 14 per cent and about 7.5 per cent, respectively. There were inter-district variations and almost clustered around the state level growth rate.

**Bheemaiah et al.**\(^{16}\) in their article ‘Effect of Integrated Application of Green Leaf Manures and Fertilizers on Growth and Yield of Summer Groundnut under different cropping systems’ found out that inter-cropping of summer groundnut in 6 years old teak and sissoo plantations did not prove beneficial, while popinac green leaf manure was found effective in increasing the yield of groundnut.
Hegde et al. in their article ‘Bio-fertilizer for Central Production in India’, reviewed critically the performance of bio-fertilizers in cereal crops under different ecologies. They studied the effect of Azospirillum with millets, wheat sorghum, etc., and found out that yield has increased. The impact of bio-fertilizer like Azola, Blue-Green Algae and Mycorrhizae were also studied. These had greater influence on the yield of cereal crops and they supplement chemical fertilizer.

Vararipour et al. in their article “Effect of Applied Phosphorus. Sulphar and Zinc on Yield and up take parameters of wheat and Soybean growth on loamy sand”, studied the effect of phosphorus, sulphar and Zinc on yield and uptake of crops, a green house experiment on wheat and soybean. Chemically pure salts were used as the source of nutrients and the crops were irrigated with distilled water. The crops were harvested at maturity and plant samples were analyzed for nutrient uptake following de-acid digest. They found after experiment that the three nutrient interactions were not found to be consistently effective.

Singh Shaktawat and Bansal in their article “Effect of different organic manures and nitrogen levels on growth and yield of sunflower” conducted a field experiment during winter season. According to them Sunflower crop fertilized with 80 Kg. N/ha produced significantly higher seed yield to the extent of 49.75 per cent over control yield of 1.40 tonnes.

Korwar and Pratibha in their article, ‘Performance of short duration pulses with African winter thorn in semi arid regions’, studied the effect of leaf-shedding in the area of black gram and Green gram cultivated as intercrops this
study conducted experiment on block gram and Green gram under the trees and found out that there was fertility improvement of the soil because of leaf-shedding.

Pandy et al.\textsuperscript{21} in their article, ‘Effect of farmyard manure and chemical N fertilizer on grain yield and quality of scented rice varieties’, analyzed the response of farmyard manure and chemical N fertilizer on the yield and N uptake and quality traits of scented rice, ‘Mathuri-II’ and ‘Pusa Basmthi-I’. They found out that Mathuri-II gave significantly higher grain yield than Pusa Basmati. The increase in grain yield was mainly associated with the significant increase in effective tillers. Mathuri II according to them recorded a higher N uptake by the grain and straw than that of Pusa Basmati I due to higher concentration and yield.

Nageswara Reddy et al.\textsuperscript{22} in their article, “Productivity and soil fertility changes under continuous fertilization of rice-rice cropping system”, conducted experiment with rice, rice-cropping system for 10 consecutive years from 1987-1996 in a semi-arid climatic zone of Andhra Pradesh. They found out that comprehensive continuous nutrition to rice is a need for better result.

Kuo Leslie\textsuperscript{23} in his work ‘Agriculture in the People’s Republic of China - Structural changes and Technical Transformation’ stressed the importance of organic fertilizers and chemical fertilizers in Chinese agriculture in stepping up production. He analyzed the fertilizer production, distribution and the use of chemical fertilizers in China. He felt that to make up deficiencies, the People’s Republic of China the needs for import of chemical fertilizers.

Singh\textsuperscript{24} in his work of ‘Fertilizer Promotion’, conducted a study to identify the variables, which significantly contribute towards the level of fertilizers use of
farmers, and to increase the level of fertilizer use in Haringhata Block of Nadia District, West Bengal. His study was based on using the analysis of Multiple Regression of the standardized index of the level of fertilizer use of Marginal, Small, and Medium and Pooled sample of farmers. Lack of detailed knowledge about fertilizers, lack of soil testing facility and inadequate irrigation facility are the constraints they met in their cultivation process.

Singh Virendra\textsuperscript{25} in an article, ‘Fertilizer Use in Food Crops’ stressed the need for application of fertilizers. It is very important practice in forage production, which supplies the nutrients to plants and animals through plant for their better growth and developments. Deficiency of these adversely affect the growth, development and production of animals. Major nutrient’s according to him like nitrogen, phosphorus and potassium are very important for the crops like sorghum, Sudargrass, Maize, Bajra, Cow pea, Guar, berseem, Oats, etc.

