Agro-Economic Research Centre, Andhra University, Research Study No.145

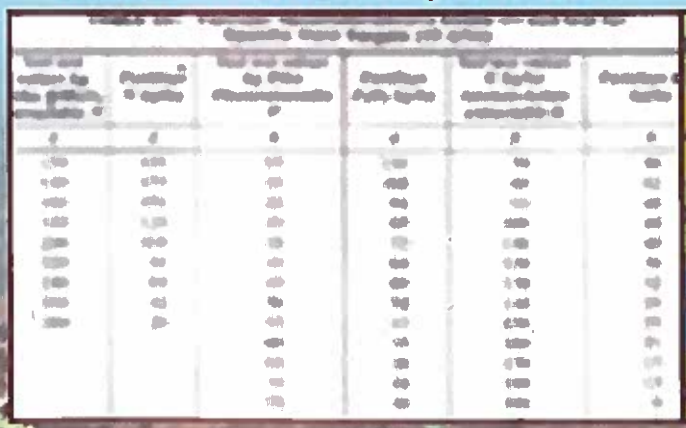
ADOPTION OF RECOMMENDED DOSES OF FERTILIZERS ON SOIL TEST BASIS BY FARMERS IN ANDHRA PRADESH

PROF. G. GANGADHARA RAO, Ph.D.,

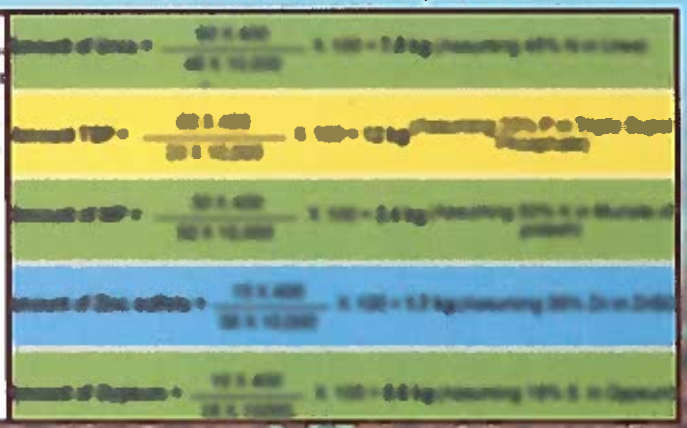
Collection of Sample

Packing of Sample

Recommended doses of Fertilizers



Recommended doses of Fertilizers



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PROF. G. GANGADHARA RAO, Ph.D.,

Report submitted to the
Ministry of Agriculture and Farmers Welfare,
Government of India

Agro-Economic Research Centre
For the states of Andhra Pradesh, Telangana and Odisha
(Ministry of Agriculture & Farmers Welfare, Government of India)

Andhra University
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Preface

The trajectory of economic development of India shows the bright picture of a green revolution, which has led the nation into the self-sufficient for food grains. Though this has become feasible with chemical fertilizers in the farming, there has been an alarming imbalance in the dosage of chemical fertilizers. This problem has been predominant across all states with imbalanced doses of nitrogen (N), phosphorous (P) and potassium (K). In India, the imbalance of NPK has been taking place as against to the optimal norm of 57.2%, 28.6%, and 14.2%, respectively, years together. The latest analysis (Ramesh Chand and S.Pavithra,2015) showed that the use of NPK was at the ratio of 68.97%, 22.70% , and 8.24%, in that order for India in 2011-12, while in Andhra Pradesh (A.P)., it was 65.52%, 44.83% and -8.73%, respectively. To rectify this scenario in the Indian farming, the scheme 'National Project on Management of Soil Health and Fertility' (NPMSF), being started in 2008-09, has been in force in all the states through central government funding. Hence, the Government of India, Ministry of Agriculture, Directorate of Economics & Statistics has assigned this study to our centre to find the ground level utility of the scheme to the farming community.

The study findings are very much helpful for the policy formulation. With only a single source of government laboratories by locating at nearly 30kms, the farmers, having found with a lack of knowledge in chemical fertiliser input dosage, have much tilted towards soil testing under the scheme to obtain enhanced yields and reduction in other inputs use and maintaining the soil health. They have much awareness in the adoption of recommended doses of chemical fertilisers in future. The necessity of soil testing and the existing number of landholdings would guide us to arrange the 'soil testing Laboratories' at mandal/block level in A.P. and this will certainly lead the farmer community to reach higher stratum of yields and incomes. It would be better to facilitate the farmer with organic fertilisers to implement the recommended doses without any deficit, as the weight of these has been increasing in the recent past in the input mix of cultivation in A.P. as well as in India.

I express my thanks to Sri K.Dhanumjaya Reddy, IAS Commissioner, Department of Agriculture, Government of A.P. for permitting in time to avail the data for this study. Without the help and cooperation of Smt. Sai Lakshmi and Sri Krupa Das, Joint Directors of West Godavari and Guntur Districts, A.P., respectively, this study could hardly be completed. They have given their support for the selection of mandals/blocks and they supplied the lists of beneficiaries of the scheme. I profusely thank them for their help in this regard. I express my gratitude to Dr. Ramappa, K.B. and Dr.Elumalai Kannan, Associate Professors and Coordinators of this study, ADRT Centre, ISEC, Bangalore for formulating the problem and arranging the blank primary data schedules and tables for this study. I appreciate the services of Dr. P. Ramu, and Dr. K. Rambabu of Senior Research Investigators of our centre for primary data collection and I admire Sri. K. Ramesh, for secretarial assistance.

Prof. G. Gangadhara Rao
Director

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Executive Summary

Background of Study:

The ever-increasing population demands additional quantum of food in the world and this leads to pressure on the food security in India, as agricultural land is endowed once for all. The available land is to be cultivated with modern techniques to bring out additional production to the added population of the country. Farmers are to adopt new methods for the increase in the yields of the crops. Some of the problems are surfaced in the agriculture sector viz. a) indiscriminate use of fertilisers without the use of proper scientific nutrient management b) falling of soil fertility and rising acidity in the soil and c) disturbance to the environment along with other menaces in the cultivation. To avoid all these problems, agricultural scientists suggest for soil testing and adopting of recommended doses of fertilisers in the fields. In this connection, "National Project on Management of Soil Health and Fertility" (NPMSF) was started in 2008-09. There is no study over the efficacy and reaching of the project to the farmers. Hence, the Directorate of Economics and Statistics, Ministry of Agriculture & Farmers Welfare, assigned this study to our centre. It has the specific objectives as:

- 1) To examine the level of adoption and its constraints in the application of recommended doses of fertilizers based on soil test reports by the farmers, and
- 2) To analyse the impact of adoption of recommended doses of fertilisers on crop productivity and income of farmers.

Data and Methodology:

This study depends on both primary and secondary data for the analysis in A.P. The state was bifurcated on 2nd June 2014 into two states as A.P. and Telangana. To avoid the confusion in the analysis in the second chapter, it is referred as 'Combined A.P. and Residual A.P. In the remaining report, the present bifurcated state, A.P. is referred as usual. The primary data was from two districts namely West Godavari and Guntur for the crops paddy and cotton and in each of the district, two mandals/blocks are selected based on the highest cropped area of the selected crops. Within each mandal/block, three villages are selected. In each district, 60 farmers from the list of soil tested farmers in that district were drawn for each crop at random from the households with different land sizes on the basis of their proportion in the universe. In addition to the above sample, 30 control (non-soil tested) farmers were selected in each district for each crop randomly from households with different land sizes amongst paddy and cotton growing cultivators following the same method. Thus, the sample forms as 240 farmers for soil tested and 120 control farmers (non-

soil tested farmers) for the two districts for the selected sample size of paddy and cotton crops in this study. For the primary survey, the reference year is 2015-16. Accordingly, kharif and rabi seasons for the paddy and cotton crops were covered. From each village, 10 sample farmers and 5 control farmers were selected based on the basis of soil tested farmers and the control farmers, respectively.

Summary of Findings of the Study:

Trends in Fertilizer Consumption of Andhra Pradesh:

- Fertilisers namely MOP and DAP report first and second places in the growth rate during 1994-01. It can be observed that the rate of consumption of MOP has increased in leaps and bounds in the study period compared to all other fertilisers in Combined A.P (1994-10). In Residual A.P. for the period 2009-15, except for urea, all the other fertilisers selected show a declining trend during 2009-15. In the rabi season, a good acceleration in consumption appears for urea out of all fertilisers under study.
- During 2007-15, Residual A.P. showed a little high growth rate (2.5%) for nitrogen (N) compared to India (2%). Surprisingly, for phosphorus (P), there has been an analogous trend for both A.P. and India in the study period either for deceleration or for acceleration. Potash (K) consumption has a declining trend at a higher level for Residual A.P. (-7%) compared to India (-5%) in the study period (2007-15).The trend in the growth rate of the total nutrients (NPK) shows a very little rise in the consumption for India and Residual A.P.(2007-15).
- Residual A.P. has 3% growth rate in the study period (1994-15) for nitrogen and this rate is derived from four districts viz. Kurnool (5%), Ananthapur (4.3%) SPS Nellore (4%) and Guntur (3.4%). For potash, we can find the first, second and third places to Vizianagaram (8%), YSR Cuddapah (7%) and SPS Nellore (6%) districts, respectively, in the consumption. The gross cropped area (GCA) has increased at 0.5% in the study period, however, nitrogen shows 0.7% rise in the consumption.

Socio-Economic Characteristics of Sample Households:

- The average family size is high for sample farmers compared to control farmers and there are no STs either in the sample or in the control group for paddy crop. In the case of the cotton crop, there is a good representation of STs in sample and control group farmers. The sample farmers of paddy crop are in a better position for operational landholdings and the same picture is shown for cotton crop. Canal irrigation has 94% and 78% for sample and

non-sample farmers, respectively, for paddy crop, though bore well irrigation has a lot of area for non-beneficiaries compared to its counterpart.

- In paddy cultivation, there is 100% of HYV for both groups of farmers. It is observed the application of HYV in fewer amounts for green and black grams in the cotton cultivated area, whereas chillies and bengal gram have higher application HYV for cultivation by both groups of farmers.
- The distribution of farm assets is in the favour of ‘soil test farmers’ in paddy and cotton crops cultivation. The sample farmer group has much outstanding credit in cooperative banks (0.44 lakhs) followed by commercial banks (0.36 lakhs) for paddy crop, whereas cotton farmers show the higher amount in commercial banks and RRBs. The purpose of the loan was meant for 81% and 69% for seasonal crop cultivation of sample and control farmers, in that order, for paddy crop. Many sample farmers have attended to the training programmes with a lot of interest of both crops-paddy and cotton compared to control farmers.

Details of Soil Testing & Recommended Doses of Fertilizers:

- There is a requirement for the encouragement of marginal and small farmer groups for a better production or yields. All the collection of soil testing samples is done for all the groups of farmers 100% by the department personnel. The reason ‘motivation from village demonstration etc.' leads over all the other reasons.
- For cotton crop, the most important of the reasons is ‘for increasing crop yield' with 56% of households followed by ‘motivation from village demonstration etc' with 37% households. Among the soil test farms of paddy, we can find the low existence of nitrogen by 61%, which is the highest out of all the fertilizers of the selected soil test farms. Contrary to the paddy cultivation, we can see the low-level use of nitrogen by 92% sample farms in the cotton cultivation and the normal dose is with 5% farms only.
- There is a lot of requirement of scientific soil testing and the subsequent dose implementation in the farms of the selected districts in A.P. The recommended doses for paddy refers to urea 104 kgs, while it is high for the cotton crop with 174 kgs. For DAP, the dose of Kharif of paddy shows similar to the dose of cotton, whereas it is high in the rabi season for paddy.

Adoption of Recommended Doses of Fertilizers and Its Constraints:

- The application of recommended doses of fertilizers is the lowest for marginal farmers (17%) in paddy cultivation and the highest appears for large farmers with 25%. The net operated area is at the larger extent to marginal farmers rather than for other groups in paddy cultivation. The Marginal group for cotton crop cultivation has adopted the recommended doses of fertilizers in higher level by 36% followed by medium and large farmer groups with 33%. Farmers are willing to continue the recommended doses in the next coming crop seasons.
- All the farmer groups view that there is no difficulty in understanding and following the recommended doses of fertilizers in paddy cultivation and the similar picture appears for cotton cultivation. Marginal (21%) and small (14%) farmers faced the lack of money for the purchase of fertilizers in cotton cultivation. The 'Department of Agriculture' shows 100% generation of information and the remaining have no role for soil testing information to the farmer community.
- It is observed that the sample farmers are in the better use of organic fertilizers covering large net cropped area compared to the use and area of control farmer group in paddy crop cultivation. For cotton crop, the area and the farmers covered are very low for control farmers against sample farmers.
- Marginal, small and medium farmer groups of sample farmers are much dependent on private shops, while large farmers from the sample group are less dependent on private shops. The soil test farmers have paid a low average price to all the fertilizers except to potash when compared to the payment of control farmers.

Impact of Adoption of Recommended Doses of Fertilisers:

- The highest yield is reported to large farmers followed by all the remaining landholding size groups under soil test farmers, while the farmer sizes of control farmer group show less increase in the yield levels for paddy crop. In the case of the value of output in paddy crop, the yield level variances are reflected in the same ratio for the value of output for two groups of sample and control farmers and its different landholding size groups.
- For cotton crop, the soil test farmer group has 8 Qtls. per acre, while it is only 7 Qtls. for control farmers. The large farmer group of soil test farmers informs the highest yield per acre with 9 Qtls. and the small farmer group comes next with 8 Qtls. The analogous trend

appears for the two groups of sample and control farmer groups for the value of output and its increase. For cotton crop, soil test farmers have 12% increase in the yield per acre.

- For the paddy crop, the sample of yields of sample and control farmers has very much variance, as the significance level is at 5% with the valid t-value 2.4458. In the case of the cotton crop, the sample of the yields of sample and control farmers do not display a valid t-value.
- There is also a requirement for the encouragement of marginal and small farmer groups for better production or yields. It is observed that the farmers of both selected crops have much concentration on the increase of productivity and in the reduction of inputs and for maintaining soil health.

Policy Measures:

- ✓ **Proximate Soil Testing Laboratories (STL):** There is an urgent need of starting a 'Soil Testing Laboratory' (STL) at the centre of three to four mandals/blocks in A.P. It will be useful, as there are a number of samples are to be undertaken at every mandal in A.P. One centre with one agricultural scientist will certainly be useful for not only soil tests but also for land reclamation, organic-bio fertiliser training and representing as the standing counsel for technical knowhow to the farmer. Since the existing landholdings are more than 11 thousand per mandal in A.P (Agricultural Census 2011-12), having with only 51 STLs across state, the S.T.L. would be much useful and tenable. This will reduce the **distance for access to** laboratory, and enable the farmer to attend the training programmes. The results could be made available to the farmer to the given mobile in his/her mother tongue- **Telugu language**. Further, this will facilitate the farmer **to interact** with the testing laboratory for consultation in future. The 'Soil Health Card' and soil test results are to be available before May/June of the year.

- ✓ **Intensive Soil Testing:** The intensive soil testing is to be taken place for the development of good nutrient management strategy to the crops in question at mandal (A.P.)/block level. This will enable the farmer to follow a proper fertiliser dosage at right time, and it will facilitate to have good yielding in the cultivation, though the change in crop/crops is taken place based on market conditions.

- ✓ **Coverage of Marginal & Small Farmers:** The marginal and small farmers will achieve the upper strata in **yields and incomes** through the good coverage of the soil testing and

maintaining the soil health in long run. Hence, it is imperative to cover all farmers from these landholding sizes under ‘Soil Testing Programme’. To achieve this, **soil testing grid could be 2.0 ha/2.5ha in the farms.**

- ✓ **Availability of Organic Fertilisers**: All the farmers view the need of much availability of organic fertilisers, and the prices of these inputs are to be at a lower level. In this connection, the methods and practices are to be ‘on hand’ to the farmers to procure the local raw material for the production of organic fertilisers. To this end, they are to be educated/trained up in these lines, to make the successful fertigation in the cultivation.

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CHAPTER - I

1.1 Introduction:

The ever increasing population demands additional quantum of food for it in the world and this leads to pressure on the food security. In the case of India, this phenomenon indicates the much concern over this issue. Agricultural land of the nation is once for all endowed and therefore, the available land is to be cultivated with modern techniques to bring out additional production to the added population of the country. Farmers are to adapt new methods for the increase in the yields of the crops and incomes for them. The imbalanced use of nutrients will cause to fewer yields in cultivation. Chemical fertilisers are the important input for the good level of production, provided other needy factors in the cultivation for the peasant.

1.2 Significance of Fertilisers in the Cultivation for better Yields:

There is a lot of need of balanced nutrients for the good level of production in the crops production. Inorganic chemical fertilisers are major source of nutrients for a good plant growth. Since mid-1960s onwards, the new crop varieties have been playing a major role in the production of food grains, and these are very much responsive to the fertilisers viz. nitrogen, phosphorous, and potassium. These increased in a phenomenal way from 26 lakhs tonnes to 240 lakhs tonnes in India during 1970-71 to 2013-14. These fertilisers are to be used in a scientific way for good yields and to avoid any harmful effect on the natural soil fertility. We may find several deficiencies in the input mix in the various crops cultivation due to lack of knowledge in soil fertility conditions. The imbalanced use of fertilisers leads to lower level crop production, and affects soil fertility.

1.3 Review of Literature:

Ramesh Chand and Pavithra S. (2015) analysed the state level use of fertilisers in India for the period 1971-14. This paper estimated the less use of nitrogen in 12 states contrary to the existing notion of higher level of nitrogen (N) use in India and further, it was found the less use of phosphorous (P) and potassium (K). They found that the Erstwhile A.P. used excess 65% of N and 44% of P and -8% deficit of K of the normative dose during 2011-12. The analysis showed the need for reduction in the use of N in one-third of states and

raise it in two-third of states and the lower levels of P and K were to be enhanced to make the fertiliser dose into a balanced one in India for the better yields.

Rajender Reddy, G.N. Sudhakar and K.V. Ramanaiah (2015) made trials over the need of balanced nutrient management based on recommendations to reap maximum yield and returns from the investment in plant nutrition. Their study gives a good full proof for the soil test based nutrient management not only ensure sustainable crop production but also steer the farmers towards economic usage of fertilisers depending on their financial status and prevailing market price of the crop under consideration. The increase in yield of seed cotton by 13.8 per cent in soil test based (2765 kg/ha) was noted over the yield obtained by using recommended levels of N-P2O5-K2O (2429 kg/ha).Soil test based fertiliser application reduced the requirement of potassium by 50 per cent in both soybean and cotton crops in rainfed black soils of Maharashtra.

Praveena Katharine, S et.al. (2013) made an investigation in Tamil Nadu over transgenic cotton on Inceptisol under drip fertigation and they found the significant relationship between soil test values and crop response to fertilisers. They, further, argued that it could be developed fertiliser prescription equations under IPNS for desired yield target of transgenic cotton. They verified the validity of fertiliser prescription equations developed for transgenic cotton under drip fertigation and found good results for yield increase to the cotton crop.

Savita K. Patilet. al. (2012) estimated the dose of nitrogen usage in the paddy cultivation in Tungabhadra project (TBP) area in Karnataka. They found that there was an excess dose of nitrogen ranged from 38.86% to 91.03% and for plant protection chemicals, from 42.53% to 70.54%. They found that the farmers were with the indiscriminate usage of chemicals in the study area.

Sing K.N. et.al.(2005) examined the computer based calculations for recommended doses for the known fertility values of the soil. They observed that the system generated calculations for the field level would be very much useful and these results will be much appropriate to achieve the targeted yield through the spatial fertiliser recommendation system using available validated fertiliser adjustment equations and Geographic Information System (GIS).

A. P. Srivastava (1983) estimated that the increase of fertilisers in cultivation did not reflect in the form of are increase in the level of growth of crop production for Punjab and Tamil Nadu at the district level for few crops, viz. wheat, rice, potato, cotton and sugarcane. This might be due to the poor management of fertilisers in the cultivation in these two states and the appropriate factors were as per the study viz. seed variety, timely irrigation and water management practices, plant protection measures, and weeding operations.

Beraet. al. (2006) found that the fertiliser dose would be effective under the similar agro-ecological zone, provided uniform cropping practices and socio-economic conditions. The study took place for paddy in the Vindhyan alluvial soils in India, where the result of the achievement of targets aimed at different level to was more than 90%. The higher yield equation of the crop would lead to costly fertiliser use basing on the financial status of the farmer and the market price of the crop under study.

