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Human and social capital aspects of soil nutrient
management, India

Annex B: Policy review

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Executive Summary

Agriculture sector plays an important role in Indian economy. Several attempts are being made to strengthen this sector through macro and sectoral policies. Increased public investments in the initial period of planning, introduction of green revolution and input subsidies provided to improve the access to inputs and price support policy led to increased food production. India could reach self-sufficiency in food production. However, it is accompanied by indiscriminate use of chemical fertilisers and over exploitation of soils. Fertiliser price policy distorted the balance of NPK use. The realisation that the sustainability of increased production is at stake led to the policy interventions for promoting conservation measures. There is a paradigm shift from top-down approach in the form of involving stakeholders in decision making. Present study is an attempt to review the agriculture policy since the inception of planning era and its impact on soil fertility management based on the existing literature. Macro policies impact micro variables through meso-variables. Soil fertility management decisions are essentially micro level decisions made at the house hold level. But, these are influenced by the general macro economic policies, which affect the income levels of the household and sectoral policies like fertiliser subsidy, minimum support price etc. Based on literature review it is observed that farmers are aware of fertility management and conservation measures. But, they are constrained by access to these measures. Incentives to invest in these measures depend on willingness and ability to invest, which are influenced by the socio-economic conditions, land ownership, input policy etc.

National agriculture policy and state agriculture policies of Andhra Pradesh and Karnataka are reviewed. The national objective of liberalisation, privatisation and globalisation is reflected in the policies of both these states. Removal of quantitative restrictions, moving towards market price of inputs from subsidised inputs, we will have mixed impact on soil fertility management practices. Simulation study revealed that when agricultural economy is globalised and the internal prices are aligned with international prices along with reduction in input subsidies, shifting of cropping pattern towards less fertiliser demanding crops like coarse cereals and pulses.

Abbreviations

AoA	Agreement on Agriculture (WTO)
DPAP	Drought Prone Area Programme
EPTD	Environment and Production Technology Division
FCC	Farmer's Contact Centre
FYM	Farm Yard Manure
GATT	General Agreement on Trade and Tariffs
GCA	Gross Cropped Area
GIS	Geographical Information System
HYVP	High Yielding Variety Programme
IADP	Intensive Agricultural District Programme
ICDP	Intensive Cattle Development Programme
IMF	International Monetary Fund
IREP	Integrated Rural Energy Programme
KAIC	Karnataka Agro Industries Corporation
KAPPEC	Karnataka Agricultural Product Processing and Export Corporation Ltd.
KVS	Key Village Scheme
LUP	Land Use Plan
MNCs	Multi National Corporations
NABARD	National Bank for Agriculture and Rural Development
NBSS	National Bureau of Soil Science
NDDB	National Dairy Development Board
NGO	Non Government Organization
NIRD	National Institute of Rural Development
NPK	Nitrogen, Phosphorous, Potash
NSSO	National Sample Survey Organization
OF	Operation Flood
OGL	Open General License
PLF	Plant Load Factor
PRA	Participatory Rural Appraisal
SAT	Semi Arid Tropic
SEBs	State Electricity Boards
SHGs	Self Help Groups
STCR	Soil Test Crop Response
T & D	Transmission and Distribution (Electricity)
WTO	World Trade Organization
WUA	Water Users Association

1 Introduction

Agricultural policy in India has been guided by the principle of achieving self-sufficiency in food grains. The necessity of feeding beaming millions of population led to various policy interventions to reach production targets necessary for self-sufficiency. The efforts yielded good results and India could reach the objective. Food grains production increased from 50.8 million tons in 1950-51 to 208.9 million tons in 1999-2000. Yield levels increased from 522 kg/ha to 1697 kg/ha during the same period. But this is achieved only with high doses of chemical fertilisers, though high yielding varieties also contributed to the yield levels. The relationship between food grain production and fertiliser consumption is given by the study of Pasricha (2001). Between 1950-51 and 1999-2000, fertiliser consumption increased by 63%. The process of achieving the objective of food self-sufficiency has led to degradation of land due to indiscriminate use of chemical fertilisers and over exploitation. The use of chemical fertilisers increased from 0.07 million tons in 1951 to 18.13 million tons in 2000 (Table 1 & Chart 1). Very high growth rate was maintained from 1956 to 1971. Sustainable fertiliser application was not given proper importance in the process of achieving production targets. Analysis of nutrient balance in semi-arid India indicated that the nutrient removal by crops is far in excess of nutrient added through fertiliser. It is estimated that this process led to a net nutrient loss of about 5.5 million tons of NPK annually (Reddy, 2001).

Higher growth rate in agricultural productivity is very important to reduce the poverty levels. Higher farm productivity since 1970s has brought both absolute and relative gains to poor rural households. A large share of the gains was via wages, though these effects took time. The benefits were not confined to those near the poverty line but reached deeper (Ravallion, 2000). According to Ravallion's study higher agricultural productivity is crucial to pro-poor rural economic growth. Using data between 1958 and 1994 Datt and Ravallion (1998) found that higher real wages and higher farm yields reduced absolute poverty in rural India. Bulk of these gains was via raising average living standards rather than improved distribution. However, rural economy has lagged in 1990s and the growth rate of agriculture sector fluctuated around 3% per annum. Datt's (1999) estimate suggests that the trend reduction in rural poverty ceased after 1991. The current challenge is maintenance and further enhancement of yield levels and sustainable use of natural resources.

1.1 Outline of The Study

The present study is an attempt to review the existing policies and their influence on soil fertility management based on the existing literature. Macro and sectoral policies of the central and state governments influence the production and marketing decisions of the farmers. Theoretical background and linkages between macro policies and micro level variables is presented in section II. Section III gives an account of agricultural policy through planning in India. Introduction of SAT India, agriculture in SAT India, changes in cropping pattern and factors responsible for these changes are parts of the section IV. Factors influencing soil fertility management decisions based on the existing literature is presented in section V. Policy initiatives at the national level based on the national agricultural policy 2000 is presented in section VI. Importance of livestock and policies relating to livestock management are given in the section VII. State level analysis forms section VIII. This section deals with the agricultural scenario, changes in cropping patterns, policy initiatives at the state level in Andhra Pradesh and Karnataka. Critical review of the national and state level policies is presented in section IX.

1.2 Soil Fertility Management – Decisions

Decisions concerning the management of natural resources and agricultural system are concentrated at three levels (Dixon, 1990).

1. Several sectors at the national level where Government resources are allocated.
2. The village or micro-watershed levels where communal resources are managed.
3. Farm household level where the bulk of agricultural production decisions take place.

According to Dixon (1990), this suggests the conceptualisation of agriculture as a multi-level hierarchical system and that analysis, intervention and monitoring should be focussed at each level.

There is a vast literature existing on factors influencing farmer's decisions regarding soil and water conservation, which is one component in the soil fertility management. Soil fertility management is a broader concept including the following elements.

- (1) Adding more nutrients into the farming system.
- (2) Minimise unproductive losses of nutrients from the system.
- (3) Maximise the recycling of nutrients within the farm.
- (4) Increase the efficiency of nutrient uptake.

While investments on soil and water conservation are long run investments whose benefits spread into many years in future, productivity enhancing investments are short range investments with immediate impact on production.

Farmers are aware of the need for soil conservation and maintaining soil fertility (Kerr, 1996; Kerr and Sanghi, 1992). They have adopted indigenous methods for soil conservation. There is a difference between soil conservation investments and productivity enhancing investments. While the long run investments like bunds, contour ploughing, terracing etc. need lumpy capital at a particular point, the short run productivity enhancing methods are applying more chemical fertilisers, organic fertilisers, providing more irrigation and animal traction. Both investments are aimed at enhancing and sustaining the fertility of the soil.

Conservation and productivity enhancing investments depend on three important aspects (Reardon and Vosti)

1. Incentives to invest i.e. net returns, risks relative to alternative farm and non-farm investments.
2. Capacity to invest i.e. household wealth, complementary assets etc.
3. External conditioning variables i.e. technology, institutions, climate, infrastructure.

2 Macro-Policies And Linkages To Micro Level Decisions

Macroeconomic policies, sectoral policies, institutional policies, research and extension priorities can strongly affect the incentives and capacities of the households to make conservation and productivity investments. However, these broad policies have complex effects on overall economic activity. Households and farming communities act within a complex socio-economic environment, which is influenced by these policy changes. According to Reardon and Vosti, a conservation investment on a given plot fits into a general income, investment and consumption strategy of the farm household. Policy affects that overall strategy, and via that strategy, a specific investment. Similarly, the effects of policy on productivity enhancing investments occur via policy effects on pricing of inputs, availability of off-farm employment, price of output, access to technology, infrastructure etc. However, the crucial intermediary links, which connect the macro policies and micro level decisions, are less explored. According to the authors, the focus is generally on how a given price or regulation change affects the use of a single resource (say land or water) without putting it in the context of effects on overall household behaviour, to understand the rationale and context of the resource use change. Understanding the household strategy can be quite important in the use of a resource in response to a policy change. For example, a policy change in PDS may affect the cropping pattern via its effect on expenditure of the household on food security. Similarly increasing the prices of commodities due to general inflation will have an impact on soil fertility management investments through its impact on real incomes of the household.

Macro policies at national level and state level influence these factors directly and indirectly. While some policies affect the households directly, some of them affect indirectly through meso variables. These meso variables are to be identified in order to understand the impact of macro policies. Markets are important meso variables. Macro policies affecting the prices of input and output influence the economic returns of the farmer. Sectoral policies have direct influence on decisions of the farmers. For example, agriculture policy influences the decisions of the farmers directly. On the other hand, the influence of macro policies like liberalisation of trade, privatisation of various sectors is through their influence on the availability of off-farm employment, opportunity costs, access to resources, availability of substitutes, access to information etc.

Macro policies and sectoral policies that make agricultural activity profitable may be necessary but not sufficient to induce farmers to invest. Policies that reduce institutional risk and transaction costs are necessary. As stressed by Barbier and others (cf. Reardon and Vosti) resource-pricing policies should be moved closer to “true scarcity values”. Though the laws promoting this exist, they are often not implemented due to weak administration, high transaction costs and political economy factors (Dapaah, 1992). Developing country governments face short run political pressures to put these goals first. The best example could be the instance of Government of India increasing the urea prices in July 1991 by 40% and reducing it in August 1991 due to political uproar.

Chemical fertilisers in the form of nitrogen, phosphorous and potash (NPK) and organic manure in the form of FYM, sheep pennings, green leaves and residues of leguminous crops are mainly used by the farmers for maintaining soil fertility. Farmers’ choice of practices depends on the availability of these fertilisers, labour, crop choices, available transportation facilities, knowledge levels, access to knowledge and socio-economic status. These primary factors are influenced by secondary factors. For example, the family

composition, off-farm employment opportunities and distance from the city affect availability of labour. Similarly, availability of FYM depends on markets for FYM, stock of livestock etc. which again are influenced by the availability of and access to grazing lands, fodder, the extent of mechanisation, availability of labour and markets for livestock products. Crop choices are influenced by market prices for inputs and outputs, availability of inputs including irrigation.

3 Agricultural Policy Through Planning In India

India has been an agricultural country. In India, farming is a way of life for marginal and small farmers since times immemorial. Ever since the planning process started, specific policy measures were initiated to strengthen this sector which was contributing 55.8% of national income at the starting of the planning process. This has come down to 31.2% by 1998-99 at current prices. However its contribution to employment has not shown any decline. Employment in agriculture sector has increased from 1,321 thousands to 1,434 thousands between 1981-1998. Along with changes in the National and International political and economic environments thrust of the various policies has also undergone changes.

In order to look at the changes in policy, it is necessary to look at the thrust given to the agriculture sector through successive plans. At the on-set of the first 5-year plan (1951-56), the country was facing acute poverty with a flow of refugees to be rehabilitated and the very low level of infrastructure development. Naturally, the objective of the first plan was rehabilitation of refugees and rapid agricultural development to achieve food self-sufficiency in the shortest possible time. About one third (31%) of the plan out-lay was allocated to agriculture. The first plan aimed at solving the food crisis in the country and easing the critical agricultural raw material situation, particularly the acute shortage of raw cotton and jute. The targets fixed were modest and due to favourable weather conditions the targets were exceeded in the production of food grains.

The second plan (1956-61) targeted at laying the foundations for industrialisation and accordingly the allocation to agriculture sector was only 20% of the plan out-lay.

Launching of the third plan (1961-66) has ushered in a new era for the agriculture sector. With the experience of one decade, planners realised that slow rate of growth of agriculture was the limiting factor for the progress of the economy. Specific programmes like the intensive agricultural district programme (IADP) and high yielding varieties programme (HYVP) were introduced. For the first time, concerted efforts were made to introduce and promote new technology. Under this effort, the Government introduced and popularised HYV of wheat and rice developed in Mexico and Philippines respectively. This continued in the latter years and led to the increased use of inputs like fertilisers, pesticides and irrigation that are essential for raising them and mechanisation of agriculture throughout the country. Spread of this new technology within the country led to what is popularly known as the “green revolution”. However, there is difference of opinion regarding the equity in the spread, adoption and accessibility to this technology (detailed account given later). But, due to drought condition in 1965-66, agricultural production was seriously affected and none of the targets were met. The shortfall in food grain led to the extensive import of food grains.

With the experience of the third plan, the Planning Commission assigned greater priority to agriculture in the succeeding plans. Though original IV plan was drafted in 1966, it

was abandoned on account of economic disturbances like two years of drought, devaluation of rupee and inflationary conditions. Instead three annual plans were implemented between 1966 - 69. The approach to IV Plan emphasised the necessity to create favourable economic conditions for the promotion of agriculture and a systematic effort to extend the application of science and technology to improve agricultural practices was envisaged. The allocation to agriculture was stepped up to 23% of the total plan out-lay. However, none of the plan targets were achieved. It was realised that the first green revolution from 1967-68 was confined mainly to Punjab, Haryana and Western Uttar Pradesh.

The Fifth plan (1974 – 79) was introduced under severe economic crisis. It was proposed to achieve the two main objectives viz. removal of poverty and attainment of self reliance through promotion of higher rate of growth, better distribution of income and a very significant step up in the domestic rate of saving. The V plan was terminated at the end of the fourth year in March 1978.

