VI.1 Summary:

This chapter addresses mainly the summary, major findings, and the suggestions for the more effective and balanced application of chemical fertilizers by the farmers, based on the important conclusions emerged from the study. It is considered that the findings and suggestions will help Fertilizer manufacturing companies, farmers, Government and all stake holders in agricultural sector.

Agriculture has been the livelihood for more than two-thirds of population in India and is playing an important role in the economic development of the country. Agriculture is central to all the strategies for socio-economic development and farmers are the India’s foremost capitalists. Agriculture has been the way of life for the masses. The contribution of agriculture and allied activities for the economic progress of the country is no less significant than that of industry and service sectors. Indian agricultural sector contributes about 15 per cent of the Gross Domestic Product and has been the backbone of the Indian economy. Even though agriculture is at the mainstay of Indian population the productivity of yields is often low, which pose challenges to the farmers, policy makers, researchers and the government. The food grain production in India has increased spectacularly as a result of Green Revolution. At present India has become the world’s largest producer of numerous agricultural products. Over the last two decades India has emerged as one of the world’s fastest growing economies after the adoption of economic reforms in 1991.

In India successive five year plans have laid special emphasis on achieving self-sufficiency and self-reliance of food grains production. There has been a substantial increase in agricultural production which is evident from the fact that the increase of 52 million Metric Tonne in 1951-52 to 258 million Metric Tonne in 2012-13. The agricultural policy, 2000 aimed at attaining the next two decades period a growth rate in excess of 4% per annum in the agricultural sector.

Indian Agricultural sector is highly vulnerable to climate change and has been facing number of challenges. The impacts of climate change on agriculture have been
severely fest in India. The problems faced are mainly from dependence on monsoon, fragmented farm holdings, low input usage, illiteracy of farmers and lack of proper agri-technology application. The prominent measures adopted to solve the problems include; transition from un-skilled on-farm to skilled off-farm, harvest technology, non-farm livelihood opportunity to landless labour, agribusiness centres, kissan credit cards, and kisal soil health cards for enhancing soil fertility and productivity.

India’s population is growing at a faster than its ability to produce food grain. As stated earlier, even though India has the highest percentage of land under cultivation in the world, the productivity has been low. Agricultural Census is taken up periodically to collect data on operational holdings, cropping pattern, irrigation, tenancy particulars, and soil fertility. The National Commission recommended that the best method of collecting statistics was by way of land records. Such detailed land records are maintained in about 91% of the operated area of the country.

The land use patterns and agrarian relations have been one of the key factors influencing agriculture in India. As per the 2011 census, India has 2.4 per cent of the world’s geographical area, but 17.5 per cent of the world’s population. Land use pattern is a complex phenomenon which is determined by economic development, infrastructure and policy making and is determined by physical, economical and institutional frameworks. Degradation of quality of land has been one of the main problems in Indian agriculture and every year land is lost due to deforestation, unsustainable farming, demographic pressures and fluctuating climatic conditions. Land degradation is also because of blind application of chemical fertilizers and pesticides.

Fertilizer has been the key input in agriculture. Chemical fertilizers have played an important role in the growth of agricultural productivity in India. However, there has been a demand-supply gap of fertilizer, leading to increased dependency on imports. Majority of Indian soils are deficient in many macro and micro nutrients, hence it is essential to apply fertilizer. Though India is second largest consumer of fertilizer in the world, the average intensity of chemical fertilizer application remains much lower than most countries in the world. The intensity of fertilizer use significantly varies from one state to another state and also from one area to other area in the same state. The fertilizer consumption also varies from crop to crop and the
quantity of plant nutrients received from soil by different crops differ according to biological structure.

In India, at present 57 large sized and 72 small and medium sized companies belong to public and private sector are manufacturing a wide range of nitrogenous, phosphatic and complex fertilizers. The Government is encouraging Indian companies to establish Joint ventures abroad, as a result number of joint ventures exists abroad in the fertilizer sector. Considering the key role played by chemical fertilizers in Green Revolution and consequent self-reliance in food-grain production, the Government of India has been consistently pursuing policies conducive to increase the availability and consumption of fertilizers in the country. The annual consumption of fertilizers in nutrient terms (N, P & K) has increased from 0.7 lakh MT in 1951-52 to 281.22 lakh MT in 2011-12, while per hectare consumption of fertilizers has risen from 1 kg. in 1952 to the level of 144 kg. in 2012.

