CHAPTER IV

SUMMARY AND CONCLUSION

India, being predominantly agricultural based country, will have to depend on agriculture sector for contribution to output and also for generating employment opportunities to its population. Though in the last two decades substantial growth has been achieved in food production, the ever growing population requires more and more food for consumption. Hence there is a need to increase food production.

The important feature of the Indian green revolution of 1960s were the use of fertilizers with fertilizer responsive hybrids and high yielding varieties and expansion of irrigation facility which resulted in a quantum jump in food production. Among the various factors, use of fertilizer is one which played a pivotal role in increasing productivity.

There has been a steady increase in the consumption of fertilizer (NPK) over the years. It was 70 thousand tonnes in 1951-52 and rose to 26486 thousand tonnes in 2009-10. This shows more than a 350 time increase in consumption of fertilizer over the years. However, the average fertilizer consumption during the last 30 years has (1980-81 to 2009-10) showed a fluctuating trend. The studies have shown that at least 6.23 per cent average annual growth in fertilizer consumption is required to meet the anticipated level of fertilizer consumption by 2020. By 2025 there could be 1.4 billion people and a food grains requirement of 350 million tonnes, which require nutrients (N+P2O5+K2O) to a level of 45 million tonnes, 30 million tonnes nutrients for food grains production and remaining 15 million tonnes for other crops production.

The analysis of district - wise fertilizer consumption would reveal the degree of variation in the growth of fertilizer consumption across the districts over a period of time. This information would provide an understanding of forces behind the fast growth of fertilizer consumption. It helps to identify the districts which have remained outside the main stream in term of fast growth in
consumption of the vital agricultural input. The present study was undertaken to analyse district-wise consumption pattern of chemical fertilizer in Tamil Nadu and to study various factors influencing the consumption pattern at the micro level. The result would help in formulating suitable policy measures to ensure uniform fertilizer consumption. The study was undertaken with the following objectives.

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

These objectives were analyzed using the following hypothesis

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

For evaluating the specific objectives of the study, both primary and secondary data were utilized. The secondary data on consumption of chemical fertilizer (NPK), season wise and nutrient-wise consumption, consumption per gross cropped area and price of fertilizer were collected from 1980-1981 to 2009-10 from the fertilizer and agriculture statistics, New Delhi. Multistage sampling procedure was adopted for the selection of the district, block, villages and farmers. Coimbatore district was purposively selected for study. From the selected district one block, Thondamuthur block representing high fertilizer
consumption and a major agricultural block was selected. From the selected block, ten villages were selected and from each village 30 farmers were randomly interviewed making the sample size 300. The necessary details were collected through personal interview method with the help of pre-tested and structured interview schedule. The data so collected pertained to the agricultural year 2009-10.

The technique of tabular presentation was followed for presenting land holding, consumption pattern, nutrient-wise and district-wise consumption of chemical fertilizers, to draw meaningful inferences. Various dimensions were compared and contrasted with the help of frequency, average and percentage. In order to analyze, the growth of fertilizer consumption, Exponential growth rate, kinked exponential model for growth rate estimation and annual growth rate were carried out. To investigate the objective of trends and pattern of fertilizer consumption, the Exponential Trend Equation, Relative Cyclical variation, Future Prediction by using Trend analysis and Spearman's Rank Correlation Co-efficient were used. To examine the objective of instability, the co-efficient of variations and instability index was used, and to find out the determinants of fertilizer consumption, Multiple Regression model, Factor analysis, Attitude scale, weighted average method, Chi-square test and Garrett's ranking technique were carried out.

MAJOR FINDINGS OF THE STUDY

The main findings of the study are given below, state and nutrient-wise fertilizer consumption indicated that, Uttar Pradesh had rare distinction of crossing three million tonnes fertilizer consumption mark during 2009-10, recording a rate of growth 15.34 percent over 1980-81. The share of fertilizer consumption was maximum accounting for 68.03, 25.56 and 7.59 percent in respect of N, P and K respectively, during the year 2009-10. The total fertilizer consumption in the state of Tamil Nadu increased from 491.30 thousand tonnes in 1980 - 81 to 1196.85 thousand tonnes in 2009-10. The share of NPK to total fertilizer consumption was 50.85, 22.03 and 27.12 percent respectively.
The percentage rate of growth of fertilizer consumption in Tamil Nadu, during 2009-10 over 1980-81 revealed a positive trend (3.48 percent) and this was due to the massive extension efforts to stimulate fertilizer consumption through media, subsidy on P\textsubscript{2}O\textsubscript{5} and K\textsubscript{2}O; adequate distribution of quality seed of high-yielding varieties, increased coverage of HYV seeds, and better availability of credit and adequate fertilizer supply.