There were two VI plans, the Janatha Party VI plan (1978 – 83) and the Congress plan (1980 – 85). From the VI Plan (1980-85), new impetus was given to agriculture with 24% of budget allocation. Agriculture sector grew at an annual rate of 4.3% and food grain production increased to 152 million tons and this was hailed as second green revolution, which has spread into eastern and central states including West Bengal, Bihar, Orissa, Madhya Pradesh and Eastern Uttar Pradesh.

The VII Plan (1985-90) laid more emphasis on specific projects like Special Rice Production Programme in the eastern region, National Watershed Programme for rain fed agriculture, National Oil Seeds Development Project, Social Forestry and so on. Seventh plan got extended up to 1992 beyond the 5-yr. period.

Eighth Plan (1992-97) was launched in a changed economic environment. At the onset of the eighth plan, New Economic Policy was introduced with stabilisation and structural adjustment measures. Liberalisation, Privatisation and Globalisation were the order of the day. On the lines of the conditionalities of the International Monetary Fund (IMF) and World Bank, steps were taken towards reducing the role of the State and encouraging active private sector participation. The same mood was reflected in the strategy of the eighth plan in the form of attempts to promote private initiatives, participation of NGOs and the Panchayat Raj Institutions.

The VIII Plan initiated progress to enable farmers in the rain fed areas to make scientific and optimum use of their land and water resources. Rain fed agriculture was given greater importance through watershed programmes. The treatment of rain fed areas on watershed basis was expected to create employment opportunities for unskilled labour by way of developing the potential of dry land, construction of water harvesting structures, plantation of horticulture crops, promotion of agro-forestry etc. This plan also attempted to promote a regionally more broad based pattern of agricultural growth that ended the neglect of vast rain fed, and dry land areas. It also made an attempt to make the use of irrigation facilities (both existing and newly created) as well as other farm inputs much more effective so that the full potentiality of yield improvement could be achieved, especially in the rain fed tracts. Measures to improve the quality of water management with active farmer participation were intensified.

While VIII Plan identified “human development” as its main focus, the IX Plan sought to achieve “growth with equity”. The objectives of the IX Plan with reference to agriculture sector were as follows

1. Priority to agriculture and rural development with a view to generate adequate production, employment and eradication of poverty.
2. Ensuring food security and nutritional security for all, particularly the vulnerable sections of the society.
3. Promoting and developing people’s participatory institutions like PRI, Co-operatives and self-help groups.

The IX Plan proposed to realise the targets through a regionally differentiated strategy based on agronomic, climatic and environment friendly conditions. For the first time IX Plan developed agriculture strategy based on the broad regional characteristics of the agro-economic situations as:

1. North Western High Productivity Region: The strategy is to promote diversification and high value crops and to strengthen linkages with the agro-processing industry and exports and creation of basic infrastructure.
2. Eastern Region with Abundant Water: The strategy is to exploit the productivity potential of this region, bringing the yield to the levels of high productivity states of Haryana and Punjab.
3. Water-scarce Region – Peninsular India and Rajasthan: Development of efficient water harvesting and conservation methods and technologies, suitable irrigation packages based on watershed approach and promoting appropriate farming systems.
4. Ecologically fragile Regions – Including Himalaya and Desert Regions: The thrust will be on the development of eco-friendly agriculture in these regions.

Wide spread programme of soil testing across the various agro-climatic regions was initiated in order to reduce the imbalance in the use of plant nutrients. Adoption of integrated pest management and use of biotic agents was also promoted. Implementation of National Watershed Development Programme will be intensified for the development of rain fed farming. In agricultural education, thrust will be on human resource development through upgrading teaching facilities.

3.1 Paradigm Shift

The VIII Plan identified people’s initiatives and participation as a key element in the process of development, particularly in improving the effectiveness of development out-lays which have been declining over the years. The role of the Government as a facilitator to promote right type of institutional infrastructure has been recognised. Active support of the political system at all levels is necessary to achieve this. From the above description it is observed that there is a paradigm shift.

As envisaged in the approach paper to the IX five-year plan (1997-2002), the planning process has to develop a common policy stance, which would be adopted both by the Centre and States. The role of planning would, therefore, involve considerable degree of policy co-ordination between the Centre and States, between States and between the State and sub-State level tiers of Government.

Though the planners have rightly identified the necessity of region-specific appropriate farming systems, nutrient management through soil testing and policy co-ordination between centre and states, operationalisation of the various strategies envisaged in the plan document is not complete for various reasons.

Old and new paradigm of agricultural development in India

Old paradigm	New paradigm
1. The thrust was mainly to increase the output.	1. Increase output with sustainable use of resources.
2. No recognition to the end users affected by the policy changes, which resulted in a top-down approach.	2. Recognition that all the stake holders should be involved in the planning, which led to the participatory methods of planning, monitoring and evaluation.
3. Public sector induced technology development.	3. Private sector induced technology development.
4. Blanket policies.	4. Region-specific policies.
5. Growth and development.	5. Recognition of the importance of sustainable development.
6. 6. Centrally controlled programmes.	6. Decentralised governance with local participation.

The plan objectives of the Government are translated into various programmes implemented both at the Central and State levels.

4 SAT India

SAT (semi-arid tropics) is generally referred to those areas with low and erratic rainfall and consequent less irrigation. Much of peninsular and western India lies in SAT. This includes large parts of Andhra Pradesh, Karnataka, Maharashtra, Tamil Nadu, Gujarat and Madhya Pradesh. Uttar Pradesh and Haryana of northern India also have sizeable SAT areas. Over 60% of the cropped area producing more than 80% of India's coarse grains, pulses, oil seeds and cotton is under SAT. Environment of SAT is generally harsh. SAT is an agro-climatological concept. Due to this, state-wise analysis of climatic zones lead to either inclusion of non-SAT regions or omission of SAT regions in SAT depending on the perceptions of planners. In order to overcome the problems associated with using the information available at the state level and understand the changes in SAT, Gulati and Kelley (1999) used district level data. According to them, use of district data allows a much closer approximation of the actual SAT boundaries since that boundary transects significant portion of many states. Districts, which have 50% or more of their land within the agro-ecological region of NBSS and LUP2 through LUP10, are classified as SAT districts. Accordingly 175 districts came under SAT India to which Karnataka and Andhra Pradesh contributed 15 districts each.

4.1 Agriculture in SAT India

SAT India occupies a significant position in Indian agriculture. According to the estimates of Gulati and Kelley (1999) 65.3% of the net cropped area was in SAT India region during 1992-94. The share of SAT in all India net irrigated area increased from 48.4% in 1968-70 to 58.3% in 1992-94. Total area under food grain crops in SAT India did not show

much difference during the same period. However, there is an increase in the total area under pulses from 72.6% in 1968-70 to 78.7% in 1992-94. Particularly, 99.7% of area under chick-pea and 79.2% of area under pigeon-pea are in SAT India. Overall, SAT contributed 87.2% of area to coarse cereals, 79.2% of area to pulses and 82% of area to oil seeds in the total area under these crops during 1992-94 period. The role of SAT in the production of commercial crops is also significant. While 89.8% of area under cotton is in SAT India, 62% of sugar cane is also in SAT during 1992-94 period. The entire area under castor, safflower and soybean is in SAT India.

The above facts clearly show the importance of SAT India to Indian agriculture. Changes that affect these regions affect a major part of the country. The response of farmers in these regions to changes in economic, technological, institutional and policy induced factors influences the cropping pattern. While changes in input and output prices come under changes in economic factors, improved seeds and irrigation are the technological factors. Access to credit, market and road density are the institutional factors and fertiliser and irrigation subsidies and procurement prices come under policy induced factors (Gulati and Kelley, 1999).

4.2 Changes In Cropping Patterns In SAT India – 1970-94

According to the estimates of Gulati and Kelley (1999, pages 19&20), the percentage of area under coarse cereals to gross cropped area (GCA) decreased from 34.7% in 1968-70 to 24.3% in 1992-94. Similarly, the area under total cereals also declined from 53.7% to 47.4% during this period. In the process of these changes what was observed was that there was a great reduction of area in the case of sorghum (16.8% to 10.8%) and marginal increase of area under rice (8.9% to 9.3%) (Table 2).

Area under wheat also increased from 10% to 12.8% during the same period. Very marginal reduction of area under pulses also could be observed in this period (16% to 15.8%). Area under oil seeds almost doubled from 10.4% in 1968-70 to 19.3% in 1992-94. Area under sugar cane also increased in a small measure.

4.3 Factors Responsible For Changes In Cropping Pattern

According to Gulati and Kelley (1999), changes in cropping pattern within a short temporal span are likely to be governed more by factors influencing the socio-economic environment. Government policies and programmes for crop production in the form of subsidies, support prices, tariffs and speed of infrastructure development influence these factors, in turn. According to their study, non-price factors, particularly irrigation played an important role in the expansion of area under paddy and wheat. Fertiliser price is the leading price variable, which was positive. As fertiliser prices increase, farmers tend to shift to kharif sorghum, which demands a smaller amount of fertiliser. This was observed in more than 70% of kharif sorghum growing area.

It was also observed that a “systems-activity” analysis is needed in order to understand the impact of these changes on agriculture through changes in livestock. From observing the movement of real prices of dry fodder over all the 25-year period from 1970 to 1994, it is reported that high protection to groundnut led to its area expansion at the expense of sorghum, which had a positive impact on the availability of green fodder and oil cakes. The area

substitution for sorghum reduced the availability of dry fodder obtained from sorghum. This was reflected in the increase in value of dry fodder in sorghum cultivation areas from 1/8th to 1/3rd of grain value.

Another study by Murthy and Lalitha (1983) showed that farmers in under-developed SAT respond significantly to price incentives. According to their study, reallocation of resources is based on relative profitability. Under rainfall shortages, they shift from moisture intensive high value crops. In their simulation of decreased rainfall they found that farmers shift from more fertiliser demanding crops like cereals, pulses, oil seeds and cash crops to low fertiliser demanding crops like sorghum and other coarse cereals.

5 Factors Influencing Soil Fertility Management Decisions

Review of literature and field studies revealed that soil fertility management decisions are generally influenced by:

1. socio-economic background and motivation of the farmers
2. size of the area owned/operated
3. ownership of the land
4. availability of inputs like credit, fertilisers, water etc.
5. policies of the government
6. access to information and adoption levels
7. choice of crops
8. institutions influencing land use pattern
 - a. the institutions governing land ownership and maintaining land use
 - b. the institutions for development of technology and transfer / disseminate the technologies developed
 - c. the institutions covering supply of credit and finance to the farming community
 - d. the institutions which help in marketing agricultural commodities

5.1 Socio-economic background

Studying the behaviour of farmer's indigenous soil and water conservation investments in SAT, it was observed that conservation investment is more in steep plots, plots of higher quality, plots that have incomplete structures and owner operated plots (Pender and Kerr, 1996). The study also observed that land markets have greater impact on investment incentives. Credit and labour market imperfections affect the conservation investments. According to this study investment is more in..

1. Households with more education
2. More debt
3. Higher percentage of off-farm income
4. More adult males
5. Less land
6. Low costs

In another study (Singh and Desai, 1991) various socio-economic factors at the farm level were found to be influencing the total NPK (kg/ha) fertilisers and FYM consumption.

The study revealed that the level of total NPK (kg/ha) is influenced by the important factors associated at household level. These are total wealth, number of livestock, operated holdings, schooling years of the farmer, the age of the farmer as proxy for his experience and caste of the farmer. Apart from this, village level characteristics like value of the land, area under irrigation, infrastructure, level of technological development, nearness to market etc. were also included among the explanatory variables. Farmers apply higher fertiliser in irrigated fields planted during rainy and post-rainy seasons compared to unirrigated fields planted during rainy and post-rainy seasons. It was shown that higher caste farmers apply higher dose of fertilisers and FYM than the lower caste farmers do, as they have access to greater resources. The literacy levels indicated by the years of schooling appear to be positively influencing the level of fertiliser application, but not the level of FYM. The analysis revealed an increasing trend in fertiliser consumption after 1980. But the application of FYM was not regular.

This study also looked into the impact of livestock on fertility management. Number of livestock was positively and significantly associated with the level of fertiliser and FYM use at the household as well as the plot level. The study concludes that most of the variability in the level of nutrient use across villages and farmers is due to inter household variation whereas village environment accounts for more than ¼ of the total variation.

5.2 Motives Of The Farmers

Gulati and Kelley (1999) looked into the factors influencing the decisions of the farmers using the profit model, consumption model and profit-cum-consumption model in SAT India. According to them, profit motivation factors are more important in the case of commercial crops like wheat, paddy, maize, cotton and oil seed rape. In the case of coarse cereals and pulses and groundnut, profit as well as consumption related factors are more important.

5.3 Technology Adoption

Introduction of HYV, which ushered in green revolution in India, is also associated with the use of higher doses of fertiliser. Modern varieties showed greater response to fertilisers and the full benefit of modern varieties could be achieved when the synergistic potential of a package of inputs was exploited. The field trials also demonstrated that Indian soils were generally deficient in nitrogen followed by phosphate and potash (Shah and Shah, 1992). This led to widespread use of nitrogenous fertilisers in some parts of the country. Experiments have shown that economics of fertiliser use can be improved if fertiliser use is adjusted according to the fertility status of the field (Shah and Shah, 1992). But a study in Gujarat (Shah and Shah, 1989) shows that only a third of the cultivators are aware of soil testing services and one out of ten farmers have even got their soils tested. Through an earlier study of Babasia (in 1970s, cited in Shah and Shah, 1992) showed that only a minority of farmers whose soils are tested, based their fertiliser use on these results; nine out of ten farmers did not even receive the results of their soil tests. The situation did not change even after two decades (Shah and Shah, 1990). The reason for non-adoption of the recommended doses as given by the farmers was..

1. The yield response from changing NPK level based on recommendations was perceived to be very uncertain.

2. These recommendations have not taken the farmer's resource base farm practices and management skills into consideration, and hence were found to be inappropriate.