India has achieved near self-sufficiency in the production of Urea. The raw materials and intermediaries with respect to phosphatic fertilizer are largely imported. Whereas the entire requirement of potash (K) is met through imports. In order to ensure supply of quality fertilizer, the Government of India has declared fertilizer as an essential commodity under the Essential Commodities Act, 1955 (ECA) and has notified Fertilizer Control Order (FCO) 1985 under this Act. As per the provisions of FCO, the fertilizers which meet the standard of quality laid down in the order can only be sold to the farmers. The testing laboratories check the quality sample of domestic fertilizer and also the fertilizer imported in the country. The vigilance activities are monitored by the Department of Fertilizers, Ministry of Chemicals & Fertilizers, Government of India.

As regards the self-sufficiency in Indian fertilizer sector, of the three main nutrients namely nitrogen, phosphate and potash (N, P & K), indigenous raw materials are available mainly for nitrogenous fertilizers. Hence the Government policy aimed at achieving maximum possible degree of self-sufficiency in the production of nitrogenous fertilizers based on utilization of indigenous feedstock. In case of phosphates, the paucity of domestic raw material has been a constraint in the attainment of self-sufficiency in the country. In the absence of commercially exploitable potash sources in the country, the entire demand of potassic fertilizers for
direct application as well as for production of complex fertilizers is met through imports. With a mission to promote balanced and integrated use of fertilizers, Department of Agriculture & Co-operation has introduced a scheme”, National Project on Management of Soil Health & Fertility” in conjunction with organic manure and soil test basis.

Agriculture is the chief source of income in Andhra Pradesh, which provides livelihood to about 65% of the State’s population. In India Andhra Pradesh is considered as one of the most progressive states with respect to agricultural development. The State comprises three regions: Coastal, Telangana and Rayalaseema. Since agriculture has been main source for the State’s economy, Andhra Pradesh is an exporter of many agricultural products. Andhra Pradesh is endowed with a variety of soils ranging from par coastal sands to highly fertile deltaic alluviums. Red soils occupy over 66 per cent of the cultivated area and are mostly located in Rayalaseema and Telengana areas. These soils have low nutrient status. Red soils are presented mostly in upland regions of coastal districts and chalukas occur mostly in Telangana districts. Black soils cover nearly 23 per cent of the cultivated area and are generally associated with poor drainage. Forest area covers about 20 per cent of geographical area of Andhra Pradesh, yield timber products such as teak, eucalyptus, cashew, casuarinas, softwoods and bamboo.

The state receives its rainfall from the south-west and north-east monsoons. The average rainfall varies from about 74 cm in south to about 200 cm in north with considerable fluctuations. The rainfall distribution in the three regions of the state differs with the season and monsoon. The total geographical area of the state is 275 lakh hectares, of which, about 45 per cent of the area 109.58 lakh ha i.e., 39.80 per cent is the net sown area (2012). Food crops occupy the prominent place in the cropping pattern representing about 58 per cent of the total cropped area. Rice being an important crop occupies about 34 per cent of gross cropped area. Among the non-good crops groundnut represents 12.41 per cent followed by cotton 10.93 per cent of the cropped area. The margina land holdings constitute 62 per cent of the gross cultivated area. Small holdings (1 to 2 ha) constitute 23 per cent of the total, where as less than 2.00 hectares constitutes about 83 per cent of the area. The ultimate irrigation potential from all the sources is estimated to be 9.50 m. ha, which includes
7.30 m.ha from surface water and 2.20 m. ha from ground water. The Krishna, Khammam and Kurnool districts represent three major regions of the State i.e., Coastal, Telangana and Rayalaseema respectively.

**Objectives of the Study:**

The overall objective of this research is to identify and analyze farmers behavior towards the application of chemical fertilizers on the major crops cultivated by them and the various factors influencing the fertilizer consumption. In accordance with this, the specific objectives of the study are as follows:

1. To evaluate the key variables determining the chemical fertilizers consumption by farmers in major crops.
2. To examine the impact of socio-economic, demographic characteristics of farmers on fertilizer buying decisions, in Andhra Pradesh.
3. To identify and analyze the evolution, growth and development of chemical and fertilizer industry in India.
4. To assess the management of fertilizer marketing systems being adapted in India.
5. To discuss the trends and challenges of Indian agricultural sector.