Anumanthra Rao\textsuperscript{26} in his special article ‘WTO and viability of Indian Agriculture’ felt the need for reforms at the grass-roots level and hold the key to improving the viability of Indian agriculture in the wake of trade liberalization. He was also of the opinion on that when private investment was stepped up in the post reform period of the 1990s in response to the liberalization of the economy and favourable terms of trade, real public investment continued to decline on account of fiscal compression and failure to reduce input subsidies.

The Economic Survey of India (2010-11)\textsuperscript{27} tells that the fertilizer consumption has increased from 216.51 lakh tonnes in 2006-2007 and in 2009-2010 the figure reached 264.86 lakh tonnes. In 2015 it may touch 364.5 lakh tonnes. The
ideal consumption of NPK for rice and wheat for the country as a whole is 4:2:1 of NPK.

Desai\(^2\) in ‘Role of Agriculture in Economic Development’ traced their importance of agriculture to Indian Economic Development. He wanted that to achieve a rapid increase in incomes a greater proportion of investment should be made in agriculture.

‘Organic manure protects, enriches soil fertility”, expert Nammalvar\(^2\) said that the usage of organic manure will protect and enrich soil fertility and the agricultural produce raised through organic manure will have more nutrient contents. Heavy use of chemical fertilizers had affected the soil fertility and advised the farmers to switch over to organic farming. Dr. Nammalvar said everyone should strive hard to prevent global warming.

Examines the effects of fertilizers subsidy on the rural poor in Indonesia. Discusses the factors which lead to rural poverty and measures which have been undertaken to combat these. Describes in detail a survey undertaken in two villages to establish the effects of the removal of the fertilizer subsidy. Concludes that there has been an increase in poverty and income inequality since its removal and suggests ways of remedying this problem (Carunia Mulya Firdausy\(^2\), 1997).\(^3\)

In less developed countries there are chronic food shortages and scarcity of arable land and water, coupled with increasing population. Widespread irrigation permits more intensive agriculture, but fertility is decreased and outbreaks of fluorosis and arsenic poisoning have occurred. Use of modern fertilizers causes soil mineral deficiency, including that of zinc. Iodine deficiency has caused outbreaks of
goiter. Increased fertilizer use leads to an unacceptably high concentration of nutrients and potential toxins in rivers and lakes. Industrial effluent also poses a serious problem (Bender and Bende, 1995).\(^{31}\)

The growing demand for fertilizers makes the Indian market highly attractive for domestic and foreign manufactures. Recent policy changes by the government are a welcome step and will open up opportunities for local companies to strengthen their domestic presence and meet global aspirations (Pratik Kadakia et al., 2008).\(^{32}\)

For India there is an urgent need to narrow the wide ratio between nitrogen (N) and phosphorus (P) and potassium (K) consumption by stepping up P and K usage, which suffered markedly during much of the 1990s. By doing so, food security will be safeguarded and agricultural practices will be more sustainable. India would need about 45 million tonnes (M t) of NPK in addition to 20 Mt of organic and bio-fertilizer sources to produce about 346 M t of food grain required by 2015 (Tiwari, 2007).\(^{33}\)

Fertilizer has to play an important role in future growth of Indian agriculture as the net area available for cultivation is shrinking due to rising demand for new houses, factories, infrastructure and other commercial uses. It seems that practically all increase in farm output in future has to come from the increase in productivity. This would require improved technology and increased application of yield enhancing plant nutrients. A large number of studies have shown that most of the increase in food grain output during the first two decades of green revolution are attributable to chemical fertilizers (Desai and Vaidyanathan 1995).\(^{34}\)
Research conducted under All India Coordinated Research Project on Long Term Fertilizer Experiments of ICAR provides strong evidence of this. It shows that continuous use of N alone produced decline in yield and has deleterious effect on long term fertility and sustainability (Indian Institute of Soil Science, 2000).35

