CHAPTER I

INTRODUCTION

The government of India has always accorded high priority for agricultural development in the country as agriculture is the backbone of the Indian economy. As of 2011, India had a large and diverse agricultural sector, accounting, on an average, for about 16 percent of GDP and 10 percent of export earnings. India’s arable land area of 159.7 million hectares (394.6 million acres) is the second largest in the world, after the United States. Its gross irrigated crop area of 82.6 million hectares (215.6 million acres) is the largest in the world. India has grown to become top among the three global producers of a broad range of crops, including wheat, rice, pulses, cotton, peanuts, fruits, and vegetables. Worldwide, as of 2011, India had the largest herds of buffalo and cattle, is one of the largest producers of milk, and has one of the largest and fastest growing poultry industries (United States Department of Agriculture - Economic Research Service, 2011). Making food grains available in adequate quantity and at an affordable price for the poor has been the basic objective of agriculture policy (Yadev, 2009).

The significance of agriculture in India arises from the fact that development in agriculture is an essential condition for the development of the national economy. It suffices to note that during the last 50 years the country has achieved and sustained historically unprecedented growth of output. Expansion of cultivated area has virtually come to a stop in recent years. Growth in yield per hectare of cultivated area has become increasingly important and is now the predominant source of growth. The virtual elimination of food grain import can also be viewed as an achievement (Swaminathan, 2002).

Indian agriculture is facing challenging task in providing food security to the ever-increasing population of our country. Food grain production could not keep pace with increase in population. The area under farming in India is dwindling due to population pressure and urban development. The present
cultivable land area is not likely to increase substantially in the near future. It is essential to increase productivity of individual crops and intensify cropping systems to meet future food needs (Nampoothiri and Balasimha, 1999).

A report derived from Census of India, Economic Survey and Ministry of Agriculture (2012) claimed, India's population is growing faster than its ability to produce food grains. The most challenging problem today is that the growth rate of food grain production dropped to 1.03 percent per annum, which was lower than the population growth rate (1.65 percent per annum) during the period 2001-11. Hence in order to realize the need based targets of agricultural production, the pattern of production enhancement will have to rest heavily on increasing yield.

The agricultural production can be increased either by bringing more area under cultivation or through increased productivity. In the Indian context, land is becoming a shrinking resource for agriculture owing to the competing demand for its use (Indian Journal of Fertilizer, 2009). This essentially calls for optimizing the usage of the existing farmland by adopting new strategies for agricultural development. This new strategy includes judicious use of fertilizers. Fertilizer is the key element to maintain the tempo of agricultural production as studies have indicated that it has contributed to about 50 per cent of increased food grain production in the world. There exists a direct correlation between the fertilizer use and agricultural production.

The use of fertilizer coupled with fertilizer responsive hybrid and high yielding varieties and irrigation resulted in a quantum jump in food production. For this reason green revolution is also called as "seed - cum- fertilizer revolution". Balanced use of fertilizer is essential to stabilize crop yields and sustain high crop productivity. The new strategy of integrated nutrient management seeks to make the best use of the available nutrient sources, both organic and inorganic as also the complementary agricultural practice so that maximum crop yields can be obtained with fertilizer inputs.

Fertilizer is the kingpin for increasing productivity in agriculture. For every tonne of fertilizer used, there is an increase of seven to eight tonnes of food
grains, other things remaining the same. It has been estimated that about 70 percent of growth in agricultural production can be attributed to increased use of fertilizers. Increase in the consumption of fertilizer over a year would thus be a good indicator of a country's performance in agriculture (Parikh, 1997 and Trivedi, 1998).

Increased fertilizer use leads to a number of benefits to agriculture like, reduction in unit cost of production, prevention of fall in agricultural productivity, protection of environmental quality and efficient use of other inputs such as irrigation and high yielding varieties. (Trivedi and Patel, 1997).