To determine the various factors influencing the fertilizer use (kg/ha) in Tamil Nadu, multiple regression models was used. Tamil Nadu state fertilizer consumption analysis indicated that net irrigated area was the most dominant factor in explaining the variations in fertilizer consumption and gross cropped area was negatively and significantly related to the quantity of fertilizer used. Likewise, the relationship between fertilizer consumption with annual rain fall, price of fertilizer and area of HYVP crops were relatively weak (non-significant). As the F value emerged is statistically significant at one percent level, it may be inferred that the overall regression model is statistically significant.

District-wise analysis on fertilizer consumption in Tamil Nadu was observed and it was found that the total fertilizer consumption was maximum in Tiruchirapalli and Coimbatore recorded fifth place with respect to fertilizer consumption.

There are deviations in the consumption of fertilizers in Coimbatore district throughout the years (1980-81 to 2009-2010). The highest average growth is witnessed in the year 1997-98, the value being 42.55 percent, due to the development of irrigation facilities, use of fertilizer, application of high yielding variety of seeds, extension of crop loan to the farmers etc. Lowest growth rate was found in the year 2006-07 with 1.67 percent, due to the unfavorable weather and monsoon conditions. Fertilizer consumption has shown an increasing trend during the study period.
To estimate the growth rate of fertilizer consumption (kg/ha) in India, Tamil Nadu and Coimbatore district, decade wise growth rate have been estimated by fitting kinked exponential function. The fertilizer consumption in India had recorded an appreciable growth rate in sub-period I (7.40 percent) and least growth rate in sub-period II (2.95 percent), while the growth of fertilizer consumption in Tamil Nadu showed a highest growth in sub-period I (6.77 percent) and least growth rate in sub-period II (1.46 percent). The fertilizer consumption in Coimbatore showed a highest growth rate in sub-period III (1.08 percent) and least growth rate in sub-period II (0.23 percent). Growth of fertilizer consumption in India and Tamil Nadu was statistically significant for all three sub-periods and for Coimbatore district sub-period I was statistically significant.

The instability indices calculated for fertilizer consumption in India, Tamil Nadu and Coimbatore districts had shown significant fluctuation. It is evident that India showed a lower variation (39.19 percent) when compared to the variation in Tamil Nadu (43.22 percent) and Coimbatore district (42.32 percent). Future trends on fertilizer consumption expected an appreciable growth in India, Tamil Nadu and Coimbatore district. The increasing trend might be due to the transport subsidy for moving fertilizers in to the interior markets, ready availability of seeds of high yielding varieties, availability of water and power on priority basis to agriculture, intensive fertilizer promotion campaign, availability of credit, etc.

The findings of the primary data are given in the following section. The total numbers of sample respondents were 300. About 66 percent of the sample respondents belong to Hindu religion, only 25.7 percent belonged to middle age group. Majority of the sample respondents (44.7 percent) were from backward community. Most of respondents were married.

Majorities (60.7 percent) of the respondent were medium farmers and 41.7 percent of them had 10-20 years of farming experience. The monthly income of the respondents revealed that, 28.3 percent of sample respondents were getting an income below ₹ 10000.
Nearly 73.1 percent of the respondents hold 5-10 acres of irrigated land and 26.9 percent of them hold non-irrigated land. Majority of the respondents (54 percent) used bore wells as a major source of irrigation in Thondamuthur block. Since electricity was provided free of cost to the agriculture sector, 61.3 percent were found to be using electric motors for drawing water. Around 37 percent spend above ₹10,000 for purchase of fertilizer.