Sacchidananda Mukherjee (2010) analysed that the farmers in Tamil Nadu were ready to have the soil sample tests. However, the factors like inadequate infrastructure and high transaction costs for undergoing sample tests were basic hindrances to make soil test samples regularly in the study area. The farmers had the choice of free service from local Sugar Mills and to some extent from local private soil testing centres instead of government service labs. Therefore, it would be better to have the services of the NGOs or students of agricultural universities. It was found that farmers were dependent 46% on fertiliser dealers and 32% of relatives and neighbours in the dosage of fertilisers, due to the absence of better agricultural extension services. They had no choice except to depend on these sources to avoid the risk of falling off the yields in his cultivation. Hence, the policy formulation was needed for the better agricultural extension services and good environmental education to the cultivators.

P. Dey (2015) estimated the dose of fertiliser achieving the targeted yield by the farmer. It was because of the soil sample test and a good level of agronomy in Tamil Nadu for paddy at district level study. The sample study took place from agricultural university farms and farmers' fields.

R Nagaraj (1982) estimated the trend for the fertiliser consumption in India for the period 1951-81 and it was found that there was a clear deceleration from mid-sixties due to falling demand. In the study area, some districts displayed the decline for wheat, though there

was no decline in fertiliser consumption. This trend was absent for rice in the consumption of fertilisers.

R. K. Tewatia (2008) observed the effect of balanced fertilization due to decontrol of phosphatic and potassic fertilisers in August 1992. However, the balanced fertilization referred to NPK by 4:2:1 ratio at the national level, the distortion took place by 9.5:3.2:1 in 1992-93. The author argued for the 'fertiliser best better management practices' (FBMPs) and in return, these would bring good returns to farmers. Further, he argued for 'Extension Services and Agencies' to make the farmer following soil and crop requirements with due regard to deficiencies in the input mix.

G. K. Sharma, et. al. (2015) conducted a field study to estimate inter-linkages of yield, soil, plant, and fertilisers-NPK(Nitrogen, Phosphorus and Potassium) in Bastar Plateau Agro-climatic zone of Chhattisgarh in 2009-11. They studied the optimum fertiliser doses for achieving the yield targets for paddy crop. The results showed that the yield targets were fulfilled for targets of 5000 and 6000 kgs per ha in farmers' fields with limited deviation by below 10%. This study clearly proved the superiority of recommended dose of fertiliser in achieving the targets of yields for paddy production.

Elumalai Kannan and K. B. Ramappa (2016) made a study in Karnataka based on the field study in some selected villages for paddy crop and they found positive effect over yields by the adoption of soil testing and its recommend doses of fertilisers. It was found the decrease in the adoption of soil testing with the increase of distance of laboratories. The less family labour has much negative effect on the adoption of soil testing and fertiliser use in scientific measure and there is a need for recurrent training programmes to the cultivators in this regard.

H.P.Singh et.al. (2013) carried out a study in the Mandsaur district of Madhya Pradesh and they found the good awareness of the farmers over the need of soil testing for better production. There is a need of starting of laboratories in different locations in the development blocks, like Bhanupura, Garoth.

P. L. Pingali & M. Shah (2008) conducted a study over Indo-Gangetic plains of South Asia. They viewed that it would be better to remove subsidies to eliminate the imbalance and excessive use of fertilisers. This, as they expressed, will lead to efficient use of fertilisers in the cultivation. Further, it was argued for the non-price policies for fertility management such

as location-specific research on soil fertility constraints, agro-economic practices, improvement in extension services, development of improved fertiliser supply and distribution systems, development of improved fertiliser supply and distribution systems, and development of physical and institutional infrastructure.

Rajan Bhatt (2013) carried a study in Punjab for the crops of sunflower and gobhi-sarson in Kapurthala district. It was found that the yield increase took place for the crops under study based on the adoption of recommended doses of fertilisers. This scientific approach led to increasing of production about 1.10-8.12% in sunflower and 10.9-15.0% in gobhi-sarson and the peasants were convinced much of the soil testing for the better yields.

1.4 Need of the Study:

Though there is much increase of production in agriculture sector after the mid-1960s green revolution, it is observed the degradation of natural resources due to imbalanced fertilization. Some of the problems are surfaced in the agriculture sector viz. a) indiscriminate use of fertilisers without use of proper scientific nutrient management b) falling of soil fertility and rising acidity in the soil and c) disturbance to the environment along with other menaces in the cultivation. To avoid all these problems, agricultural scientists suggest for soil testing and adopting of recommended doses of fertilisers in the fields. In this connection," National Project on Management of Soil Health and Fertility" (NPMSF) was started in 2008-09 with three features: 1) Strengthening of soil testing laboratories (STLs) 2) Promoting the use of integrated nutrient management and 3) strengthening of fertiliser quality control laboratories. This has been in force in all the states with the financing of Central Government funds. There is no study over the efficacy and reaching of the project to the farmers. Hence, Directorate of Economics & Statistics, AER Division, Ministry of Agriculture, GOI assigned this study to our centre to undertake this study in Andhra Pradesh (A.P.).

1.5 Objectives of the Study:

The specific objectives of the study are as follows:

1. To examine the level of adoption and its constraints in the application of recommended doses of fertilisers based on soil test reports by the farmers and
2. To analyse the impact of adoption of recommended doses of fertilisers on crop productivity and income of farmers

1.6 Data and Methodology:

This study depends on both primary and secondary data for the analysis in A.P. The state was bifurcated on 2nd June 2014 into two states as A.P. and Telangana. The present state A.P. has 13 districts and this is referred as Residual A.P. in the 'Bifurcation Act'. To avoid the confusion in the analysis in the second chapter, it is referred as 'Combined A.P. and Residual A.P., wherever the analysis is taken place with the combined data and bifurcated state data in the comparing of secondary data. In the remaining report, the present bifurcated state, A.P. is referred as usual. The secondary data was obtained from the Fertiliser Section, Department of Agriculture, Government of A.P. relating to fertiliser consumption, area, production and productivity of paddy and cotton crops.

Primary data were collected from two districts namely West Godavari and Guntur for the crops paddy and cotton from A.P. The two districts are selected based on having relatively higher concentration of paddy and cotton crops cultivation in A.P. In each of the district of West Godavari and Guntur, two mandals/blocks are selected based on the highest cropped area of the selected crops. Within each mandal/block, three villages are selected (Table: 1.1). In each village, a complete list of cultivating households, covering all social categories, including SC, ST and women farmers growing paddy and cotton crops is prepared and stratified according to four land size groups such as marginal (less than 1 hectare), small (1 to 2 hectares), medium (2 to 4 hectares) and large (more than 4 hectares).In each district, 60 farmers from the list of soil tested farmers in that district were drawn for each crop at random from the households with different land sizes on the basis of their proportion in the universe. In addition to the above sample, 30 control (non-soil tested) farmers were selected in each district for each crop randomly from households with different land sizes amongst paddy and cotton growing cultivators following the same method. Thus, the sample forms as 240 farmers for soil tested and 120 control farmers (non-soil tested farmers) for the two districts for the selected sample size of paddy and cotton crops in this study. The beneficiaries lists are collected from the: 1) Joint Director of Agriculture, Department of Agriculture, West Godavari District, Eluru, A.P., and 2) Joint Director of Agriculture, Department of Agriculture, Guntur District, Guntur, A.P.

For the primary survey, the reference year is 2015-16. Accordingly, kharif and rabi seasons for the rice and cotton crops were covered. The sample size, adopted at the district, mandal/block and village level for the primary survey is given in Table 1.1. From each village, 10sample farmers and 5control farmers were selected based on the soil tested farmers and the control farmer's basis, respectively.

Table -1
Details of District, Mandal and Village Wise Selected Sample

District	Mandal	Village	Soil test farmers	Control farmers
	Paddy			
West Godavari	Tadapalligudem	Krishnarayapalem	10	5
		Tadepalli	10	5
		Nandamuru	10	5
	Bheemadolu	Gundugolanu	10	5
		Surappagudem	10	5
		Pulla	10	5
		Sub total	60	30
Guntur	Tenali	Kothapalli narikelapalli	10	5
		Moparru	10	5
		Amarthaluru	10	5
	T.Sunduru	Modukuru	10	5
		T.Sunduru	10	5
		Pyaparru	10	5
		Sub total	60	30
	Cotton			
West Godavari	Buttayagudem	Doramamidi	10	5
		Antarvedigudem	10	5
		Kummarikunta	10	5
	Polavaram	Mungopal	10	5
		Reddykunkala	10	5
		Pathakunkala	10	5
		Sub total	60	30
Guntur	Pedanandipadu	Katarapadu	10	5
		Palaparru	10	5
		Varagani	10	5
	Prathipadu	Ganikapudi	10	5
		kondepadu	10	5
		Koyavaripallem	10	5
		Sub total	60	30
		Grand total	240	120

Source: Field survey 2016

1.7 Organisation of Present Study:

Having with seven chapters in the study, the first chapter elaborates the background, review of literature, objectives, database and methodology of the study. As the second chapter presents the growth trends in fertiliser consumption in A.P., the third chapter describes the socio-economic profile of the soil tested and control farmers of paddy and cotton crops in West Godavari and Guntur districts in A.P. The fourth chapter examines the issues relating to soil testing and adoption of the recommended doses of fertilisers in the study area in A.P., while the fifth chapter projects the adoption of recommended doses of fertilisers and its constraints. The sixth chapter measures the impact of the adoption of recommended doses of fertilisers on the productivity of crops of the sample and control farmers in the study area, whereas the final chapter provides the concluding remarks and policy measures based on the present study.

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CHAPTER – II

TREND IN FERTILISER CONSUMPTION IN ANDHRAPRADESH

The trend in consumption of fertilisers of material products is examined for Combined A.P. and Residual A.P. for the periods 1994-15 and 2009-15, respectively, for kharif, rabi and total. In this chapter, as mentioned earlier, the Residual A.P. is referred for the state with 13 districts after the bifurcation of erstwhile A.P. with 23 districts on 2nd June, 2014. It could be noticed that the name of A.P. remains after the formation of Telangana. It may lead to some confusion and therefore, it is here referred as Residual A.P., as in the bifurcation Act June 2014 to make the analysis with reference to the comparing years. It is tried to estimate the growth trend in the consumption of nitrogen, phosphorus and potash, for India and Residual A.P. for 2007-15,and for its districts during 1994-15.Further, it is examined the trend in consumption of fertilisers for recommended quantity in the cultivation of selected crops of paddy and cotton in terms of nutrients for Residual A.P. during 2009-14 for both seasons kharif and rabi separately.

2.1a Trend of Fertiliser Consumption in Terms of Material (Product) in Combined A.P.- Kharif Season:

The trend in fertiliser consumption in terms of material (Product) in Combined A.P. for kharif season is given in Table 2.1. This table gives information for linear growth rate in consumption of fertilisers for three periods-1994-10, 2001-10 and 1994-01 along with the year to year percentage change for Combined A.P. during 1994-10. In 1994-10, the highest acceleration appears for MOP with 11% growth rate out of all the fertilisers studied. 'Complex' fertiliser comes as next one with 4% in the same period and the only decline is reported to SSP. During 2001-10, DAP and MOP show the highest growth rates (12%) followed by 'complex' with 9%. MOP and DAP report first and second places in the growth rate in 1994-01. It can be observed that the consumption of MOP has increased in leaps and bounds in the study period compared to all other fertilisers in combined A.P. during 1994-10.

When we study the year-to-year change in per cent for the fertilisers, the decline in consumption for urea appears in 1997-98, 2001-02 and 2009-10 years, while the highest is reported to 2005-06 with 27% followed by 1995-96 with 18%. For SSP, as many as 8 years became negative change out of 16 years and the remaining years reported at the lower level change in SSP. MOP has increased at a higher level over year to year , though many years show a decline in the change. DAP has informed decline for four years out of 16 years study period and it shows much increase for the 12 years. 'Complex' fertiliser displays four years decrease in the percentage change and for remaining years, it shows a arise in the consumption. It is observed that the oscillations are there in consumption of fertilisers over year-to-year due

to monsoons and other factors in the demand and supply. We can notice that there is no sharp increase in the fertiliser consumption in the combined A.P. during 1994-10.

Table 2.1a.Trend of Fertiliser Consumption in Terms of Material (Product) in Combined A.P.- Kharif Season: 1994-10

('000 tonnes)

Year	Kharif									
	Urea	**%**	**SSP**	**%**	**MOP**	**%**	**DAP**	**%**	**Comp**	**%**
1994-01*	4.18		4.04		16.47		9.56		2.12	
2001-10*	7.59		-3.63		11.69		12.42		8.69	
1994-10*	2.69		-2.04		10.82		3.05		4.03	
1994-95	772.15	0	88.99	0	33.64	0	220.96	0	499.05	0
1995-96	908.07	17.60	137.15	54.12	62.25	85.05	237.86	7.65	541.59	8.52
1996-97	935.06	2.97	129.28	-5.74	60.04	-3.55	271.23	14.03	474.36	-12.41
1997-98	830.04	-11.23	137.67	6.49	73.68	22.72	412.81	52.20	408.82	-13.82
1998-99	954.09	14.95	122.97	-10.68	42.61	-42.17	399.89	-3.13	459.96	12.51
1999-00	1031.95	8.16	137.48	11.80	118.32	177.68	415.9	4.00	546.74	18.87
2000-01	1044.27	1.19	138.92	1.05	112.55	-4.88	354.34	-14.80	600.37	9.81
2001-02	742.31	-28.92	118.46	-14.73	118.27	5.08	268.56	-24.21	476.64	-20.61
2002-03	745.86	0.48	115.8	-2.25	108.69	-8.10	186.78	-30.45	479.38	0.57
2003-04	852.94	14.36	109.25	-5.66	120.86	11.20	206.42	10.52	438.91	-8.44
2004-05	866.34	1.57	113.9	4.26	164.2	35.86	252.59	22.37	527.4	20.16
2005-06	1101.28	27.12	100.72	-11.57	148.01	-9.86	318.46	26.08	701.6	33.03
2006-07	1172.78	6.49	115.71	14.88	144.54	-2.34	352.93	10.82	717.36	2.25
2007-08	1213.76	3.49	108.96	-5.83	215.69	49.23	377.23	6.89	763.57	6.44
2008-09	1363.93	12.37	54.69	-49.81	314.3	45.72	461.88	22.44	833.91	9.21
2009-10	1191.26	-12.66	106.87	95.41	225.48	-28.26	571.85	23.81	837.7	0.45

Source: Fertilisers Section, Department of Agriculture and Cooperation, Govt. of AP.

* Linear growth rates, the formula run is: linest/mean*100

2.1b Trend of Fertiliser Consumption in Terms of Material (Product) in Residual A.P. for Kharif Season:

The trend of fertiliser consumption in terms of material (product) in Residual A.P. for kharif season is given in Table 2.1b. It is analysed the fertiliser consumption in kharif season in Residual A.P. for the period 2009-15. Except for urea, all the other fertilisers selected have shown a decline during 2009-15 and the highest appears for DAP with -20%, while others show between -3% to -5% in the study period. Urea shows two years decline in the year-to-year percentage change in 2012-13 and 2014-15. In the five years comparing period, DAP exhibits a higher-level fall in the year-to-year percentage change, as it shows -40% in 2014-15 and -39% in 2012-13. It indicates a sharp fall in the consumption in the study period in kharif season. 'Complex' fertiliser shows much decline during 2012-14, though it has increased in other years. Therefore, it reported -5% linear growth rate decline in the five-year period. The analogous trend is traced for MOP and SSP. Though one or two years show an increase in consumption , the other years with a high decline in consumption has made the consumption trend as negative for these fertilisers.

Table 2 .1b.Trend of Fertiliser Consumption in Terms of Material (Product) in Residual A.P. for Kharif: 2009-15

(Qty. In Lakh MTs.)

Year	Kharif									
	Urea	%	DAP	%	Comp	%	MOP	%	SSP	%
2009-15*	3.20		-20.17		-4.91		-4.03		-2.68	
2009-10	6.04		3.09		4.84		1.33		0.93	
2010-11	6.75	11.66	3.66	18.44	6.19	27.94	1.64	23.21	1.24	33.67
2011-12	7.14	5.82	2.80	-23.38	6.35	2.59	0.58	-64.94	1.30	5.19
2012-13	6.81	-4.59	1.71	-39.06	4.82	-24.12	0.96	66.27	0.82	-37.24
2013-14	8.22	20.59	1.82	6.23	4.26	-11.59	0.93	-3.01	0.99	20.96
2014-15	6.78	-17.49	1.08	-40.52	4.53	6.30	1.36	46.33	0.98	-0.99

Source: Fertilisers Section, Department of Agriculture and Cooperation, Govt. of AP.

* Liner growth rates, formula run:linest/mean*100

2.2a Trend of Fertiliser Consumption in Terms of Material (Product) in Combined A.P. for Rabi Season:

The trend of fertiliser consumption in terms of material (product) in Combined A.P. for rabi season is shown in Table 2.2a. Either in short run or in long run , MOP has shown the highest growth rate in the study period and in its sub-periods, while the declining trend is reported to SSP in 1994-10 and in 2001-10 for the combined A.P. The DAP shows second place in the acceleration during the study period and sub-periods compared to urea, SSP and 'complex' fertilisers. Urea shows the lowest with 2.40% in 1994-10 and 1% in 1994-01 out of all the fertilisers under study. As many as four years are reported declining trend for urea in 1994-10 and it shows the higher change in 2005-06,1998-99 and 2002-03 years. SSP informs negative change in the per cent change for 8 years out of 16 and further, it reports decline for 6 years during 2001-10. Though MOP has four years decline in the rabi season during 1994-10, it shows a higher increase in the remaining years in the year to year percentage change in the consumption in Combined A.P. The similar trend appears for DAP under study period with the increase in many years. It can be observed that 'complex' fertilisers display lower percentage change compared to DAP, of course, with 9 years increase in the study period except for six years decline. In the rabi season, much consumption appears for urea out of all fertilisers under study.

Table 2.2a.Trend of Fertiliser Consumption in Terms of Material (Product) in Combined A.P. for Rabi Season:1994-10

('000 tonnes)

Year	Rabi									
	Urea	**%**	**SSP**	**%**	**MOP**	**%**	**DAP**	**%**	**Comp**	**%**
1994-01*	1.06		3.28		12.30		16.70		6.12	
2001-10*	6.18		-4.12		11.96		7.37		5.11	
1994-10*	2.40		-3.29		11.54		5.36		4.40	
1994-95	1019.09		101.94		61.93		115.42		466.13	
1995-96	920.38	-9.69	127.38	24.96	63.69	2.84	103.44	-10.38	528.89	13.46
1996-97	997.03	8.33	100.07	-21.44	56.87	-10.71	166.73	61.19	423.67	-19.89
1997-98	827.02	-17.05	114.04	13.96	69.51	22.23	200.5	20.25	380.7	-10.14
1998-99	1049.09	26.85	143.33	25.68	113.1	62.71	267.65	33.49	544.95	43.14
1999-00	982.79	-6.32	119.85	-16.38	102.84	-9.07	282.07	5.39	563.8	3.46
2000-01	1056.61	7.51	129.09	7.71	112.26	9.16	277.41	-1.65	696.52	23.54
2001-02	1020.87	-3.38	99.08	-23.25	143.25	27.61	270.06	-2.65	476.64	-31.57
2002-03	836.65	-18.05	81.02	-18.23	130.11	-9.17	168.06	-37.77	622.11	30.52
2003-04	901.97	7.81	104.15	28.55	155.05	19.17	200.15	19.09	686.4	10.33
2004-05	885.73	-1.80	86.99	-16.48	188.36	21.48	225.41	12.62	664.83	-3.14
2005-06	1228.14	38.66	115.73	33.04	262.46	39.34	291.35	29.25	866.76	30.37
2006-07	1056.19	-14.00	91.56	-20.88	258.45	-1.53	251.14	-13.80	828.13	-4.46
2007-08	1298.69	22.96	45.15	-50.69	233.75	-9.56	317.16	26.29	645.35	-22.07
2008-09	1369.93	5.49	92.59	105.07	286.79	22.69	425.35	34.11	710.03	10.02
2009-10	1411.35	3.02	65.06	-29.73	373.92	30.38	314.63	-26.03	938.85	32.23

Source: Fertilisers Section, Department of Agriculture and Cooperation, Govt. of AP.
* Linear growth rates, the formula run linest/mean*100

2.2bTrend of Fertiliser Consumption in Terms of Material (Product) in Residual A.P. for Rabi Season:

The trend of fertiliser consumption in terms of material (product) in Residual A.P. for rabi season is presented in Table 2.2b. In Residual A.P., urea consumption was more than three times compared to DAP, MOP and SSP during 2009-15 followed by 'complex', whereas SSP showed the lowest as usual based on its level of requirement in the cultivation. SSP shows the highest growth rate and after observing the data in absolute figures, there is no any sharp decline in the consumption.