The modern era of fertilizers began with the Justus Von Liebig who developed the idea of organic chemistry and its application to agriculture and physiology in 1840. He is generally considered to be the "Father of the world fertilizer industry". The German agricultural chemist Liebig was the first to put forward the theory that Phosphorus, Potash and Nitrogen will increase the agricultural output. The mineral nutrients of plants and law of minimum were the turning point in fertilization which resulted in demand for mineral fertilizers and emerging fertilizer industry. According to Justus Von Liebig, theory of mineral nutrients of plants, nutrient depletion caused by crop productions need mineral fertilizers supplementation to maintain or to increase soil fertility enabling conditions for plants growth. For achieving these effects we need to use at proper proportion, the form and composition of these supplementing substances. The theory advocates the use of Nitrogen (N), Phosphorus (P) and Potassium (K) to be the basis for determining healthy plant growth. However, this theory, which dates to the 1800s, does not take into account the dozens of other nutrients and elements that are essential for plant growth such as Sulfur, Hydrogen, Oxygen, Carbon, Magnesium, etc. (Viswanath, 1940).

Fertilizer is an organic or inorganic material of natural or synthetic origin (other than liming materials) that is added to soil to supply one or more plant nutrients essential for growth of plants (Stewart et al., 2005). Fertilizers are inorganic materials of a concentrated nature and are used mainly to increase the
supply of essential nutrients, e.g. nitrogen, phosphorous and potash. Fertilizers contain these elements in the form of soluble or readily available chemical compounds. This includes urea, di-ammonium phosphate, ammonium sulphate, ammonium chloride, calcium ammonium nitrate, complex fertilizer, mixed fertilizers super phosphate and micronutrients. Nitrogen (N), phosphorous (P) and Potassium (K) are the three primary plant nutrients produced by the fertilizer industry. (Fortune India, 2007).

Historical evidence indicates that prior to 1940, the use of chemical fertilizer was confined only to plantations and cash crops. For food crops, use of organic manures was generally recommended. Subsequently, certain unprecedented development such as outbreak of World War II and the Bengal Famine in 1943 forced the Government of India to take measures for averting any major shortfall in food grain output. Consequently, „grow more food’ campaign was initiated at the national level under which the use of fertilizer was an essential ingredient for increasing the yield of crops in the short run. Since then chemical fertilizers have been receiving prime importance under all agricultural development programs.

Fertilizer consumption in India has increased from less than 70,000 tonnes in 1950-51 to more than 20 million tonnes at present (Chand and Pandey, 2009). No other single agricultural input has seen this kind of growth. The growing application of fertilizers has played a very strategic role in increasing productivity and in the production of a large number of crops in the country.

India is the second largest user of agro-fertilizers in the world after China. The increased use of chemical fertilizers is attributed to factors such as (i) Compensating the adverse effect of a decline in per capita arable land (ii) Meeting the deficiency of soil arising out of various forces including intensive cultivation of land in all the different regions in the country and (iii) Exploiting the prevailing potential for higher use of chemical fertilizer and the need for exploitation in Indian agriculture. In India the production of fertilizer lags behind the actual consumption and hence a lot has to be imported from other countries. This situation is presented in Annexure -1.
From annexure-1, it is clear that, the consumption of chemical fertilizer has been growing rapidly. It increased from 70 thousand tonnes in 1951-52 to 26486 thousand tonnes in 2009-10. The government of India has been promoting the consumption of fertilizers by giving heavy subsidies. In recent years special measures were taken to streamline distribution of available supplies through better transport, regulated supply to priority crops and areas specified by the state governments etc. Production of fertilizers rose from 39 thousand tonnes in 1951-52 to over 16,298 thousand tonnes in 2009-10. Due to shortage of production and increasing demand, the government had to depend on imports. Imports increased from 52 thousand tonnes in 1951-52, to 8123 thousand tonnes in 2009-10. Large import of fertilizers by using scarce foreign exchange and heavy subsidies has laid a great burden on the government exchequer.

Absence of assured water supply, which is a primary condition for the application of chemical fertilizer, is lacking in many parts of country. The government has taken steps in recent years to increase the consumption of fertilizers in these areas. Annexure - 2, gives an account of the consumption of NPK fertilizer in India from 1980-81 to 2009-10.

In India, the consumption of nitrogenous fertilizers had increased from 3678.1 thousand tonnes in 1980-81 to 15580 thousand tonnes in 2009-10, the consumption of Phosphatic and Potassic fertilizers had risen from 1213.6 and 623.9 thousand tonnes in 1980-81 to 7274 and 3632.4 thousand tonnes in 2009-10. The total NPK fertilizers has increased from 5515.6 thousand tonnes in 1980-81 to 26486.4 thousand tonnes in 2009-10. In a span of 30 years fertilizer consumption has increased by more than five times. However the average fertilizer consumption during the last 30 years (1980-81 to 2009-10) has shown a fluctuating trend.