**Significance of the study:**

Agriculture plays a pivotal role in overall economic and social well being of India. The food grain production in India has increased spectacularly due to the Green Revolution. Agricultural growth has a direct impact on poverty eradication and is an important factor in employment generation. Agriculture is extremely vulnerable to climate change. Indian agriculture faces the dual challenge of feeding a billion people in a changing climatic and economic scenario. It is the main source of livelihood for almost 70% of the country’s total population. The impact of climate change on agriculture has been severely felt in India. The low productivity of Indian Agricultural Sector which is mainly because of climatic change, small land holdings, improper application of fertilizers, old and traditional methods of cultivation, illiteracy of farmers etc.
Fertilizer is the substance that adds inorganic or organic nutrients to soil for the purpose of increasing the growth of crops, trees, or other vegetation. Fertilizers give plants nutrients. Each crop year, certain amounts of these nutrients are depleted and must be returned to the soil to maintain fertility and ensure continued, healthy future crops. Because fertilizer is the most controllable source of plant nutrients, farmers through careful selection of chemical fertilizers will be able to supply the food plant need at nearly optimum levels to achieve economical and environment efficiency. At present there is a need for more food grains production in the country which could only be achieved through proper policy initiatives and planning. For sustainable agricultural growth and to promote balanced nutrient application, it is imperative that fertilizers are made available to farmers at affordable prices. The Department of Fertilizers is mandated to ensuring smooth and timely availability of fertilizers in adequate quantity to farmers in all parts of the country. Government has implemented Nutrient Based subsidy (NBS) for decontrolled phosphatic and potassic Fertilizer with effect from 1st April 2010 with a view to promote balanced fertilization. Efforts are on to make available chemical fertilizers in time and in sufficient quantity. Therefore the study proposes to examine the application of fertilizer on crops by farmers.

Development of fertilizer industry is very important to improve agricultural productivity. Despite the importance of the problem, there was no much research work so far been done on this specific issue. Hence this study is an attempt to fill the above gap by addressing the issues relating farmers in their chemical fertilizer application on principle crops.

**Data Sources and Methodology:**

**Primary Data:**

The data used for the present research study is primary in nature. The primary data was collected through the field survey using pre tested structured questionnaire administered during the period June 2012 – December, 2012. Taking into consideration the time and other practical constraints, the questionnaire is administered on a judgmental sampling of 390 farmers living in Krishna, Khammam and Kurnool districts of Andhra Pradesh. The selection of respondents was on the basis of socio, economic and demographic profile of the farmers.
Secondary Data:

The secondary data has also been collected from different sources mainly the Annual Reports and Statistics of Department of Fertilizers, Ministry of Chemicals and Fertilizers, Department of Agriculture and Cooperation, Ministry of Agriculture, Government of India and Fertilizers Association of India. Research papers published in journals, Internet, Newspapers and books related to the topic. The secondary data was mainly considered for having clear view on Indian Agricultural sector, Indian Fertilizer Industry, Agricultural scenario in Andhra Pradesh and for better understanding of the farmers’ profile.

Method of Analysis:

The data analysis, results and discussion were based on the responses drawn from 450 questionnaires duly filled up by the farmers, who enthusiastically participated in the survey of which only 423 questionnaires were filled in all respects. The data collected from primary sources are analysed using statistical tools, factor analysis i.e., exploratory factor analysis and confirmatory factor analysis, Manwitney test, Kolmogorov Smirnov test, Pearson coefficient of correlation and Wilcoxon test.

Sample Design:

In the present research firstly an exploratory study was carried out to determine the farmer characteristics i.e., socio-economic and demographic influencing their application of chemical fertilizers on crops. Thereafter a field survey was conducted using pretested structured questionnaire to gather the data necessary to test the relationships among the constructs in the research framework. The population frame for the present study was the farmers of different categories in the state of Andhra Pradesh. The sampling frame for the present study comprised of farmers of choosen categories in the districts of Krishna, Khammam and Kurnool districts of Andhra Pradesh. The rationale behind the sampling frame is the farmers in the three districts i.e., Krishna, Khammam and Kurnool cultivate different crops under different conditions and three districts belongs to three major regions of the state i.e., Krishna district, Coastal, Khammam district, Telengana, Kurnool district, Rayalaseema.

Statement of the Problem:
Increased fertilizer consumption has been instrumental in the success of green revolution and helped improve agricultural productivity and farm incomes in India. Agriculture accounts for one fifth of GDP and provides sustenance to two-thirds of our population. India’s success in agricultural sector, not only in terms of meeting total requirement of food grains but also generating exportable surpluses and the significant role played by chemical fertilizers is well recognized and established. Keeping in view the vital role played by chemical fertilizers in the self-reliance of food grain production, the Government of India has been consistently pursuing policies conductive to increased availability and consumption of fertilizers in the country. For sustained agricultural growth and to promote balanced nutrient application, it is imperative that suitable fertilizers are made available to farmers at affordable prices. Hence it is essential to know the application of chemical fertilizers by farmers, the various factors influencing the consumption of fertilizers and also the impact of fertilizer usage in agricultural productivity.