Table - 2. 2b Trend of Fertiliser Consumption in Terms of Material (Product) in Residual A.P. for Rabi Season:2009-15

(qty. in Lakh MTs.)

Year	Rabi									
	Urea	%	DAP	%	Comp	%	MOP	%	SSP	%
2009-15*	1.90		-5.31		1.13		-13.04		4.20	
2009-10	9.09		2.33		6.69		2.48		0.60	
2010-11	9.10	0.14	2.01	-13.70	6.97	4.18	1.92	-22.58	1.08	80.92
2011-12	8.98	-1.32	2.72	35.72	7.06	1.27	2.01	4.68	1.38	27.62
2012-13	8.55	-4.79	2.01	-26.25	5.48	-22.44	1.10	-45.38	1.10	-19.97
2013-14	9.85	15.18	1.90	-5.50	6.96	27.11	1.30	18.70	1.01	-8.85
2014-15	9.96	1.16	1.75	-7.82	7.55	8.45	1.47	12.87	1.00	-0.63

Source: Fertilisers Section, Department of Agriculture and Cooperation, Govt. of AP.
* Linear growth rates, the formula run: linest/mean*100

2.3a Trend of Fertiliser Consumption in Terms of Material (Product) in Combined A.P. for Total (kharif and Rabi):

The trend of fertiliser consumption in terms of material (product) in Combined A.P. for total (kharif and rabi) is given in Table 2.3a. In Combined A.P., urea had the highest consumption out of all the fertilisers under study, while 'complex' fertilisers showed second place in the consumption. The least consumption appeared for SSP during 1994-10. MOP has the highest growth acceleration in the study period and in its sub-periods with more than 14% to 11% compared to the rates of all the fertilisers under study. DAP had a good increase in 1994-01 and 2001-10 periods, while it reported 4% during 1994-10. Out of all the fertilisers under study, SSP shows a declining trend in consumption in second sub-period (2001-10) and in the total period (1994-10).

In the percentage change in the consumption year to year, MOP has as many as 8 years with more than 15% in the study period and it shows a lot of increase in the year to year demand for it, while the decline refers to four years with a lower level in the change taken place. Against to this trend, SSP shows 8 years decline in the study period in the consumption in the Combined A.P. DAP and 'complex' demonstrate similar trend of MOP with a low level by 10 years and 9 years increase, in that order in the year to year change of consumption for Combined A.P. For urea, there has been a high increase in the per cent change in the second sub-period. It is found that urea shows as many as 5 years declining in consumption in the second period (2001-10). It shows many oscillations in the consumption of fertilisers in this period.

Table 2.3a Trend of Fertiliser Consumption in Terms of Material (Product) in Combined A.P. for Total (Kharif and Rabi):1994-10

('000 tonnes)

Year	Total (Kharif and Rabi)									
	Urea	%	SSP	%	MOP	%	DAP	%	Comp	%
1994-01*	2.57		3.67		14.24		12.27		3.64	
2001-10*	6.86		-3.85		11.84		10.14		5.38	
1994-10*	2.54		-2.62		11.22		4.03		4.17	
1994-95	1791.24		190.92		95.56		336.39		965.17	
1995-96	1828.45	2.08	264.53	38.56	125.94	31.79	341.3	1.46	1070.48	10.91
1996-97	1932.09	5.67	229.35	-13.30	116.91	-7.17	437.96	28.32	898.03	-16.11
1997-98	1657.06	-14.23	250.71	9.31	143.19	22.48	613.31	40.04	789.52	-12.08
1998-99	2003.18	20.89	266.3	6.22	155.71	8.74	667.54	8.84	1004.91	27.28
1999-00	2014.74	0.58	257.33	-3.37	221.16	42.03	697.97	4.56	1110.54	10.51
2000-01	2100.88	4.28	268.01	4.15	224.81	1.65	631.75	-9.49	1246.89	12.28
2001-02	1763.18	-16.07	217.54	-18.83	261.52	16.33	538.62	-14.74	1224.04	-1.83
2002-03	1582.51	-10.25	196.82	-9.52	238.8	-8.69	354.84	-34.12	1101.49	-10.01
2003-04	1754.91	10.89	213.4	8.42	275.91	15.54	406.57	14.58	1125.31	2.16
2004-05	1752.07	-0.16	200.89	-5.86	352.56	27.78	478.00	17.57	1192.23	5.95
2005-06	2329.42	32.95	216.45	7.75	410.47	16.43	609.81	27.58	1568.36	31.55
2006-07	2228.97	-4.31	207.27	-4.24	402.99	-1.82	604.07	-0.94	1545.49	-1.46
2007-08	2512.45	12.72	154.11	-25.65	449.44	11.53	694.39	14.95	1408.92	-8.84
2008-09	2733.86	8.81	147.28	-4.43	601.09	33.74	887.23	27.77	1543.94	9.58
2009-10	2602.61	-4.80	171.93	16.74	599.4	-0.28	886.48	-0.08	1782.14	15.43

Source: Fertilisers Section, Department of Agriculture and Cooperation, Govt. of AP.

* Linear growth rates, the formula run: linest/mean*100

2.3b Trend of Fertiliser Consumption in Terms of Material (Product) in Residual A.P. for Total:

The trend of fertiliser consumption in terms of material (product) in Residual A.P. for total (kharif and rabi) is given in Table 2.3b. There is a sharp deceleration in growth rate (linear) for DAP with -13% and followed by MOP by -9%, during 2009-15 for Residual A.P., however, urea and SSP are showing gradual increasing trend during the same period with 2% and 0.8%, respectively. 'Complex' fertiliser has a very lower deceleration in 2009-15 by -1% in Residual A.P. In the per cent change, DAP shows a continuous decline in the year to year change from 2011-12 onwards, while MOP reports first three years a declining traend in the year to year change in the consumption. 'Complex' fertiliser informs only one-year (2012-13) decline with a higher per cent (-23%). Urea showed a good jump in the consumption in 2012-13, whereas 'complex' and SSP did in 2010-11.

Table2.3b Trend of Fertiliser Consumption in Terms of Material (Product) in Residual A.P. for Total:2009-15

(Qty. in Lakh MTs)

Year	Total (kharif and rabi)									
	Urea	%	DAP	%	Comp	%	MOP	%	SSP	%
2009-15*	2.45		-13.16		-1.48		-9.45		0.80	
2009-10	15.13		5.42		11.53		3.81		1.52	
2010-11	15.85	4.74	5.67	4.64	13.16	14.15	3.56	-6.56	2.32	52.19
2011-12	16.12	1.72	5.53	-2.45	13.41	1.89	2.59	-27.44	2.68	15.64
2012-13	15.36	-4.70	3.72	-32.74	10.30	-23.23	2.06	-20.49	1.92	-28.36
2013-14	18.06	17.58	3.71	-0.11	11.22	8.99	2.23	8.58	2.00	3.84
2014-15	16.74	-7.32	2.83	-23.80	12.08	7.63	2.83	26.80	1.98	-0.81

Source: Fertilisers Section, Department of Agriculture and Cooperation, Govt. of AP.

* Liner growth rates, the formula run: linest/mean*100

2.4. Trend in Growth Rate & Change in Consumption of Fertiliser Nutrients for India & Residual A.P.:

Linear growth trend and change in consumption of fertiliser nutrients for India & Residual A.P. are presented in Table 2.4. During 2007-15, Residual A.P. showed a little high growth rate (2.5%) for nitrogen (N) compared to India (2%). It is found that there was a decline in India and an increase for Residual A.P. in 2010-15, with -1% and 0.4% in that order. Nitrogen has much acceleration in the consumption, as there is a high rate in Residual A.P. and India with 6% and 4%, in that order, during 2007-11. Further, it could be observed by year-to-year per cent change. A.P. has three years much higher change in consumption of nitrogen. When nitrogen consumption was negative for India, it was 14% for A.P. in 2013-14.

Surprisingly, for phosphorus (P), there has been an analogous trend for both A.P. and India in the study period either for deceleration or for acceleration. During 2007-15,

phosphorus informs a declining trend for both A.P. and India with nearly same rate, whereas the acceleration in growth rate is shown to both of them by 12% in 2007-11. Interestingly, the declining trend for phosphorus consumption was -10% during 2010-15 for both Residual A.P. and India. It indicates that the national consumption trend for phosphorus is replicated for Residual A.P. It could be noticed through the yearly change in the consumption. In 2008-11, the higher change in consumption might be traced for both nation and state. We can observe the deceleration in the latter years except for 2013-14 in the consumption of phosphorus.

Potash (K) consumption has a declining trend at a higher level for Residual A.P. (-7%) compared to India (-5%) in the study period (2007-15) and India shows much higher consumption (9%) compared to A.P. (5%) in the first sub-period (2007-10).Against to this, A.P. shows 1% increase in the consumption of potash in the following sub-period (2010-15), while India reports a decrease (-0.4%). The higher deceleration in the consumption of potash confirms that there has been very much declining trend in the state and the country in the cultivation. Though potash consumption had increased in 2008-10, in the per cent change year to year, it reported the next three years deceleration for both Residual A.P. and India. However, it confirms the diminishing trend in consumption based on the estimation of year-to-year change of potash for both residual A.P. and India.

Now the trend in the growth rate of the total nutrients (NPK) could be estimated. It shows a very little rise in the consumption of NPK for India and Residual A.P. in the study period. In the sub-periods, we can find different trend for NPK consumption across nation and Residual A.P. During 2007-11, it is found 8% and 7% growth rates in the consumption for Residual A.P. and India, in that order, whereas the opposite trend is traced for the next five years (2010-15) for both of them. In absolute figures, the consumption of NPK has been stable around 17 lakhs Mts. for Residual A.P. and 250 lakhs Mts. for India during the study period excluding 2010-12. In the per cent change, we can find notwithstanding the increase of the first three years for state and country level, that there has been a decline in the latter three years except for Residual A.P. It indicates the sluggish trend in the consumption of NPK in the per cent change from year to year. However, it could be noticed that the meager acceleration in consumption of NPK for the eight years period tells the stable trend in the consumption of nutrient fertilisers for the whole nation and Residual A.P.in future, provided no technical change in the method of present cultivation.

Table 2.4 Trend of Linear Growth Rate & Change in Consumption of Fertiliser Nutrients for India & Residual A.P.: 2007-15

('000MTs.)

Year	India								A.P.							
	N	%	P	%	K	%	Total	%	N	%	P	%	K	%	Total	%
2007-15*	2.24		-0.41		-5.30		0.73		2.46		-1.08		-6.73		0.18	
2007-11*	4.48		12.25		9.02		7.14		6.33		12.33		4.56		7.79	
2010-15*	-0.67		-9.84		-0.41		-2.98		0.37		-10.21		1.27		-2.48	
2007-08	14419		5515		2636		22570		898		434		264		1596	
2008-09	15090	4.65	6506	17.97	3313	25.68	24909	10.36	948	5.57	492	13.36	298	12.88	1738	8.90
2009-10	15580	3.25	7274	11.80	3632	9.63	26486	6.33	1021	7.70	562	14.23	309	3.69	1892	8.86
2010-11	16558	6.28	8050	10.67	3514	-3.25	28122	6.18	1082	5.97	628	11.74	305	-1.29	2015	6.50
2011-12	17300	4.48	7914	-1.69	2576	-26.69	27790	-1.18	1111	2.68	618	-1.59	215	-29.51	1944	-3.56
2012-13	16821	-2.77	6653	-15.93	2062	-19.95	25536	-8.11	993	-10.62	440	-28.80	171	-20.47	1604	-17.49
2013-14	16750	-0.42	5633	-15.33	2099	1.79	24482	-4.13	1135	14.30	461	4.77	184	7.60	1780	10.97
2014-15	16946	1.17	6098	8.25	2532	20.63	25576	4.47	1077	-5.11	444	-3.69	219	19.02	1739	-2.30

Legend: N-nitrogen, P-phosphorus, and K-Potash. Source: Fertilisers Section, Department of Agriculture and Cooperation, Govt. of AP.

* Linear growth rates, the formula run: linest/mean*100

2.5. Growth Rate of Nutrient Fertiliser Consumption District wise in Residual A.P.:

The growth rate of nutrient fertiliser consumption district wise in Residual A.P. is given in Table 2.5. There are 13 districts in the state and these are very much dependent on agriculture. Residual A.P. has 3% of growth rate during the study period (1994-15) for nitrogen and as many as 9 districts do not cross this rate and therefore, this higher growth rate is derived from four districts viz. Kurnool (5%), Ananthapur (4.3%) SPS Nellore (4%) and Guntur (3.4%). These four districts have stood for the highest growth rate in the consumption of nitrogen in the state. Visakhapatnam (1%) and East Godavari (1.4%) districts report the lowest consumption in nitrogen. During 1994-15 in the phosphorus consumption, there is a different trend as seven districts have more than that of the state's growth rate (3.6%). Vizianagaram district has the highest with 5.1% followed by Kurnool district with 5% and Visakhapatnam district with 4.7%. The lowest consumption appears in Krishna and West Godavari districts by 2% and 2.2%, respectively. A good level of acceleration is noticed with the districts of SPS Nellore (4.50%), Prakasam (4.5%), Guntur (4%) and Ananthapur (4%) and these districts demonstrate the higher rate than that of the state. For potash consumption, we can find the first, second and third places with Vizianagaram (8%), YSR Cuddaph (7%) and SPS Nellore (6%) districts, while six districts show the lower level growth rate compared to the state's rate. The lowest growth rate is with Krishna district (2%) followed by Chittoor district(3%).In the long-run (1994-15), residual A.P. has shown 3% growth rate for the total NPK, whereas seven districts report less than the state's rate. Kurnool, SPS Nellore and Ananthapur districts show the higher rates out of all other districts in the state and the lower levels are with Krishna, Chittoor and Visakhapatnam districts in the total NPK consumption.

Further, it is examined the trend in consumption into two sub-periods, as 2015-01 and 2001-94 to know in detail the trend in different periods. During 2015-01, Residual A.P. has 4% for nitrogen consumption. It is found that Kurnool district stands first in nitrogen consumption and SPS Nellore and Guntur districts come in the following places, in that order, in the consumption at the district level. The Rayalaseema districts (Ananthapur, Chittoor, Kurnool and YSR Cuddaph) except Chittoor emerge as the higher growth rate districts for nitrogen. The lowest growth rate is with East Godavari district by 3% followed by Srikakulam district. There is a higher growth rate for phosphorus than that of nitrogen for Residual A.P. in the study period. Vizianagaram and Kurnool districts report the higher level of growth rate out of all districts for phosphorus consumption in 2015-01, nevertheless, East Godavari and Chittoor districts inform the lowest growth rates across districts. There are four districts with the increase more than the state's rate for phosphorus consumption. In the case of potash, state

growth rate is 2%, whereas three districts viz. Krishna, Visakhapatnam and East Godavari show deceleration in the consumption of potash during 2015-01. Vizianagaram and YSR Cuddaph report the highest rate with 7% and 6%, respectively, followed by SPS Nellore and Srikakulam districts. The total NPK consumption shows a good increase with 5% rate, though ten districts are placed below to this rate, only three districts namely, Visakhapatnam, East Godavari and Prakasam report a higher rate compared to the state in 2015-01. It indicates a higher rate in NPK in residual A.P. compared to India. The lowest rates are with Vizianagaram and SPS Nellore districts (below 3%) at district level in Residual A.P.

Table 2.5 Growth Rate* of Fertiliser Consumption of Nutrient Fertilisers District wise in Residual A.P.: 1994-15

Name of the district	1994-15				2001-15				1994-01			
	N	P	K	Total	N	P	K	Total	N	P	K	Total
Srikakulam	1.85	3.33	5.60	2.55	2.92	3.25	4.02	3.12	2.07	7.81	12.39	3.94
Vizianagaram	2.59	5.10	8.20	3.73	4.96	6.12	6.84	5.45	-0.27	9.85	14.52	2.47
Visakhapatnam	1.17	4.69	4.11	1.97	2.97	4.04	-0.97	2.65	0.52	10.87	-5.95	1.25
East Godavari	1.38	2.85	3.42	2.02	2.67	2.14	-0.32	2.06	2.85	10.28	9.74	5.19
West Godavari	2.38	2.17	5.92	2.86	3.11	2.33	3.63	2.99	1.10	8.71	10.39	4.01
Krishna	2.39	2.10	2.06	1.69	4.05	3.69	-2.07	2.97	-2.58	6.25	14.14	3.24
Guntur	3.36	4.32	4.61	3.77	5.17	4.47	1.48	4.56	0.24	7.32	9.47	2.90
Prakasam	2.66	4.45	3.76	3.34	4.27	4.19	2.21	4.05	3.71	8.16	10.32	5.49
SPS Nellore	4.00	4.50	6.43	4.38	5.34	4.13	5.48	5.04	1.04	7.40	9.27	3.26
Kurnool	5.07	4.98	5.23	5.06	6.52	5.28	3.39	5.71	5.24	7.66	4.10	5.98
Anantapur	4.27	4.13	4.99	4.35	5.08	3.27	0.60	3.69	2.05	6.03	6.95	3.99
YSR Cuddaph	1.65	3.11	6.94	2.83	4.42	3.42	5.51	4.26	-0.88	3.31	5.34	0.89
Chittoor	1.65	2.18	2.50	1.88	2.95	2.30	1.33	2.58	0.23	-3.69	-4.67	-1.22
A.P.	2.82	3.57	4.59	3.17	4.30	3.76	1.90	3.81	-1.13	-7.45	-9.45	-3.76

Legend: N-nitrogen, P-phosphorus, and K-Potash. Source: Fertilisers Section, Department of Agriculture and Cooperation, Govt. of AP.* Linear growth rate, formula run:linest/mean*100

In the second sub-period (2001-94), nitrogen reports decline in four districts, while state shows 3% acceleration in the consumption. Only two districts, West Godavari (5%) and Ananthapur (4%) show more than the rate of the state. Three districts report below a half per cent. This divulges that there has been much lower consumption during this period for nitrogen. Residual A.P. has shown a very much decline by 7% in the consumption of phosphorus in the second sub-period and Chittoor district also reports deceleration by -4%. On the other side, Visakhapatnam, East Godavari and Vizianagaram districts display more than 10%, while YSR Cuddaph shows 3% in the growth of consumption of phosphorus. For potash, there is a huge decline in the consumption in the second sub-period at the state level by -9% (2001-94) and there are Visakhapatnam and Chittoor districts with deceleration by -6% and -5%, respectively. Other districts like Vizianagaram, Krishna and Srikakulam report more than 12% in the same period. Though the consumption of potash shows rapid decline at the state

level, some districts report very much acceleration in the consumption. There are with 10% increase by three districts and the four districts with the range between 9% to 5%, nevertheless, Visakhapatnam and Chittoor districts report sharp decline by -6% and -5%, in that order. Thus, potash shows a different trend from other two of its counterparts in this period. A very important trend appears in the growth rate for the second sub-period in the consumption of NPK, being distinct from the first period discussed earlier, Residual A.P. shows -4% decline in the NPK consumption. Chittoor district shows deceleration by -1%, while YSR Cuddaph (1%) and Visakhapatnam (1%) districts show a very limited acceleration in the consumption in the total NPK. However, six districts display more than 4% growth rate in NPK in the second sub-period.

2.6 Fertiliser Consumption in Terms of Nutrients of Gross Cropped Area in Residual A.P.:

Fertiliser consumption in terms of nutrients of gross cropped area in Residual A.P. is given in Table 2.6. The gross cropped area (GCA) has increased at 0.5% in the study period, however, nitrogen showed 0.7% rise in the consumption. The total NPK has declined at -4% in the study period for state, whereas potash and phosphorus report a lot of decline in the consumption by -17% and -8%, in that order. It indicates a deceleration in the consumption of nutrients in the state.

Table 2.6 Fertiliser Consumption in Terms of Nutrients of Gross Cropped Area in Residual A.P.:2009-14

(Area in Lakh ha &Qty. in Lakh MTs)

S.No	Area/Nutrient Fertiliser	Years					Growth Rate*
		2009-10	2010-11	2011-12	2012-13	2013-14	2009-14
1.	Gross Cropped Area	63.97	73.44	67.42	67.13	68.84	0.50
2.	Nitrogen (N)	160	147	165	148	165	0.70
3.	Phosphorus ($P_2O_{5)}$	88	86	92	66	67	-7.77
4.	Potash (K_2O)	48	42	32	25	27	-16.95
	Total (N+P+K)	296	275	289	239	259	-4.05

Source: Fertilisers Section, Department of Agriculture and Cooperation, Govt. of A.P.