The ideal ratio of NPK consumption for the country as a whole is placed at 4:2:1. The average fertilizer consumption per hectare in India during the year 2008-09 was 138.6 kg, which was quite low as compared to that in Egypt (388.1 kg), Korea (272.4 kg), Japan (220.4 kg) and Malaysia (204.8) (Fertilizer Statistics 2009-10).
The use of fertilizer is affected by a number of factors such as irrigation, high yielding variety seeds, size of the farm, availability of credit etc. Increased area under high yielding varieties leads to increased food grains productions. These high yielding varieties respond more to the use of chemical fertilizers. There exists a large gap between actual and potential level in fertilizer use (Singh, 2002).

In developing countries actual fertilizer use is usually below the economic potential. Sufficient credit is often necessary to convert farmer's perception of profitability on fertilizer use to their effective demand for this input. To promote efficient use of fertilizers non-irrigated segments of the agricultural sector needs to get more attention than in the past (Desai and Gunvant, 1997).

In spite of large area of the country having the best kinds of soil in the world, abundance of rainfall, plentiful sunshine and ideal temperature almost throughout the year, the yield per hectare of crops in India is low. It is due to the exhausted soils which have been over cropped from centuries without adequate replenishment of plant nutrients through fertilizer. Thus the role of chemical fertilizer in increasing agricultural production is well established. A corollary of this established fact is that, more fertilizer used, the more will be agricultural production hence the demand for fertilizer is consistently increasing.

Having recognized the importance of fertilizers in agriculture, the real question concerning the future is not whether to increase fertilizer consumption but how to accelerate the growth of fertilizer consumption and ensure its maximum efficiency in agriculture production. In order to know the possibilities for increasing fertilizer consumption in future, it is necessary to examine the experience of the past.

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National Academy of Agricultural Science considered fertilizer as the key for securing food requirement for more than 1.25 billion Indians by the year 2025. Working on the conservative population forecast at 1.25 billion by the year 2025, India would need 30.35 million tonnes of N P K fertilizers in addition to the 10 million tonnes from organic and bio-fertilizer sources to produce the minimum food grain needs of 300 million tonnes (Kareem and Ramasamy, 2000).

The major states which had a per hectare fertilizer consumption higher than an all India average included Puducherry (878 kg), Punjab (237.1 kg), Andhra Pradesh (225.6 kg), Haryana (209.9), Tamil Nadu (205.8), Uttar Pradesh (171.0 kg), West Bengal (168.6 kg), Bihar (165.6 kg), Karnataka (159.7 kg) and Gujarat (147.2 kg). In other states, per hectare consumption was lower than the all India average. In India, Uttar Pradesh is the highest fertilizer consuming state, with 4261.5 thousand tonnes in 2009 - 2010. Tamil Nadu is placed in the tenth position with 1196.85 thousand tonnes (Fertilizer statistics, 2009 - 2010). There exists wide variation in fertilizer consumption amongst different states. Indiscriminate use of chemical fertilizer by the farmers has led to poor nutrient use efficiency. Further, low factor productivity, depletion of soil's nutrient reserve and associated environmental problems result in low yield and low profit levels. Thus nowadays, our country is tempted to have organic farming. It is obvious that farming in India without adequate fertilizer input will prove fatal for food security hence it has become necessary to use fertilizers for crops in a balanced amount in order to meet the needs of growing population.
Against this background an attempt is made to study the pattern, growth and determinants in fertilizer consumption in the state of Tamil Nadu. The universe of the present study is the state of Tamil Nadu. Area wise it is the eleventh largest state in India and the second largest state in GDP as of 2012, overtaking Uttar Pradesh and Andhra Pradesh in two years since 2010 until which it was the fourth largest contributor to India's GDP. It's varied agro-climate condition and efforts to develop agriculture have a greater bearing on the direction and magnitude of agricultural growth and its regional difference.