During last 60 years consumption of P increased by 9.41 percent per year while use of N and K increased by around 8.50 percent. These growth rates show that, over time, fertilizer use in India has moved somewhat in favour of P and, there is no evidence of fertilizer use moving in favour of N. This prompted us to estimate exact nature of imbalance in fertilizer use against norm of balance use of N, P and K which is recommended to be in the ratio of 4:2:1. This was estimated by using an indicator of imbalance adopted in earlier studies (Mehta et al., 2007)36 as under:

\[ I = \sqrt{\frac{(N_a - N_n)^2 + (P_a - P_n)^2 + (K_a - K_n)^2}{3}} \]

where I is the measure of deviation in proportion of actual use of N, P and K from the norm and subscript ‘a’ indicates actual and subscript ‘n’ indicates norm. Value of I away from zero measures the magnitude of imbalance. When N, P and K are used in the recommended ratio then I is 0. If entire amount of fertilizer is in the form of K, which is the lowest digit in the norm, then I reach the value of 0.6. Thus I would lie between 0 and 0.49 or 0 percent and 49 per cent representing perfect balance and extreme imbalance.

Tankdon37 in his work ‘Sulphur Fertilizers for Indian Agriculture’, is of the view that sulphur is more recognized as the fourth nutrient in addition to nitrogen, phosphorous and potassium. He considered about the deficiency and toxicity
symptoms, among the crops Alfalfa, Banana, Cocoa, Coffee, Cotton, Groundnut, Maize, Oil palm, Pineapple, Potato Sugarcane, Tea, Wheat, etc., According to him sulphur improves the quality and marketability of the produce. This sulphur was not priced formerly. It was ignored. At present sulphur is the cheapest.

Tandon et al.\textsuperscript{38} in their work, ‘Elemental Sulphur-Based and other Available Sulphur Fertilizers’, said that more than 60 fertilizers are used in agriculture worldwide. They found out that the application of elemental sulphur can result in significant increases of 20 percent to 106 percent in crop yields. Magnesium sulphate is produced and used most commonly in India. Copper, Sulphate, Iron Sulphate, Manganese sulphate and Zinc sulphate are having sulphur content among micro-nutrient carriers.

Vaidyanathan\textsuperscript{39} in his article ‘Fertilizers in Indian Agriculture’, traced the salient features of Agriculture in India and the growth of fertilizer use. According to him the principal affecting factor are the prices of fertilizers and of output. He is of the view that fertilizers are now the dominant source of – additional production. He also speaks about the fertilizer use efficiency and efficiency in fertilizer production.

Mishra et al.\textsuperscript{40} in their article, ‘Soil Water and Fertilizer Management for Wheat Cultivation in Rice-Wheat Rotation’. Studied the crop rotation among wheat and rice. According to the study wheat yield in rice-wheat rotation is considerably low. After rice is harvested, the soil condition then is quite favourable for the growth and yield of the subsequent crop like wheat. They also accepted that balanced application of nutrients is important for getting higher yield in addition to irrigation, plant production, etc.
Parmar and Walia\textsuperscript{41} in their analysis, Green revolution in India has made us self sufficient in the production of food grains. This phenomenon increase in food production has been made possible by increased use of inorganic (Phosphatic, N-P and N-P-K) and organic fertilizers. Modern trend is towards production and use of mixed fertilizers containing N and P and quite often these are blended with K to make it a complete fertilizer. Besides urea, ammonium nitrate is also widely used in admixture with Phosphatic fertilizer in the form of N, P or NPK. NPK fertilizers are available in different grades having different proportion of the elements based on crop requirements and soil needs. The good points of such mixed fertilizers are that they are readily soluble in water, are highly concentrated and their nutrient ratios can be adjusted as recommended. Over the years fertilizer consumption in the country has increased manifold and is expected to rise to about 364 lakh tonnes by 2015 AD.

Though inorganic fertilizers have been used very successfully for several decades, some limitations of such use are coming to be known. It has been found to escape into atmosphere as products of denitrification or being highly soluble in water get leached to ground water as nitrate or nitrite. The atmospheric burden of N\textsubscript{2}O which is about 1500 million tonnes (1500 Tg) is alarmingly increasing at 0.2\% per annum and may lead to depletion of the ozone layer. In high rain fed rice growing zones the effective use of urea is only up to 35\% and the rest is washed away or volatilized or decomposed. In upland areas the utilization is about 50-60\%. At present there is no effective means to prevent this loss. Apart from high wastage of fertilizers, nitrite and nitrate ions ultimately find their way in water reservoirs and
cause undesirable growth of algae. Researchers at Indian Agricultural Research Institute are working to develop products with enhanced fertilizer-N use efficiency. Since fertilizers and allied agrochemicals are potential contaminants of concern in integrated land and water management, their environmental implications needs to be properly assessed.