The consumption of total fertilizer was highest for sugarcane (233.67 kg/acre) which N accounted 61 percent, which K and P had a share of 25 percent and 13 percent. Next in line was Maize with 139.18 Kg. The share of N, P and K was 56 percent, 23 percent and 19 percent respectively. Almost all the crops received excess N fertilizer and less than recommended level P and K fertilizer. Highly profitable crops like sugarcane, rice, turmeric and tapioca received excess fertilizer and majority (50.7 percent) of the sample respondents used 250 kg to 500 kg of fertilizer for their farming and 44.7 percent of the respondents earned an income of ₹20,000 - 40,000 from agricultural production by using fertilizer. Most of the respondents preferred FACT brand fertilizers for their farming and the main reason for using this brand was increase in yield (34 percent).

Factor analysis was used in the study to identify the level of satisfaction and determinants of fertilizer usage. The result of factor analysis showed that factor one had significant loadings for four dimensions namely product availability, price, quantity and quality. Factor one was very powerful accounting for 66 percent of the variance. Factor two had significant loadings for three dimensions namely convenience in area, sales service and package weight. Factor two explains 17 percent of the variance. In order to investigate the relationship between level of satisfaction of fertilizer user and farming experience of the sample respondents, Pearson’s chi-square test was done and the study found significant association between the level of satisfaction and farming experience of the sample respondents.

Again Factor analysis was applied to determine the underlying pattern of relationship between various dimensions of the respondent's satisfaction with the supplier. Factor one had significant loadings on four dimensions namely, information on fertilizers, quality fertilizers, credit facility and customer service. Factor one was
very powerful because it explains 44 percent of the variance. Factor two had significant loadings on two dimensions namely, price details and availability of fertilizers. It explains only 15 percent of the variance. Factor three had significant loadings on two dimensions namely, adequate stock and advertisement. It explains only 10 percent of the variance.

Among the selected sample farmers, majority of the farmers indicated that the most important problem faced was lack of credit and lengthy procedure to get the credit (1\textsuperscript{st} rank). The second most (2\textsuperscript{nd} rank) important problem was higher prices of the fertilizer followed by promptness of fertilizer (3\textsuperscript{rd} rank).

To determine the various factors influencing the use of fertilizer use (kg/acre) in Thondamuthur block, a multiple regression model was used. The R\textsuperscript{2} value of 0.81 indicated that the fit was good that is, 64 percent of the variation in fertilizer use was caused by six explanatory variables. All independent variable, except cost of ploughing and cost of labour were statistically significant and positively related with fertilizer consumption. As the f value emerged is statistically significant at 1 percent level, it may be inferred that the overall regression model is statistically significant.

Majority (58 percent) of the sample respondents had applied the recommended quantity of fertilizer, 51 percent of the respondents had applied the organic manure for their farming 48 percent of them have applied the bio fertilizer for their farming, 60 percent of the respondents have not availed any loan for fertilizer purchase,64 percent of the respondents have attended training for using the fertilizer in their land, 38.7 percent of them, have received service from agricultural university, 52.3 percent of them reported that the increase in fertilizer price has not affected the consumption of fertilizer, 54.7 percent of the respondents, agree that they have obtained maximum possible yield in the use of fertilizer, 57.7 percent of the respondents have no storage facilities, farmers purchase fertilizer as and when required and used almost the entire quantity of fertilizer at a time to avoid the risk of quality and quantity loss during storage.
CONCLUSION

From the analysis, it can be concluded that on an average fertilizer consumption in the state of Tamil Nadu had experienced a positive growth, however this acceleration was not significant. Growth rate of fertilizer consumption in Tamil Nadu is less than all India growth rate. The growth rate of fertilizer consumption of the districts in Tamil Nadu almost clusters around state level growth rate. While there is not much of a change in the ranking of district, there is some reduction in the inter-district variations in the levels of per hectare consumption of fertilizer during the study.

Among the factors affecting determinants of fertilizer use (kg/ha) in Tamil Nadu, net irrigated area was the most dominant factor explaining the variations in fertilizer consumption and Gross cropped area was negatively and significantly related to the quantity of fertilizer used.