* Linear growth rate, formula run:linest/mean*100

2.7a. Fertiliser Consumption in Recommended Quantity for Paddy in Terms of Nutrients in Residual A.P. for Kharif:

Fertiliser consumption in recommended quantity for paddy in terms of nutrients in residual A.P. for kharif is given in Table 2.7a. There is no change in the recommended quantity of nutrients for paddy crop cultivation in the kharif season. All the nutrients are at the same dose level in the study period for paddy cultivation in the kharif season, and remain the same for all the five-year study period.

Table 2.7a Fertiliser Consumption in Recommended Quantity for Paddy in Terms of Nutrients in Residual A.P. for Kharif: 2009-14

(ha/kgs.)

S.No	Nutrient Fertilisers	Years				
		2009-10	2010-11	2011-12	2012-13	2013-14
1.	Nitrogens (N)	99	100	100	100	100
2.	Phosphorus (P_2O_5)	50	50	50	50	50
3.	Potash (K_2O)	40	40	40	40	40
4.	Total (N+P+K)	189	190	190	190	190

Source: Fertilisers Section, Department of Agriculture and Cooperation, Govt. of AP.

2.7b.FertiliserConsumption in Recommended Quantity for Paddy in Terms of Nutrients in Residual A.P. for Rabi:

Fertiliser consumption in recommended quantity for paddy in terms of nutrients in residual A.P. for rabi is given in Table 2.7b. As in the case of kharif, there is no change in the recommended quantities of nutrients for rabi season for the cultivation of paddy crop in Residual A.P. All the nutrients show the same dosage in all the five year period for the entire state.

Table 2.7bFertiliserConsumption in Recommended Quantity for Paddy in Terms of Nutrients in Residual A.P for Rabi: 2009-14

(ha/kgs.)

S.No	Nutrient Fertilisers	Years				
		2009-10	2010-11	2011-12	2012-13	2013-14
1.	Nitrogens (N)	120	120	119	119	120
2.	Phosphorus (P_2O_5)	81	80	80	80	80
3.	Potash (K_2O)	40	40	39	40	40
4.	Total (N+P+K)	240	240	239	239	239

Source: Fertilisers Section, Department of Agriculture and Cooperation, Govt. of AP.

2.8a.Fertiliser Consumption in Recommended Quantity for Cotton in Terms of Nutrients in Residual A.P. for Kharif:

The fertiliser consumption in recommended quantity for cotton in terms of nutrients in Residual A.P. for kharif is given in Table 2.8a. The dosage in the cotton crop cultivation is not changed in the five-year study period for kharif season. All the nutrients have an analogous dose in all the years under study.

Table 2.8aFertiliser Consumption in Recommended Quantity for Cotton in Terms of Nutrients in Residual A.P. for Kharif: 2009-14

(ha/kgs.)

S.No	Nutrients of Fertilisers	Years				
		2009-10	2010-11	2011-12	2012-13	2013-14
1.	Nitrogens (N)	121	120	121	121	121
2.	Phosphorus (P_2O_5)	59	60	59	59	60
3.	Potash (K_2O)	59	60	59	59	60
4.	Total (N+P+K)	238	241	239	239	240

Source: Fertilisers Section, Department of Agriculture and Cooperation, Govt. of AP.

2.8b. Fertiliser Consumption in Recommended Quantity for Cotton in Terms of Nutrients in Residual A.P. for Rabi:

Fertiliser consumption in recommended quantity for cotton in terms of nutrients in Residual A.P. for rabi is presented in Table 2.8b. There is no data for rabi crop for cotton cultivation since the rabi crop is very limited in Residual A.P. Therefore, we find lack a of three years data out of five years. In the comparing two years (2012-14), there is a change in the use of all nutrients from 114 kgs. to 124 kgs. to nitrogen and from 57 kgs. to 60 kgs. to phosphorus and the same change for potash is observed as in the case of phosphorus.

Table 2.8b Fertiliser Consumption in Recommended Quantity for Cotton in Terms of Nutrients in Residual A.P. for Rabi: 2009-14

(ha/kgs.)

S.No	Nutrient Fertilisers	Years				
		2009-10	2010-11	2011-12	2012-13	2013-14
1.	Nitrogens (N)	NA	NA	NA	114	124
2.	Phosphorus (P_2O_5)	NA	NA	NA	57	60
3.	Potash (K_2O)	NA	NA	NA	57	60
4.	Total (N+P+K)	NA	NA	NA	228	244

Source: Fertilisers Section, Department of Agriculture and Cooperation, Govt. of AP.

Summary:

Fertilisers namely MOP and DAP report first and second places in the growth rate in 1994-01. It can be observed that the consumption of MOP has increased in leaps and bounds in the study period compared to all other fertilisers in Combined A.P. during 1994-10.It is observed that the oscillations are there in consumption of fertilisers over year to year due to monsoons and other factors in the demand and supply. We can notice that there is no sharp increase in the fertiliser consumption in the Combined A.P. during 1994-10 in kharif season. In Residual A.P. for the period 2009-15 except for urea, all the other fertilisers selected have shown a decline during 2009-15 and the highest appears for DAP with -20%, while others show between -3% to -5% in the study period. It indicates a sharp fall in the consumption in the study period in kharif season. The declining trend is reported to SSP in 1994-10 and in 2001-10 for the combined A.P. In the rabi season, much consumption appears for urea out of all fertilisers under study. In Residual A.P., the trend in consumption of urea is more than three times compared to DAP, MOP and SSP during 2009-15. SSP shows the highest growth rate and after observing the data in absolute figures, there is no any sharp decline in the consumption in it in Residual A.P. In Combined A.P., urea has the highest consumption out of all the fertilisers under study, while 'complex' fertilisers show second place in the consumption. The least rate in consumption appears for SSP during 1994-10. MOP has the highest growth acceleration in the study period and in its sub-periods, with more than 14% to 11% compared to the rates of all the fertilisers under study in Combined A.P., while out of all

the fertilisers under study, SSP shows declining trend in consumption in second sub-period (2001-10) and in the total period (1994-10). On other, there is a sharp deceleration in growth rate (linear) for DAP with -13% and followed by MOP by -9%, during 2009-15 for Residual A.P.

During 2007-15, Residual A.P. reports a little high growth rate (2.5%) for nitrogen (N) compared to India (2%).Surprisingly, for phosphorus (P), there has been an analogous trend for both A.P. and India in the study period either for deceleration or for acceleration. It indicates that the national consumption trend for phosphorus is replicated for Residual A.P. Potash (K) consumption has declining trend at a higher level for Residual A.P. (-7%) compared to India (-5%) in the study period (2007-15).There are 13 districts in the state and these are very much dependent on agriculture in Residual A.P. and it has 3% of growth rate during the study period (1994-15) for nitrogen and this rate is derived from four districts viz. Kurnool (5%), Ananthapur (4.3%) SPS Nellore (4%) and Guntur (3.4%). During 1994-15 in the phosphorus consumption, it is found a different trend that seven districts have more than that of the state's growth rate (3.6%). A good level of acceleration is noticed with the districts of SPS Nellore (4.50%), Prakasam (4.5%), Guntur (4%) and Ananthapur (4%) and these districts demonstrate the higher rate than that of the state. For potash, we can find the first, second and third places with Vizianagaram (8%), YSR Cuddaph (7%) and SPS Nellore (6%) districts in the consumption of potash. In the long-run (1994-15), residual A.P. has shown 3% growth rate for the total NPK, whereas seven districts report less than the state's rate. Kurnool, SPS Nellore and Ananthapur districts show the higher rates out of all other districts in the state and the lower levels are with Krishna, Chittoor and Visakhapatnam districts in the total NPK consumption.

The gross cropped area (GCA) has increased at 0.5% in the study period, however, nitrogen shows 0.7% rise in the consumption. The total NPK has declined at -4% in the study period for state, whereas potash and phosphorus report a lot of decline in the consumption by -17% and -8%, in that order. There is no change in the recommended quantity of nutrients for paddy crop in the kharif and rabi seasons. All the nutrients have an analogous dose in all the years under study. In the case of recommended quantity for the cotton crop for rabi season has no data, since the rabi crop is very limited in Residual A.P. In the comparing two years (2012-14) for cotton crop in rabi season, there is a change in the use of all nutrients from 114 kgs. to 124 kgs. to nitrogen and from 57 kgs. to 60 kgs. to phosphorus and the same change for potash is observed as in the case of phosphorus.

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CHAPTER – III

SOCIO-ECONOMIC CHARACTERISTICS OF SAMPLE HOUSEHOLDS

This chapter examines the socio-economic conditions of the sample villages from the selected districts in A.P. The analysis gives distribution of sample households, operation of landholdings, sources of irrigation, cropping pattern, area under HYV, aggregate value of crop output, farm assets and credit and outstanding liabilities for both selected crops under this study. Further, the purpose of the agricultural loan is examined in the paddy and cotton crops cultivation.

3.1 Distribution of Sample Households:

Table 3.1 presents the distribution of sample household by farm size category for both paddy and cotton. It is given 40% weight in the total sample for marginal farmers followed by small farmers with 30%. Medium and large farmers are given 24% and 12% in the total sample of study from village clusters for both crops paddy and cotton. The total sample for each crop is 120 and control group is 60. The field survey took place in 2016.

Table 3.1: Distribution of Sample Households by Farm Size Category in A.P. (% of Households)

Particulars	Paddy		Cotton	
	Soil test farmers	Control farmers	Soil test farmers	Control farmers
Marginal	48 (40.00)	24 (40.00)	36 (30.00)	24 (40.00)
Small	36 (30.00)	24 (40.00)	36 (30.00)	24 (40.00)
Medium	24 (20.00)	8 (13.33)	36 (30.00)	8 (13.33)
Large	12 (10.00)	4 (6.67)	12 (10.00)	4 (6.67)
Total	120 (100.00)	60 (100.00)	120 (100.00)	60 (100.00)

Source: Field Survey 2016.

3.2a. Socio-Economic Characteristics of Sample Households – Paddy Crop in A.P.:

The socio-economic characteristics of sample households for Paddy Crop in A.P are given Table 3.2a. The number of sample farmers is 120 and 60 for sample and control group for crop paddy and the average age of respondents is 46 years, 48 years and 47 years for soil test farmers and control farmers and overall, respectively. It shows the lower age of sample farmers compared to control group farmers. The average years of education are slight low for sample farmers (5.45) compared to control group farmers (5.77). This indicates that higher education base is with the non-sample farmers in the study for paddy crop. The agriculture has much base as the main occupation among sample farmers (97%) rather than with control

farmers group (95%). In case the of gender, both groups display an equal representation of respondents. Average family size is high for sample farmers compared with its counterpart. It is found that the sample farmers (1.97) are much engaged in agriculture comparatively with control farmer group (1.75). The farmers from sample group possess much experience in farming rather than non-beneficiaries and the same reflects for the 'member of any association', as there is a lot of variation between these two groups. In the non-beneficiaries, the scheduled castes (SC) representation is high with 12%. There is no presence of scheduled tribes (ST) in the selected villages. Other Backward Castes (OBCs) show much presence as non-beneficiaries with 32%. Other Castes are 65% and 57% of beneficiaries and non-beneficiaries in that order for paddy crop.

Table 3.2 a: Socio-Economic Characteristics of Sample Households – Paddy Crop in A.P.

Particulars	Soil test farmers	Control farmers	Overall
Number of sample farmer households	120	60	180
Average age of respondent (years)	46.02	48.45	46.83
Average years of respondent education	5.45	5.77	5.56
Agriculture as main occupation (% of respondents)	96.67	95.00	96.11
Gender (% of respondents)			
Male	98.33	98.33	98.33
Female	1.67	1.67	1.67
Average family size	3.61	3.57	3.59
Average number of people engaged in agriculture	1.97	1.75	1.89
Average years of experience in farming	28.15	24.98	27.09
% of farmers being a member of any association	43.33	23.33	36.67
Caste (% of households)			
Scheduled Castes (SCs)	10.83	11.67	11.11
Scheduled Tribes (STs)	0.00	0.00	0.00
Other Backward Castes (OBCs)	24.17	31.67	26.67
Other Castes (OCs)	65.00	56.67	62.22

Source: Field Survey 2016.

3.2b Socio-Economic Characteristics of Sample Households – Cotton Crop:

Socio-Economic Characteristics of Sample Households for Cotton Crop is shown in Table 3.2b. As in the case of paddy crop, the sample farmers/beneficiaries and control group/non-beneficiaries are 120 and 60, in that order. The average age of the respondent is high for control group farmers with 49 years. A number of years of education show nearly equal for both farmer groups for cotton crop. All the non-beneficiaries show 100% for the agriculture as the main occupation, whereas sample farmers stand with 97%. Farmers with the male are 98% in non-beneficiaries, while it is 97% for sample farmers. For females, this becomes vice versa. Average family size is 3.73 and 3.85 for beneficiaries and non-beneficiaries, while an average number of people engaged in agriculture show much in sample farmer group with 2.36. Both farmer groups are nearly with similar farming

experience. The non-beneficiaries are with much for 'member of any association'. In the composition of caste, STs have good representation in both farmer groups by 48%, followed by other castes.

Table 3.2b: Socio-Economic Characteristics of Sample Households – Cotton Crop

Particulars	Soil test farmers	Control farmers	Overall
Number of sample farmer households	120	60	180
Average age of respondent (years)	48.33	49.17	48.61
Average years of respondent education	4.79	4.80	4.79
Agriculture as main occupation (% of respondents)	97.50	100	98.33
Gender (% of respondents)			
Male	96.67	98.33	97.78
Female	3.33	1.67	2.22
Average family size	3.73	3.85	3.77
Average number of people engaged in agriculture	2.36	2.23	2.32
Average years of experience in farming	27.66	27.55	27.62
% of farmers being a member of any association	12.50	16.67	13.89
Caste (% of households)			
Scheduled Castes	3.33	3.34	3.33
Scheduled Tribes	48.33	48.33	48.33
Other Backward Castes	5.84	0.00	3.89
Other Castes	42.50	48.33	44.44

Source: Field Survey 2016.

3.3a Operational Landholdings of Sample Households–Paddy Crop:

Operational Landholdings of Sample Households–paddy Crop are presented in Table 3.3a. We can observe that the sample farmers under study in a better position for operational landholdings for all the variables under study. There are no landholdings for leased-out and uncultivated/fallow land. Beneficiaries have a better edge for leased-in land and gross cropped area with nearly double of the landholdings. In the case of cropping intensity also, we will find an analogous trend. Thus, the soil test farmers are under good operational landholding.

Table 3.3a: Operational Landholdings of Sample Households–Paddy Crop

(acres/hh)

Particulars	Soil test farmers	Control farmers	Overall
Owned land	4.31	2.53	4.05
Leased-in	2.36	1.95	2.22
Leased-out	0.00	0.00	0.00
Uncultivated/fallow	0.00	0.00	0.00
Net operated area	6.68	5.45	6.27
Net irrigated area	6.65	5.37	6.22
Net un-irrigated area	0.03	0.08	0.05
Gross cropped area	11.71	4.41	9.28
Cropping intensity (%)	175.41	80.97	148.10

Source: Field Survey 2016.

3.3b: Operational Landholdings of Sample Households – Cotton Crop:

Operational Landholdings of Sample Households– cotton crop are shown in Table 3.3b. For cotton crop, the similar trend of operational landholdings of paddy crop appears in the sample villages. Beneficiaries have a better situation compared to non-beneficiaries in operational landholdings and they show more owned and leased-in land compared to control farmers. There is no leased out land from both farmer groups. The un-irrigated area is high for the cotton crop based on the nature of cultivation of the crop in the study area, as it is cropped as rabi crop in un-irrigated land pockets in this area. The net operational area is in a larger extent for beneficiaries. The gross cropped area is three times high for sample farmers than that of the control group. There is double the cropping intensity of beneficiaries compared to non-beneficiaries. It indicates the good base of operational landholdings to the beneficiaries for cotton crop.

Table 3.3b: Operational Landholdings of Sample Households– Cotton Crop

(acres/hh)

Particulars	Soil test farmers	Control farmers	Overall
Owned land	5.93	4.68	5.49
Leased-in	1.69	0.99	1.47
Leased – out	0.00	0.00	0.00
Uncultivated/fallow	0.00	0.00	0.00
Net operated area	7.62	5.66	6.96
Net irrigated area	0.94	0.00	0.63
Net un-irrigated area	6.68	5.66	6.59
Gross cropped area	9.31	3.62	7.41
Cropping intensity (%)	122.25	63.92	106.39

Source: Field Survey 2016.

3.4a Sources of Irrigation-Paddy Crop:

Sources of irrigation-paddy crop are shown in Table 3.4a. Out of all the five sources of irrigation, there are canal and bore well irrigation for the cultivation of paddy crop for both groups of farmers in the study area. Canal irrigation has 94% and 78% for sample and non-sample farmers, respectively. Bore well irrigation has a lot of area for non-beneficiaries compared to its counterpart. Other sources of irrigation are completely absent for paddy crop.

Table3.4a: Sources of Irrigation- Paddy Crop

(% of net irrigated area)

Particulars	Soil test farmers	Control farmers	Overall
Open /dug well	0.00	0.00	0.00
Bore well	6.16	19.56	10.08
Canal	93.84	78.22	89.92
Tank	0.00	0.00	0.00
River/Ponds and Others	0.00	0.00	0.00
Total	100.00	100.00	100.00

Source: Field Survey 2016

3.4b Sources of Irrigation for Cotton Crop:

Sources of the irrigation for cotton crop are given in Table 3.4b. There is no irrigated source for the cultivation of cotton crop for the non-beneficiary group, while sample farmers have three sources of irrigation. Out of these, beneficiary farmers are much dependent on 90% of bore well irrigation followed by canal irrigation with 8%. It shows that the non-beneficiaries are much dependent on the un-irrigated area for cultivation of the cotton crop.

Table 3.4b: Sources of Irrigation-Cotton Crop

(% of net irrigated area)

Particulars	Soil test farmers	Control farmers	Overall
Open /dug well	0.00	0.00	0.00
Bore well	89.74	0.00	89.74
Canal	7.69	0.00	7.69
Tank	0.00	0.00	0.00
River/Ponds and Others	3.13	0.00	3.13
Total	100.00	0.00	100.00

Source: Field Survey 2016

3.5a Cropping Pattern of the Sample Households-Paddy Crop:

Cropping pattern of the sample households-paddy crop is given Table 3.5a. The sample farmers have a higher area under kharif compared to control group farmers and in rabi season, we can find the same trend for paddy crop. For bengal gram, the control group farmers have a larger extent for rabi crop than that of its counterpart.

Table 3.5a: Cropping Pattern of the Sample Households-Paddy Crop

(% of GCA)

Season/crop	Soil test farmers	Control farmers	Overall
Kharif			
Paddy	62.41	51.09	60.61
Rabi			
Paddy	32.29	25.32	31.19
Bengal Gram	5.30	23.59	8.20
GCA	100.00	100.00	100.00

Source: Field Survey 2016

3.5b: Cropping Pattern of the Sample Households-Cotton crop:

Cropping Pattern of the Sample Households-Cotton crop is presented in Table 3.5b. The beneficiaries show the higher area under kharif (78%) for cotton cultivation compared to non-beneficiaries (57%). Chillies reports much area for the control farmers and it comes next to cotton in the kharif season. In rabi season, bengal gram shows a higher area out of all three crops cultivated by both groups of farmers followed by green gram with 8% by non-beneficiaries. As annual crop, the cashew crop has an insignificant area in the villages selected for cotton crop.

Table 3.5b: Cropping Pattern of the Sample Households-Cotton Crop

(% of GCA)

Season/crop	Soil test farmers	Control farmers	Overall
Kharif			
Cotton	77.98	57.37	74.62
Paddy	5.19	8.30	5.70
Chilly	1.79	10.59	3.22
Rabi			
Bengal Gram	9.98	15.69	10.91
Green Gram	3.00	8.06	3.82
Black Gram	1.16	0.00	0.97
Annual /perennial			
Cashew	0.90	0.00	0.75
GCA	100.00	100.00	100.00

Source: Field Survey 2016

3.6 Area under HYV or Hybrid Variety of Major Crops:

The area under HYV or Hybrid variety of major crops is given in Table 3.6. It is found that farmers, who are engaged in paddy cultivation, are not with many crops. Against this scenario, cotton farmers are with different crops under cultivation in both groups of farmers. In the case of farmers with paddy crop, the cultivation of many crops is much constrained. It may be because of the soil specific nature, as this land is very much suitable for paddy crop only. In the case of cotton crop, it appears vice versa. In a similar way, the HYV varieties are cultivated in a larger extent by cotton farmers in both beneficiary and non-beneficiary groups. For other crops, the beneficiary farmers have adopted HYV in a larger extent. In paddy cultivation, there is the 100% of HYV for both groups of farmers, and the other crop, bengal gram has 88% and 69% of HYV for sample and control farmers, respectively, in paddy cultivated area. It is observed the application of HYV in low amount for green and black grams cropping in the cotton cultivated area, whereas chillies and bengal gram have a higher application of HYV for cultivation by both groups of farmers.