5.4 Farm Size And Ownership Of Land

A decision of the farmers on the crops to be grown and the fertiliser to be used is influenced by the area operated. The 54th round of NSS on cultivation practices in India supports this. According to this study the area under major five food grains is more (72%) in the case of marginal farmers in Andhra Pradesh and Karnataka(68%). Similarly in the case of large growers the area under food grains was 35% in the case of Andhra Pradesh and 60% in Karnataka. Greater variation is observed in Andhra Pradesh than in Karnataka. The study revealed an inverse relationship between size of the holdings and area under paddy. While 63% of the marginal farmers are growing paddy, only 29% of the large growers are growing paddy. Majority of the large growers is growing wheat, sugarcane, pulses, oilseeds and other crops. However, the number of farms growing vegetables is more among marginal and small category. Similarly, the study also revealed that more fertilisers are used for wheat, sugar cane and other cash crops, which are mainly grown by large farmers (Tables 3,4&5). But, in the absence of actual amount of fertiliser used, the conclusions are only indicative.

However the study of Singh and Desai (1991) in seven villages of five contrasting agro-climatic regions of SAT did not show any influence of the size of the farm on fertiliser use at the household and plot level

Ownership on land that the farmer cultivates influences his decision regarding the fertility management. In a system of exploitative tenancy, agricultural production suffers as neither the tenant nor the landowner would be interested in any investment (Bandyopadhyay, 2001). A study of the impact of tenancy reforms on productivity, improvement in socio-economic status of poor tenants showed that in Kolar district of Karnataka 90% of the farmers reported that they have undertaken land improvement measures on the lands on which ownership right was conferred. The case studies of some of the tenants who got ownership also support this (Haque, 2001).

5.5 Cropping Pattern

The nature of the crop grown influences the use of chemical and organic fertilisers, which, in turn, influence the soil fertility. According to the NSSO report (45th round) 96% of the sugar cane growers use NPK and 99% of them use both NPK and manure (FYM). According to this study, NPK use was relatively less (65%) in the case of pulses. Relatively greater use of FYM was observed in the case of sugar cane (86% of growers) followed by that of cash crops (78%) and kharif paddy (77%).

Greater use of pesticides and herbicides was observed in the case of rabi paddy and cash crops. Apart from rabi paddy, herbicides are in use by 30% of sugar cane growers and 20% of kharif paddy growers. Among the crops other than rabi paddy and cash crops, pesticides are used by 59% of vegetable growers, 52% of kharif paddy growers and oil seeds growers. Among the southern states, fertiliser is used by a larger percentage of growers in Andhra Pradesh (94%) than in Karnataka (82%). Similarly greater use of pesticides is observed in Andhra Pradesh (82%) than in Karnataka (55%)(Table 5).

Studies in SAT area showed that irrigated crops are more fertiliser demanding than rain fed crops (Pasricha, 2001).

5.6 Policies Influencing The Prices of Fertilisers And Power

Fertiliser policy in India came into existence mainly with the green revolution, which introduced seed – fertiliser – water technology. In order to facilitate the process of adoption of high yielding varieties (HYV) which demand complementary inputs like fertilisers, irrigation and credit, subsidies came into existence. Since then Government has been subsidising inputs and at present the subsidies offered are to the tune of Rs.112 billion (fertiliser subsidy) and Rs.202 billion (power subsidy) which constitute nearly 2% of GDP (Gulati and Narayanan, 2000). The magnitude of these uncovered costs on these inputs has been raising more than the public investment in this sector (Vaidyanathan, 2000). In 1994-95 the total uncovered costs on account of water, fertiliser and power for agriculture was estimated at nearly Rs.30000 crores as against a total public sector plan outlay on agriculture and rural development including irrigation and special area programmes of Rs.21600 crores (Table 6). While fertiliser subsidies come under the purview of Central Government, power subsidy comes under that of State Government. In the case of both subsidies, the actual difference between what the user pays per unit and the cost of production per unit is borne by the government.

5.7 Impact Of Input Subsidies On Consumption

5.7.1 Fertiliser Subsidies

Deliberate policy of the Government to promote fertiliser consumption resulted in the increase of chemical fertiliser use at an annual average of 4.74%. However, the consumption is not uniform across the states (Reddy, 2001). Only six districts consumed more than 200 kg/ha. whereas 32 districts had the consumption of less than 10 kg/ha. Out of the total fertiliser consumption more than 40% is consumed by three states viz. Uttar Pradesh , Andhra Pradesh and Maharashtra. Crop-wise fertiliser disparity indicated that more than 80% of the fertiliser is used for rice and wheat crops.

Fertiliser use pattern in the country is overly imbalanced with excessive use of nitrogen. Despite the efforts to correct the imbalance through various measures like promotion of complex fertilisers, selling in packages of recommended doses the ratio of NPK particularly the potash is highly imbalanced. The consumption ratio is particularly highly unfavourable in the states where cropping intensity and per hectare fertiliser use is high (Pasricha, 2001). This imbalance was attributed to the differential subsidies prevailing in the country. Large subsidies on nitrogen compared to phosphorous and potash resulted in excessive use of the former. On the recommendations of the Joint Parliamentary Committee, phosphatic and potassium fertiliser prices were decontrolled and the urea price was lowered by 10% in 1992. As a result the decontrolled prices of P and K fertilisers shot up by more than 100% while urea price came down to Rs.2760/- per ton. Due to subsequent de-canalisation of the imports of DAP and MOP and introduction of flat rate subsidy of Rs.1000/- per ton on DAP and MOP, the price ratio between NPK distorted and the consumption ratios got heavily tilted in favour of N (Table 7).

Fertiliser and power subsidies generated considerable interest among the researchers who tried to look into who gained out of these mounting subsidies. Before getting into that

debate, let us look into the impact of fertiliser prices on consumption of fertilisers and cropping pattern.

According to Vaidyanathan (1993), increase in fertiliser prices may not reduce fertiliser consumption and food production. This would happen only when nutrients are managed with maximum efficiency, technically feasible with available know how. Neither supposition is valid.

Vyasulu and Gadgil (1992) expressed the opinion that reduced fertiliser subsidy may improve the soil fertility which has been damaged in highly irrigated areas by excessive application and improper placement of fertilisers.

According to a study of the impact of fertiliser prices on consumption of fertilisers in Karnataka between 1984-85 (Hanumappa and Rajasekhar, 1994), fertiliser price hike has affected the consumption of fertilisers by small and marginal farmers in semi-irrigated and dry villages. An increase in the fertiliser prices had a negative impact on dry crops grown in these villages and on poor families. Their study also revealed that fertiliser doses are higher than recommended in wet villages.

5.7.2 Power Subsidies

Power subsidy is another important factor influencing the soil fertility management practices. Irregular, insufficient and low quality of power supply influences the use of fertilisers and cost of cultivation. Farmers consider this as an important factor in influencing their decisions and profits. Power supply influences the fertiliser use indirectly through irrigation. The value of irrigation was calculated to be 59.25% in influencing the fertiliser use. The farmers in the study villages in Karnataka opined that the damage due to insufficient and irregular supply of irrigation water is more than that due to an increase in fertiliser prices. According to them, “if the output prices also increase, it offsets the damage due to increase in fertiliser prices” (Hanumappa and Rajasekhar, 1994).

Power subsidy comes under state budget. Operational inefficiencies and poor technology coupled with high transmission and distribution (T & D) losses resulted in bulging of the power subsidy bill. Micro level studies revealed that the actual power consumed by agriculture was far less than what was claimed by state electricity boards (Gulati and Narayanan, 2000). The quality of power services and the timing and duration of power supply undermine the subsidy effect. The farmers’ protest against higher price under the rationalisation of power sector is justified based on the number of pump-set and motor burn-outs in Haryana due to low quality power (ORG, 1999).

5.8 Distribution of Agricultural Subsidies

Input subsidies are not evenly distributed. States like Uttar Pradesh, Punjab, Andhra Pradesh, Tamil Nadu and Maharashtra accounted for a major part of the subsidies. Differential pattern of infrastructure growth is the reason for this (Reddy and Deshpande, 1992). In a more recent study, Gulati and Narayanan (2000) examined who are actually benefited out of the fertiliser and power subsidies in India. While fertiliser subsidy falls under Central budget, power subsidy is under State budget. According to this study, the farmer’s share in the Central Government fertiliser subsidy increased from 24.54% in 1983-84 to 131.8% in triennium ending 1995-96. But it declined to 45.85% in 1999-2000. The decline is

due to a drop in the import parity price of urea by almost half, raising the share of fertiliser industry. In the words of the authors, “In the case of farmers, the fertiliser subsidy seems to have been passed on to the consumers of grains as the aggregate measure of support for wheat and rice is negative for Indian farmers. But in the case of industry, the fertiliser subsidy seems to be a price for self-sufficiency or to protect the “extra fat” or “gold plating” of the fertiliser plants or perhaps both.

Government has been subsidising the power supply to agriculture sector. The actual power consumption by pump-sets was 26% of the total sold against official figures of 37.3%. Reported figures in power consumption in Karnataka are much higher than the actual consumption (Reddy and Gladys, 1999). As far as power subsidy is concerned T&D losses account for 24.1% in 1997-98 and 21% in 1998-99 at all India level which is much higher than the 12% average loss in any country. Unit cost for calculation is more due to T & D losses and low plant load factor (PLF). Estimated T & D loss was 30%, while reported was only 18.6%. Since part of the pilferage or consumption that is not paid for is being shown as power supplied to agriculture, the authors ask, “are not the pilferers of electricity also beneficiaries of the subsidy widely regulated as agricultural users of power?” According to the authors, agriculture is not the sole beneficiary of the subsidies believed to accrue to this sector. Based on their analysis, the authors ask..

- a. Aren't estimated subsidies to agriculture, in fact, subsidisation of theft?
- b. Is there no subsidisation of the inefficiency of SEBs as well?
- c. Does low input prices that the farmer gets imply that the benefits are passed on to the consumers?

The study of Reddy (2001) looks into the distribution aspects of fertilisers, irrigation and electricity subsidies in Andhra Pradesh. The study showed that though the land distribution is skewed, the proportion of subsidies accruing to different categories of farmers is more or less equal. It also revealed an inverse relationship between per hectare subsidies and farm size. It was attributed to higher proportion of irrigated area in the case of smallholdings.

Apart from the agricultural production subsidies, food subsidies are also offered mainly in the form of public distribution system (PDS). However, there is a trade off between food subsidies and production subsidies in any developing country. Based on the analysis undertaken with an economy wide multi-sector model in India, it was shown that there are larger income gains for all food buyers through production subsidies. While targeted food subsidies benefit urban poor, rural poor benefit from more targeted production subsidies (Praveen, John, 1994).

5.9 Credit Policy

Timely availability of capital plays an important role in farmer's decisions regarding input use. Credit policy is the instrument through which access to this crucial input is facilitated to the small and marginal farmers. Commercial banks, co-operative societies, land development banks, regional rural banks and local moneylenders are important sources of credit. The emergence of self-help groups in rural areas and bank linkages provided to these groups opened another source of credit. As observed by the expert committee on rural credit under the chairmanship of V.S. Vyas (2000), the agricultural scenario is changing. The tendency is towards diminishing dependence on agriculture, increasing proportion of smaller

land holdings, greater use of purchased inputs, preference for high value crops, growing importance of animal husbandry, fisheries and forestry. Under these circumstances institutions like SHGs, non banking financial companies have to play a major role in meeting the credit needs. The committee rightly observed that target oriented-subsidy driven programmes would have limited impact on asset creation and income generation on a sustainable basis. SHGs proved that poor are credit worthy even without subsidies.

NABARD is the apex body promoting and co-ordinating rural credit through its refinancing facilities. It has introduced the Kisan Credit Card scheme in 1998-99 in order to facilitate rural lending. Recently, it started providing bank linkages to SHGs through its regional rural banks.

5.9.1 Flow of Institutional Credit to Agriculture

Flow of institutional credit increased from Rs. 26411 crores in 1996-97 to Rs. 44617 crores in 1999-2000 (Table 8). Commercial banks continue to be playing an important role in meeting the rural credit needs with 48% of the total credit provided by them. Co-operative banks also play an important role. Out of the total institutional credit to agriculture during 2000 – 2001, 44% is provided by the co-operatives. Regional rural banks have a share of nearly 8%. The share of Co-operatives and Commercial Banks has come down marginally between 1996-97 and 2000- 2001. According to the observation of the Expert Committee on Rural Credit, Co-operative credit institutions are meeting 40% of the agricultural needs. According to their observation 24% of the investment credit and 51% of the production credit is provided by the co-operatives in rural areas. The committee is of the opinion that the methods of fixing the scale of finance require to be modified in view of the growing importance of purchased inputs as well as expansion of high value crops.

Rural credit plays an important role in meeting the financial requirements of the resource poor. Greater dependence on local moneylenders, fertiliser suppliers and traders increase their exploitation in the form of higher interest rates, use of only the available fertiliser and credit tied sales. Recent changes in the credit system of providing the credit through the group increased the bankability of the resource poor farmers and increased their access to the credit. This will have a positive impact on the soil fertility management. However, the impact depends on how far the loan availed is used for the specified purpose.

5.10 Watershed Development – Its Role

Watershed development has been considered basically as a strategy for protecting the livelihoods of the people inhabiting the fragile ecosystems experiencing soil erosion and moisture stress. The aim was to ensure the availability of drinking water, fuel wood and fodder and raise income and employment for farmers and land less labourers through improvements in agricultural productivity and production (Rao, 2000). The 4th, 5th and 6th five-year plans witnessed radical changes in approaches to water and soil conservation. The early watershed models were clearly designed on scientific principles with little input from the user communities. The basic objective was land and water resource management for sustainable production. In 1993, a high level committee under the chairmanship of Prof. Hanumantha Rao critically reviewed the existing DPAP and Desert Development Programmes and highlighted the need for an effective participatory approach. Incorporating the suggestions of the committee, new watershed development guidelines were issued in 1994 for the implementation of Integrated Watershed Development Programme.

Several studies were undertaken in order to analyse the impact of these programmes. The inferences based on the study of Hanumantha Rao Committee (Rao, 2000) revealed that the overall impact of the programme is positive and significant when compared to the period before the implementation of new guidelines. A marked improvement in the access to drinking water, increase in crop yields in area under cultivation in rabi season leading to a raise in the employment and reduction in migration of labour. Availability of fodder for animals also improved leading to an increase in yield of milk. But, from all the evaluations, one does not get a direct indication of soil conserved through watershed development except indirectly as reflected in crop yield (Rao, 2000).