**VI.2 Major Findings:**

The study analyzed the application of chemical fertilizer by the sample respondent farmers in Andhra Pradesh and the different factors directly or indirectly influencing their perceptions on buying and using decisions of fertilizer in farm holdings. The major findings that emerge from the present study of farmers in Andhra Pradesh succinctly outlined as follows.

- As regards the household status of sample respondents, it is found that majority of the respondent families i.e., 91.73% are male headed, where as 8.27% of the families are female headed. It can be noted that the female headed families are ‘nil’ in Kurnool district. The percentage of female headed families is more in Khammam district compared with Krishna district.

- With regard to distance to the market, the respondents have to travel for purchasing agricultural inputs and also selling their agricultural produce, it is observed from the study that more than 50 per cent of the respondents are travelling more than six kilometers to reach the market. The study revealed that in Khammam district, the market is below five kilometers, where as in Krishna and Kurnool districts it is more than six kilometers.
Regarding distance to the Agricultural Extension Office, it is delineated from the study that for majority of the respondents i.e., about 49 per cent agricultural extension office is below five kilometers from their native place, and for 43% of the respondents the range is six to ten kilometers.

An analysis of the socio-economic status of the sample respondents reveals that among the three classes i.e., Upper, middle and lower it is almost similar among the three selected district respondents. More respondents i.e., 53 per cent belong to lower class in Krishna district. Comparatively majority Khammam district respondents belong to upper class and less number of respondents belongs to lower class.

With regard to major crops cultivated by the respondent farmers in the three selected districts, it is found that paddy is extensively cultivated in Krishna district (97%) followed by Kurnool district (89%). In Khammam 78 per cent are cultivating cotton and it is only one per cent and nil in Krishna and Kurnool district respectively. Chilly is cultivated by 74 per cent of the respondents in Khammam and only by 7 per cent and nil in Krishna and Kurnool districts respectively. Groundnut is cultivated by 56 per cent of the respondents in Kurnool and meager 6 per cent in Krishna district. Pulses are cultivated by 75 per cent of the respondents in Krishna and 16 per cent each in Khammam and Kurnool districts. Hence the consumption of fertilizer in these three districts varies accordingly.

A perusal of experience of the sample respondents shows that no respondent in all the three districts have less than one year experience. Majority of the sample respondents i.e., 31 per cent in Khammam, 32 per cent in Krishna and 33 per cent in Kurnool among the sample respondents are having more than five years experience.

As far as land holding pattern of the farmers is concerned, it is inferred from the study that majority of the farmers i.e., 198 belong to two and half to five acres category followed by above five acres class (115). District-wise, in Khammam majority respondents have above five acres (17%) followed by two and half to five acres (13%). In Krishna district majority belong to one to two and half acres
category followed by above five acres category. Finally in Kurnool district majority farmers are in the two and half to five acres category.

- As concerning marketing of agricultural produce, it is found that majority of the farmers i.e., 53.42 per cent among the sample respondents are selling their agricultural produce to the local trader followed by brokers and city market. Whereas in Kurnool district majority farmers are selling to brokers (18.43%) followed by city market (14.42%).

- Regarding irrigation sources, it is observed that majority of the sample respondents i.e., 83.38% are cultivating their agricultural plots through irrigation. The entire farming in Khammam district only 13.24% is having irrigation facilities. In Kurnool 32.86% of farmers have irrigation source. As regards the source of irrigation water, majority i.e., 65.25 per cent of the respondents are depending on river and stream water and about 45 per cent through borehole.

- With regard to farmers rating on the need for training on usage of irrigation water towards soil fertility management majority of the sample respondents felt that training is needed for soil fertility.

- Majority of sample respondents are having the opinion that soil crop residue will improve soil fertility. This feeling is high among Krishna district farmers whereas low among Khammam district farmers. Further farmers are interested in Collecting Crop residues from neighbouring farmers.

- The rating given by the sample respondents on using crop residue as mulch indicates that they are interested in applying crop residue as mulch. This rating is high in Khammam district where as low in Kurnool district.

- It has been the practice of farmers to use pruning hedges / boundaries materials for surface mulching. The rating of the sample respondents in this regard indicates that they are strongly willing for using pruning hedges / boundaries for surface mulching. This trend is high in Khammam district and low in Krishna district.
As regards the collection of Livestock manure and exchange of fodder with neighbours, it is evident from the study that, the respondents are interested in collecting livestock manure in sufficient quantities from neighbouring farmers, the rating on which is high in Khammam district, while low in Kurnool district. They also interested in exchanging fodder for sufficient livestock manure. The rating on this is high in Krishna district and low in Kurnool district.