Table 3.6: Area under HYV or Hybrid Variety of Major Crops

(% of cropped area)

Crop name	Paddy farmers	Cotton farmers
Soil test farmers		
Paddy	100.00	100.00
Cotton	-	100.00
Bengal Gram	88.00	92.00
Green Gram	-	67.00
Black Gram	-	44.00
Chilly	-	98.00
Control farmers		
Paddy	100.00	100.00
Cotton	-	100.00
Bengal Gram	69.00	85.00
Green Gram	-	56.00
Black Gram	-	-
Chilly	-	100.00

Source: Field Survey 2016

3.7a: Aggregate Value of Crop Output – Paddy Crop:

The aggregate value of crop output and value of output sold– Paddy Crop is given in Table 3.7.The beneficiary farmer group has good financial strength compared to non-beneficiary farmer group for the value of output per household or per acre value output and the analogous trend appears for the value of output sold. The marginal and small farmer size groups show a lower level of value of output and value of output sold per household/acre in both sample and control farmer groups in paddy crop cultivation.

Table 3.7a: Aggregate Value of Crop Output and Value of Output Sold– Paddy Crop

Particulars	Value of output		Value of output sold	
	Rs/household	Rs/acre	Rs/household	Rs/acre
Soil test farmers				
Marginal	91,752	33,010	89,562	32,222
Small	2,06,940	33,996	2,02,744	33,306
Medium	4,47,441	32,515	4,40,591	32,017
Large	17,49,460	41,219	17,44,378	41,099
Total	24,95,592	35,185	24,77,275	34,661
Control farmers				
Marginal	60,444	20,801	57,077	19,643
Small	1,46,317	21,468	1,42,575	20,919
Medium	4,22,033	21,727	4,16,363	21,435
Large	13,58,150	33,160	13,50,875	32,982
Total	19,86,944	24,289	19,66,890	23,745

Source: Field Survey 2016

3.7b Aggregate Value of Crop Output and Value of Output Sold–Cotton crop:

The aggregate value of crop output and value of output sold–cotton crop is given in Table 3.7b. There is no variation in between value of output and value of output sold for cotton crop in the study villages. As discussed earlier for paddy crop, the farmer size groups from sample farmers display the higher level of output value and value of output sold except for marginal farmer size group and this farmer size group has better output and sold value for control farmer group. The highest per household output value is with large farmer group in both sample and control farmer groups. The same trend is with the value of output sold. The better value of output and value of output sold are with large farmer groups in the beneficiary and non-beneficiary groups.

Table 3.7b: Aggregate Value of Crop Output and Value of Output Sold–Cotton Crop

Particulars	Value of output		Value of output sold	
	Rs/household	Rs/acre	Rs/household	Rs/acre
Soil test farmers				
Marginal	52,031	29,065	52,031	29,065
Small	1,22,653	30,879	1,22,653	30,879
Medium	2,81,967	28,496	2,81,967	28,496
Large	8,76,992	34,221	8,76,992	34,221
Total	2,24,694	30,950	2,24,694	30,950
Control farmers				
Marginal	55,773	33,199	55,773	33,199
Small	1,10,904	28,546	1,10,904	28,546
Medium	3,41,050	23,314	3,41,050	23,314
Large	3,99,800	32,150	3,99,800	32,150
Total	1,38,798	27,729	1,38,798	27,729

Source: Field Survey 2016

3.8a Distribution of Farm Assets- Paddy Crop:

The distribution of farm assets- paddy crop is given in Table 3.8a. The distribution of farm assets is in favour of 'soil test farmers' and they have higher assets and in these stand for tractors, harrows, electric motor, animal shed/pump house. Thus, the total value of the farm assets accrued to 0.67 lakhs for beneficiary farmers, while it is only 0.63 lakhs to the non-beneficiaries. In manual sprayer and bulk cart, control farmers have better edge of asset distribution. It indicates the less mechanization in cultivation for the non-beneficiaries for paddy crop. The tractorisation is much found in the sample farmer group.

Table 3.8a: Distribution of Farm Assets- Paddy Crop

Particulars	Soil Test Farmers		Control Farmers	
	Number/ household	Value/ household (Rs)	Number/ household	Value/ household(Rs)
Tractor, trailer/trolley	0.16	54,542	0.18	51,667
Harrow and cultivator	0.05	1,433	0.05	967
Electric motor/diesel engine	0.16	4,450	0.13	3,158
Thresher	0	0	0	0
Planker	0	0	0	0
Manual/power sprayer	0.2	1,548	0.23	2,717
Food chopper	0		0	
Bullock cart	0.01	417	0.07	4,250
Drip/sprinkler system	0	0	0	
Small tools (spade, hoe, sickle etc.)	0.03	75	0	0
Animal shed/pump house	0.04	1,155	0	0
Others	0.12	4,000	0	
Total	0.77	67,620	0.66	62,759

Source: Field Survey 2016.

3.8b Distribution of Farm Assets -Cotton Crop:

The distribution of farm assets for cotton crop is given in Table 3.8b. The asset distribution of soil test farmers is greater than that of the control farmers. The total number of assets is 0.94 and 0.64per household for sample and control farmers, respectively. Tractors, cultivators, electric motors, manual sprayers are possessed in higher level by sample farmers than their counterpart. For threshers, bullock carts and others, control farmer group shows higher level. It informs that the sample farmers are comparatively in a better distribution of farm assets.

Table 3.8b Distribution of Farm Assets -Cotton Crop

Particulars	Soil Test Farmers		Control Farmers	
	Number/ household	Value/ household (Rs)	Number/ household	Value/ household(Rs)
Tractor, trailer/trolley	0.12	33,333	0.08	31,167
Harrow and cultivator	0.04	750	0.08	1,200
Electric motor/diesel engine	0.32	14,935	0.03	1,200
Thresher	0		0.02	2,400
Planker	0	0	0	0
Manual/power sprayer	0.3	1,640	0.03	540
Food chopper	0		0	
Bullock cart	0.13	3,733	0.3	5,067
Drip/sprinkler system	0.01	125	0	0
Small tools (spade, hoe, sickle etc.)	0	0	0	0
Animal shed/pump house	0.01	417	0	0
Others	0.01	50	0.1	258
Total	0.94	54,983	0.64	41,832

Source: Field Survey 2016.

3.9a Agricultural Credit Outstanding by the Sample Household for Paddy Crop:

The agricultural credit outstanding amount by the sample households for paddy crop is given in Table 3.9a. The sample farmer group has much outstanding credit in cooperative banks with 45% followed by commercial banks with 34%, while the control farmers have higher credit in commercial banks with 32% followed by cooperative credit with 17%. The control farmers have the higher loan amount at money lenders with 13%, whereas it is only 5% for sample test farmers. The higher part of the sample farmers (88%) have outstanding amount, while it is only 62% in the case of control farmers. The sample farmers have the outstanding in RRBs with 0.05 lakhs, whereas this is absent for control farmers across selected villages.

Table 3.9a: Agricultural Credit Outstanding by Sample Households- Paddy Crop

(Rs/household)

Source	Soil test farmers	% of farmers	Control farmers	% of farmers
Co-operative credit societies	43858.33	45.00	3833.33	16.67
Land development banks	0.00	0.00	0.00	0.00
Commercial banks	36416.67	34.17	23833.30	31.67
RRBs	5375	3.33	0.00	0.00
Money lenders	3333.33	5.00	9166.67	13.33
Friends/relatives	0.00	0.00	0.00	0.00
Traders/commission agents	0.00	0.00	0.00	0.00
Others	0.00	0.00	0.00	0.00
Total	88983.33	87.50	36833.30	61.67

Source: Field Survey 2016

3.9b Agricultural Credit Outstanding by Sample Households- Cotton Crop:

Agricultural credit outstanding by the sample households for cotton crop is given in Table 3.9b. The sample farmer group has much outstanding credit in commercial banks with 40%, while the control farmers have higher credit in cooperative credit societies with 18%. Sample farmers do not have outstanding amount at moneylenders, though the control farmers do have in little transaction. The second highest outstanding credit is reported at co-operative societies by 8 thousand for both groups of farmers. The total outstanding is high to sample farmers than that of the other farmer group. Control farmers have the borrowings at moneylenders and it is not there for the sample farmers. Both group of farmers do not show loan realisation from traders/commission agents and friends/relatives. The major part of loans are from institutional sources for both sample and non-sample farmers in the study area.

Table 3.9b: Agricultural Credit Outstanding by Sample Households- Cotton Crop

(Rs/household)

Source	Soil test farmers	% of farmers	Control farmers	% of farmers
Co-operative credit societies	7875	6.67	8333.33	18.33
Land development banks	0.00	0.00	0.00	0.00
Commercial banks	55750	40.00	1058.33	10.00
RRBs	6666.67	5.83	28666.70	15.00
Money lenders	0.00	0.00	1583.33	3.33
Friends/relatives	0.00	0.00	0.00	0.00
Traders/commission agents	0.00	0.00	0.00	0.00
Others	0.00	0.00	0.00	0.00
Total	70291.67	52.50	39641.69	46.67

Source: Field Survey 2016

3.10a Purpose of Agricultural Loan Availed-Paddy Crop:

The purpose of agricultural loan availed-paddy crop is given in Table 10.a. The purpose of the loan was meant for 81% and 69% for seasonal crop cultivation of soil test farmers and control farmers, respectively, for paddy crop. It indicates the productive purpose

of the loan borrowed by peasants. However, in the case of other purposes, there are certain variations between two groups of farmers. In the purchase of a tractor and other implements, sample farmers show the high amount, while control farmers show the little amount. For consumption expenditure, and marriage and social ceremonies, control farmers spent double of the sample farmer group. To livestock and land development, both farmers did not spend the borrowed amount for paddy crop cultivation.

Table 10a: Purpose of Agricultural Loan Availed-Paddy Crop

(% of farmers)

Source	Soil test farmers	Control farmers
Seasonal crop cultivation	80.83	68.75
Purchase of tractor and other implements	5.00	2.08
Purchase of livestock	0.00	0.00
Land development	0.00	0.00
Consumption expenditure	7.50	16.67
Marriage and social ceremonies	5.83	12.50
Non-farm activities	0.83	0.00
Other expenditures	0.00	0.00
Total	100.00	100.00

Source: Field Survey 2016

3.10b.Purpose of Agricultural Loan Availed-Cotton Crop:

The purpose of Agricultural Loan Availed-Cotton Crop is given in Table 3.10b. It is observed that the cotton crop has the higher spending loan for seasonal crop cultivation compared to soil test farmers. Purchase of tractor and other implements had much spending from beneficiary farmers than that of non-beneficiary farmers. There is no spending for the purchase of livestock and land development by both farmer groups. Consumption expenditure appears in borrowed amount by 14% and 13% for both sample and control farmers in cotton crop cultivation.

Table 3.10b: Purpose of Agricultural Loan Availed-Cotton Crop

(% of farmers)

Source	Soil test farmers	Control farmers
Seasonal crop cultivation	67.50	68.42
Purchase of tractor and other implements	8.33	7.89
Purchase of livestock	0.00	0.00
Land development	0.00	0.00
Consumption expenditure	14.17	13.16
Marriage and social ceremonies	7.50	10.53
Non-farm activities	2.50	0.00
Other expenditures	0.00	0.00
Total	100.00	100.00

Source: Field Survey 2016.

3.11 Training Programme Attended on Application of Chemical Fertilisers by the Sample Farmers:

The training programme attended on the application of chemical fertilizers by the sample farmers is shown in Table 3.11 In all the three variables taken, the sample farmers of paddy crop have shown the higher representation and it indicates the much interest in them towards the latest technical know-how. Many sample farmers have attended to the training programmes of paddy crop compared to control farmers and they show much interest in training programmes and in the duration of training programme. In the case of cotton crop, the similar trend appears for the programmes run. The sample farmers of the cotton crop have attended at 27%, while it is only 21% for control farmers and the number of training programmes attended is also high for the sample farmers of the cotton crop. Soil test sample farmers have attended many days (6) to the training programmes compared to control farmers (4). Hence, it is confirmed that the taken sample farmers for both crops paddy and cotton are much interested in the soil testing programme in the study villages.

Table 3.11: Training Programme Attended on Application of Chemical Fertilisers By the Sample Farmers

Particulars	Paddy crop	Cotton crop
Soil test farmers		
Average number of trainings attended	10-12	2-5
% of farmers attended	43.00	27.00
Average number of days	12	6
Control farmers		
Average number of trainings attended	8-10	2-4
% of farmers attended	39.00	21.00
Average number of days	10	4

Source: Field Survey 2016

Summary:

The average family size is high for sample farmers compared to control farmers and there are no STs. either in the sample or in the control group for paddy crop. In the case of the cotton crop, there is a good representation of STs. in sample and control farmer groups. The sample farmers of paddy crop are in a better position for operational landholdings than its counterpart and the same picture is shown for cotton crop. Sample and non-sample farmers have 94% and 78% canal irrigation, respectively, for paddy crop cultivation, though bore well irrigation has much portion for non-beneficiaries compared to its counterpart. Cotton crop has a different scenario since beneficiary farmers are much dependent on 90% of bore well irrigation followed by canal irrigation with 8%. In cropping pattern, the sample farmers have a higher area under kharif compared to control group farmers for paddy crop, and in rabi season, we can find the same trend. In the cotton crop, the cropping pattern has a polyculture,

which is absent in paddy crop cultivation. In paddy cultivation, there is 100% of HYV for both groups of farmers. It is observed the application of HYV in fewer amounts for green and black grams in the cotton cultivated area, whereas chillies and bengal gram have higher application HYV for cultivation by both groups of farmers. The beneficiary farmer group has a better edge in aggregate output and value of output sold than that of the non-beneficiary group in paddy crop and the lower size farmer groups have disadvantage out of all groups. For cotton crop, the similar trend appears. The distribution of farm assets is in favour of 'soil test farmers' in paddy and cotton cultivation. The sample farmer group has much outstanding credit in cooperative banks (0.44 lakhs) followed by commercial banks (0.36 lakhs) for paddy crop, whereas cotton farmers show the higher amount in commercial banks and RRBs. Many sample farmers have attended to the training programmes of both crops-paddy and cotton compared to control farmers and they show much interest in training programmes and in its duration of training.

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CHAPTER – IV

DETAILS OF SOIL TESTING & RECOMMENDED DOSES OF FERTIILISERS

In this chapter, the analysis is made for distribution of sample soil test farmers, sources of information about soil testing and reasons for soil testing of sample households. The status of soil health in terms of nutrients on the sample average quantity of split doses of fertilisers is estimated based on soil test. It is further examined the average quantity of split doses of fertilisers recommended based on the field survey**.**

4.1 Distribution of sample Soil Test Farmers-Paddy crop:

The distribution of sample soil test farmers for paddy crop is presented in Table 4.1. It is taken place for the soil testing with much tilt towards marginal and small farmers by 40% and 30%, respectively, for the last two years, and medium and large farmers are given 20% and 10%, in that order. There is no cost of soil testing to any farmer group under study. The average distance of soil testing laboratory ranges from 28 km to 30 km for paddy crop cultivation. The lower distance appears for marginal and small farmer size groups rather than with medium and large farmers. The per plot soil testing is only one testing for all farmer groups. A number of plots for soil testing are high for medium and large farmers since these groups farmers would have large area under cultivation. The lowest coverage is reported for marginal farmer group with 0.85 acres, while other groups show ranging from 11 acres to 2 acres. No farmer collected the soil test samples on their own. All the soil test samples from all farmer sizes are collected from the department personnel.

Table 4.1: Distribution of Sample Soil Test Farmers -Paddy crop

Particulars	Marginal	Small	Medium	Large	Total
% of farmers tested their soil in the last two years	40.00	30.00	20.00	10.00	100.00
Average cost of soil testing (Rs/sample)	0.00	0.00	0.00	0.00	0.00
Average distance from field to soil testing lab (km)	28.35	28.89	28.25	29.58	28.62
Average number of soil samples taken per plot	1.00	1.00	1.00	1.00	1.00
Average no. of plots considered for soil testing	1.04	1.00	1.33	1.75	1.16
Average area covered under soil test (acre)	0.85	1.95	4.94	11.06	3.02
Area covered as % of net operated area					
% of farmers who collected samples themselves	0.00	0.00	0.00	0.00	0.00
% of soil sample collected by the department officials	100.00	100.00	100.00	100.00	100.00

Source: Field survey 2016

4.2 Distribution of Sample Soil Test Farmers for Cotton crop:

The distribution of sample soil test farmers for cotton crop is given in Table 4.2**.** For last two years, marginal, small and medium farmer groups had 30%, while the large farmer

group had 10% in the soil testing. It is not found any cost of soil testing to the farmer. The average distance from soil sample to the testing laboratory is reported from 27 km to 30 km for different farmer size groups for cotton crop. The lowest distance appears to medium group with 27 km. and the highest is to larger farmer group with 30 km. With a little variation, all the farmer groups have the same average number of samples with 1.00 per plot. In the case of an average number of plots considered, the soil testing is high for larger farmer group with 2.50 followed by 1.44 of medium farmers. The average area for soil testing is found with the highest of larger farmer group with 10.57 acres and the lowest of medium of farmer group with 0.77 acres. There are no collection samples by the farmers at their own interest. All the collection of soil testing samples is done for all the groups of farmers 100% by the personnel of the 'Department of Agriculture' for the cotton crop.

Table 4.2: Distribution of Sample Soil Test Farmers-Cotton Crop

Particulars	Marginal	Small	Medium	Large	Total
% of farmers tested their soil in the last two years	30.00	30.00	30.00	10.00	100.00
Average cost of soil testing (Rs/sample)	0.00	0.00	0.00	0.00	0.00
Average distance from field to soil testing lab (km)	27.33	28.00	27.03	30.17	27.73
Average number of soil samples taken per plot	1.00	1.00	1.04	1.04	1.02
Average no. of plots considered for soil testing	1.00	1.17	1.44	2.50	1.33
Average area covered under soil test (acre)	0.77	1.64	4.36	10.57	3.09
Area covered as % of net operated area					
% of farmers who collected samples themselves	0.00	0.00	0.00	0.00	0.00
% of soil sample collected by the department officials	100.00	100.00	100.00	100.00	100.00

Source: Field Survey 2016

4.3 Sources of Information about Soil Testing:

Sources of information about soil testing by sample households of soil test farmers are given in Table 4.3. There are five sources referred in our study for soil testing. Both paddy crop cultivators and cotton crop cultivators have the 100% source of information from the state agricultural department and the remaining sources viz. SAUs, KVKs, private companies and friends and relatives, have no role in the soil testing for any farmer size group in the study area. All the farmer groups are much dependent on state agricultural department.

Table 4.3: Sources of Information about Soil Testing by Sample Households of Soil Test Farmers

(% of farmers)

Sources	Marginal	Small	Medium	Large	Total
Paddy crop					
SAUs	0.00	0.00	0.00	0.00	0.00
KVKs	0.00	0.00	0.00	0.00	0.00
State Agri. department	100.00	100.00	100.00	100.00	100.00
Private companies	0.00	0.00	0.00	0.00	0.00
Friends/neighbours	0.00	0.00	0.00	0.00	0.00
Total	100.00	100.00	100.00	100.00	100.00
Cotton crop					
SAUs	0.00	0.00	0.00	0.00	0.00
KVKs	0.00	0.00	0.00	0.00	0.00
State Agri. Department	100.00	100.00	100.00	100.00	100.00
Private companies	0.00	0.00	0.00	0.00	0.00
Friends/neighbours	0.00	0.00	0.00	0.00	0.00
Total	100.00	100.00	100.00	100.00	100.00

Source: Primary data 2016.

4.4 Reasons for Soil Testing of Sample Households of Soil Test Farmers:

The reasons for soil testing of sample households of soil test farmers are given in Table 4.4. The reason ‘ motivation from village demonstration etc.’ leads for all reasons, as it has 54% of households by ‘most important’ out of all reasons followed by ‘for increasing crop yield’ with 37% for paddy crop. The ‘Peer farmers group pressure’ also displays 33% most important. Under ‘important’, we can see the highest to ‘adopt new technological practices’ with 42% of farmers out of all referred reasons and the next comes ‘motivation from village demonstration etc’ by 35% of sample households followed by ‘for increasing crop yield’ with 32% of sample households. In the soil testing, households give the highest least importance to ‘for availing benefits under subsidy schemes’ with 72% of farmers from paddy crop cultivation.