An evaluation of dry land watershed development projects in India (Kerr et al., 2000) showed that watershed projects are not succeeding in stimulating soil and water conservation investments.

None of these studies have included the adoption levels of practices suggested for fertility management and their impact on the fertility status. Though success stories are recorded and models are developed under integrated watershed development programme, the benefits are location specific and unevenly distributed among the targeted people. Most of the projects have failed to generate sustainability because of the failure of the Government agencies to involve people (Saxena, 2001).

In the view of Hanumantha Rao, the present strategy of watershed development is prompted by the need to protect the people in fragile ecosystems from droughts. Though successful implementation may lead to increase in employment and incomes, according to him, it is necessary to distinguish this strategy for protection or survival from a wider or holistic strategy for the development of agriculture in dry lands or rain fed areas. This wider strategy involves many more issues of suitable technology, credit position, marketing, transportation, trade policies etc. Even though some of these are part of the programmes implemented by some of the NGOs, it needs a much wider strategy, the kind of strategy adopted during green revolution. The author says that such strategy is needed to derive full benefit from soil and moisture conservation already accomplished in some areas under watershed development programmes. Among the administrative problems, very weak horizontal linkages between line agencies at the district level are important. Though watershed development requires integration of soil conservation techniques with plantation, there is little likelihood of effective co-ordination between district soil conservation officer and forest officer (Saxena, 2001).

6 Policy Initiatives At The National Level

Due to liberalisation, privatisation and globalisation process started during 1991, the macro-environment in which the agriculture sector operates has changed. With the implementation of GATT and linking the economy with outside world, producers have to compete with their counterparts in other countries. In tune with the World Bank and IMF conditionalities and marketisation process, the role of Government is shrinking. Under these conditions, the National policy on agriculture assumes significance. For the first time, the Government started looking beyond the targets of 5 years, leaving its myopic vision, and extended it to a 20-year period. Though some of the policy decisions, which affect the agriculture sector are in the administrative power of respective state governments (e.g.

electricity, state agricultural marketing etc.), a majority of the policy decisions are at the central level and the corresponding programmes initiated to achieve the objectives stated in the National policy are implemented through the State Governments in view of National interest.

6.1 The National Agricultural Policy For The Next Two Decades – Aims To Attain

1. A growth rate in excess of 4% per annum in the agriculture sector.
2. A growth that is based on efficient use of resources and conserves our soil, water and bio-diversity.
3. A growth with equity, i.e. growth which is wide spread across regions and farmers.
4. Growth that is demand driven and caters to domestic markets and maximises benefits from exports of agricultural products in the face of the challenges arising from economic liberalisation and globalisation.
5. Growth that is technologically, environmentally and economically sustainable.

In order to attain these objectives, the policy gives importance to the following areas.

1. Promoting sustainable agriculture through promoting technologically sound, economically viable, environmentally non-degrading and socially acceptable use of natural resources, increasing crop insularity through multiple cropping and inter-cropping.
2. Special measures for conserving soils and enriching their fertility.
3. Watershed approach for development of $\frac{3}{4}$ of India's rain fed cropped area.
4. Sensitisation of farming community with the environmental concerns.
5. Move towards a regime of financial sustainability of extension services though affecting in a phased manner, a more realistic cost recovery of extension services and inputs, while safe guarding the interests of poor and vulnerable groups.
6. Mainstreaming gender concerns in agriculture with appropriate structural, functional and institutional measures for empowerment of women.
7. Promotion of balanced and optimum use of fertilisers together with the use of organic manures and bio-fertilisers.
8. Adequate and timely supply of inputs.
9. Protection of plant varieties.
10. Creating favourable atmosphere for increasing public and private capital formation.
11. Providing the benefits that the industry enjoyed and promotion of agri-business.
12. Input subsidy reforms will be pursued as a combination of price and institutional reform.
13. Consolidation of holdings, redistribution of ceiling surplus lands and waste lands among the land less farmers, unemployed youth with initial capital, tenancy reforms to recognise the rights of tenants and share croppers.
14. Development of lease markets for increasing the size of holdings by making legal provisions for giving private lands on lease for cultivation and agribusiness.
15. Private sector participation will be promoted through contract farming and land leasing arrangements to allow accelerated technology transfer, capital inflow and assured markets for crop production, especially oil seeds, cotton and horticultural crops.
16. Micro-credit will be provided as an effective tool for poverty alleviation.
17. The Central Government will move away from schematic approach to macro-management mode and assumes a role of advocacy, articulation and facilitation to help the States in their efforts towards achieving accelerated agricultural development.
18. Quality aspects at all stages of farm operations from sowing to primary processing will be given importance.

19. To prepare agriculture sector for global competition.

The National agricultural policy is a broad policy and it is in a way the extension of what was proposed in the IX Plan. But, the themes are too general and unrelated to the specified objectives. Due to this, the document does not lead to a cogent set of policy measures and it does not prioritise the tasks to be undertaken (Thamarajakshi, 2000). The document does not spell clearly the strategies to be adopted and it neglects the most important aspect of mounting subsidies, decreasing public and private investment and growing disparities among the states. Without proper infrastructure, it is not possible to make the agriculture sector competitive in the process of globalisation.

6.2 WTO – Impact on Agriculture

Signing of the WTO agreement is one of the measures towards globalisation of Indian economy. Ever since India signed the agreement, a lot of debate has been going on about its implications for Indian economy, especially on agriculture which is still a predominant sector. The following are the important points of agreement on agriculture (AoA).

1. AoA covers five major areas under WTO viz.
 - a. Market Access
 - b. Domestic Support
 - c. Export Competition
 - d. Trade Related Investment Measures (TRIMs)
 - e. Trade Related Intellectual Property Rights (TRIPs)
2. Non-tariff barriers such as quantitative restrictions are to be replaced by tariffs to provide same level of protection.
3. The agreement distinguishes subsidies into three categories
 - a. Prohibited subsidies
 - b. Actionable subsidies
 - c. Non-actionable subsidies
4. Green box and blue box measures provide subsidies excluded from Aggregate Measure of Support (AMS)

6.2.1 *Specific Liberalisation Policies Pertaining to Agriculture Since 1991 (Report of WTO cell, 2001)*

1. Changes in 1991
 - a. Removing a few items from negative list of imports
 - b. Shifting of commodities out of the restrictive list
 - c. A system of advanced license was designed for agricultural exporters with duty free access to imports
 - d. EXIM Scrips facilities for a number of agricultural commodities and allied products like fish products, cashew, fresh fruits, vegetables, cut flowers, plants, spices, instant tea, coffee etc.
 - e. De-canalisation of jute pulp, raw fibre, manila grass, raw jute, molasses and sugar in imports
2. Changes during 1992-97

- a. Duty free licensing scheme for agricultural exporters
 - b. Introduction of special import license
 - c. Reduction in number of restricted items to 215
 - d. Agricultural imports other than cereals, oil seeds, edible oils were de-canalised.
 - e. Quantitative restrictions removed on agricultural commodities
 - f. Export of agricultural items except onion and oilseeds de-canalised
 - g. MEP restrictions on Basmati rice abolished
 - h. Export controls on all common varieties of rice are abolished
 - i. Private export of Duram wheat allowed – QR s removed
 - j. Import of palm oil was put on OGL
 - k. All edible oils except coconut oil and palm oil were put on OGL
 - l. Export control of sun flower seeds, rape seeds and mustard removed.
 - m. Sugar imports were de-licensed
3. Changes during 1997 – 2000
- a. Import restrictions on cloves, cinnamon and cassava were converted to canalisation
 - b. Export of sterilised milk, vegetable oil except groundnut oil de-licensed
 - c. Pulses, paddy and rice continued on the list of exports
4. Changes in on 1st April, 2000
- a. 80 items broadly coming under the agricultural and allied sectors were removed from the list of items having quantitative restrictions.
 - b. Tariff policy revised

These policy changes will have an impact on the production, prices and export of these commodities. Depending on the market share and price elasticity of demand for these commodities in the importing countries some crops may be gaining and some may be losing. Mapping of the gainers and losers will help in understanding the impact of these policies on cropping pattern, soil fertility management and demand for specific inputs. However simulation exercises (Gulati & Kelley, 1999) revealed that when internal prices are aligned with international prices, 50% increase in water charges and 50% decrease in fertiliser subsidies are implemented, supply of rice and wheat comes down. Diversion of resources takes place from rice, wheat, sugar cane and cotton to coarse cereals and pulses which are less fertiliser demanding.

7 Livestock

Livestock is an integral part of agriculture and has profound influence on sustainability. Apart from generating higher incomes, livestock generates employment and produces organic manure. A systematic management of livestock will have a much more positive impact on land productivity in the mixed farming context. The complementary and supplementary roles of cattle and crops under a mixed farming system through draught power for agricultural operations and rural transport, organic manure for maintaining soil fertility and fuel for cooking were highlighted in the literature (George, 1996). Draught power provided by livestock for agricultural operations and transport, supply of dung as organic manure and the utilisation of green fodder and crop bi-products for milk production are some

of the links between these sectors. Most of the empirical studies are confined to Punjab and Haryana region (George, 1996).

Quantity and quality of livestock influence the soil fertility management both directly and indirectly. It contributes directly by influencing the availability of organic manure. It contributes indirectly through its influence on incomes of the households. Increased income through livestock increases the capacity of the household to invest on productivity enhancing methods through purchase of off-farm inputs.

Livestock economy is changing very rapidly. The growth of draught animal stock has slowed down and milch animal stock is growing relatively fast. The proportion of cross breeds among milch animals is growing rapidly (Saxena and Sardana, 1997).

7.1 Developmental programmes and policies

Several programmes and policies have been initiated to promote animal husbandry and dairying. Key Village Scheme (KVS) was introduced during the I-five year plan. The programme aimed at promoting artificial insemination, health care and cultivation of fodder crops at the level of various village clusters. Intensive Cattle Development Project (ICDP) was launched in the III-five year plan. It aimed at rapid enhancement of milk production through dairy projects in the rural milk sheds. Both KVS and ICDP have adopted partial approach and had limited success. But, a comprehensive Operation Flood (OF) programme for dairy development was launched in 1970 which aimed at promoting co-operatives of milk producers to facilitate production, processing and marketing of milk as well as breed improvement and animal health care. Apart from this, integrated rural energy programme (IREP), drought prone area programme (DPAP) etc. were introduced mainly to encourage dairying among the poor families. These programmes have a positive impact on livestock development.

Breed improvement is one of the important components of livestock policy. Cross-bred cows require more and better feed and greater care in management which works out to be costly for marginal and small farmers. This discourages them to keep livestock. The policy of encouraging cross breed stock may place small farmers and land less in a disadvantageous position to take up dairying as a source of supplementary income. This will have an impact on the availability of FYM. However, with good feed support, these stall-fed livestock may improve the availability of FYM due to higher percentage of recovery of dung than in the case of grazing animals. Majority of the research studies on livestock looked at the profitability of dairying but it is necessary to look into the impact of increased mechanisation of agriculture, changing relative costs of animal and mechanical power, the returns to milk production, and the emergence and growth of lease/exchange arrangements for draught power on livestock population. Nair's (1977) study of Kerala looks into some of these factors. According to him, the reasons for exceptionally small number of draught animals per acre of cropped area in Kerala are existence of a bullock rental market, decreased demand for draught animals due to increase in the number of small farmers and substitution of milch animals for draught animals due to greater profitability.

In rural areas dung is used not only as manure but also as a fuel. Increased cross-bred livestock may increase the demand for fodder, consequently less biomass is available for use as fuel. As a result, dung has a high opportunity cost for use as a fuel. According to the study of Motavalli and Anders (1991) high opportunity cost of dung for use as fuel has reduced its

application to crops. According to them, biomass shortages limit farmer's ability to retain stubble on croplands during the dry season, which renders the land highly prone to erosion by early rains.

8 State agricultural policies

8.1 Andhra Pradesh

8.1.1 Overview

Andhra Pradesh is the fifth largest state in India both in area (275, 068 km²) and population (around 78 million). Bounded by Madhya Pradesh and Orissa in the north, the Bay of Bengal in the east, Tamil Nadu and Karnataka in the south and Maharashtra in the west, Andhra Pradesh forms the major link between the north and the south of India. The northern area of Andhra Pradesh is mountainous; the highest peak Mahendragiri rises 1500m above the sea level. The climate is generally hot and humid. Average rainfall of the state is 925 mm. The Krishna and the Godavari are the major rivers in the state. With a 970km coastline, Andhra Pradesh is the largest maritime state in India. Andhra Pradesh consists of 22 districts, spread across three distinct regions: Andhra: the coastal region made up of nine districts, Rayalaseema: the interior region to the south of the state consisting of four districts, Telangana: interior northern region, consisting of the capital Hyderabad and nine adjoining districts.

Resources: The Poor natural resources base of the inland areas contributes to the area's poverty. Poor soils, low and erratic rainfall, limited infrastructure and irrigation, often-declining groundwater and little support to agricultural enterprise also add to poverty. Cyclones are a common phenomenon. Although, the average annual rainfall is good, some of the districts in Rayalaseema, Telangana regions and some of the coastal districts face recurring drought. There are extensive areas of rain fed agriculture in Andhra Pradesh, which could potentially benefit from the sort of watershed development approaches seen elsewhere. Rain fed agricultural land is the primary livelihood source for most farmers. Landholding distribution varies between villages, and there is widespread inequality in land distribution. Most cultivators are either small or marginal farmers and since a holding of at least two hectares is required for a household to derive subsistence, most of them are at risk. Water supply is the key variable affecting cropping pattern and intensity. Where irrigation is possible paddy and groundnut are the main crops. Where irrigation is not available, maize, millet, pulses (e.g. red gram) are cultivated. In unirrigated fields farmers are exposed to a major economic risk if the monsoon fails. There has been a recent increase in bore-well drilling in dry areas of Andhra Pradesh. This increase in bore-wells has led to an increase in the irrigated area. There is concern that, in conjunction with unreliable rains over the last decade, the pattern of increased groundwater extraction may be unsustainable, without effective rainwater harvesting. Although there is little systematic data so far, groundwater levels are felt to be declining in many areas. There is a need for some form of regulation of groundwater extraction, particularly to secure drinking water supplies.