Kumarasamy\textsuperscript{42} in his articles, the plants absorb all the nutrients as inorganic ionic forms only, irrespective of the sources through which they are supplied. The plants do not and cannot differentiate between the nutrients supplied through manures and fertilizers. The nutrients supplied through organic and inorganic sources do not behave or interact differently after being absorbed by the plants. For example, plants can absorb nitrogen either as NH\textsubscript{4} ions or as NO\textsubscript{3} ions, irrespective of the source of these ions being a nitrogenous fertilizer or manure. The behavior and functions of the nutrients within the plant will also be same irrespective of their sources. The nutrients from the organic and inorganic sources differ only in their relative availability for crop uptake. The nutrients from the fertilizers are readily available as most of the fertilizers are water-soluble while the nutrients supplied through organic manures would become available for crop uptake slowly and gradually but would be available for longer duration due to slow decomposition of the organic manures and gradual release of the nutrients into the labile pool. After being released into the labile pool, the nutrients from the fertilizers as well as the manures will behave and interact similarly.

Among the different farming enterprises compared for integration along with low-transplanted rice viz. fish culture, rabbit rearing and poultry rearing performed
significant superior. Positive interactions among these enterprises resulted in higher crop yield, economic indices and soil fertility status. The highest net returns of ₹ 1,55,920 ha and ₹ 2,28,090 during the first and second season, respectively were obtained with integrated rice + fish culture poultry farming systems. The same also recorded the highest grain yield of rice (5.67 tonnes and 5.25 tonnes/ha during first and second season, respectively). The highest post-harvest nutrient status with regard to N, P and K was also observed with rice+ fish culture + poultry farming system.

Bio-pesticides are one broad spectrum of plant protection methods that are supportive to the environment. The modern agriculture practices such as increased and indiscriminate use of agro-chemicals due to this, a number of new problems emerged especially in the field of plant protection, over dependence on these pesticides has led to problems like development of insecticidal resistance, residue in food chain, degradation in quality of ecosystem human health and adverse effect on beneficial micro biota. Moreover with increase in cost of cultivation, the net income per unit area has gone down sharply. Maintaining the productivity in a sustainable manner with sound sources of management would be key issue in the coming decades.

Murugan and Kathiresan\textsuperscript{43} pointed out in their article, the agriculture research though made considerable progress in addressing food security, adopted policies to grow more and more food to support the growing population, ignoring the issues of health and environment, which lead to disastrous situations. The adequate food and environmental security would remain the key issues confronting
mankind in the third millennium. The use of chemical pesticides in agriculture has seen a sharp increase in recent years. In current scenario plant protection was mainly oriented towards the chemical control. Though chemical gained lot of importance and proved their positive effects in targeting the food security but their continuous and injudicious use has resulted in several implications such as development of insecticidal resistance in key species of pests and environmental problems, residue in human foods and loss of beneficial micro biota. Especially in terms of Asian agriculture, small farmers with very few exceptions dominate this. While many are directly benefiting from the dramatic urban-oriented growth that characterizes many parts of Asia, a far greater number still struggle to produce sufficient food and income.

Mishra et al. discussed that the plant diseases were traditionally managed by the application of chemical pesticides. However, they have been proven to cause adverse environmental effects and result in health hazards to humans as well as other organisms. Furthermore, relatively few chemicals are available to control soil-borne diseases that can be caused by bacteria, fungi or nematodes as they cannot easily be delivered into soil. Therefore, alternative disease management strategies are needed. Bio control or biological control can be defined as the use of natural enemies to control pests. Natural enemies of pests are categorized as parasites, predators and pathogens. Organic rise farming technology development and its feasibility, the primary concern for organic rice relies on its quality parameters that will ensure its unique standard for global disposal to the international market. Major quality parameters viz. crude protein content, total amylase content, bran oil
content, milling percentage and hardness are ensured appropriately in the grain produced organically. Nonetheless, Organic rice farming is reported to enhance the quality parameters appreciably. Studies comprising nutrient management purely with organic sources revealed comparable grain quality with that obtained following conventional farming by applying chemical sources of nutrients. It implies no quality deterioration following organic farming so far as inherent qualitative parameters of the rice grain is concerned. Contrary to that, as all the inputs/practices are of organic in nature, it is most unlikely to obtain any chemical residues in rice grain. However, presence chemical residues in the long run is yet to be confirmed. There is a possibility that contamination of some uncontrolled inputs, mainly irrigation water from either surface sources or ground water sources or even rainwater may cause some chemical residue, particularly heavy metals, in the soil in the long run; impact of which on grain quality needs further study.