The analysis indicated that, efficiency use of fertilizers on sample farms is quite low and fertilizers need to be judiciously combined with other complementary inputs, such as credit, improved seed and implements, irrigation. Insecticides and technical know-how at the right time and at reasonable prices. Farmers were rational in both usage and purchase of fertilizer and the quantity of fertilizer applied per acre was dependent on the type of crop grown, i.e. the expected returns from the crop. Almost all the farmers apply heavy dosage of fertilizer to commercial crops such as sugarcane and lowest quantity in case field or subsistence crop like flowers. The NPK ratio applied was very imbalanced as compared to the recommended dose of fertilizer in all the crop and some of the most important factor for the same were inadequate returns from the crops and no knowledge among the farmers about the recommended dose.

While estimating the major reason for purchase from specific source, the farmer opined that credit (lower rate of interest) and timeliness (accessibility), lower price and easy availability were indicated as the major reasons. Some of the most important problems faced by the farmers in obtaining fertilizers were lack of credit and lengthy procedures to get the credit, higher prices of the
fertilizers and non-timely availability of fertilizers. Likewise the determinants of fertilizer use among the farmers in Tamil Nadu indicated that, all independent variable, except cost of ploughing and cost of labour were statistically significant with fertilizer consumption.

**SUGGESTIONS AND POLICY IMPLICATIONS**

> Agriculturally forward states like Punjab, Haryana and Andhra Pradesh had been making use of fertilizer to a large extent and it is this reason which made these states to attain their present status. The study area has not progressed well and it may be due to shortage in the use of fertilizer. Hence efforts must be made to use more fertilizer whenever feasible to enhance the productivity.

> Production incentives like subsides on fertilizer need to be provided by the government so as to raise the agricultural production.

> Improved farming methods and management practices, availability of all fertilizer on credit through government co-operative outlets at subsidized rates and remunerative prices of crop output need to arranged, so as to ensure adequate net returns to the farmers. This should be given due importance in any policy decision for accelerating fertilizer consumption.

> Steps should be taken by the state government and private agencies to remove the practical difficulties faced by the cultivators at field level which is possible through timely supply of required fertilizers at block level, in subsidiary rate to the marginal and small farmers. Providing irrigation facilities to all cultivators and providing training on fertilizer application by community centers would help the farmers.

> Farmers should be educated about sustainable integrated plant nutrients approach for maintenances of soil health and enhancing crop productivity as well as their farm income.

> Farmers can be helped to adjust their input use by providing relevant information pertaining to fertilizers yield response and its impact on net returns and farmers inclination to invest more in crop where the yield risk low.
> In the district of Coimbatore, where irrigation facility has been extended, there was tremendous increase in the consumption of fertilizer. Therefore creation of additional irrigation facilities in other district would help in enhance fertilizer consumption. However irrigation facilities cannot be created beyond certain limit hence there is need to popularize the application of fertilizer in dry land areas using the integrated watershed management approach.

> The area under fertilizer intensive crop like sugarcane, paddy and maize is the most important factor influencing the consumption of fertilizer. Expansion of area under these crops would lead to increased consumption.

> The projected consumption for of fertilizer shows that there would be an upward trend in the consumption of fertilizer not only in India and state of Tamil Nadu but also across the districts. Distribution network need to be strengthened.

> The fertilizer consumption pattern is dominated by cash crops growers. So efforts must be made to popularize the use of fertilizer in cash crops in all areas.

> The ideal recommended ratio of the NPK for the country is 4:2:1. But the farmers in general do not have this knowledge. It is therefore imperative that they need to be trained to use it in the right proportion, to boost productivity.

**AREAS FOR FURTHER RESEARCH**

> A study can be made on various interrelated issues like production, import, subsidy and price of fertilizer to give more reliable information on fertilizer consumption.

> Inter-regional fertilizer allocation and their impact on cropping pattern can be undertaken.

> Fertilizer consumption study in other blocks of the Coimbatore district can be attempted.
Consumption is based on demand and supply. The determinants of demand and supply of fertilizer is a concept of great relevance.

A comparative analysis consumption of chemical fertilizers, bio-fertilizer, nano fertilizers and organic fertilizer can be taken up for further research.