For cotton crop, the most important from the reasons is ‘for increasing crop yield’ with 56% of households followed by ‘motivation from village demonstration etc’ with 37% households. The reason ‘adopt new technological practices’ also shows 30% households for the ‘most important reason’. The households of the sample show importance for the reason ‘motivation from village demonstration etc’ with 45% of sample farmers. The next reason is ‘peer farmers group pressure’ with 31% of households under ‘important’. The cotton farmer households are clearly expressing the ‘least importance’ to ‘for availing benefits under subsidy schemes’ with 62% and the reasons namely ‘peer farmers group pressure ‘and ‘adopt new technological practices’ report 48% of households under the same weight for the cotton crop.

Table 4.4: Reasons for Soil Testing of Sample Households of Soil Test Farmers

(% of farmers)

Reasons	Paddy crop				Cotton crop			
	Most impor-tant	Impor-tant	Least impor-tant	Total	Most impor-tant	Impor-tant	Least impor-tant	Total
For availing benefits under subsidy schemes	6.67	20.83	72.50	100.00	9.17	28.33	62.50	100.00
For increasing crop yield	37.50	31.67	30.83	100.0	55.83	26.67	17.50	100.00
Motivation from village demos/training/ exposure visits to places with best farming practices	54.17	35.00	10.83	100.00	37.50	45.00	17.50	100.00
Peer farmers group pressure	33.33	30.00	36.67	100.0	20.83	30.83	48.33	100.00
Adopt new technological practices	32.50	42.50	25.00	100.0	30.00	21.67	48.33	100.00
Others	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Source: Primary data 2016

4.5 Reasons for not Testing Soil systems by Control Farmers:

The reasons for not testing soil during the last three years of control farmers are given in Table 4.5. The non-sample farmers express the 'most important' reason for not soil testing as 'Others' with 61% of the sample for paddy crop. The remaining significant reasons under 'most important' are 'do not know how to take samples' with 22% and 'do not know whom to contact for details on testing' with 17% of control farmers. These reasons indicate that control farmers are aware of the support of government and sample execution in the field. Under 'important', all the reasons except 'Others' report more than 27% of the non-sample farmers and it obviously explains the significance of these reasons for not testing the soil in paddy cultivation during the last three years. This is further confirmed by the opinion of the control farmers expressed over the 'least important' in the paddy cultivation.

In the case of the cotton crop, the analogous opinion of the paddy peasants appears for not testing the soil. The reasons viz. 'Others, 'do not know whom to contact for details on testing' and 'soil testing laboratories are located far away' show 71%, 62% and 30%, respectively. Under 'important', all reasons except 'others' inform more than 25% of households. It demonstrates the causative effect of the reasons under study for the non-soil testing of cotton farmers. The 'least importance' weight given to the reasons also confirms the above factorial effect for non-soil testing of the cotton crop cultivation of non-sample farmers.

Table 4.5 Reasons for not Testing Soil systems by Control Farmers
(% of farmers)

Reasons	Paddy crop				Cotton crop			
	Most impor-tant	Impor-tant	Least impor-tant	Total	Most impor-tant	Impor-tant	Least impor-tant	Total
Do not know how to take soil samples.	22.50	51.67	25.83	100.00	11.67	39.17	49.17	100.00
Do not know whom to contact for details on testing	16.67	39.17	44.17	100.00	62.50	25.00	12.50	100.00
Soil testing laboratories are located far away	8.33	45.83	45.83	100.00	30.00	27.50	42.50	100.00
Soil testing not required for my field as crop yield is good	15.83	26.67	57.50	100.00	6.67	36.67	56.67	100.00
Others	60.83	21.67	17.50	100.00	70.83	16.67	12.50	100.00

Source: Primary data 2016

4.6 Status of Soil Health of Sample Farms from the Health Card of Sample Farmers:

The status of soil health in terms of nutrients of sample soil test farms (as reported in the soil health card) of soil test farmers is given in Table 4.6. Among the soil test farms of paddy, we can find the low existence of nitrogen by 61%, which is the highest out of all the fertilisers of the selected soil test farms. The high usage of nitrogen appears among 13% soil test farms, while the normal dose is found with 11% of sample farms in paddy cultivation. In the phosphorus dosage, soil test farms report 56% high, whereas the other extreme of low-level dosage is also with 26% sample farms. This dispels that the farmers are with much lack of knowledge over the dose of the chemical fertilizer input in the cultivation and further, the normal dose is covered with 5% farms only in the paddy cultivation. For the potassium fertiliser, the sample farms display 52% and 34% of high and medium usage in the dose and the other two elements like ‘normal’ and ‘low’ show insignificant share in the sample farms across paddy cultivation.

Contrary to the paddy cultivation, we can see the low-level use of nitrogen by 92% sample farms in the cotton cultivation and the normal dose is with 5% farms only. Though there is the usage of a dose of ‘high’ and ‘medium’ by meager farms, the existence of nitrogen shortage in the cultivation of cotton appears in the sample farms. Supporting to this, phosphorus usage is taken place at a higher level by 79% with including of ‘high’ (52%) and ‘medium’ (27%) dosage in the cotton cultivation of sample farms. In the case of potassium, the normal usage is covered with 1% soil test farms in the cotton cultivation, on the other, this fertiliser has the use of 57% high and 16% medium. At the same time, the lower dose exists with 27% sample farms in the cotton cultivation. Hence, this obviously permits us to infer the non-existence of proper soil health for the cultivation of paddy and cotton crops in

the study area. There is a lot of requirement of scientific soil testing and the subsequent dose implementation in the farms of the selected districts in A.P.

Table 4.6: Status of Soil Health in Terms of Nutrients of Sample Soil Test Farms (as reported in the Soil Health Card) of Soil Test Farmers

Fertilisers	Normal	High	Medium	Low	Total
Paddy					
Nitrogen	10.83	13.33	15.00	60.83	100.00
Phosphorus	5.00	55.83	13.33	25.83	100.00
Potassium	7.50	51.67	34.17	6.67	100.00
Cotton					
Nitrogen	5.00	2.50	0.83	91.67	100.00
Phosphorus	5.83	52.50	26.67	15.00	100.00
Potassium	0.83	56.67	15.83	26.67	100.00

Source: Primary data 2016

4.7 Average Quantity of Recommended Doses of Fertilisers of Soil Test Farmers:

The average quantity of recommended doses of fertilisers given based on soil test (as reported in the health card) of soil test farmers is given in Table 4.7. The recommended doses for paddy refers to urea 104 kgs, while it is high for the cotton crop with 174 kgs. For DAP, the dose of kharif of paddy shows similar to the dose of cotton, whereas it is high in the rabi season for paddy. In the case of single super phosphate, paddy crop has a similar dose in kharif and it differs in the rabi season with the dose of cotton. Potash dosage also shows a difference between paddy and cotton crops in rabi season.

Table 4.7: Average Quantity of Recommended Doses of Fertilizers Given Based on Soil Test (as reported in the Health Card) of Soil Test Farmers

(kg/ acre)

Crop	Paddy kharif		Paddy Rabi		Cotton	
	Straight fertilizer	Complex	Straight fertilizer	Complex	Straight fertilizer	Complex
Urea	104	84	209	178	174	153
DAP	-	52	-	78	-	52
Single Super Phosphate	150	-	225	-	150	-
Potash	27	27	53	53	40	40

Source: Field Survey 2016

4.8 Average Quantity of Split Doses of Fertilisers Recommended of Soil Test Farmers:

The average quantity of split doses of fertilisers recommended by the state of crop growth of soil test farmers is given in Table 4.8. There are five major stages for growing for paddy and cotton crops and these are basal, intercrop cultivation, vegetative, flowering and grain formation. During grain formation, there is no need of any chemical fertilizer as per the dosage recommended for either crop under study. The rabi cropping of paddy shows the highest dosage for all the fertilsers compared to cotton cropping. This scenario varies in the

case of kharif paddy compared to cotton cropping. During the basal application, cotton crop demands much urea and potash against to its counterpart's requirement. In the following stages of crop growing, cotton exhibits the higher dosage compared to the dosage of the kharif season of paddy cropping.

Table 4.8: Average Quantity of Split Doses of Fertilisers Recommended By Stages of Crop Growth of Soil Test Farmers

(kgs./acre)

Particulars	Basal application		After inter cultivation (weeding, thinning, etc.)		Vegetative growth		Flowering		Grain formation	
	Straight	Complex	Straight	Complex	Straight	Complex	Straight	Complex	Straight	Complex
Paddy Kharif										
Urea	35	28	0	0	34	28	35	28	0	0
DAP	00	52	0	0	0	0	0	0	0	0
SSP	150	0	0	0	0	0	0	0	0	0
Potash	13.50	13	0	0	0	0	13.50	13	0	0
Paddy Rabi										
Urea	70	60	0	0	69	59	70	59	0	0
DAP	00	78	0	0	0	0	0	0	0	0
SSP	225	0	0	0	0	0	0	0	0	0
Potash	26.5	26.5	0	0	0	0	26.5	26.5	0	0
Cotton										
Urea	44	38	43	39	44	38	43	38	00	00
DAP	00	52	00	00	00	00	00	00	00	00
SSP	150	00	00	00	00	00	00	00	00	00
Potash	20	20	00	00	00	00	20	00	00	00

Source: Soil Test Department, Govt. of Andhra Pradesh.

Summary:

There is the requirement for the encouragement of marginal and small farmer groups who are to be encouraged for better production or yields. A number of plots for soil testing are high for medium and large farmers since these group farmers would have many areas under cultivation. No farmer collected the soil test samples on their own knowledge. All the collection of soil testing samples is done 100% for all the groups of farmers by the department personnel. Though there are five sources referred in our study for soil testing, only one source, i.e. the Department of Agriculture (state government) has the role of 100% in generating the whole soil testing samples to all farmers groups. The reason ' motivation from village demonstration etc.' leads for all reasons, as it has 54% of households by 'most important' out of all reasons followed by 'for increasing crop yield' with 37% of paddy crop. For cotton crop, the most important of the reasons is 'for increasing crop yield' with 56% of households followed by 'motivation from village demonstration etc' with 37% households.

The non-sample farmers express the ‘most important’ reason for not soil testing as ‘Others’ with 61% of the sample for paddy crop.

Among the soil test farms of paddy, we can find the low existence of nitrogen by 61%, which is the highest out of all the fertilisers of the selected soil test farms. Contrary to the paddy cultivation, we can see the low-level use of nitrogen by 92% sample farms in the cotton cultivation and the normal dose is with 5% farms only. In the case of potassium, the normal usage is covered with 1% soil test farms in the cotton cultivation, on the other hand, this fertiliser has the use of 57% high and 16%, medium. It obviously permits us to infer the non-existence of proper soil health for the cultivation of paddy and cotton crops in the study area. There is a lot of requirement of scientific soil testing and the subsequent dose implementation in the farms of the selected districts in A.P.

The recommended doses for paddy refers to urea 104 kgs, while it is high for the cotton crop with 174 kgs. For DAP, the dose of kharif of paddy shows similar to the dose of cotton, whereas it is high in the rabi season for paddy. In the case of single super phosphate, paddy crop has a similar dose in kharif and it differs in the rabi season with the dose of cotton. There are five major stages for growing paddy and cotton crops and these are basal, intercrop cultivation, vegetative, flowering and grain formation. During grain formation, there is no need of any chemical fertilizer as per the dosage recommended for either crop under study. The rabi cropping of paddy shows the highest dosage for all the fertilisers compared to cotton cropping. This scenario varies in the case of kharif paddy compared to cotton cropping and the cotton crop shows higher dosage need.

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CHAPTER – V

ADOPTION OF RECOMMENDED DOSES OF FERTILISERS AND ITS CONSTRAINTS

In this chapter, the analysis is taken place for the estimation of application and constraints in the recommended doses of fertilisers. It is examined the level of awareness and sources of information of sample households, the actual quantity of fertilisers along with split doses and method of application of chemical fertilisers. The application of organic fertilisers in the cultivation is analyzed for the selected crops. Sources and quantities of purchases of chemical fertilisers are outlined as per the given information to farmers. It is examined the average prices of fertilisers and its transport costs and the participation of farmers in the training programmes of dosage of fertilisers and its relevant information.

5.1 Application of Recommended Doses of Fertilisers for Paddy and Cotton:

The application of recommended doses of fertilisers for paddy and cotton crops of soil test farmers is given in Table 5.1. The application of recommended doses of fertilisers is the lowest for marginal farmers (17%) in paddy cultivation and the highest appears for large farmers with 25%. The analogous trend is shown for an average area under application of recommended dosages of fertilisers, while larger famer size group has the highest with 5 acres and the marginal farmer group followed with 0.40 acres. The area covered under net operated area is at the larger extent to marginal farmers rather than other groups. All land holding size groups followed the application of recommended doses for two seasons. For paddy crop, the farmers from all size groups are willing to continue the application of recommended doses in the coming years.

Table 5.1: Application of Recommended Doses of Fertilisers for Paddy and Cotton of Soil Test Farmers

Particulars	Marginal	Small	Medium	Large	Total
Paddy					
% of farmers applies recommended doses of fertilisers	16.67	27.78	33.33	25.00	25.69
Average area (acre)	0.40	1.00	1.98	5.00	2.09
Area covered as % of net operated area	36.25	25.65	16.52	18.52	24.24
Average number of seasons applied	2	2	2	2	2
% of farmers willing to continue applying recommended doses of fertilisers	100.00	100.00	100.00	100.00	100.00
Cotton					
% of farmers applies recommended doses of fertilisers	36.11	22.22	33.33	33.33	31.25
Average area (acre)	0.43	1.20	2.85	8.50	3.24
Area covered as % of net operated area	19.50	21.00	36.40	40.20	29.28
Average number of seasons applied	1	1	1	1	1
% of farmers willing to continue applying recommended doses of fertilisers	100.00	100.00	100.00	100.00	100.00

Source: Field Survey 2016

The peasants from the marginal group for cotton crop cultivation have adopted the recommended doses of fertilisers at higher level by 36% followed by medium and large farmers group with 33%. This situation is different from paddy crop cultivation, where the marginal

farmer group shows the lowest adoption. The area under application is at larger extent for larger farmer group and the similar trend appears for the net operated area. As the cotton crop is cultivated in rabi season only, there is one crop application for cotton crop for all the groups of farmers. We will find the same as in case of paddy for continuing the application of recommended doses of fertilisers in coming seasons for cotton crop.

5.2 Constraints in Applying Recommended Doses of Fertilisers:

The constraints in applying recommended doses of fertilisers are given in Table 5.2. The paddy farmers express that there is an adequate availability of fertiliser for the application. The very limited farmers from the marginal group say about the high prices of fertilisers. In the case of purchase of fertilisers, marginal farmers group (9%) viewed that they lacked money for purchase of fertilisers for the application of recommended doses of fertilisers. All the farmers are comfortable in the application of recommended doses of fertilisers, as all the groups inform the proper advice in the use of method and application. All the farmer groups view that there is no difficulty in understanding and following the recommended doses of fertilisers in paddy cultivation.

Table 5.2 Constraints in Applying Recommended Doses of Fertilisers

(% of farmers)

Reasons	Paddy				Cotton			
	Most impor-tant	Import-ant	Least impor-tant	Total	Most impor-tant	Impor-tant	Least impor-tant	Total
Adequate quantity of fertilisers not available	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Prices of fertiliser are high	4.50	0.00	0.00	4.50	8.50	10.00	0.00	18.50
Lack of money to purchase fertilisers	9.50	0.00	0.00	9.50	21.00	14.50	0.00	35.50
No technical advice on method and time of fertiliser application	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Difficult to understand and follow the recommended doses	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other	86.00	0.00	0.00	86.00	70.00	0.00	0.00	70.00

Source: Field Survey 2016.

In the cultivation of the cotton crop, either group of farmers does not report the inadequacy of availability of fertilisers. For the high prices of fertilisers, farmers from marginal (8%) and small (10%) groups informed the prevailing high prices for application of recommended doses. Marginal (21%) and small (14%) farmers faced with a lack of money for the purchase of fertilisers. The cotton cultivators of all farmer size groups did not find any non-availability of technical advice in the application of recommended doses of fertilisers and they had no difficulty to understand and follow the recommended doses in their fields. No farmer group of paddy and cotton crops has constraints in the application of doses recommended by the department officials.

5.3 Awareness and Sources of Information of Recommended Doses of Fertilisers:

The awareness and sources of information of recommended doses of fertilisers of sample households and control farmers are given in Table 5.3. In the paddy cultivation, medium and large farmers have 100% awareness than other two groups. Marginal farmer size group has the lowest awareness out of all groups with 79% awareness. The information about soil testing is received from the Department of Agriculture and it shows 100% use and generation of information and the remaining sources have no role in the generation of soil testing information. For cotton cultivation, we find a similar trend as in paddy crop. Except for marginal farmer group, all the other groups in cotton cultivation show 100% awareness over the soil testing. In the case of sources of information, farmers express that they are 100% dependent on department of agriculture for information of soil testing.

Table 5.3: Awareness and Sources of Information of Recommended Doses of Fertilisers of Sample Households and Control Farmers

(% of farmers)

Source	Marginal	Small	Medium	Large	Total
Paddy					
% of awareness	79.50	83.42	100.00	100.00	90.73
Source of information					
Department of agriculture	100.00	100.00	100.00	100.00	100.00
Agricultural university	0.00	0.00	0.00	0.00	0.00
Cooperatives/growers association	0.00	0.00	0.00	0.00	0.00
Private input dealers	0.00	0.00	0.00	0.00	0.00
Fellow farmers	0.00	0.00	0.00	0.00	0.00
NGO/others	0.00	0.00	0.00	0.00	0.00
Total	100.00	100.00	100.00	100.00	100.00
Cotton					
% of awareness	86.75	100.00	100.00	100.00	96.69
Source of information					
Department of agriculture	100.00	100.00	100.00	100.00	100.00
Agricultural university	0.00	0.00	0.00	0.00	0.00
Cooperatives/growers association	0.00	0.00	0.00	0.00	0.00
Private input dealers	0.00	0.00	0.00	0.00	0.00
Fellow farmers	0.00	0.00	0.00	0.00	0.00
NGO/others	0.00	0.00	0.00	0.00	0.00
Total	100.00	100.00	100.00	100.00	100.00

Source: Field Survey 2016.

5.4 Actual Quantity of Fertilisers Applied in 2015 for Paddy Crop:

The actual quantity of fertilisers applied by the sample farmers in 2015 for paddy crop is given in Table 5.4. The range of urea appears 95 kgs. to 101 kgs. among the peasant size groups, however, small and medium farmers used higher dose by 106 kgs. and 105 kgs. in that order. DAP was used between 51 kgs. and 56 kgs. among farmer groups, though small and marginal farmers used higher doses, 56 kgs and 55 kgs, respectively, compared to other two groups. For SSP and potash fertilisers, the dose had no much variation among farmer size groups. However, complex fertilisers showed a lot of variation, as the range took place between 84 kgs. and 125 kgs. The

large farmer used the highest dose of 125 kgs. followed by small farmer group with 96 kgs. The lowest dose of complex fertiliser took place in the fields of marginal farmers with 84 kgs.

Control farmers of paddy crop displayed the highest usage of dose for the fertilisers compared to sample farmers and the total fertilizers of average of control farmers reported much higher than that of sample farmers for all varieties of fertilisers under study. The usage of fertiilsers show much variation among farmer groups under the control farmer groups : as urea 130 & 140 kgs., DAP 74 & 71 kgs., SSP 166 & 160 kgs, potash 53 & 49 kgs. and complex 135 & 115 kgs. It shows obviously the better edge of sample farmers for the dosage of fertilisers in the cultivation of paddy. We can find the higher doses by all the sizes of farmers under control farmer group.

Table 5.4: Actual Quantity of Fertilisers Applied by the Sample Farmers in 2015 for Paddy Crop

(kg/acre)

Source	Marginal	Small	Medium	Large	Total
Paddy					
Soil test farmers					
Urea	98	106	105	95	101
DAP	55	56	54	51	54
SSP	151	150	152	150	151
Potash	34	32	33	32	33
Complex	84	96	95	125	100
Control farmers					
Urea	130	126	125	140	130
DAP	75	75	71	75	74
SSP	163	166	160	164	163
Potash	52	49	53	51	51
Complex	110	115	120	135	120

Source: Field Survey 2016

5.5 Actual Quantity of Fertilisers Applied in 2015 for Cotton Crop:

The actual quantity of fertilisers applied by the sample farmers in 2015 for the cotton crop is given in Table 5.5. The total average dose of all fertilizes is higher for control farmers compared to soil test farmers, while urea, SSP and complex fertilisers report the much higher usage in the fields of control farmers compared to soil test farmers. Marginal farmers from control farmer group used a higher dose for urea, DAP, SSP and potash fertilisers compared to the same farmer size group of soil test farmers. The anoogous trend is there for other groups of farmers in the use of fertilisers for cotton cultivation in the study area. It clearly indicates the lack of knowledge of the cultivator in the use of dosage of fertilisers and further, it informs the economic burden of fertilisers and the loss of soil fertility due to higher dose of these fertlisers to the control farmers.