**Panneer Selvam and Rajkumar** explained there are some states realizing the importance of organic farming and they have passed special Act. Recently Mizoram is the first state to bring in an organic farming Act which bans the sale and use of fertilizers and thus transforms the farm into organic paradise. Nagaland and Sikim are the two states in the northeast which are in the process of declaring themselves organic in the near future. In Tamil Nadu also realizing the benefits of organic farming many farmers have started converting their farming techniques to organic way. Studies have shown that organic agriculture is economically viable and farmers can achieve more income through premium prices and they need fewer inputs to maintain returns. A recently concluded international agriculture far in the
UK focused on organic food production. According to Dushyant Laijawala, partner Nico Organic Manures, there is a good scope for organic products in UK and Europe and at least 100 Indian Companies are engaged in exporting organic items.

Vipin state the role of sulphur is very important in attaining normal growth and sustaining the productivity of crops. Sulphur is found to be absorbed by the rice crop in amounts equal to phosphorous and is considered essential for the attainment of 90 per cent of optimum yield of rice. It is thus being identified as the fourth major nutrient agriculture. Sulphur fertilizers and their nutrient content commonly used for correction of its deficiency in different soils and crops depends on their cost and easy accessibility. Ammonium Sulphate and single super phosphate contain 24 percent and 12 percent of sulphur respectively and can be regarded as two excellent sources of sulphur for rice. Other fertilizer sources include Ammonium Phosphate Sulphate (18% sulphur), Potassium Sulphate (18% sulphur), Zinc Sulphate (15% sulphur), Gypsum (13-20 co-sulphur), Iron Pyrites (22-24% sulphur), Phosphogypsum (11% sulphur). Other non-fertilizer sources include press mud. Several studies aimed to evaluate optimum rate of sulphur in rice indicated that yield of rice increased significantly with 10 to 40 kg S/ha and optimum comes between this. Only a portion of added sulphur is utilized by the first crop. The benefit of added sulphur is carried over to the succeeding crops. The succeeding crops benefit more when the rate of sulphur application to the previous crops was high, the first crop utilized less sulphur, and insoluble sources like pyrites, elemental sulphur of FYM and press mud were used economic gains from sulphur use. Composition of nutrient prices shows that among N, P, K and sulphur,
the price of sulphur is lowest. Research from experimental station and farmer’s field deficient station and farmers field deficient in sulphur shows that application of 20 to 40 kg/ha over recommended dose of NPK is highly economical. The return from 1 kg of fertilizer sulphur application to paddy, on an average is ₹ 116.2. The value cost ratio comes to around 20.4. Thus, sulphur application is considered highly profitable in sulphur deficient soils of India.

Sathya Sundaram in his article, cropping systems and crop production practices are also important. The type of pests and their behaviour differ with the crop eco-system. Also, the natural enemies’ composition varies with the cropping systems. Pests should not reach a critical number. The ‘non-pesticidal management’ can bring in both ecological and economic benefits to the farmers. Farmers should take to crop rotation, supply of micro-nutrients to crops, judicious use of badly needed chemical fertilizers and pesticides along with green manure and bio-pesticides to boost productivity and minimize the harmful effects from pesticides.

Panwar and Ompal Singh in their article, to meet out the nutrient requirement of the crop, a balanced nutrient supply should be ascertained for healthy growth and maximum biomass production. The soil rich in nutrients play a very important role for higher productivity. To meet out the food requirement of population in the world, particularly in Asian countries, more attention has been laid towards increasing productivity through the use of inorganic fertilizers and using the NPK fertilizers exorbitantly that are deficient in micronutrients and few nutrients are available in proper amount. In India, farmers supply nitrogen fertilizers exorbitantly that erected imbalance in the nutrient supply. During green revolution,
much importance was given for increasing productivity without keeping in mind the integrated nutrient management, which caused the imbalanced nutrient availability. The fertilizer application should also be based on the soil test and special nutrient requirement of the crop.