8.1.2 Changes in Cropping Pattern in Andhra Pradesh

An analysis of cropping pattern in Andhra Pradesh shows that between 1980 and 2000 the percentage of area under coarse grains in total cereals has declined from 42 to 16%. Area under paddy in total food grains has increased from 44 to 53%. Area under groundnut has shown considerable increase from 15.5 to 23.44% during the same period. Area under pulses

also increased from 2.74 to 5.4%. This shows that oil seeds and pulses have increased at the expense of coarse grains (Table 9).

8.1.3 Vision 2020

In Vision 2020 of Andhra Pradesh Government, it is stated that “By 2020, Andhra Pradesh will be the powerhouse of Indian Agriculture with a well developed, efficient and productive allied sector and strong agro-industries”. The agriculture sector will have shifted to a high-growth trajectory and will be more than four times its current GSDP. All regions will enjoy agricultural development and balanced regional development and equity will have changed the face of rural AP.

To realise its vision, the state is pursuing a strategy aimed at integrated development of the agriculture sector. Three major imperatives are:

1. Harnessing water resources,
2. Developing agriculture in rain-fed areas and
3. Spurring growth through policy reform.

In order to realise the above, the following strategy has been envisaged in Vision 2020 of Andhra Pradesh Government.

1. The State will invest around Rs. 70,000 crore by 2010 and roughly 1,60,000 crore by 2020 in agriculture.
2. Irrigation is considered as a lead input in agriculture and rural development. The strategy for development of drought prone areas comprise the following: Godavari Water for Telengana Region, so far 720 TMC has been utilized, balance 775 TMC is yet to be tapped and if this is utilized it could irrigate – 23.5 lakh acres of backward and drought prone areas in the state. Similarly it is envisaged that Krishna waters would be supplied to Rayalseema, Southern Telengana and Prakasam districts, Pennar flood waters for Nellore and Chittoor and Vamsadhara, Janjhavatia and Bahuda water for North Andhra. Water use efficiency is to be improved by the 10942 Water Users Associations WUAs and 174 Distributory Committees functioning in the State.
3. Developing Rainfed Agriculture: The initiatives include promotion of soil conservation strategies to prevent land degradation, orienting research particularly towards developing crop varieties that can withstand drought and by promoting location specific technologies. The state will need to ensure availability of high quality inputs, seeds, fertilizers and pesticides to the rainfed areas. Since these areas are fiscally poor, innovative measures have to be encouraged to promote crops and cropping patterns suited to dry land conditions.
4. Policy Reforms to stimulate growth: The document states that, “Since Government resources are limited, a large part of the investment should come from the private sector corporations, cooperatives, and individuals”. Farmers/enterprises have a significant role to play in agriculture development. Agriculture policy therefore must ensure that these players are induced to invest (p.177).
5. Promotion of contract farming
6. Rationalisation of Taxes to promote large scale investment in agriculture.
7. Wastelands are to be developed by setting up a business entity in which the Government has an equity share, it is suggested that this equity be distributed among the landless labourers.
8. Rice – It is aimed that by 2020 the state would be the largest and most efficient producer of rice in the country. Increasing the area under irrigation and setting up WUAs will

increase productivity. Farmers in drought prone areas would be promoted to use seed varieties that can withstand these conditions with the help of bio-technological research. Extension services would be provided and export markets would be developed. The Government would facilitate the development of R&D in coordination with ICAR and state agricultural universities. Extension work is to be carried out through local NGOs and vocational schools would be set up to train the extension agents.

9. Poultry-This sector will be developed to make the state the country's largest producer of eggs and broilers. Investment by large companies is to be encouraged and this is to be initially focused in Telengana Region. Contract farming would be promoted. Report states – “The State will consider formulating a legal framework for contract farming that clearly defines a tripartite contract farming relationship between the farmers, corporate institution and the government”. The Government as a third party to the contract will make sure that the farmer's interests are protected. Enforcement mechanisms including for the quick resolution of disputes will be provided (P.203).
10. Simplifying the land acquisition process – The report calls for an easier process for corporations to acquire land. The report states – “It is extremely difficult for a corporation to acquire/lease land, particularly agricultural land...the government will have to simplify the land acquisition process”. This entails setting up accurate land records and rationalizing the taxes and duties to speed up acquisition process (p.203).
11. Horticulture - is to be promoted and it is envisaged that by 2020, the state will be the preferred destination for private investment in the food processing sector and would grow at the rate of 10% from 1995 driven mainly by export demand. The focus would be in east and west Godavari districts, parts of Krishna district, areas around Hyderabad, Chittoor, Cuddapah and Anantapur. The Government provides strong institutional support by setting up boards such as Mango Board, which would provide the provision of crucial inputs such as credit, extension and education. Strong linkages along the horticultural chain are proposed to be developed and the suggested strategy is to invite large corporations to enter this sector. It is proposed that cultivable wasteland would be brought under horticulture through watershed development programmes. Fiscal incentives would be provided to modernise the sector and subsidies would be offered for equipments to encourage their use (eg. drip and sprinkler systems) and tax benefits/reduction of customs duty for procuring modern equipment.

8.1.4 Involving Stakeholders For Better Water Management

Involving the users in the management of their common resources is the best way for ensuring effective local management. Recognising this, the state has made a pioneering move to create water-users association (WUA) under the Andhra Pradesh Farmers' Management of Irrigation Systems Act, 1997. Through these WUAs, the stakeholders are involved in the maintenance and management of irrigation systems. WUAs have been created at the primary level and distributory committees and project-level committees are also functioning to facilitate efficient water utilisation by farmers. Currently 10, 292 WUAs and 174 Distributory Committees are functioning in the state. The primary task of these WUAs is to manage (operate and maintain) water resources. This not only involves raising funds for maintenance but also supervising works, deciding on water allocation and improving services. This will help break the vicious cycle of poor cost recovery (56%) leading to poor maintenance and unreliable irrigation services. These WUAs would also be bringing together strong forces in encouraging water conservation through committed participation in watershed development programmes, establishing water markets for varied uses such as floriculture, greenhouses etc., and promoting agricultural extension. The WUAs could also play a critical role in spreading awareness of alternative irrigation systems such as drip and sprinkler systems for horticulture,

for example, where the entire field need not be flooded with water. These efforts are expected to have a positive impact on the soil fertility management decisions.

The government of Andhra Pradesh has constituted water conservation mission to focus attention on conservation of water by taking large-scale water conservation measures under “neeru-meeru” (WATER and YOU) programme. Activities like continuous contour trenching, staggered trenching, check dams, rockfill dams and percolation tanks with gully plugging are currently under implementation.

An analysis of the Andhra Pradesh villages before and after the implementation of watershed management shows increased access to water for irrigation and drinking, increase in wages and employment opportunities, decreased soil erosion and soil conservation on uncultivated lands and drainage lines at the village level. At the plot level, changes are: increased cropping intensity, adoption of new varieties, higher yields, less soil erosion and conservation of cultivated lands, increased farmers’ land improvement investments and higher annual net returns from cultivation.

Findings of the analysis show that government watershed projects (NWDPR, DPAP and World Bank) have performed poorly on the whole compared to watershed projects managed by NGOs or NGOs in collaboration with government agencies. The government projects succeeded only in improving the condition of drainage lines (Kerr, 2000).

None of these studies have looked into the factors responsible for the increase in yield and its sustainability. The linkage between the subsidies extended under the project and the results are not clearly established. On account of this the withdrawal effect of these subsidies also remains uncertain.

For monitoring the soil fertility levels in the villages, the state government has started village adoption programmes, soil fertility monitoring programmes and seed-village programmes. At present 27 soil testing laboratories are rendering soil-testing services to the farmers with an annual capacity of 3.38 lakh soil samples. The net area sown in the State is about 103 lakh ha. If all the area sown has to be covered with soil test based fertiliser recommendation at least once in five years, by collecting one sample for every two hectares, existing soil testing laboratories have to analyse 10.24 lakh soil samples per year. The task is not possible for the existing soil testing laboratories that have the capacity to analyse only 3.38 lakh soil samples.

8.2 Karnataka

8.2.1 Overview

Karnataka is the eighth largest state in the country with an area of 1.91 lakh sq.km. It has a coastline of 310 km. The state is divided into 27 districts with 175 taluks comprising 27066 inhabited villages. Based on rainfall pattern, quantum and distribution, soil type, texture, depth, physico-chemical properties, elevation and topography and major crops and vegetation, the State has been divided into 10 agro-climatic zones. This classification is based on taluk as boundary.

8.2.2 Changes In Cropping Pattern

Cropping pattern trends in Karnataka show declining share of coarse cereals. The percentage of area under coarse cereals in total area under cereals has declined from 71 to 62% between 1980 and 1999. Similarly, coarse cereals in total food production declined from 55 to 45%. Area under paddy declined marginally. Area under oil seeds and pulses increased marginally. Area under maize in total food crops increased considerably from 3 to 8% during the same period (Table 10).

8.2.3 *Karnataka State Agriculture Policy*

Karnataka announced its new agriculture policy in 1995. It clearly reflects the mood of the macro economic policies oriented towards liberalisation, privatisation and globalisation. The salient features of the policy are as follows:

1. Giving industry status to agriculture
2. Improving public and private sector investments in agriculture

Public sector investment is sought in

- a. creation of economic and social infrastructure
- b. higher out-lays in agricultural research and development
- c. investment in major and minor irrigation projects
- d. investment in water harvesting, roads, development of markets
- e. social infrastructure like primary health and education
- f. providing low-cost housing

Private investment is sought in

- a. production, marketing and processing activities
- b. seed multiplication
- c. high tech agriculture ranging from floriculture, horticulture, sericulture, dairy, poultry and meat
- d. foreign investment with institutional support to safe guard the property rights
- e. setting-up cold storage chains
- f. agro-processing, bringing new technology in processing
- g. working with farmers on their fields in raising their productivity, providing them with a forward market

1. Funds to be raised by selling of public sector enterprises, appropriately pricing water and electricity
2. Rationalisation of lending policy by re-organising co-operative sector
3. Shifting from top-down to bottom-up approach in irrigation policy, promotion of water users associations to collect water charges
4. High priority towards soil and moisture conservation through watershed development
5. Price and market reforms by providing storage facilities, preventing the crash-down of prices of the coarse grains below the minimum support price
6. Providing market information through various media and delegation of progressive farmers to other countries
7. Institutional frame work for people's participation and involvement of NGOs
8. Encouraging leasing of landholdings among the small and marginal farmers for promoting agro-farming, group farming to reach out for modern technology and larger farm investments to avail market opportunities
9. Reduction in subsidies on chemical fertilisers, canal water and electricity

10. Promotion of horticulture, floriculture, aquaculture, dairy and animal health in order to strengthen the horticulture base by legalising contract farming (up to 54 acres), creating flower auction yard, fodder development and providing health care to livestock
11. Appropriate framework for exports
12. Safe guarding the interests of poor by giving them appropriate representation in institutional bodies, support operations and ensuring minimum wages

8.2.4 *Livestock in Karnataka*

Department of animal husbandry and veterinary services is overall in-charge for the implementation of livestock sector. The departmental activities include animal health and veterinary services, livestock development, sheep and wool development, poultry, piggery, rabbit development, feed and fodder development, implementation of socio-economic programmes like special component programme, tribal sub-plan, special livestock breeding programme, IRDP programmes etc.

Livestock population in Karnataka has increased considerably since 1951 as shown in the table 11. Trends in the growth of livestock show the changing composition of livestock in Karnataka. While the proportion of cows in the total population has decreased from 36.56% to 22.57% between 1951 and 1997, the share of sheep increased considerably from 17.39% to 39.62%. Similarly the share of poultry also increased. This may be due to decreased demand for draught animals, increased cost of maintaining livestock, decreased availability of labour etc. Increase in the share of sheep may be due to the implementation of various programmes under DW CRA, IRDP, Women Development Programme etc. However, field studies are necessary to establish the reasons.

Information regarding the production of dung and its utilisation in Karnataka (Annual Report – 1999-2000) showed that 84.45% of the dung produced is used for manure and 12.67% is used for dung cakes (fuel). Greater proportion of dung is used for manure in winter than in summer and rainy. Average dung production per animal per day has increased from 3.5 kg in 1983-84 to 5.5 kg in 1999-2000. These values are only indicative because average yield of dung of bovines was worked out for the period excluding that of grazing in the field and there are no separate estimates for indigenous and cross-bred breeds.

8.2.5 *Policy Initiatives And Agriculture Sector In Karnataka*

In tune with the policy announced, various administrative changes have been initiated in the Agriculture Department. New programmes were also introduced accordingly.

1. Integrated watershed development, which is based on a holistic strategy is recognised as an important tool for sustainable agriculture. A separate watershed development department was created from 1.1.2001, abolishing the earlier dry land development boards. This department has an office in 24 districts. At the State level, it is headed by a director assisted by joint directors and a chief accounts officer. At the district level, watershed development officers implement the programme assisted by multi-disciplinary heads under the overall control/supervision of Zilla Panchayats.
2. To ensure smooth and effective extension network, the Department of Agriculture was re-organised by merging crop husbandry and soil conservation wings during 1995-96. In this new set up Gram Panchayat mode of functional unit is introduced for taking up all extension activities at grass roots level and an extension worker i.e. agricultural assistant is placed at Gram Panchayat level to carry out the extension activities of the Department

including horticulture. An assistant agriculture officer is in-charge of a range, which includes 3-5 Gram Panchayats. An agriculture assistant works as a technical assistant to help the farmers in getting the desired technical information.