Table 5.5: Actual Quantity of Fertilisers Applied by the Sample Farmers in 2015 for Cotton Crop

(Kgs./Acre)

Source	Marginal	Small	Medium	Large	Total
Cotton					
Soil test farmers					
Urea	101	105	95	104	101
DAP	77	72	71	82	75
SSP	70	75	81	80	76
Potash	55	49	50	46	50
Complex	94	96	110	101	100
Control farmers					
Urea	210	200	188	190	197
DAP	100	97	98	100	99
SSP	170	175	174	180	175
Potash	70	70	55	65	65
Complex	110	115	125	130	120

Source: Field Survey 2016

5.6 Actual Quantity of Split Doses of Fertilisers Applied By Stages of Crop Growth in 2015 for Paddy Crop:

The actual quantity of split doses of fertilisers applied by stage of crop growth in 2015 for paddy crop is given in Table 5.6. The average total fertiliser dosage of control farmers of paddy crop is higher than that of soil test farmers. It clearly indicates the good edge of dosage of fertilisers of all the components under study to the soil test farmers. In the basal application, the soil test farmers used lower level fertiliser viz. urea and potash compared to its counterpart. In the inter-cultivation, DAP, SSP and potash are used at a lower dose in paddy cultivation by soil test farmers than that of control farmers and the analogous trend is seen for vegetative growth and flowering stages of paddy cultivation. The grain formation does not require any fertilisers for paddy crop.

Table 5.6: Actual Quantity of Split Doses of Fertilisers Applied By Stages of Crop Growth in 2015 for Paddy Crop **(Kgs. /Acre)**

Particulars	Basal application	After inter cultivation (weeding, thinning etc)	Vegetative growth	Flowering	Grain formation	Total
Soil test farmers						
Urea	34.67	0.00	33.67	32.66	0.00	101.00
DAP	54.00	0.00	0.00	0.00	0.00	54.00
SSP	151.00	0.00	0.00	0.00	0.00	151.00
Potash	20.00	0.00	0.00	13.00	0.00	33.00
Complex	50.00	50.00	0.00	0.00	0.00	100.00
Control farmers						
Urea	50.00	30.00	30.00	20.00	0.00	130.00
DAP	50.00	00.00	24.00	0.00	0.00	74.00
SSP	163.00	00.00	0.00	0.00	0.00	163.00
Potash	26.00	00.00	00.00	25.00	0.00	51.00
Complex	50.00	50.00	0.00	20.00	0.00	120.00

Source: Field Survey 2016

5.7 Actual Quantity of Split Doses of Fertilisers Applied By Stages of Crop Growth in 2015 for Cotton Crop :

The actual quantity of split doses of fertilisers applied by stage of crop growth 2015 for the cotton crop is shown in Table 5.7. The total average fertiliser dosage is lower for all fertilisers of soil test farmers. Except for inter-cultivation, all the remaining states of cultivation in cotton crop cultivations shows higher usage of fertilisers. In basal application, there is no difference between two farmer groups, however, there is a variation of dosage in DAP and complex fertilisers during inter-cultivation with a higher dose from control farmers. It is observed that the basal application shows the much variation in the fertiliser use at higher level in cotton cultivation rather than the other stages of crop cultivation and it informs the higher use by control farmers in this stage compared to other stages in the growth of the crop.

Table 5.7: Actual Quantity of Split Doses of Fertilisers Applied By Stages of Crop Growth in 2015 for Cotton Crop

(Kgs. /Acre)

Particulars	Basal application	after inter cultivation (weeding, thinning etc)	Vegetative growth	Flowering	Grain formation	Total
Soil test farmers						
Urea	35.00	35.00	35.00	35.00	0.00	140.00
DAP	75.00	00.00	00.00	0.00	0.00	75.00
SSP	153.00	00.00	00.00	0.00	0.00	153.00
Potash	25.00	00.00	00.00	25.00	0.00	50.00
Complex	0.00	50.00	25.00	25.00	0.00	100.00
Control farmers						
Urea	55.00	50.00	47.00	45.00	0.00	197.00
DAP	70.00	29.00	0.00	0.00	0.00	99.00
SSP	175.00	00.00	0.00	0.00	0.00	175.00
Potash	30.00	00.00	00.00	35.00	0.00	65.00
Complex	0.00	60.00	30.00	30.00	0.00	120.00

Source: Field Survey 2016

5.8 Method of Application of Chemical Fertilisers of Paddy Crop:

The method of application of chemical fertilisers of paddy crop is shown in Table 5.8. Both groups of farmers are dependent on paddy cultivation on the broadcasting method of application of all chemical fertilisers under study and we do not find variance in the method of application of fertilisers in paddy cultivation.

Table 5.8: Method of Application of Chemical Fertilisers of Paddy Crop

(% of farmers)

Method	Urea	DAP	SSP	Potash	Complex
Soil test farmers					
Broadcasting	100.00	100.00	100.00	100.00	100.00
Dibbling	0.00	0.00	0.00	0.00	0.00
Fertigation	0.00	0.00	0.00	0.00	0.00
Line application	0.00	0.00	0.00	0.00	0.00
Spraying	0.00	0.00	0.00	0.00	0.00
Total	100.00	100.00	100.00	100.00	100.00
Control farmers					
Broadcasting	100.00	100.00	100.00	100.00	100.00
Dibbling	0.00	0.00	0.00	0.00	0.00
Fertigation	0.00	0.00	0.00	0.00	0.00
Line application	0.00	0.00	0.00	0.00	0.00
Spraying	0.00	0.00	0.00	0.00	0.00
Total	100.00	100.00	100.00	100.00	100.00

Source: Field Survey, 2016.

5.9 Method of Application of Chemical Fertilisers of Cotton Crop:

The method of application of chemical fertilisers of the cotton crop is shown in Table 5.9. There is no use of fertigation and spraying methods in the cultivation of either farmer group in the cotton crop cultivation. Out of the remaining three methods, line application method has much use in the fertilization in the cultivation of cotton crop by both farmer groups followed by a dibbling method in both groups. Both groups of farmers for all fertilisers under study apply these two methods nearly with equal weight. However, control group farmers used at large extent of the broadcasting method for all fertilisers in the cultivation of the cotton crop.

Table 5.9: Method of Application of Chemical Fertilisers of Cotton Crop

(% of farmers)

Method	Urea	DAP	SSP	Potash	Complex
Soil test farmers					
Broadcasting	20.00	20.00	20.00	20.00	20.00
Dibbling	30.00	30.00	30.00	30.00	30.00
Fertigation	0.00	0.00	0.00	0.00	0.00
Line application	50.00	50.00	50.00	50.00	50.00
Spraying	0.00	0.00	0.00	0.00	0.00
Total	100.00	100.00	100.00	100.00	100.00
Control farmers					
Broadcasting	25.00	30.00	30.00	25.00	30.00
Dibbling	25.00	30.00	30.00	25.00	30.00
Fertigation	0.00	0.00	0.00	0.00	0.00
Line application	50.00	40.00	40.00	50.00	40.00
Spraying	0.00	0.00	0.00	0.00	0.00
Total	100.00	100.00	100.00	100.00	100.00

Source: Field Survey, 2016.

5.10 a. Use of Organic Fertilisers by the Sample Farmers for Paddy Crop:

The use of organic fertilisers by the sample farmers for paddy crop is given in the Table 5.10a.There is only 36% of farmers in using the organic fertilisers out of the sample farmers. The age-old practice of farmyard manure shows 30% and the remaining 6% is shared by vermin compost and green manure of the paddy cultivators. For quantity, the farmyard manure reports 27 hundred kgs per acre, while vermin-compost and green manure are taken place in 34 kgs. and 8 kgs., respectively. We will find that there is a large variation in the prices of these organic fertilisers, as the prices were paid by the sample farmers as Rs. 280, Rs.4.00 and Rs.3.75 for green manure, farmyard manure and vermin-compost in that order. These prices reflect the higher cost of inputs of the sample farmers in the sample villages. The large area was covered with farmyard manure. When compared to sample farmers, control farmers used organic fertilisers at a lower level by 27%. In case of organic fertiliser quantity, control group farmers used only 31 kgs. per acre, which is very lower compared to sample farmers and the price paid is also high for farmyard manure. The net-cropped area covered under organic fertilisers refers to very low level (12 acres) for control farmers. Thus, it is observed that the sample farmers are in a better use of organic fertilisers covering the large net-cropped area compared to the use and area of control farmer group in paddy crop cultivation in the sample villages.

Table 5.10a Use of Organic Fertilisers by the Sample Farmers for Paddy Crop

Particulars	Farm yard manure	Vermin-compost/ biogas waste	Bio-fertiliser	Green manure	Other organic manure	Total
Soil test farmers						
% of farmers applied	30.42	2.50	0	3.25	0	36.17
Quantity applied (kg/acre)	2680	34.50	0	8	0	2722.50
Price (Rs/kg)	4	3.75	0	280	0	287.75
Area covered (% of net cropped area)	23.50	2.25	0	1.12	0	26.87
Control farmers						
% of farmers applied	11.67	0	0	0	0	11.67
Quantity applied (kg/acre)	3120	0	0	0	0	3120
Price (Rs/kg)	4.5	0	0	0	0	4.5
Area covered (% of net cropped area)	11.80	0	0	0	0	11.80

Source: Field Survey 2016

5.10b Use of Organic Fertilisers by the Sample Farmers for Cotton Crop:

Use of organic fertilisers by the sample farmers for cotton crop is given in Table 5.10b. The soil test farmers of cotton crop employed organic fertilisers by 30% of the sample group. The farmyard manure has 25%, while it is 5% for vermin-compost. The quantity is also very high for farmyard manure with 34 hundred kgs. per acre. The price is low for farmyard manure compared to vermin-compost. The total net cropped area covered is 18 acres. The control farmer group

shows a very low level by 8% farmers, while it is 30% for the non-control group. However, the quantity of farmyard manure is high for control farmers and price of the same is low by Rs.0.50. Area and the farmers covered are very less for control farmers against sample farmers.

Table 5.10b. Use of Organic Fertilisers by the Sample Farmers for Cotton Crop

Particulars	Farm yard manure	Vermin-compost/ biogas waste	Bio-fertiliser	Green manure	Other organic manure	Total
Soil test farmers						
% of farmers applied	25.00	5.00	0	0	0	30.00
Quantity applied (kg/acre)	3380	50.00	0	0	0	3430.00
Price (Rs/kg)	5.50	7.00	0	0	0	12.50
Area covered (% of net cropped area)	16.50	1.80	0	0	0	18.30
Control farmers						
% of farmers applied	8.00	0	0	0	0	8.00
Quantity applied (kg/acre)	4016	0	0	0	0	4016
Price (Rs/kg)	5	0	0	0	0	5
Area covered (% of net cropped area)	6.00	0	0	0	0	6.00

Source: Field Survey**,** 2016.

5.11Sources of Purchase of Fertilisers:

The sources of purchase of fertilisers is given in Table 5.11. There are two major sources of purchase of fertilisers for the sample and control farmers viz. private fertiliser shops and co-operative societies. Marginal, small and medium farmer groups of sample farmers are much dependent on private shops, while large farmers from the sample group are less dependent on private ones. The better situation is there for a large farmer group, as it is getting fertilisers from company authorized dealers by 8%. Both sample and non sample groups of farmers have the same sources of purchase of fertilisers except for a larger farmer group. However, marginal farmers from control group have the highest dependence on the source of private fertiliser shops. The large farmer group from the sample farmers has better sources of purchase of fertilisers in the sample villages.

Table 5.11 Sources of Purchase of Fertilisers

(% of farmers)

Source	Marginal	Small	Medium	Large	Total
Soil Test Farmers					
Private fertiliser shops/dealers	71.25	72.22	70.83	58.33	70.17
Company authorized dealers	0.00	0.00	0.00	8.33	0.83
Co-operative societies	26.67	27.78	29.17	33.33	28.17
Govt. agency	2.08	0.00	0.00	0.00	0.83
Other	0.00	0.00	0.00	0.00	0.00
Total	100.00	100.00	100.00	100.00	100.00
Control Farmers					
Private fertiliser shops/dealers	75.00	72.22	69.44	72.22	71.67
Company authorized dealers	0.00	0.00	0.00	2.78	0.83
Co-operative societies	25.00	27.78	30.56	25.00	27.50
Govt. agency	0.00	0.00	0.00	0.00	0.00
Other	0.00	0.00	0.00	0.00	0.00
Total	100.00	100.00	100.00	100.00	100.00

Source: Field Survey 2016.

5.12 Quantity of Fertilisers Purchased by the Sample Farmers:

The quantity of fertilisers purchased by the sample farmers is given in Table 5.12. There is no variation in the weight given to the source of the fertilisers purchased in between sample and control farmers. All the fertilisers of urea, DAP, SSP, potash and complex are in large quantities purchased from the similar sources with nearly in analogous quantities. All the purchases (99%) are from two major sources i.e. private shops and co-operative societies. There is no big difference in the quantities purchased of different fertilisers by the both groups of farmers. However, private fertiliser shops are the major and predominant ones for the fertilisers purchased in the study area for all verities of fertilisers.

Table 5.12: Quantity of Fertilisers Purchased by the Sample Farmers

(per cent)

Source	Urea	DAP	SSP	Potash	Complex
Soil test farmers					
Private fertiliser shops/dealers	64.17	72.50	72.50	72.50	70.00
Company authorized dealers	0.83	0.83	0.83	0.83	0.91
Co-operative societies	34.17	26.67	26.67	26.67	29.09
Govt. agency	0.83	0.00	0.00	0.00	0.00
Other	0.00	0.00	0.00	0.00	0.00
Total	100.00	100.00	100.00	100.00	100.00
Control farmers					
Private fertiliser shops/dealers	72.50	67.50	67.50	74.17	73.33
Company authorized dealers	0.00	0.00	0.00	0.00	0.83
Co-operative societies	27.50	29.17	29.17	25.83	25.83
Govt. agency	0.00	0.00	0.00	0.00	0.00
Other	0.00	0.00	0.00	0.00	0.00
Total	100.00	100.00	100.00	100.00	100.00

Source: Field Survey, 2016.

5.13 Average Price of Fertilisers and Transport Costs Incurred by Selected Farmers:

The average price of fertilisers and transport cost incurred by sample and control farmers is given in Table 5.13. The soil test farmers have paid the low average price to all the fertilisers except to potash when compared to the payment of control farmers. The control farmers have paid a higher amount per kg.of average price for SSP out of all fertilisers keeping in view of the difference of the amount paid compared to soil test farmers. The analogous trend appears for transport cost. However, control farmers have paid the average price at triple and double of the payment of the sample farmers for the transport of SSP and complex fertilisers, in that order.

Table 5.13: Average Price of Fertilisers and Transport Cost Incurred by Selected Farmers

Fertilizer type	Soil test farmers		Control farmers	
	Average price (Rs/kg)	Transport cost (per Bag)	Average price (Rs/kg)	Transport cost (per Bag)
Urea	5.70	5	6.00	7
DAP	25.00	3	25.60	5
SSP	7.00	1	9.60	3
Potash	25.00	2	25.00	3
Complex	23.00	2	24.30	4
Bio-fertilizer	0	0	0	0

Source: Field Survey 2016

Summary:

The application of recommended doses of fertilisers is the lowest for marginal farmers (17%) in paddy cultivation and the highest appears for large farmers with 25%. Net operated area is at the larger extent to marginal farmers rather than for other groups in paddy cultivation. The Marginal group for cotton crop cultivation has adopted the recommended doses of fertilisers in a higher level by 36% followed by medium and large farmers group with 33%. Farmers are willing to continue the recommended doses for next crop seasons. There is an adequate availability of fertiliser for cultivation, however, marginal farmers view the prevailing prices at a high level. All the farmer groups view that there is no difficulty in understanding and following the recommended doses of fertilisers in paddy cultivation and the similar picture appears for the cotton crop cultivation. Marginal (21%) and small (14%) farmers faced the lack of money for the purchase of fertilisers in cotton cultivation. All the farmers find no difficulty to follow the technical advice and there are no constraints in the application of recommended doses. In the paddy cultivation, medium and large farmers have higher awareness (100%) than that of other two groups. The ‘Department of Agriculture’ shows 100% use and generation of information and the remaining have no role for soil testing information to the farmer community. It is obvious the better edge of sample farmers for the dosage of fertilisers in the cultivation of paddy. The average total fertiliser dosages of control farmers of the cotton crop are higher than that of soil test farmers across all stages of growth of the crop. We can hardly find much dosage difference in cotton

cultivation across soil test farmers and control farmers. Both groups of farmers are dependent on paddy cultivation on the broadcasting method of application of all chemical fertilisers. The ‘line application’ method has much use in the fertilization in the cultivation of cotton crop by both farmer groups followed by a ‘dibbling’ method in both groups.

It is observed that the sample farmers are in the better use of organic fertilisers covering large net cropped area compared to the use and area of control farmer group in paddy crop cultivation in the sample villages. For cotton crop, area and the farmer covered are very low for control farmers against sample farmers. Marginal, small and medium farmer groups of sample farmers are much dependent on private shops, while large farmers from the sample group are less dependent on private shops. The private fertiliser shops are the major and predominant ones for the fertilisers purchased in the study area for all verities of fertilisers. The soil test farmers have paid the low average price to all the fertilisers except to potash when compared to the payment of control farmers.

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CHAPTER - VI

IMPACT OF ADOPTION OF RECOMMENDED DOSES OF FERTILISERS

This chapter deals with the impact of adoption of recommended doses over the selected crops in the selected districts of A.P. through primary data collected in 2016. It is analyzed the change in productivity and output value of the sample crops of paddy and cotton during 2015. The changes are observed after the application of recommended doses of fertilizers over selected crops in between soil test farmers and control farmers.

6.1 Productivity and Output Value of Sample Crops in 2015:

Productivity and output value of sample crops for sample and control farmers in 2015 is given in Table 6.1. The total change took place at 28 Qtls. per acre for the soil test farmers for paddy crop, while it was only 24 Qtls. per acre for control farmers. The highest yield appears to large farmers followed by all the remaining farmer size groups in soil test farmers, while the farmer sizes from control farmer group show a less increase in the yield levels for paddy crop. Among the farmer sizes of soil test farmers, large farmer size has 32 Qtls. per acre followed by small and marginal farmer sizes with 27 Qtls. per acre and medium farmer size group shows the lowest yield with 26 Qtls. per acre. The total percentage difference is 19% in the yield in between two groups of farmers and it is much higher among the farmer landholding sizes. Much yield variation appears for marginal farmers with 27% between two groups of sample and control farmers and the lowest is reported for large landholding group with 11%. In the case of the value of an output of paddy crop, the yield level variances are reflected in the same ratio for value of output for two groups of sample and control farmers.

Table 6.1: Productivity and Output Value of Sample Crops for Sample and Control Farmers in 2015

Particulars	Average yield (Quintal/acre)			Average value of output (Rs/acre)		
	Soil test farmers	Control farmers	% difference in yield	Soil test farmers	Control farmers	% difference in yield
Paddy						
Marginal	26.67	21.01	26.93	33010	20801	26.93
Small	26.86	21.58	24.49	33996	21468	24.49
Medium	25.60	22.08	15.94	32515	21727	15.94
Large	31.93	28.83	10.73	41219	33160	10.73
Total	27.97	23.59	18.58	35185	24289	18.58
t-value	2.4458 (1.86 critical value)					
Significance level	0.05/ 5% level					
Cotton						
Marginal	7.70	9.03	-14.73	29065	33199	-14.73
Small	8.30	7.57	9.64	30879	28546	9.64
Medium	7.53	6.16	22.24	28496	23314	22.24
Large	9.08	8.17	11.14	34221	32150	11.14
Total	8.23	7.40	11.22	30950	27729	11.22
t-value	0.9209 (2.447 critical					
Significance level	0.05/ 5%					

Source: Field Data 2016

For cotton crop, the soil test farmer group has 8 Qtls. per acre, while it is only 7 Qtls. for control farmers. Among the landholding sizes, we can observe that the marginal farmer landholding group from soil test farmer group shows only 8 Qtls. per acre, while it was 9 Qtls. per acre under control farmer group. All the remaining landholding sizes reported higher yields compared to the relevant of size groups of control farmer group for cotton crop yields. The large farmer group of soil test farmers informs the highest yield per acre with 9 Qtls. and the small farmer group comes next with 8 Qtls. Out of all the landholding groups, medium farmer group reports the highest yield increase by 22%, and the larger landholding size comes the second position in the increase of the yield among the landholding groups of soil test farmer group compared to control farmers group. The analogous trend appears for the two groups of sample and control farmer groups for the value of output and its increase. Further, among the landholding sizes of the farmers, the same trend is found for the yields and for the value of output and its increase.