Agriculture is the most predominant sector of the economy of Tamil Nadu. The demographic pattern in Tamil Nadu is changing rapidly, indicating major shifts in the profile of the population. In 2011, the state had a population of 72 million, accounting for six percent of India's total population holding the seventh position (Census, 2011). Forty two percent of the state's population is engaged in agriculture and allied activities for their livelihood. Tamil Nadu has an area of 130.27 Lakh hectares with a gross cropped area of around 58.43 lakh hectares of which the gross irrigated area is 33.09 lakh hectares (57%) and the balance 43% of the area is under rain fed cultivation. The state has been divided into seven agro-climatic zones for planning agricultural development (Census, 2011). Semi-arid conditions dominate the climate in three sub regions: north, northeast coastal and southeast coastal. The delta and central regions mainly have semi-arid to dry, sub-humid climates. These five regions consist of 97% of the total area. The average rainfall varies from 865 to 3127 mm among sub regions, and the climate of a major part of the state is categorized as semi-arid to dry sub humid.

The state is historically known for its agriculture from ancient times. Annual food grains production in the year 2009-10 was 7511.4 thousand tonnes (www.indiastat.com), but now this is steadily declining due to industrialization, growth of real estate business and migration of the younger generation out of villages for education and white collar jobs.
The principal food crops grown in the state are rice, maize, jowar (cholam), bajra (cumbu), ragi, and pulses (Bengalgram, Redgram, Greengram, Blackgram and Horsegram). Cash crops include cotton, sugarcane, oilseeds, coffee, tea, rubber, coconut, gingelly and chilies. The important horticultural products are bananas and mangoes. This state is the largest producer of bananas, flowers, tapioca, and the second largest producer of mangoes, natural rubber, coconut, groundnut and the third largest producer of coffee, sapota, tea and sugarcane. Tamil Nadu is well known for its sugarcane globally. The state has 17,000 hectares of land under oil palm cultivation, the second highest in India. Paddy is grown in large area because rice is the staple diet of the state.

In Tamil Nadu, though the continued increase in fertilizer use per hectare of gross cropped area is encouraging the current rate of fertilizer consumption, (208.3 kg / ha in 2009-10) is still far below the levels of consumption of some of the progressed states. Even the success achieved over a period of time is confined to only a few parts of the state. Hence, it is necessary to identify consumption pattern, growth and determinants of fertilizer use in the state of Tamil Nadu.

Though there are a number of studies on fertilizer at the national level, the studies at the disaggregated level are limited. The exercise at national level in any case is expected to give us some broad perspectives of the trends in fertilizer consumption and nature and extent of the impact of various factors on fertilizer consumption. This has to be supplemented by district - wise studies, because the total fertilizer consumption figure gives only a consolidated picture of disaggregated data from different districts. Districts may differ widely in respect of soil, climatic conditions, irrigation, adoption of HYVs, the size of farm and so on. All these differences are concealed in the national estimates and make them inappropriate for use in region specific situation.

Analysis of district - wise data on fertilizer consumption will be useful as it reveals the degree of variation in the growth of fertilizer consumption across the districts. The consumption over a period of time provides an understanding of the forces behind the growth of fertilizer and reveals the practices of districts which
have remained outside the main stream of fast growth in this vital agricultural input. This in turn will indicate the nature of policy required to achieve rapid growth in fertilizer consumption.

A fertilizer use decision at the farmers' level is a complex process. To start with the farmer has to decide whether or not to use fertilizer and then follow the decision of which crops to be fertilized and at what rates. Capital rationing and other factors often necessitate decisions on how much crop area is to be fertilized. It is generally noticed that farmers are not using recommended levels of fertilizers. Farmers need to be educated to use fertilizers in the correct dosage at appropriate time, so as to increase production. With this background the study aims to analyze and examine selected factors with respect to fertilizer consumption in Tamil Nadu.

**OBJECTIVES OF THE STUDY**

The objectives of the study are as follows.

1. To examine the trends in chemical fertilizer consumption in Tamil Nadu
2. To estimate the growth and instability of chemical fertilizer consumption.
3. To ascertain the determinants of fertilizer consumption.
4. To examine the usage of chemical fertilizers by selected farmers.
5. To estimate and predict the potential consumption of chemical fertilizers and to suggest policy measures.

**HYPOTHESIS**

The following hypotheses were framed for the study

1. The growth in fertilizer consumption in the state of Tamil Nadu is positive and significant but with wide disparities.
2. Fertilizer consumption is likely to increase in future.
3. Fertilizer consumption is independent of the influence of related variable like rainfall, irrigation, price of fertilizer, area of HYVP crops and gross cropped area.