3. In order to disseminate scientific technology, Farmer's Contact Centres (FCC) were established under Rytha Mithra Yojana launched by the Government of Karnataka during 2000. Under this programme it is proposed to establish FCCs in all 745 revenue hobli headquarters. The main objective of FCC is to guide the farmer in input use, pest management, introduction to modern agricultural inputs, methods of farming and also act as the resource centre to collect and maintain basic agricultural information, update it periodically and provide feedback information to scientists about local field problems.
4. Implementation of fertiliser recommendations based on recent research findings of Soil Test Crop Response (STCR) in 15 districts through 11 soil health centres.
5. An agriculture officer with an agriculture assistant exclusively for farm management studies has been posted at Joint Director office.
6. Agricultural Technology Information Centre was established at Dharwad UAS to fulfil the objectives through "single window delivery system", where improved quality seeds, seedlings, publications and advisory services are made available.
7. Floriculture division at Karnataka Agro Industries Corporation(KAIC) started a flower auction house which is first of its kind in India on 15.10.1995 at KAIC, Hebbal Campus, Bangalore.
8. Karnataka Agricultural Product Processing and Export Corporation Limited (KAPPEC) was established on 22nd April, 1996 with an authorised share capital of Rs.500 lakhs. The important objectives are
 - a. To develop and promote the production, processing and export of agricultural, horticultural, floricultural products.
 - b. To identify the modern technology for increasing the productivity, production, processing and storage of these commodities.
 - c. To create post harvest infrastructure facilities for the development and export of agricultural commodities and promote private participation.
 - d. To undertake market research about the export quality products and disseminate information to both exporters and growers.
 - e. To undertake seminars/ workshops/meetings/exhibitions.
9. KAPPEC was issued export licence for the export of 5000MT of Niger seed. KAPPEC has been nominated as canalising agency for the export of Niger seed from India. It was awarded the status of "Export House".
10. World Bank aided Agricultural Extension Project was I operation till 1992-93. Between 1993-1997 it culminated as state sect of Plan scheme. During 1997-98 it was transferred Plan to Non Plan scheme along with its components.
11. Establishemnt of Bio Technology Centre at Hulimavu horticultural farm near Bangalore with an objective to produce quality planting materials and conserve the genetic diversity of plants.
12. Assistance to NDDDB intervention in setting up markets for the horticultural products.
13. Cold storage Subvention Scheme is implemented at a cost of Rs. 27 lakhs to provide a subvention of Rs.1 per unit of power consumption by the cold storage of horticultural produce in order to reduce post harvest losses, during 2000-2001.
14. Setting up of Karnataka Agriculture Commission.

8.2.6 Programs Implemented

Agriculture Department has been implementing various programmes either supported by the State Government or in collaboration with the Central Government. Apart from this,

various Central sector schemes and externally aided projects are also implemented at the State sector and the District sector. This excludes watershed programmes. During 2000-2001 there are 108 schemes which comprise 67 plan schemes and 41 non-plan schemes. Under the plan scheme 49 State schemes are implemented, out of which 39 are under State sector. There are 9 schemes jointly sponsored by Central and State Governments, 7 Central sector schemes and 2 externally aided projects are also in operation (Table 12).

The above list of various administrative changes and programmes implemented in the State reflect the policy mood of the Government. Recent introduction of some of the changes like creation of separate watershed department, introduction of Gram Panchayat mode of functional units in extension net works, implementation of fertiliser recommendations based on research findings of STCR, creation of KAPPEC, setting up of Karnataka Agricultural Commission. Introduction of flower auction centre at Bangalore and implementation of various new schemes to translate these changes into action at the grass-roots level clearly reflect the philosophy of the agriculture policy of Karnataka, 1995. Though it gives an array of changes to give industry status to agriculture and make agriculture sector viable in the wake of global changes many challenges remain in the effectiveness of these measures in reaching the goals due to ground realities.

Land distribution in Karnataka is skewed towards marginal and small farmers. According to 1995-96 census 42% are marginal farmers and 27% are small farmers. But, only 10% of the area operated is in the hands of these 42% marginal farmers and 21% of the area is under the control of small farmers. New agriculture policy proposed changes to the existing Karnataka Land Reforms Act 1961, in order to facilitate the leasing process and accordingly Karnataka Land Reforms (amendment) Bill 1995 was passed. The changed bill is supposed to facilitate leasing in and out which helps the non-viable marginal farmers to consolidate their non-viable holdings. In a seminar at NIRD, Hyderabad, it was argued that marginalised people in Agriculture should be encouraged to move out and that the present tenancy legislation comes in their wake. But, moving out of agriculture is not really proving to be advantageous when we look at the cases reported around Bangalore. The plight of the farmers who sold their lands to floriculture units amply describes the situation (Rao and Hanumappa, 1999). Since these farmers are unskilled and have little managerial capability to manage the other activities than cultivation. They are not successful in alternative activities. According to them, "We can not do anything other than farming. If we invest in anything else, it vanishes like a bubble". Farming is a way of life for many of the cultivators in India.

8.3 Impact Of Macro And Sectoral Policies On Agriculture Sector In Andhra Pradesh And Karnataka

The macro economic policy of liberalisation, privatisation and globalisation which the Government of India embarked up on from 1991 has entered into all sectors and the process of liberalisation of different sectors is taking place. Current budget (2002-2003) proposed to liberate farmer from all internal constraints and the allocations to state budgets are linked to the process of liberalisation. Under these circumstances the strategies of all the state governments move towards the same objective. Especially the governments of Andhra Pradesh and Karnataka are following similar strategy of opening up of agriculture sector and encouraging corporatisation of agriculture. However due to differences in the initial conditions in these states, the effects may be different. The likely impact of these changes is presented below.

1. Government policy to conserve land and water resources through watershed programmes did not prove to be very successful for various reasons. Vaidyanathan (1998) observed that the scale of these watershed programmes is minuscule in relation to the magnitude of the area in need of treatment. “The technical and organisational problem of finding a cost-effective solutions remain daunting”. Some of the review studies also revealed that sustainability of the fruits of the positive impact of these watersheds is questionable.
2. According to Kurien (1981), the process of marketisation will encourage the less efficient big farmers at the expense of efficient small and marginal farmers. Even if irrigation is provided the return per family member per annum was slightly above the poverty line in the case of small farmers while it is more than four times larger in the case of two top groups having six hectares or more.
3. The introduction of high tech agriculture facilitated by the encouragement given to MNCs and private investment does not seem to be very effective in improving the position of small and marginal farmers. Recent study of the farmers in Ranibennur taluk who are actively involved in high tech supported farming by seed companies (Rao and Hanumappa, 1999) shows that the gains are more to medium and large farmers. The project hardly seems to have helped the lowest size group of farmers to improve their status. Rao and Hanumappa (1999) conclude that even adequate access to information, high value crop, full range of services like extension, input supplies, credit and marketing do not seem to be capable of lifting the marginal and small farmers above poverty and dependence on casual labour. Apart from this, these corporations have little concern for soil fertility and environment. Short term monetary gains over rule the long run sustainability concerns. Targeted production is achieved by increased use of chemical fertilisers.
4. The ecological and social costs of technology and demand led agricultural are not properly considered; though there was a mention about need to provide safety. Modern farming based on high technology is capital intensive, which leads to heavy debt for the purchase of inputs. Farmers suicides across the country stand as a mute testimony to this debt trap in the process of small and marginal farmers shifting their production strategies to market signals. According to Vandana Shiva (2001) indebtedness and crop failure, which are the inevitable outcome of corporate model of industrial agriculture, are the main reasons for these suicides. It is ecologically unsustainable as it leads to mono culture of introduced varieties and unsustainable practices of chemically intensive farming. While the benefits of globalisation go to the seed and chemical corporations through expanding markets, the costs and risks are exclusively born by the small farmers and land less peasants.
5. Commercialised farming also reduces the practice of crop rotation, which was followed by our farmers for generations. In fact this is the only method of improving the soil fertility for generations which is reflected in PRA exercises in study areas. In Warangal district of Andhra Pradesh, the cotton crop replaced the crop rotation based on Jowar(rabi) and green gram(Kharif). The acreage under green gram/jowar sequence has shown a drastic decline in the last one decade (Shiva, 2001).
6. Switching over from traditional crops to commercial crops without proper knowledge about the practices also lead to the miseries of small and marginal farmers. Only with the hope to improve their monetary income these farmers switch over to commercial crops. PRA exercises in study villages revealed that the farmers mainly depend on the ancestral

knowledge from elders in farming, which is also easily accessible. Since knowledge about the new modified commercial crops is not available with the elderly people, the new growers naturally take the advice of the local educated people. In the process the private moneylenders play an important role in not only providing money but also chemicals and fertilisers. In the words of Shiva (2001), these private moneylenders took on the role of “pest management advisors” to farmers. This not only exploits the farmer in monetary terms, but also depletes the soils due to excessive fertiliser and pesticide use. As reported in Warangal, the innocent farmers are made to spend Rs.8000 to Rs.10000 on pesticides alone.

7. Improving public sector and private sector investment is one of the policy initiatives. Public sector capital expenditure for agriculture shows a declining trend in all states between 1974-75 and 1996-97(Ramesh Chand, 2001). The decline is observed in almost all the heads and the highest decline was observed in the resources allocated by the union government for agricultural infrastructure. An account of per hectare (Net sown area) public investment in agriculture at constant prices in Karnataka , Andhra Pradesh and All India are given in Table 13.

Both in Andhra Pradesh and Karnataka, annual average public expenditure is less than the all India average. Among the larger states, per capita expenditure was highest in Punjab. Similarly in private investment also Punjab ranks highest. Private investment in Karnataka increased from Rs. 81/ha in 1981-82 to Rs. 184 in 1991-92 (at constant prices). But in the case of Andhra Pradesh, it increased from Rs 86/ha to Rs.96/ha during the same period.

Different opinions exist in the literature regarding the complementarity between the public expenditure and private investment in agriculture depending on the methodologies used in estimation. The study of Ramesh Chand with improved methodology showed no long-term relationship between these two series during the period 1980-81 to 1996-97, which means that public sector investment did not have a positive impact on private investment during the study period. Terms of trade for agriculture and institutional credit advanced for asset formation has positive and significant impact on capital formation in agriculture. State-wise analysis showed that public sector capital expenditure and institutional term loans are important factors determining the private investment during 1980 –81 period. However the importance of public sector investment has disappeared during 1991-92. Based on this study improving the terms of trade for agriculture and providing institutional credit are important determinant tools for promoting private investment. But, in the case of Karnataka, the terms of trade have been unfavourable for agriculture due to adverse cost price ratios of major crops. Under these conditions, the new policy has to concentrate on improving the price situation and institutional credit to influence private investment to reach desired goals.

8. The strategy of encouraging private investment in agriculture through encouraging investment in seed technology, marketing and agro-processing and horticulture etc. has been criticised. Allowing leasing-in of land by private seed farmers will lead to corporate land lordism (Assadi, 1995). According to Assadi (1995), the new agriculture policy paves the way for corporate land lordism while increasing the trends towards de-peasantisation and sharpening of economic and cultural crisis in the countryside.
9. As regards livestock, the agricultural policy aims at improvement in quality of the livestock and the poultry feeds, establishment of rabbit farms, fodder development, massive programmes of piggery and poultry development. Livestock sector in Karnataka

occupies an important place in the State's economy. As per 1997-98 estimates, this sector contributed Rs. 10256 crore to the State's GDP. Livestock plays an important role in maintaining soil fertility status. The ruminant animals have the ability to fix atmospheric nitrogen through microbial flora present in the rumen. Growth of livestock population in Karnataka shows an increasing trend in all animals. This macro picture at the State level does not represent the regional differences. PRA exercises from the study villages show decreased livestock population, which is identified as one of the reasons for non-availability of FYM though it is identified as one of the important factors in the soil fertility management. According to one estimate 0.7% of the cultivated area in Karnataka is under fodder either as an inter-crop with coconut or as fodder jowar. But with the emphasis on commercialisation of agriculture and greater importance to high value crops and higher harvest index, there may be a fodder crisis, forcing people to keep less livestock. But with increased production of pulses, oil seeds including cotton, the feed concentrate requirement can be met from the crushed grain of pulses, cereals, oil cake etc. Implementation of watershed development programmes in which social forestry is an integral component with selective tree planting there is a possibility of increasing the availability of fodder. However, the magnitude of these impacts may not be very significant.

10. PRA exercises conducted in the study villages clearly brought out the importance of NGO presence not only in providing the necessary information directly, but also in facilitating the interventions by the Government machinery. This shows the complementarity between the NGOs and Government activities. While villagers in the NGO village (BAIF) are considering the NGO as an important source of information on technology, they also gave second importance to agriculture department. Apart from this, the other departments and cooperative bank were also considered important. Though elderly people in the village, friends and relatives are important source, the absence of Government machinery is conspicuous in non-NGO village.
11. This study also brought out another factor relating to accessibility to important sources (agriculture and veterinary departments). Though a vast extension machinery with various programmes is working for information dissemination, their out-reach is very limited. The objective of revitalising the stagnant agricultural economy is not possible under the present system of extension services.
12. Privatisation of extension services is mentioned in the Karnataka agriculture policy. However, the results of this may be mixed because privatised extension services may not be within the reach of the poor, small and marginal farmers due to the cost. Private extensionists may not have social concern and they are motivated only by the cost benefit/returns.
13. The policy makes a reference to the new institutional set up in which the user groups, NGOs and self-help groups, participate in the shaping of the development process, by sitting in the management boards. This is a welcoming trend, if it gets operationalised in real sense.
14. The other side of the story is that (discussions with agriculture officers at the district level) the farmers are least interested in understanding the importance of soil fertility management and new technology. Very few enterprising farmers are interested in learning and experimenting with new technologies. Another important point that emerged in

discussions is the large gap between supply and demand for various agricultural implements. Though agricultural implements are supplied at subsidy, the number of some of these instruments is so low that the extensionists are afraid of offering the same because it leads to conflicts.

15. The emerging scenario in agriculture sector is a kind of dualistic picture. We have on one hand the highly enterprising, efficient agro based sunrise industries in the areas of horticulture, floriculture etc. and on the other hand a considerable section of marginal and small farmers who still depend on their land for food security, employment, who are outside the market mechanisms and look forward for advice on improving their productivity.
16. The official figures supplied by the monitoring cell gives the extent of target realisation in terms of both physical and financial targets. But in reality who are the actual beneficiaries and what percentage of the money and resources reach the target group is a question.

But all the above observations are location specific. It is necessary to look into the impact of the location of the village (closer or far way from the headquarters), Other infrastructure in the village, socio-economic conditions etc. to have a clear understanding of the impact of the policies.