The study revealed that farmers are interested in applying straws and wood shavings used in livestock stall into the filled, hiring labour in applying livestock manure in their plots, except Kurnool district where the rating is low which implies they are reluctant to hire labour. The sample respondents are also interested in composting livestock manure. But the respondents who are hiring labour are preferring relatively more than the respondents who are not composting livestock manure.

An analysis of the opinion on application of chemical fertilizers in micro-doses at the rest zone of crops. The study of sample respondents reveals that farmers have interest in applying chemical fertilizers in micro-doses equivalent at the root zone of the crops. The rating on this is high in Kurnool district and low in Krishna district. Further, the farmers who have been adopting this practice are relatively preferring more.

Combining chemical fertilizers with organic manure is a practice adopted by farmers. The rationale in this practice is rated by the sample respondents, which indicates that they are preferring to combine chemical fertilizers with organic manure in their farm holdings towards enhancing agricultural productivity. There exists significant difference on this aspect and those who adopt the practice have preference towards it.

With regard to the knowledge on cropping patterns for crop rotation, rating was given by the sample respondents and it indicates that majority farmers are interested in knowing cropping pattern for crop rotation. Those who practiced this have been preferring more than those who do not practice it.

Regarding supplementing chemical fertilizers by agro-industrial by-products, it is found from the study that, overall the farmers are not interested in agro-industrial
by-products in their farm fields as a supplement to livestock manure. Only Krishna district respondents are interested to some extent towards this practice.

- As regards the training required to the farmers towards preparation and application of compost manure, it is observed from the study overall the sample respondent farmers are not showing interest on this. However, the Kurnool district farmers are interested in seeking training on compost manure.

- Soil analysis is an essential requirement before applying fertilizers on seedbed for optimum use of fertilizer. The study extracted the farmers’ opinion and existing practice on this revealed that overall about 50 per cent of the farmers are going for soil analysis. In the three selected districts for the study Krishna district farmers are ahead followed by Kurnool and Khammam districts respondents towards the practice of soil analysis. The study also made it clear that majority farmers are taking help from agricultural extension officers (65%) and the remaining on their own and from fellow farmers.

- The application of chemical fertilizer on major crops among the sample respondents in three selected districts is also studied and it is found that, the use of fertilizer is high among Krishna district farmers (34%), followed by Kurnool district (33%) and Khammam district (32%). It seems there exist a very significant difference among the farmers in different areas.

- As regards the type of fertilizer used by the farmers, it is observed that farmers are using organic, inorganic and also both the categories of fertilizers. Category-wise, about 78 per cent are using both organic and inorganic fertilizers, and a meager 10 per cent and 12 per cent are using organic and inorganic per cent are using organic and inorganic fertilizers respectively.

- The key factors influencing the selection of organic and inorganic fertilizers by the farmers is surveyed among the sample respondents, and about 312 respondents expressed that they are using fertilizer because of the rich nutrients, and 283 respondents with a view to improve soil fertility. These two seems to be the major factors in the use of fertilizer.
With regard to the type of inorganic fertilizers used by the farmers, the study found that among sample respondents majority i.e., 94 per cent are using Straight Nitrogen fertilizers, followed by N P K complex fertilizers (87%), N P complex fertilizers (85%) and Straight potash fertilizers (80%). The straight potash fertilizer consumption of fertilizer is low in Krishna district compared to the other two district, and less consumption of straight phosphorous fertilizers is taking place in Kurnool district compared to the other two districts of the study.

Reference group's influence on usage of inorganic fertilizers by farmers, from the study it is very clear that majority farmers i.e., about 70 per cent are under the influence of the opinion of fellow farmers. A significant per cent of farmers i.e., 22 per cent are influenced by the suggestion from co-operative society. It is to be noted that the farmers influenced by agricultural Extensionists in this regard is only meager 4 per cent.

The farmers brand preference over the different categories of fertilizer and brands is studied from the survey and found that farmers have brand preference, however the actual usage of different brands is based on the availability of those brands of fertilizer. As regard the brands of Straight Nitrogen fertilizer majority i.e., about 75 to 83 per cent of the farmers in Khammam and Krishna districts are using Nagarjuna Brand in Andhra Pradesh even though 5 to 10 per cent of them have preference over IFFCO and PPL brands. Where as in Kurnool hundred per cent fertilizer brand preference is towards Nagarjuna brand.

The brand preference towards straight phosphorous fertilizers identified through the study reveals that majority of the respondents in the selected three districts, Khammam (63%), Krishna (86%) and Kurnool 100% are using Godavari brand only. About 28 per cent in Khammam are using Navaratna brand and 7 per cent in Krishna district are using PPL brand. Hence, it appears that there exist no significant difference between the brands preferred by farmers and the fertilizer brand they are using.