**Manna et al.** in their article, phosphate bio fertilizers are an important source of augmenting nutrients supplies for crop production systems. In this article, quality of nutritionally enriched phosphor compost prepared from different crop residues and city garbage has been analyzed and their field performance studied, compared with chemical fertilizers. Yield gains and uptake of P on soybean showed that the application of enriched phosphor compost at 5 tonnes/ha was comparable with single superphosphate when used at 60 kg P$_2$O$_5$/ha. Direct application of P-solubilizers into transplanted seedlings done not give promising effect for higher crop productivity. This is mainly due to interaction of many inherent micro-organisms under field conditions and low content of energy sources present in the soil. To overcome such difficulties, organic enrichment compost by utilizing crop residues, city garbage with bioinoculum is one of the viable alternatives to improve land productivity and biological system of the soil.

Microbial inoculant can generally be defined as preparations containing live or latent cells of efficient strains of nitrogen-fixing, phosphate solubilizing or cellulolytic micro-organisms used for application to seed or composting areas with the objective of increasing the number of such micro-organisms and accelerate those microbial processes which augment the availability of nutrients that can be easily assimilated by plants. Bio-fertilizers can also be considered as the nutrient
inputs of biological origin for plant growth. Here biological origin should be referred to as micro-biological process synthesizing complex compounds and their further release into outer medium, to the close vicinity of plant roots which were again taken up by plants. Therefore, the appropriate term for bio-fertilizers should be microbial inoculants. Fertilizer has become the part and parcel of agricultural inputs. In most of the developing countries, use of fertilizer is consistently increasing. For well-balanced normal growth and proper development plants need water, air, light, a favorable temperature, sufficient root space and physical support, proper drainage and physical condition, or suitable tilt of the soil, and plant nutrients.

Manganese, copper, boron, and zinc have been found during comparatively recent years to be essential for plant growth. These elements are present in most, if not all soils, but other elements or some abnormal soil condition may prevent the plant from using them. Consequently the plant suffers as if these elements were not present in the soil. Iodine and sodium are often helpful to plants but plant scientists do not generally accept this evidence as conclusive that either iodine or sodium is absolutely essential for plant growth. Chlorine and silicon which some had believed to be essential are not so regarded now.

**Time of Application**

The time of application of fertilizer often makes a considerable difference in its utilization by the crop. Plants absorb large, quantities of nitrogen, phosphoric acid, and potash during the early stage of growth.
Therefore, the fertilizers should be applied to most crops at or before sowing time. Fertilizers need not be applied to annual crops in the latter stages of their growth. A late application of nitrogen to a crop increases the nitrogen content, prolongs the growing period and delays maturity. But crops of log duration, like sugarcane, enquire the application twice or thrice at suitable intervals.

The phosphoric fertilizers should be applied a little before or at the time of planting the crop, as phosphorus is not leached out of the soil. Potash is applied at the time of planting and to a limited extent as a top-dressing a later stage of crop growth.

**Response of Fertilizers**

The response to fertilizers varies with the nature of the soil, the crop grown, and whether it is rain-fed or irrigated. Results of extensive trials conducted throughout India in cultivator’s fields show that the best response with nitrogen fertilizer on rice was obtained on old alluvial soils, with an increase of 859 lbs. Of paddy over the control plot. In decreasing order the responses on the other soils were: black soil, and soil, red gravelly soil, and on a mixture of red and black soil. The least responses with nitrogen fertilizer on paddy was obtained on coastal alluvium, detail and saline soils, new alluvium and late rite. The increase in paddy yield over the control plot as a result of applying 30lbs. Of N was 514 IBs of grain. The respective yield I case of bajra was 155 lbs. Ragi 4121IBs, wheat 289 lbs. Per acre over the control plot.
Green Revolution

Green Revolution initiated in the 1960’s centered around the use of semi-dwarf high yielding varieties responsive to irrigation and chemical fertilizers yielded good results in giving a big boost to the production of wheat in the first stage and later to the production of rice. But more recently, it has been felt that high yielding varieties have reached a plateau and the scope for future increase in production appears to be very limited. In other words, it is being argued that the seed-water-fertilizer technology has exhausted its potential to reach a point of diminishing returns. But the planning commission has set a target of food grains production of the order of 300 million tonnes by 2007 – 08. Consequently, the skeptics believe that traditional Green Revolution breeding techniques have come to a dead end.