For the paddy crop, the sample of yields of sample and control farmers has very much variance, as the significance level is at 5% with the valid t-value 2.4458. In the case of cotton crop, the sample of the yields of sample and control farmers do not display a valid t-value. It

indicates that the cotton farmers have not been much influenced through the recommended doses in the selected villages.

6.2 Impact of Application of Recommended Doses of Fertilizers on Crop Yield of Soil Test Farmers:

The impact of the application of recommended doses of fertilizers on crop yield of soil test farmers is given in Table 6.2. Soil test farmers got 20% of the increase in the yield of paddy crop due to following recommended doses. Among the landholding size groups, the marginal farmer size reports the highest change in crop yield with 30%. Small farmer group shows second place with 23% of the increase in the paddy crop yield. The least change in yield appears for medium size farmers. This indicates obviously the benefit accrued by the all farmer groups due to applying the recommended doses of fertilizers in paddy cultivation.

Table 6.2: Impact of Recommended Doses of Fertilizers on Crop Yield of Soil Test Farmers

Particulars	Average yield (Qtls. /acre)		% change in yield
	Before	After	
Paddy			
Marginal	20.50	26.67	30.10
Small	21.75	26.86	23.49
Medium	23.50	25.60	8.94
Large	27.20	31.93	17.39
Total	23.24	27.97	20.35
Cotton			
Marginal	7.00	7.70	10.00
Small	7.50	8.30	10.67
Medium	7.00	7.53	7.57
Large	8.00	9.08	13.50
Total	7.38	8.23	11.59

Source: Primary Data, 2016.

For cotton crop, soil test farmers have 12% hike in the yield per acre, though it varies within the landholding sizes of the cultivators. The highest yield change appears for large farmer group, while the lowest increase in yield is reported for medium farmer group with 8%. Both marginal and small peasant landholding groups demonstrate nearly the same level of change in the productivity in the cotton crop. All the groups within the soil test farmers under cotton cultivation inform the increase of crop yield due to the recommended doses fertilizers through the soil testing method in cultivation. It would be better to encourage the lower farmer groups to get higher yields through educating in other factors in cultivation to get the yields on par with the larger farmer group in cotton cultivation.

Therefore, this could be enhanced or applied to all farmers in the cultivation of all crops to increase production and incomes of peasants, and to safeguard the soil fertility and stable

food security to the nation. There is also the requirement for the encouragement of marginal and small farmer groups to be encouraged for better production or yields, as these groups are lagging behind.

6.3 Changes Observed after Application of Recommended Doses of Fertilizer in Paddy and Cotton of Soil Test Farmers:

The changes observed after the application of recommended doses of fertilizers on paddy and cotton crops of soil test farmers is given in Table 6.3. The 'most important' is shown for the 'decrease in application of other inputs' by both paddy and cotton crop farmers by 60% farmers and it indicates the weight given indirectly to the lowering the cost of cultivation and increase of production. The farmers express 44% as most important to 'improvement in soil texture' followed by 38% farmers to 'increase in crop yield in the paddy cultivation. Farmers in paddy cultivation have given top priority to soil health and yields. The similar trend appears for cotton crop, as the farmers opinion weight by 61%, 52% and 49% to 'decrease in application of other inputs', 'increase in crop yield' and 'improvement in soil texture', respectively. Cotton farmers have much interest in crop yield and reduction of inputs in the cultivation. The 'improvement in grain filling' reports the lowest out of all the variables. In the cotton crop, the 'most important' shows for four variables with more than 45% and the least may be found in vice versa. We may infer that the farmers of both study crops have much concentration in the increase of productivity, in the reduction of inputs and for maintaining soil health with regard to soil testing for the selected crops in the cultivation.

Table 6.3: Changes Observed after the Application of Recommended Doses of Fertilizers on Paddy and Cotton Crops of Soil Test Farmers

(% of farmers)

Particulars	Paddy				Cotton			
	Most impor-tant	Impor-tant	Least impor-tant	Total	Most import-ant	Impor-tant	Least impor-tant	Total
Increase in crop yield	38.33	36.67	25.00	100.00	51.67	35.83	12.50	100.00
Improvement in soil texture	44.17	23.33	32.50	100.00	49.17	24.17	26.67	100.00
Improvement in crop growth	24.17	35.83	40.00	100.00	33.33	36.67	30.00	100.00
Improvement in grain filling	4.17	45.83	50.00	100.00	10.83	18.33	70.83	100.00
Less incidence of pest and diseases	35.83	38.33	25.83	100.00	45.00	29.17	25.83	100.00
Decrease in application of other inputs like seed, labour, pesticide etc.	60.00	20.00	20.00	100.00	60.83	25.83	13.33	100.00
Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Source: Primary Data, 2016.

Summary:

The highest yield appears for large farmers followed by all the remaining farmer size groups under soil test farmers, while the farmer sizes, from control farmer group, show less increase in the yield levels for paddy crop. In the case of the value of output in paddy crop, the yield level variances are reflected in the same ratio for the value of output for two groups of sample and control farmers and its different landholding size groups. For cotton crop, the soil test farmer group has 8 Qtls. per acre, while it is only 7 Qtls. for control farmers. The large farmer group of soil test farmers informs the highest yield per acre with 9 Qtls. and the small farmer group comes next with 8 Qtls. The analogous trend appears for the two groups of sample and control farmer groups for the value of output and its increase. Soil test farmers got 20% of the increase in the yield of paddy crop due to the recommended doses. This indicates obviously the benefit accrued by the all farmer groups due to the applying of the recommended doses of fertilizers in paddy cultivation.

For cotton crop, soil test farmers have 12% hike in the yield per acre, though it varies within the landholding sizes of the cultivators. Some of the groups within the soil test farmers in cotton cultivation inform the increase of crop yield due to recommended doses of fertilizers through the soil testing method in cultivation. For the paddy crop, the sample of yields of sample and control farmers has very much variance, as the significance level is at 5% with the valid t-value 2.4458. In the case of cotton crop, the sample of the yields of sample and control farmers do not display a valid t-value. There is also a requirement for the encouragement of marginal and small farmer groups for better production or yields, as these groups are lagging behind in the cultivation. We can notice that the farmers of both selected crops have much concentration in the increase of productivity, in the reduction of inputs and for the maintaining of soil health with regard to soil testing for the selected crops in the cultivation.

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CHAPTER - VII

SUMMARY AND CONCLUSIONS AND POICY MEASURES

7.1Background of Study:

The ever-increasing population demands additional quantum of food in the world and this leads to pressure on the food security in India, as agricultural land is endowed once for all. The available land is to be cultivated with modern techniques to bring out additional production to the added population of the country. Farmers are to adopt new methods for the increase in the yields of the crops. There is a lot of need for balanced nutrients for the good level of production in the crops production. Inorganic chemical fertilisers are a major source of nutrients for a good plant growth. Some of the problems are surfaced in the agriculture sector viz. a) indiscriminate use of fertilisers without the use of proper scientific nutrient management b) falling of soil fertility and rising acidity in the soil and c) disturbance to the environment along with other menaces in the cultivation. To avoid all these problems, agricultural scientists suggest for soil testing and adopting of recommended doses of fertilisers in the fields. In this connection, "National Project on Management of Soil Health and Fertility" (NPMSF) was started in 2008-09.This has been in force in all the states with the finance of central government funds. There is no study over the efficacy and reaching of the project to the farmers. Hence, the Directorate of Economics and Statistics, Ministry of Agriculture & Farmers Welfare, assigned this study to our centre. It has the specific objectives as: 1) To examine the level of adoption and its constraints in the application of recommended doses of fertilizers based on soil test reports by the farmers, and 2) To analyse the impact of adoption of recommended doses of fertilisers on crop productivity and income of farmers, and it is done through seven chapters.

7.2. Summary of Findings of the Study:

7.2.1 Trends in Fertilizer Consumption of Andhra Pradesh:

Fertilisers namely MOP and DAP report first and second places in the growth rate during 1994-01. It can be observed that the rate of consumption of MOP has increased in leaps and bounds in the study period compared to all other fertilisers in Combined A.P (1994-10). In Residual A.P. for the period 2009-15, except for urea, all the other fertilisers selected show a declining trend during 2009-15. In the rabi season, a good acceleration in consumption appears for urea out of all fertilisers under study. In Residual A.P., the growth rate of urea consumption

is found with more than three times compared to DAP, MOP, and SSP during 2009-15. In Combined A.P., urea has the highest rate of consumption out of all the fertilisers under study, while 'complex' fertilisers show a second place in the consumption. The least rate in consumption is traced for SSP during 1994-10. MOP has the highest growth acceleration in the study period and in its sub-periods. During 2007-15, Residual A.P. showed a little high growth rate (2.5%) for nitrogen (N) compared to India (2%). Surprisingly, for phosphorus (P), there has been an analogous trend for both A.P. and India in the study period either for deceleration or for acceleration. Potash (K) consumption has a declining trend at a higher level for Residual A.P. (-7%) compared to India (-5%) in the study period (2007-15).The trend in the growth rate of the total nutrients (NPK) shows a very little rise in the consumption for India and Residual A.P.(2007-15). Residual A.P. has 3% growth rate in the study period (1994-15) for nitrogen and this rate is derived from four districts viz. Kurnool (5%), Ananthapur (4.3%) SPS Nellore (4%) and Guntur (3.4%). For potash, we can find the first, second and third places to Vizianagaram (8%), YSR Cuddaph (7%) and SPS Nellore (6%) districts, respectively, in the consumption. The gross cropped area (GCA) has increased at 0.5% in the study period, however, nitrogen shows 0.7% rise in the consumption. The total NPK has declined at -4% in the study period for the state, whereas potash and phosphorus report a lot of decline in the consumption by -17% and -8%, in that order. There is no change in the recommended quantity of nutrients for paddy crop in the kharif and rabi seasons. In the case of recommended quantity for the cotton crop for rabi season has no data since the rabi crop is very limited in Residual A.P. In the comparing two years (2012-14) for cotton crop in rabi season, there is a change in the use of all nutrients from 114 kgs. to 124 kgs. to nitrogen and from 57 kgs. to 60 kgs. to phosphorus, and the same change for potash is observed.

7.2.2 Socio-Economic Characteristics of Sample Households:

The average family size is high for sample farmers compared to control farmers and there are no STs either in the sample or in the control group for paddy crop. In the case of the cotton crop, there is a good representation of STs in sample and control group farmers. The sample farmers of paddy crop are in a better position for operational landholdings and the same picture is shown for cotton crop. Canal irrigation has 94% and 78% for sample and non-sample farmers, respectively, for paddy crop, though bore well irrigation has a lot of area for non-beneficiaries compared to its counterpart. Cotton crop has a different scenario since beneficiary farmers are much dependent by 90% of bore well irrigation followed by canal irrigation with 8%. In paddy cultivation, there is 100% of HYV for both groups of farmers. It is observed the application of

HYV in a fewer amounts for green and black grams in the cotton cultivated area, whereas chillies and bengal gram have higher application HYV for cultivation by both groups of farmers. The distribution of farm assets is in the favour of ‘soil test farmers’ in paddy and cotton crops cultivation. The sample farmer group has much outstanding credit in cooperative banks (0.44 lakhs) followed by commercial banks (0.36 lakhs) for paddy crop, whereas cotton farmers show the higher amount in commercial banks and RRBs. The purpose of the loan was meant for 81% and 69% for seasonal crop cultivation of sample and control farmers, in that order, for paddy crop. Many sample farmers have attended to the training programmes of both crops-paddy and cotton compared to control farmers and they show much interest in training programmes and in its duration of training.

7.2.3 Details of Soil Testing & Recommended Doses of Fertilizers:

There is a requirement for the encouragement of marginal and small farmer groups for a better production or yields. A number of plots for soil testing are high for medium and large farmers since these group farmers would have a lot of area under cultivation. All the collection of soil testing samples is done for all the groups of farmers 100% by the department personnel. The reason ‘ motivation from village demonstration etc.' leads for all reasons, as it has 54% of households by ‘most important' out of all reasons followed by ‘for increasing crop yield' with 37% of paddy crop. For cotton crop, the most important of the reasons is ‘for increasing crop yield' with 56% of households followed by ‘motivation from village demonstration etc' with 37% households. Among the soil test farms of paddy, we can find the low existence of nitrogen by 61%, which is the highest out of all the fertilizers of the selected soil test farms. Contrary to the paddy cultivation, we can see the low-level use of nitrogen by 92% sample farms in the cotton cultivation and the normal dose is with 5% farms only.In the case of potassium, the normal usage is covered with 1% soil test farms in the cotton crop cultivation. There is a lot of requirement of scientific soil testing and the subsequent dose implementation in the farms of the selected districts in A.P.

The recommended doses for paddy refers to urea 104 kgs, while it is high for the cotton crop with 174 kgs. For DAP, the dose of kharif of paddy shows similar to the dose of cotton, whereas it is high in the rabi season for paddy. In the case of single super phosphate, paddy crop has a similar dose in kharif and it differs in the rabi season with the dose of cotton. There are five major stages for growing paddy and cotton crops and these are basal, intercrop cultivation, vegetative, flowering and grain formation. During grain formation, there is no need of any chemical fertilizer as per the dosage recommended for either crop under study. The rabi

cropping of paddy shows the highest dosage for all the fertilisers compared to cotton cropping. This scenario varies in the case of kharif paddy, as the cotton cropping demands higher dosage of fertiliser.

7.2.4 Adoption of Recommended Doses of Fertilizers and Its Constraints:

The application of recommended doses of fertilizers is the lowest for marginal farmers (17%) in paddy cultivation and the highest appears for large farmers with 25%. Net operated area is at the larger extent to marginal farmers rather than for other groups in paddy cultivation. The Marginal group for cotton crop cultivation has adopted the recommended doses of fertilizers in higher level by 36% followed by medium and large farmer groups with 33%. Farmers are willing to continue the recommended doses in the next coming crop seasons. There is an adequate availability of fertilizer for cultivation, however, marginal farmers viewed the prevailing prices at a high level. All the farmer groups view that there is no difficulty in understanding and following the recommended doses of fertilizers in paddy cultivation and the similar picture appears for cotton cultivation. Marginal (21%) and small (14%) farmers faced the lack of money for the purchase of fertilizers in cotton cultivation. The 'Department of Agriculture' shows 100% generation of information and the remaining have no role for soil testing information to the farmer community. The average total fertilizer dosages of control farmers of the cotton crop are higher than that of soil test farmers across all stages of growth of the crop. We can hardly find much dosage difference in cotton cultivation across soil test farmers and control farmers. It is observed that the sample farmers are in the better use of organic fertilizers covering large net cropped area compared to the use and area of control farmer group in paddy crop cultivation in the sample villages. For cotton crop, the area and the farmers covered are very low for control farmers against sample farmers. Marginal, small and medium farmer groups of sample farmers are much dependent on private shops, while large farmers from the sample group are less dependent on private shops. The soil test farmers have paid a low average price to all the fertilizers except to potash when compared to the payment of control farmers.

7.2.5 Impact of Adoption of Recommended Doses of Fertilisers:

The highest yield is reported to large farmers followed by all the remaining landholding size groups under soil test farmers, while the farmer sizes of control farmer group show less increase in the yield levels for paddy crop. In the case of the value of output in paddy crop, the yield level

variances are reflected in the same ratio for the value of output for two groups of sample and control farmers and its different landholding size groups. For cotton crop, the soil test farmer group has 8 Qtls. per acre, while it is only 7 Qtls. for control farmers. The large farmer group of soil test farmers informs the highest yield per acre with 9 Qtls. and the small farmer group comes next with 8 Qtls. The analogous trend appears for the two groups of sample and control farmer groups for the value of output and its increase. For cotton crop, soil test farmers have 12% increase in the yield per acre, though it varies within the landholding sizes of the cultivators. Some of the groups within the soil test farmers under cotton cultivation inform the increase of crop yield due to recommended doses of fertilizers through the soil testing method in cultivation. For the paddy crop, the sample of yields of sample and control farmers has very much variance, as the significance level is at 5% with the valid t-value 2.4458. In the case of cotton crop, the sample of the yields of sample and control farmers do not display a valid t-value. There is also a requirement for the encouragement of marginal and small farmer groups for better production or yields, as these groups are lagging behind in the cultivation. We can observe that the farmers of both selected crops have much concentration on the increase of productivity and in the reduction of inputs and for maintaining soil health through the given opinion of the farmers over the factors under study with regard to soil testing for the selected crops in the cultivation.

7.3 Conclusions:

a) There is no sharp increase in the fertiliser consumption in the Combined A.P. (1994-10), despite, MOP shows much acceleration. Residual A.P. has 3% growth rate in the study period (1994-15) for nitrogen and this higher growth rate is derived from four districts viz. Kurnool (5%), Ananthpur (4.3%) SPS Nellore (4%) and Guntur (3.4%).

b) Paddy farmers are with monoculture, while cotton farmers are with polyculture. The marginal and small farmer size groups show a lower level of value of output in both sample and control farmer groups in paddy crop cultivation and the asset distribution of ‘soil test farmers' is greater than that of the control farmers. The purpose of the loan was spent much for crop cultivation by soil test farmers in paddy and the vice versa for cotton crop.

c) The average distance from the soil testing laboratory ranges from 27/28 km to 30 km for the samples of paddy and cotton crops with only the source of a government laboratory. The farmers are much motivated with ‘village demonstrations' followed by ‘the yield' for soil testing of paddy crop, whereas ‘the yield' stands the most important for cotton crop.

d) Farmers lack much knowledge in chemical fertiliser input usage since the majority of the sample farmers of both paddy and cotton crops are with a low dosage of nitrogen, and with a high dosage of phosphorus and potash.

e) The adoption of recommended doses of fertilizers is higher in marginal and small size groups rather than in large and medium groups of sample farmers from cotton crop, while the vice versa prevails in paddy cultivation. However, all the farmer groups from both crops strongly wish to adopt the recommended doses in future.

f) The lower farmer size groups have private fertilizer shops and co-operative societies as the primary and exclusive sources for fertilisers, while the large and medium farmers have the sources of dealers and distributors in addition to the above two sources.

g) The Sample farmers of both paddy and cotton crops report the yield increase due to soil testing, and they, further, view the accrual of benefit through the reduction of other inputs and the achieving of the soil health due to the undergone soil testing for the cultivation.

7.4 Policy Measures:

i) Proximate Soil Testing Laboratories (STL):

There is an urgent need of starting a 'Soil Testing Laboratory' (STL) at the centre of three to four mandals/blocks in A.P. It will be useful, as there are a number of samples are to be undertaken at every mandal in A.P. One centre with one agricultural scientist will certainly be useful for not only soil tests but also for land reclamation, organic-bio fertiliser training and representing as the standing counsel for technical knowhow to the farmer. Since the existing landholdings are more than 11 thousand per mandal in A.P (Agricultural Census 2011-12), having with only 51 STLs across state, the S.T.L. would be much useful and tenable. The good proximity of soil test centres to farmers will influence in generating the **awareness** and importance of soil testing for the good cultivation. This will reduce the **distance for access to** laboratory, and enable the farmer to attend the training programmes at the nearest place. The results could be made available to the farmer to the given mobile in his/her mother tongue-**Telugu language**. Further, this will facilitate the farmer **to interact** with the testing laboratory for consultation in future for the change of crop and the other purposes as referred earlier. The 'Soil Health Card' and soil test results are to be available before May/June of year.

ii) Intensive Soil Testing:

The intensive soil testing is to be taken place for the development of good nutrient management strategy to the crops in question at mandal (A.P.)/block level. This will enable the

farmer to follow a proper fertiliser dosage at right time, and it will facilitate to have good yielding in the cultivation, though the change in crop/crops is taken place based on market conditions.

iii) Coverage of Marginal &Small Farmers:

The marginal and small farmers will achieve the upper strata in **yields and incomes** through the good coverage of the soil testing and maintaining the soil health in long run. Hence, it is imperative to cover all farmers from these landholding sizes under 'Soil Testing Programme'. To achieve this, soil testing grid could be 2.0 ha/2.5ha in the farms.

iv) Availability of Organic Fertilisers:

All the farmers view the need of much availability of organic fertilisers, and the prices of these inputs are to be at a lower level. In this connection, the methods and practices are to be 'on hand' to the farmers to procure the local raw material for the production of organic fertilisers. To this end, they are to be educated/trained up in these lines, to make the successful fertigation in the cultivation.

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