An analysis of the brand preference of the straight potash fertilizer by the sample respondent farmers it is very clear that above 90 per cent of the farmers in all the three districts are preferring and also using the PPL brand, and hence indicates
that there exists no significant difference between the brands preferred and brand presently used by the respondents.

- With regard to the brand preference of Nitrogen phosphorous fertilizer, it is found that majority are preferring and using Godavari brand in Khammam, Krishna and Kurnool districts. In Krishna district there is an extensive preference towards Gromor, Nagarjuna and Coromandel brands. However, there exists significant difference on the part of farmers as to the brands they prefer and brands they are using at present.

- As regards the preference and usage of Nitrogen Phosphorous and Potash Complex fertilizer majority have preference towards FACT, Gromor, Godavari, PPL, Nagarjuna and Navaratna brands and applying the fertilizer of those brands. District-wise there exist some difference towards the preference and usage of said fertilizer brands.

- It is observed from the study that agro-ecology factors i.e., rainfall, Irrigation, crop varieties and socio-economic profile of farmers i.e., income levels education and culture are playing a prominent role in the application of fertilizer by the farmers.

- The study revealed that the availability of agricultural credit, pricing and subsidy system of fertilizers are also the significant factors determining the fertilizer consumption.

- A glance at the fertilizer consumption trends pertaining micro nutrients (N, P, K) throughout India during the period 1951 and 2012 delineates that there has been a continuous and consistent growth in fertilizer consumption except in five or six years. It signifies the need for application of fertilizers in enhancing the productivity in Agricultural sector. The fertilizer consumption throughout India increased from 65.6 thousand tonnes in 1951 to 27740.0 thousand tonnes in 2012.

- An analysis of State-wide consumption of fertilizers throughout India in 2012 in the five zones: South, West, North, East and North East reveals certain interesting facts relating to application of fertilizers by the farmers. It is striking to note that Andhra Pradesh tops in all the five zones i.e., 28 states and 7 union territories.
with 3342.35 followed by Maharashtra with 3022.15 and Karnataka with 2335.55 thousand tonnes.

- In the post reforms period i.e., from 1991-92 till 2011-12, the production and consumption of N,P,K has increased from 127.28 lakh tonnes in 1991-92 to 277.40 lakh tonnes in 2011-12 and the per hectare consumption for the same period from 69.84 kgs to 144.33 kgs. Even though Andhra Pradesh tops the fertilizer consumption throughout India, in terms of per hectare consumption Punjab tops the list with 230 kgs followed by Andhra Pradesh with 225 kgs, Tamil Nadu 220 kgs, and Haryana 275 kgs.

- There has been an increased realization of food insecurity situation by government. In the last few decades, the government has prioritized the development of agriculture. The increased subsidy, agricultural credit, high yielding crop varieties and farmers awareness are leading to an increased use of chemical fertilizers in Andhra Pradesh.

- India has often changed the fertilizer policies in a bid to ensure and uninterrupted supply throughout the country and to accelerate growth in food production through the intensive use of fertilizers. However, supplying enough fertilizer to the farmers has always been a challenge to the government. This has been attributed to institutional weakness which has led to failure to prioritize fertilizer supply and poor delivery of inputs. Fertilizer system was not so effective and information was not disseminated to all stakeholders.

- It is identified from the study that due to poor extension services there has be a lack of awareness and disproportionate use of Nitrogen (N), Phosphorous (P) and Potassium (K) fertilizers among the farmers and they are in the view that much quantity of fertilizer shall be applied for enhancing productivity on high yielding crop varieties.

- As regards the pricing of fertilizer, there has been a continuous rise of prices, so farmers could not afford to buy fertilizers of good quality. As the prices of inputs in the global markets are showing downward trend, it is expected that there would be reduction in farm gate prices and the demand is likely to get a boost.
However, this reduction in farm gate price may be partly neutralized by the impact of Rupee value depreciation.

- As far the supply and demand situation of fertilizer is concerned there has been a gap between supply and demand of fertilizer. In several cases the dealers and local shop keepers would hide the fertilizer and sell later at a very high price capitalizing the demand during peak agricultural season. There were several instances of diversion of fertilizers for non-agricultural purposes as well as smuggling of fertilizers in border districts in the Eastern / North-Eastern States according to the observation of Department of Fertilizers. Further, the requirement of fertilizer was not assessed properly by considering the availability of irrigation facilities, soil conditions and other influencing factors.