Irrigation

An important constituent of the current strategy for raising agricultural production is the increasing reliance on irrigation. The strategy of Intensive Agricultural District Program (IADP) and the High Yielding Varieties Program (HYVP) were initially introduced only in those areas which had assured rainfall and irrigation facilities. As the scope for extending the cropped area is limited in fact, the cropped area has ranged between 140 to 141 million hectares in recent years – greater reliance has to be placed on irrigation so as to have double or multiple cropping. The basic objective is to produce a much higher yield of grain output per hectare by promoting the sowing of two or more crops on irrigated land.
**Improved Seeds**

In the past, Indian farmers generally used seeds of very indifferent quality either because the special good quality seeds kept for sowing are consumed away during the off-season or because good seeds deteriorated through bad storage. Agricultural Department and the Indian council of Agricultural Department and the Indian council of Agricultural Research have done much to evolve and popularize improved and disease - resisting varieties of seeds suitable for different local condition.

Seed is “basic and crucial input for attaining sustained growth in agricultural production”. Seed is the carrier of new technology to crop production, propagation and multiplication. Accordingly, production of quality seeds and distributions of new improved plant varieties constitute an important component of Government’s agricultural policy. In fact, it is the success of this policy initiative which is the main reason for India’s current self-sufficiency in food grains.

A number of high yielding varieties of rice and wheat, hybrids of maize, jowar and barge have been introduced. The High Yielding Varieties Program (HYVP) was started in 1966 by 1997 – 98 a total of 76 million hectares of land were covered by high yielding varieties. While coverage of area under HYV is as high as 90% in the case of wheat, the coverage under rice is much lower.

The organized seed sector particularly for food crops and cereals is dominated by the public sector. The Government is giving considerable attention.

i. To research in evolving better seeds suitable to Indian condition.

ii. Large production and better distribution of quality seeds.
iii. Expansion of irrigation and fertilizer and pesticides which are necessary for the use of quality seed.

**Organic Manures**

The practice of applying organic manures has stood the test for centuries as it has helped to keep the soil in a fertile state over long period. However, in the First Year Plan, sufficient attention was not devoted to the development and increased production of local manorial resources in rural areas. Even in the Second Plan, only schemes for making town or urban composts found a place. It was later realized that there was considerable scope for developing manures of local origin from the wastes in National Extension Service and Community Development. Blocks and schemes for the production of night soil compost in the bigger Panchayats and smaller villages were formulated in 1956.

**Rural Compost**

It was envisaged that the compost production per adult cattle per annum could be stepped up from one ton to two tons and the nitrogen contents of the manure increased from 0.5 per cent to one per cent. During the Second Plan period this scheme functioned in about 1,500 blocks. The rural compost production reported for 1960-61 works out to about 83 million tons against the agreed total target of 150 million tons for the Third Plan.

**Urban Compost**

A scheme for the preparation of compost from city wastes, like garbage, night soil, sewage, sludge, slaughterhouse wastes, was sponsored as early as 1943-44 by
the Indian Council Agricultural Research. Legislation has since been passed in some of the States making it obligatory on the part of the municipal committees to compost refuse wastes within their jurisdiction. The scheme on town composting now constitutes an important activity of the increased agricultural production programme. Both loans and subsidies are being to State Governments from the Center for equipping the Municipalities with necessary transport needed for production and distribution of compost manure. The target of compost production by the end of the Second Plan was three million tons and the actual achievement has been reported to about 2.7 million tons. In the third Plan, a financial allocation of ₹ 180 lakh has been made and it is programmed to cover all the urban centers (about 3,000) in the country to achieve production of town compost to its potential capacity of about five million tons.

The elements Nitrogen, phosphorus, and potassium are regarded as the more important fertilizer elements, since it is one or more of these which most often controls or limits the yield of crops. They may limit crop yields because they are really lacking, or because they occur in insoluble material from which the crop cannot obtain the supply of them needed for good growth. In addition to these three, calcium, magnesium, manganese, sulfur and occasionally copper, boron, and iron may not be present in available from or in sufficient quantities for well-balanced normal growth.

**Uniqueness of the present study**

Though various studies on fertilizer have been conducted, no specific study is conducted in the study area, which is situated on the banks of River Coleroon
(Kollidam). This study is unique in nature as the study area is not analyzed by researchers with regard to pattern of fertilizer use. Further, a comparative study is done with reference to the farmers of Paddy and Banana. This study, therefore, is unique in nature and tries to identify the relationship between various factors affecting the use of fertilizers.