9 Summary, Conclusions And Suggestions For Further Research

Soil fertility management decisions are essentially decisions made at the household level. These decisions could be related to short run productivity enhancing investments in the form of using more fertilisers and better management practices or long run conservation investments to maintain sustainability. These decisions are influenced by incentives to invest and ability to invest, which in turn are influenced by various socio-economic factors at the macro level (national), meso level (village level) and at the micro level (household level). General economic policies and the sectoral policies affect the factors either directly or indirectly. Table 14 summarises these policies, instruments and their impact on Soil Fertility Management. Since the objectives of the national policies and the respective state policies (Andhra Pradesh and Karnataka) follow the same direction of liberalisation, privatisation and globalisation the table gives an over view of the macro policies applicable to both states. One to one relationship between the proposed strategy in the documents and policy instruments to translate this into reality is not observed.

Review of the research studies has shown clearly the limitations of price policy in motivating the farmers. The positive impact of other complementary factors like timely availability of credit, proper infrastructure facilities, ensuring quality power supply, providing access to information etc., are important in enhancing the soil fertility management decisions of the farmers. The rationalisation of input prices is essential for improving the efficiency of these inputs. Increased price in the process of rationalisation is likely to have negative impact. But it is necessary to increase access to information. It is also necessary to formulate the policies with the participation of the stakeholders that can be achieved through the bottoms-up approach. It is also necessary to see that the economic rationale are not sacrificed for political mileage.

9.1 Suggestions For Further Research

Review of literature on policy analysis brought out the following gaps which can help appropriate policy formulations.

1. Regional variations are too vast in India and characterisation is difficult. Decisions based on macro level analysis may lead to distortions. Hence in-depth region specific studies are needed to understand the impact of any policy change.
2. The linkages between the policy changes and fertility management decisions are not clearly established. Micro level studies using system approach will be able to elucidate these factors.
3. Development of markets for organic fertilisers and their channels, access to these markets is to be studied.
4. Economics of organic farming are to be worked out in order to encourage organic farming for sustaining the soil fertility
5. Impact of livestock policy of promoting cross breed livestock is not explored.
6. Yield data shows an increasing trend in productivity of major crops. But we don't have sufficient information of how much of the increase is due to increased fertilisers, irrigation, proper management and the existing initial conditions. Such dis-aggregated analysis helps in designing appropriate policies.
7. Soil fertility management decisions are influenced by profitability of production, which in turn depends on prices of what the producer receives and what he pays for the inputs. Crop specific estimates of this help in appropriate policy for inputs and output.
8. Subsidising inputs with the assumption that it leads to greater access and utilisation without knowing the region specific impact will lead to wastage of the resources. Moreover, as stated earlier the subsidised input prices do not represent the true value of these inputs and leads to 'market failure'. Micro level studies to understand the impact of these subsidised inputs on soil fertility management decisions along with the other complementary factors like infrastructure facilities, knowledge levels, access to information etc., are needed.

9.2 Hypotheses To Be Tested

1. There is a positive relationship between prices of output and the quantity of FYM used.
2. Use of FYM is dependent on the livestock, economic status of the family.
3. The influence of FYM on productivity levels
4. Fertiliser consumption is dependent on fertiliser prices, output prices, crops grown and the availability of irrigation.
5. Soil fertility management decisions are the function of knowledge levels of the decision makers, economic status based on sources of income, assets position including livestock, prices of output, prices of inputs, access to credit and irrigation, ownership of land and tenancy conditions.
6. The percentage of actual benefit from projects to the target groups is less than 50 percent.

Annex tables

Table 1 All India consumption of NPK (in 000 tons)

Year	N	P	K	Total
1950-51	55	8.8	6	69.8
1951-52	58.7	6.9	6	65.6
1952-53	57.8	4.6	3.3	65.7
1953-54	89.3	8.3	7.5	105
1954-55	94.8	15	11.1	120.9
1955-56	107.5	13	10.3	130.8
1956-57	123.1	15.9	14.8	153.7
1957-58	149	21.9	12.8	183.7
1958-59	172	29.5	22.4	223.8
1959-60	229.3	53.9	21.3	304.6
1960-61	211.7	53.1	29	293.8
1961-62	249.8	60.9	28	338.3
1962-63	333	82.8	36.4	452.2
1963-64	376.1	116.5	50.6	543.2
1964-65	555.2	148.7	69.3	773.2
1965-66	574.8	132.5	77.3	784.6
1966-67	737.8	248.6	114.2	1100.6
1967-68	1034.6	334.8	169.6	1539
1968-69	1208.6	382.1	170	1760.7
1969-70	1365	416	210	1982
1970-71	1479.3	541	236.3	2256.6
1971-72	1798	558.2	300.6	2656.8
1972-73	1839	581.3	347.6	2767.9
1973-74	1829	649.7	359.8	2838.6
1974-75	1765.7	471.5	336.1	2573.3
1975-76	2148.6	466.8	278.3	2893.7
1976-77	2456.9	634.7	319.2	3410.9
1977-78	2913	866.6	506.2	4285.8
1978-79	3419.5	1106	591.5	5116.9
1979-80	3498.1	1150	606.4	5255.4
1980-81	3678.1	1213.6	623.9	5515.6
1981-82	4068.7	1322.3	676.2	6067.2
1982-83	4224.2	1435.9	726.5	6386.6
1983-84	5204.4	1730.3	775.4	7710.1
1984-85	5486.1	1886.4	838.5	8211
1985-86	5660.8	2005.4	808.1	8474.1
1986-87	5716	2078.9	850	8644.9
1987-88	5716.8	2187.1	880.5	8784.3
1988-89	7251	2720.7	1068.4	11040.1
1989-90	7385.9	3014.2	1168	11568.2
1990-91	7997.2	3221	1328	12546.2
1991-92	8046.3	3321.2	1360.6	12728
1992-93	8426.8	2843.8	883.9	12154.5
1993-94	8788.3	2669.3	908.7	12366.3
1994-95	9507.1	2931.7	1124.8	13563.6
1995-96	9822.8	2897.5	1155.8	13876.2
1996-97	10301.8	2976.8	1029.6	308.1
1997-98	10901.8	3913.6	1372.5	187.8
1998-99	11353.8	4112.2	1331.5	16797.5
1999-2000	11620.7	4804.1	1704.2	18128.9

Source: Fertiliser statistics 1999-2000.

Table 2 Area Under Selected Crops in Semi Arid Tropics (SAT)

Crops	Area (m ha)			As % of Gross Cropped Area (GCA)		
	1968-70	1980-82	1992-94	1968-70	1980-82	1992-94
Rice	8.81	9.75	10.60	8.90	9.2	9.3
Kharif Rice	8.18	9.09	-	8.20	8.6	-
Rabi Rice	0.63	0.66	-	0.60	0.6	-
Wheat	10.04	12.94	14.58	10.0	12.2	12.8
Sorghum	16.70	15.63	12.35	16.8	14.7	10.8
Kharif Sorghum	10.61	9.98	6.85	10.7	9.4	6.0
Rabi Sorghum	6.09	5.65	5.50	6.1	5.0	4.8
Pearl Millet	11.94	10.79	9.85	12.0	10.2	8.7
Finger Millet	1.60	1.50	1.47	1.6	1.4	1.3
Maize	2.69	3.04	3.37	2.7	2.9	3.0
Barley	1.55	1.06	0.53	1.6	1.0	0.5
Coarse Cereals	34.48	32.03	27.58	34.7	30.2	24.3
Total Cereals (including other cereals)	53.33	54.73	53.83	53.7	51.6	47.4
Chickpea	5.98	6.31	6.11	6.0	6.0	5.3
Pigeonpea	2.13	2.37	2.85	2.1	2.2	2.5
Minor Pulses	7.79	7.95	9.03	7.8	7.5	7.9
Total Pulses	15.90	16.63	17.99	16.0	15.7	15.8
Groundnut	6.64	6.15	7.52	6.7	5.8	6.6
Rape seed-Mustard	0.54	1.32	4.21	0.5	1.3	3.7
Sesame	1.43	1.30	1.49	1.4	1.2	1.3
Castor	0.39	0.50	0.70	0.4	0.5	0.6
Linseed	0.71	0.76	0.54	0.8	0.7	0.5
Safflower	0.63	0.74	0.75	0.6	0.7	0.7
Soybean	0.00	0.64	4.02	0.0	0.6	3.5
Sunflower	0.00	0.25	2.10	0.0	0.2	1.8
Total Oil Seeds	10.34	11.66	21.91	10.4	11.0	19.3
Cotton	7.21	7.04	6.81	7.3	6.6	6.0
Sugarcane	1.42	1.76	2.25	1.4	1.7	2.0

Source: Gulati & Kelley (1999)

Table 3 Percentage of Average of Five Major Crops Under Food Grains by Category of Holdings

	Marginal	Small	Semi medium	Medium	Large	All
AP	72	66	57	54	35	60
K'nataka	68	63	65	62	60	64
All India	80	75	72	66	62	72

Source: NSSO Survey 54th Round

Table 4 Percentage Area Under a Crop Group Reporting Use of Improved Seeds, Chemical Fertilisers, Manures, Herbicides and Pesticides.

Crop	Improved Seeds	Fertilisers NPK	Manure	Herbicides	Pesticides	Both fertiliser & Manure
Paddy (Kharif)	51	83	77	26	52	94
Paddy (Rabi)	66	89	73	35	74	94
Wheat	63	93	72	28	44	98
Other Cereals	64	71	79	14	32	91
Pulses	47	65	67	12	39	84
Oilseeds	59	82	71	23	52	93
Sugarcane	61	96	86	30	51	99
Vegetables	59	77	76	21	59	92
Cash Crops	82	91	78	24	76	97
All Crops	59	81	74	22	47	93

Source: NSSO Survey 54th Round

Table 5 Percentage of Field Crop Cultivator (FCC) Households Reporting Cultivation of Crops in different Crop Groups

Size Class	Paddy Kharif	Paddy Rabi	Wheat	Pulses	Oil seeds	Sugar Cane	Vegetables	Fodder	Fruits & nuts	Other cash crops	Mixed Crop
0.01-0.20	54	7	36	8	6	1	18	3	13	10	4
0.21-0.50	65	9	44	19	12	4	14	7	4	7	4
0.51-1.00	63	9	44	25	16	7	17	11	4	10	6
1.01-2.00	56	7	46	31	23	8	16	15	3	14	8
2.01-4.00	48	6	49	37	31	9	15	19	3	17	10
4.01-10.00	35	4	50	43	38	9	10	24	3	26	14
10.01 & above	29	2	49	48	47	6	11	32	6	35	13

Source: NSSO Survey 54th Round

Table 6 Fertiliser and Power subsidies in India (in Rs. Crore)

Year	Fertiliser subsidies	Power subsidies	Total	As % of GDP
1980-81	505	368.00	873.00	0.71
1981-82	375	447.38	822.38	0.57
1982-83	605	582.92	1187.92	0.75
1983-84	1042	767.39	1809.39	0.97
1984-85	1927	997.22	2924.22	1.41
1985-86	1924	1304.31	3228.31	1.38
1986-87	1897	1705.84	3602.84	1.39
1987-88	2164	2535.00	4699.00	1.59
1988-89	3201	3007.41	6208.41	1.76
1989-90	4542	3593.84	8135.84	1.99
1990-91	4389	4621.48	9010.48	1.89
1991-92	4800	5884.34	10684.34	1.93
1992-93	5796	7343.81	13139.81	2.08
1993-94	4400	8956.41	13356.41	1.67
1994-95	5241	10938.67	16179.67	1.72
1995-96	6235	13643.23	19878.23	1.80
1996-97	6093	15298.95	21391.95	1.66
1997-98	10026	17535.10	27561.10	1.93
1998-99(B.E)	9983	20197.18	30180.18	-
1998-99(B.E)	11388	20197.18	31585.18	-

Source: Gulati and Narayanan (2000, p.785)

Table 7 Changes in NPK Ratios(1991 - 2000)

Year	N	P	K
1991	6	2.4	1
1992	5.9	2.4	1
1993	9.5	3.2	1
1994	9.7	2.9	1
1995	8.5	2.6	1
1996	8.5	2.5	1
1997	10	2.9	1
1998	7.9	2.9	1
1999	8.5	3.1	1
2000	7	2.8	1

Source:Pasricha, N.S. 2001.

Table 8 Flow of Institutional Credit to Agriculture in India (Rs.crore)

	1996-97	% of total	97-98	% of total	98-99	% of total	99-00	% of total	2000-01	% of total
Co-operative Banks	11,944	45.22	14,085	44.08	15,957	43.29	18,429	41.31	22,706	44.12
Short-term	9328		10895		12571		14648		17598	
Medium/Long-term	2,616		3190		3386		3781		5108	
Regional Rural Banks	1,684	6.38	2,040	6.38	2,460	6.67	3,329	7.46	4,061	7.89
Short-term	1,121		1396		1710		2,517		2412	
Medium/Long-term	563		644		750		812		1649	
Commercial Banks	12,783	48.40	15,831	49.54	18,443	50.04	22,854	51.23	24,693	47.98
Short-term	6,549		8349		9,622		11697		10973	
Medium/Long-term	6,234		7482		8,821		11,157		13720	
Total	26,411		31,956		36,860		44,612		51,460	