- The challenges of Indian fertilizer industry mainly includes the gap between demand and supply, excessive dependence on imports, failure to reduce burden on government in subsidy rates, infrastructural bottlenecks, uncertainties in government policies, lack of sufficient mechanism at state level for physical verification of stacks, and deficiencies in licensing and other arrangements for sale of fertilizer.

- As regards quality control, the infrastructure available in the country and the capacity of quality control mechanism is inadequate. According to the statistics of Department of Fertilizers, the capacity is only one fourth of the required capacity for testing. As a result farmers were unknowingly using sub-standard fertilizers.

- There was a high degree of correlation between the consumption rates and the proportion of irrigated area, the higher the rate of consumption of fertilizers. For instance, Punjab with 95 per cent of irrigated farm holdings, consuming about 225 kg / ha, while in Jharkhand with 10 per cent irrigated area consuming only 60 kg / ha. The pattern of fertilizer consumption across different states was highly skewed, with states like Andhra Pradesh, Punjab, Haryana having high consumption rates. Further the data on fertilizer consumption is based on first point sales at the district levels and does not taking note of actual consumption of
individual farmers. Hence, several times the data available on fertilizer consumption may not be reliable.

- Intensive agriculture resulted in deficiency of secondary as well as micro nutrients there by depletion of soil organic. The main threat associated with the use of nitrogenous fertilizer (mainly urea) is that it may cause nutrient imbalances in the soil. Soil bacteria oxidize ammonium based fertilizers to NO₃ and H⁺, thus causing soil acidification. One reason is due to the intensive use of chemical fertilizer and the declining use of farmyard manure.

VI.3 Suggestions:

On the basis of the findings of the study, the following suggestions have been made to improve the soil fertility and increasing agricultural productivity of crops through the balanced use of chemical fertilizer by the farmers in Andhra Pradesh.

- It is highly essential to sustain the soil health in agricultural activity from the challenges of imbalanced use of fertilizers, deteriorating nutrient use efficiency and present soil fertility status of soil in selected districts for the study in Andhra Pradesh demands the usage of necessary nutrients in a balanced manner and requires serious efforts by the Government.

- Soil Fertility management through forecasting and monitoring of nutrient deficiencies and well defined crop management systems relevant to different agro-ecological zones is needed. There is a need for evolving a fertilizer policy for encouraging fertilizer products towards soil specific nutrient management. Soil fertility maps in the districts shall be made available to the farmers for effective and balanced use of fertilizers.

- Agricultural extension activities must be taken up in an effective manner and on a large scale to create awareness among the farmers about the application of balanced fertilizers based on soil test and also towards the need for using organic fertilizers, as the productivity in agriculture can be increased only through the judicious use of chemical as well as organic fertilizers. The awareness on proportionate use of Nitrogen (N), Phosphorous (P) and Potassium (K) fertilizer should also be created among the farmers.
The increased cost of cultivation has made the livelihoods of small and marginal farmers miserable. That is why lowering the cost of production is must for increasing the livelihood security. Lowering production costs through ecological agriculture also improves the health and fertility of the soil.

The farmers shall give less dosage of fertilizers mixed with neem powder thereby to save about 50 per cent of cost of fertilizer. They should also avoid applying excessive chemical fertilizer as it leads to deterioration of soil health. Due to excessive use of fertilizers land is being converted into saline rendering it useless for farming.

More training shall be offered to the farmers on usage of irrigation water, application of fertilizers, compost manure, crop residue as mulch, livestock manure for enhancing soil fertility, thereby to achieve higher product. Steps should also be taken for enhancing the farmers awareness on application of chemical fertilizers in micro-doses and combining chemical fertilizers with organic manure.

As the study reveals, more than 50 per cent of the farmers are not conducting soil analysis, which is an essential requirement for the optimum application of fertilizers, the agricultural extension officers have to focus on this issue and ensure that all farmers have done soil analysis.

The study further reveals that majority farmers have awareness on different brands of fertilizer and there exists no much difference between the brands preferred and actual usage of fertilizer brand by the farmers. However, due to non-availability of preferred brands, several times farmers are forced to use low quality locally available non-brand fertilizer. There is a need to concentrate on this matter.

Farmers’ access to the efficient distribution of quality fertilizers must be ensured. Most of the times farmers were unaware of policy changes, of those who were aware, most were dissatisfied with changes. Hence farmers’ awareness shall be enhanced in this regard through proper communication channel.
The subsidy policy should target the small and marginal farmers. Fertilizer subsidy policy of the Government shall ensure the supply of fertilizers at affordable prices to farmers and encourage domestic production and balanced application of fertilizers.

The challenge of food security to ever increasing population can be addressed only by increasing agricultural productivity with proper application of fertilizers. The Indian Fertilizer Industry shall overcome the challenges through maximizing domestic production, less reliance on imports, effective logistics management and management of fertilizer marketing systems.

As the study reveals, more than 50 per cent of travel to distant places to access agricultural extension office to get advice on fertilizer consumption, it is suggested that measures shall be adopted by the government to overcome the problem. The farmers are facing several problems in purchasing agricultural inputs and also selling their agricultural produce, the government should come forward to provide marketing services, input supply, etc., so that the farmers could take up remunerative economic activities.

As the socio-economic profile of the sample respondents reveals, more than 50 per cent respondents belong to lower class and are small and marginal farmers in terms of land holding, the measures, policies shall aim at these farmers to improve their agricultural productivity thereby living standard.

There is every need to enhance the agricultural credit, introducing high-yielding crop varieties, subsidy system which are significant factors determining the consumption of fertilizer by the farmers for achieving higher productivity in the farm sector. Insufficient loans and advances by banks forcing the farmer to approach private money lenders who collect high interest rates. The agricultural labourers should also be educated on effective farming methods tailored for different crop varieties, thereby the workers guide the growers on the best practices being followed in the field.

All the needed efforts shall be made by Central Government, State Government and all other agricultural institutions to avoid the gap between demand and
supply, block marketing activities by the dealers and unfair trade practices during the peak agricultural season.

- The infrastructure for quality control of fertilizer shall be enhanced thereby protecting the farmers from using sub-standard fertilizers. As Andhra Pradesh has high fertilizer consumption rate based on irrigation facilities, the data on fertilizer requirement shall be based on first point sales at the district levels.

- More focus shall be placed on field demonstrations to train the farmers who are less educated or uneducated and most importantly based on their socio-economic conditions. The agricultural Research Institutes, Scientists, agricultural departments of government shall visit the farms and educate the farmers on soil fertility management and balanced application of fertilizers for enhancing agricultural productivity.

- As regards the fertilizer industry, the Department of Fertilizers under the Ministry of Chemicals & Fertilizers, Government of India shall adopt more effective sectoral planning, monitoring of production, pricing and distribution of fertilizers.

- The excessive use of chemical fertilizers and pesticides to be avoided and the farmers should follow the agricultural extension officers advises towards the optimum use of fertilizers.

It can be concluded that strategies shall be identified and implemented for the optimum use of chemical fertilizers to enhance the agricultural productivity thereby to improve the farmers lives in Andhra Pradesh. The livelihoods of small and marginal farmers are possible only by liberating farmers from costly inputs and the debt trap. Agriculture is viable when production costs are reduced and ecological agriculture improves the health and fertility of the soil. The Central Government recently introduced Food Security Bill, due to become an act soon is considered as a solution to the Indian Agrarian Crisis as well as the food crisis. But the most important step in this process is securing farmers’ livelihoods.

The Andhra Pradesh Government has come out with the country’s first Budget proposals for the agricultural sector. It has proposed an action plan of Rs.25,962 crore for agriculture and allied subjects for the year 2013-14. It is expected that the
budget will show a way in ushering in a new era for the farmers and suggest solutions for the problems faced in the sector. The Government of Andhra Pradesh made it clear that the key strategies identified for the farm sector to grow rapidly includes: enhancing farmers awareness on optimum use of fertilizers, establishment of agriculture technology mission, measures to keep soil fertility, extension services, Interest free crop loans, farm mechanization and input subsidies. However the bottlenecks in timely supply of fertilizer to farmers still remains a matter of concern. In the prevailing circumstances, the farmers have to buy fertilizer from open market at inflated prices. The Markfed, which is responsible for supply of subsided fertilizer shall overcome storage and transportation problems and ensure timely supply of fertilizer. In tune with the basic theme of 12th Five Year Plan, “faster, more inclusive and sustainable growth” and in order to achieve the growth target of 6 percent under the farm sector, the Andhra Pradesh State has set an ambitious target of increasing food grain production to 300 lakh tonnes by 2016-17.

The Government of India has been consistently pursuing policies conducive to increased availability and consumption of fertilizers in the country. As regards the major factors determining fertilizer use, besides price several non-price factors such as soil fertility, irrigation, high yield crop varieties, were more important in influencing demand for fertilizers. In order to ensure self-sufficiency in food grains production in the country, availability of fertilizers at affordable prices to the farmers is of utmost importance. To meet the projected demand of about 42 million tonnes in 2020, the government shall evolve a comprehensive policy in meeting the fertilizer requirement in Indian Agricultural sector.