Source: Annual Reports, RBI/NABARD

Table 9 Changes in cropping pattern in Andhra Pradesh

Year	P Millet	F Millet	Sorghum	Total Coarse cereals	% to total cereals	Paddy	% to food grains	Maize	% to food grains	Total cereals	Pigeon pea	% to food grains	G nut	% to food grains	Total food
1980	512900	237800	2079100	2829800	41.95	3607300	34.29	308800	43.71	6745900	226400	2.74	1280000	2.74	8252300
1981	548100	265000	2177500	2990600	41.98	3801600	33.96	332100	43.17	7124300	248420	2.82	1433900	2.82	8806620
1982	488900	232500	1940500	2661900	40.42	3594500	32.01	328500	43.22	6584900	239700	2.88	1491417	2.88	8316017
1983	492743	255302	1943800	2691845	37.45	4163657	30.09	332600	46.55	7188102	265102	2.96	1491417	2.96	8944621
1984	394600	220800	1754900	2370300	38.20	3531000	29.11	303200	43.37	6204500	242700	2.98	1695300	2.98	8142500
1985	364700	225500	1691500	2281700	37.65	3467700	28.52	310200	43.34	6059600	262700	3.28	1678700	3.28	8001000
1986	332100	185800	1615119	2133019	36.30	3431918	27.64	310800	44.46	5875737	271100	3.51	1571638	3.51	7718475
1987	324600	163700	1572500	2060800	37.60	3123200	27.11	296200	41.09	5480200	334000	4.39	1787400	4.39	7601600
1988	295700	167600	1314000	1777300	28.27	4218000	19.94	292100	47.32	6287400	335700	3.77	2290800	3.77	8913900
1989	277600	171000	1337000	1785600	28.46	4190700	20.05	297300	47.05	6273600	346100	3.89	2287000	3.89	8906700
1990	234600	165100	1245200	1644900	27.60	4005900	18.91	309400	46.05	5960200	344800	3.96	2394000	3.96	8699000
1991	192000	146000	1067000	1405000	24.83	3936000	16.57	318000	46.42	5659000	339000	4.00	2481000	4.00	8479000
1992	171000	144000	1052000	1367000	25.83	3604000	17.13	322000	45.17	5293000	313000	3.92	2372000	3.92	7978000
1993	143229	140336	1053217	1336782	25.77	3546815	16.61	304034	44.08	5187631	307000	3.82	2551850	3.82	8046481
1994	137330	129920	944398	1211648	23.44	3637558	15.85	320441	47.58	5169647	299000	3.91	2176298	3.91	7644945
1995	133315	126826	887505	1147646	22.19	3692001	14.86	333130	47.82	5172777	328000	4.25	2220197	4.25	7720974
1996	132414	119934	852583	1104931	19.82	4108962	13.58	360676	50.52	5574569	361000	4.44	2198324	4.44	8133893
1997	95622	97746	788835	982203	20.13	3500253	13.97	395875	49.78	4878331	319000	4.54	1834032	4.54	7031363
1998	127267	102972	752523	982762	17.25	4316611	12.16	398600	53.40	5697973	394000	4.87	1991919	4.87	8083892
1999	116603	96752	735929	949284	17.53	4014248	12.42	452080	52.52	5415612	432000	5.65	1795117	5.65	7642729
2000	143000	99000	677000	919000	16.15	4243000	11.49	528000	53.06	5690000	432000	5.40	1874000	5.40	7996000

Source: State Agricultural Department, Andhra Pradesh

Table 10 Changes in cropping patterns in Karnataka

Year	P Millet	F Millet	Sorghum	Total Coarse cereals	% to cereals	% to total food	Maize	% to food	Paddy	% to food	Total cereals	% to total food	Pigeon pea	% to total food	Coconut	G. Nut	Total oilseeds	% to food	Total food crops
1980	483918	910053	1625312	3019283	70.96	54.85	150975	2.74	1084748	19.71	4255006	77.30	310429	5.64	171500	767377	171502	3.12	5504312
1981	508832	1123179	1743904	3375915	72.46	57.01	152716	2.58	1130310	19.09	4658941	78.67	310429	5.24	173460	779242	173462	2.93	5922072
1982	514761	987015	2074147	3575923	74.35	58.60	157755	2.59	1076177	17.64	4809855	78.83	258433	4.24	178947	854665	178949	2.93	6101900
1983	514761	987015	2190175	3691951	74.80	58.99	167747	2.68	1076177	17.19	4935875	78.86	258433	4.13	186218	879200	186220	2.98	6258726
1984	456036	988347	2106423	3550806	72.88	56.29	165575	2.62	1155652	18.32	4872033	77.23	379584	6.02	193922	862545	193924	3.07	6308084
1985	458656	998703	2042422	3499781	80.61	60.46	163661	2.83	678390	11.72	4341832	75.01	387530	6.70	202775	856034	202777	3.50	5788171
1986	451807	1106950	2381365	3940122	75.44	56.65	171247	2.46	1111645	15.98	5223014	75.09	436714	6.28	207744	1088000	207746	2.99	6955472
1987	521061	1120120	2459604	4100785	76.46	57.54	211919	2.97	1050818	14.74	5363522	75.26	461028	6.47	212150	1090148	212152	2.98	7126848
1988	452483	1140034	2106300	3698817	71.23	51.58	255959	3.57	1238000	17.26	5192776	72.41	495198	6.91	219482	1264003	219484	3.06	7171459
1989	513289	1167249	2343000	4023538	73.70	54.67	252757	3.43	1183317	16.08	5459612	74.18	480962	6.53	225398	1194000	225400	3.06	7359972
1990	424464	1052134	2155777	3632375	72.01	52.25	245461	3.53	1166170	16.78	5044006	72.56	462351	6.65	232874	1212171	232876	3.35	6951402
1991	414000	1118000	2105000	3637000	69.90	49.75	283000	3.87	1283000	17.55	5203000	71.17	510000	6.98	239000	1359000	239002	3.27	7311000
1992	374000	1038000	2306000	3718000	69.50	50.78	315000	4.30	1317000	17.99	5350000	73.07	450000	6.15	246000	1276000	246002	3.36	7322000
1993	300000	1028500	2085500	3414000	66.87	49.03	317500	4.56	1373900	19.73	5105400	73.33	360800	5.18	252900	1243300	252902	3.63	6962400
1994	294100	944200	2165300	3403600	67.49	49.99	343700	5.05	1295500	19.03	5042800	74.07	301900	4.43	263800	1200100	263802	3.87	6808600
1995	400100	1019900	1976300	3396300	67.57	49.07	365100	5.28	1265200	18.28	5026600	72.63	423900	6.12	278800	1191900	278802	4.03	6921200
1996	416600	1035400	1998500	3450500	65.67	47.42	445700	6.12	1358500	18.67	5254700	72.21	445400	6.12	291400	1285500	291402	4.00	7277000
1997	302176	938546	1896999	3137721	62.10	46.03	561371	8.23	1353463	19.85	5052555	74.12	421810	6.19	302393	1040382	302395	4.44	6817140
1998	417113	1030679	1849867	3297659	63.86	45.93	512368	7.14	1353463	18.85	5163490	71.92	475396	6.62	310399	1230022	310401	4.32	7179307
1999	424000	899000	2024000	3347000	61.96	44.94	608000	8.16	1447000	19.43	5402000	72.53	506000	6.79	310399	1230022	310401	4.17	7448421

Source: State Agricultural Department Karnataka

Table 11 Livestock in Karnataka (No. in 100,000)

Species	1951	% to total	1961	% to total	1972	% to total	1983	% to total	1997	% to total
Cattle	88.15	36.56	96.73	32.89	100.19	31.26	113	30.79	102.48	22.57
Buffalo	25.66	10.64	30.26	10.29	32.16	10.04	36.48	9.94	41.28	9.09
Sheep	41.92	17.39	47.65	16.20	46.62	14.55	47.91	13.05	74.43	39.62
Goat	26.69	11.07	28.94	9.84	37.26	11.63	45.47	12.39	44.51	9.80
Pig	1.62	0.67	2.07	0.70	2.61	0.81	3.19	0.87	3.47	0.76
Poultry	57.05	23.66	88.41	30.07	101.63	31.71	120.96	32.96	187.86	41.38
Total	241.09	100.00	294.06	100.00	320.47	100.00	367.01	100.00	454.03	100.00

Source: Annual Report of the Department of Animal husbandry, Government of Karnataka

Table 12 Details of watershed programmes implemented (1984-2000)

Sl. No.	Name of the Project	Area treated (ha)	Expenditure (Rs. Cr)
1	World Bank (1984-1993)	136337	37.564
2	District watersheds	515200	121.978
3	NWDPPRA	872872	182.995
4	DANIDA	23000	16.036
5	PIDOW (1985-1993)	9680	4.140
6	ISPWDK (1995-1999)	30000	12.595
7	KFW	24600	16.221
8	River Valley Project	541800	91.119
9	DFID	52719	83.400
	TOTAL	2206208	566.48

Source: Annual reports of Agriculture Department of Govt. of Karnataka

Table 13 Capital Expenditure per hectare of Net Sown Area at Constant Prices, 1974-75 to 1996-97

Period	Karnataka	Andhra Pradesh	All India	Union Govt.
V Plan	168	182	311	63
VI Plan	130	147	258	34
VII Plan	92	142	197	18
VIII Plan	156	174	188	9
Average for 74-75 to 96-97	146	160	239	29
Trend rate of growth	-1.66	-0.78	-3.16	-11.16

Source: Ramesh Chand, 2001

Table 14 Summary of Policy Review

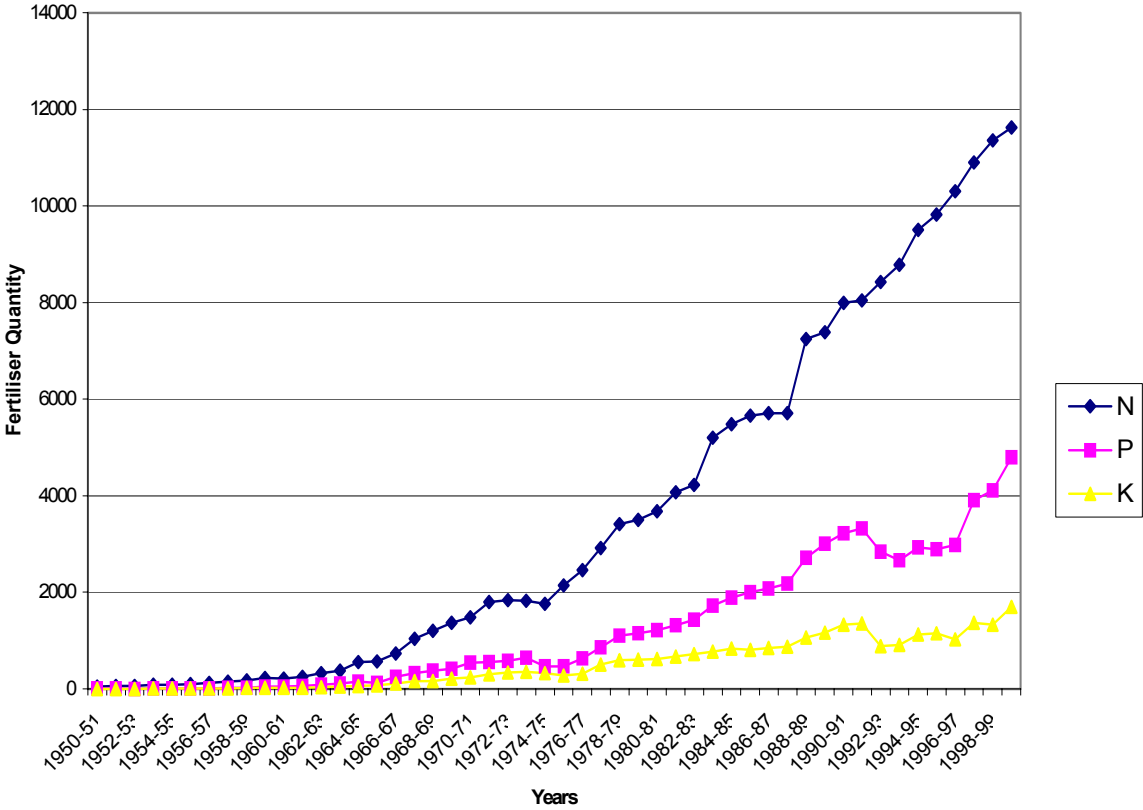
Macro-Policy	Objectives of Policy	Instruments	Impact on SFM	Research findings
Globalisation, Liberalisation and Privatisation	Improving the efficiency of the productive resources	Trade liberalisation, rationalisation, disinvestment, reducing the role of government	(-) in the short run (+) in the long run due to stabilisation	Immediate effect of SAP resulted in increased poverty and through reduced real wages, fertilizer prices increased
Agricultural Policy		Measures to improve irrigation, water conservation measures	(+) More nutrient input (external) organic as well as inorganic	Research studies established increased gross cropped area, fertilizer use per ha. No specific information on organic manures etc.
Increasing cropping intensity	Agricultural growth rate to exceed 4% per annum.			
Management of land and water resources on watershed basis	Sustainable agriculture	Various programmes for soil and water conservation	(+) Shift towards wet crops. More use of inorganic and organic fertilisers (organic depends on available biomass)	Conservation practices established SFM by addition of nutrients not clearly established.
Thrust on INM and IPM	Sustainable increase in agricultural production Minimise indiscriminate and unjudicious use of chemical fertilisers and pesticides	Promoting research for suitable IPM packages and providing access to information on INM and IPM through extension services	(+) or (-) depends on the extension services	Studies have shown the inefficiency and Inaccessibility of extension services
Importance of GMO technology for food crops	Increased production and inputs for agro-based industries	Providing research support	(?) Uncertain- depends on the adoption levels Impact assessment not available	To be evaluated

Table 14 - continued

Macro-Policy	Objectives of Policy	Instruments	Impact on SFM	Research findings
Cultivation of fodder trees and crops	To meet animal nutrition and welfare	Through various programmes implemented at the central, state and local levels	(+) on FYM availability	Links are to be established
Farmer responsible and farmer accountable extension system	To improve the quality and effectiveness of research and extension services	Through appropriate changes in the extension services.	(+) or (-) depends on outreach, because it is not farmer-led or farmer-participatory	Research findings through village PRA indicate negligible impact of agricultural extension in AP and Karnataka
Promoting private sector participation in production, processing, marketing and extension through contract farming and land lease arrangements	Accelerated technology transfer, capital flow and assured markets	Land reforms and modifications to the existing tenure systems	(+) Use of chemical fertilisers (-) Inefficient nutrient cycling because of monocropping	Evidences are documented in contract forming and monoculture
Credit policy	Timely and adequate credit	Encouragement to micro credit and providing bank linkages to informal credit groups	(+) Increases SFM	Evidences of credit market imperfections on SFM decisions
Price policy	Ensuring remunerative prices to the growers Act as an incentive for private investment	Rationalising the procedure for the calculation of Minimum support price and extend it to other crops	+ or - Depends on the crops promoted And time of the announcement of MSP	Price responsiveness of various crops is established
Fertiliser policy Subsidies	Encourage use of fertilisers	Through price policy	Distorts the composition of the nutrients depending on the policy adopted	Established results indicate responsiveness of fertilisers use to prices

Chart 1

All India Consumptions of Fertilisers (1950-51 to 1999-2000)
(in 000 tons)



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