CHAPTER – II
REVIEW OF LITERATURE

2.1 INTRODUCTION

Agriculture is one of the most important economic activities in almost all the developing countries and also in India. Fertile soil is important for increasing agricultural production. Excess usage of chemical fertilizers is one of the reasons for decline in soil fertility. Public policy plays an important role in influencing the behaviour of the farmers. The present chapter reviews the research studies relating to public policy and its impact on agricultural sector.

Several researchers have made attempts to evaluate the impact of Agricultural policy on the Soil Fertility Management Practices (SFM). Agricultural policy has been analyzed focusing on its impact on production, prices, exports etc. Similarly, studies on SFM are focused on the documentation of SFM practices under different agronomic conditions and factors influencing SFM.

2.2 EMPIRICAL STUDIES

Empirical literature on impact of agricultural policies has been classified into three sections focussing on the following issues:

1. The studies related to Agriculture, Agricultural policy and Cropping Pattern.
2. The studies on Fertilizer policy and Fertilizer consumption.
3. The studies about Soil fertility management practices.

2.2.1 The studies related to Agriculture, Agricultural Policy and Cropping Pattern

Reardon et al (1992) analyzed the impact of policies in their study ‘Issues in the analysis of the effects of policy on conservation and productivity at the household level in developing countries’. According to the authors policies can strongly affect the capacity of households to make both productivity and conservation investment and use of sustainable land use practices. The major observation of this study was that macro and sectoral policies affect relative product prices within agriculture. Hence the sub sectoral product mix macro and sectoral policies determined the profitability of
agriculture and hence the households will to make investments in agriculture. It is also recommended that the state needs complementary, specific policies to encourage and enable the household to make complimentary soil conservation investment.

In a study on causes and consequences of changing cropping pattern in Kerala Mahesh (1999) identified the causes for changes in cropping pattern. They are increase in land use for non agriculture purpose, technological change, increasing pressure on land, modernization and commercialization of agriculture, price factors, etc. The identified consequences are changes in agriculture production, changes in farm income, decrease in women’s participation, etc. The study also observed that there is a shift in the area from seasonal/annual crops to high value/cash crops.

Thimmarajakshi (2000) examined the national agricultural policy in India. Government of India announced the first national level agricultural policy in July 2000. Its aims are to achieve a growth rate in excess of 4 per cent per annum in the agriculture sector, growth that is based on efficient use of resources and conservation of soil, water and bio-diversity, growth with equity, demand drive growth that caters to domestic markets and maximizes benefits from exports of agricultural products and growth that is sustainable technologically, environmentally and economically. This study criticized the national agricultural policy saying that its treatment of them is too general and unrelated to the objectives specified. The author opines that the document does not lead to a cogent set of policy measures and it does not prioritise the tasks to be undertaken.

Pingali (2001) examined the impact of agriculture commercialization and agro industrialization on agriculture and economic growth. According to the author the economic growth and urbanization have lead to commercialization of agriculture which lead to the rapid agro industrialization. This leads to gradual decline in integrated farming systems and surely has an impact on the natural resource base. But the speed of this commercialization or agro industrialization differs from one country to another country. However this process has both positive and negative impacts on Agriculture. The negative impacts of this are mainly in terms of chemical input use. Because higher use of insecticides and fungicides have adverse environmental consequences and also pesticide related illness and in some way it also leads to soil
erosion and land degradation. At the same time it is also helping the reduction in the soil erosion by reducing the cultivation in the marginal lands.

**Dhoot (2006)** critically analyzed the national agricultural policy 2000. The major observations are that it has set unrealistic targets, no clear cut strategy for achieving the respective targets. “It looks more like a document citing issues involved in agriculture than any serious statement of policy and intent by the central government. It does not explain as to how the implementation shall be done and how the goals and objectives shall be achieved”. It does not mention any deadline or timeframe for the accomplishment of any task and lacks the target based result oriented approach.

**Gilmour and Rajendra kumar (2008)** analyzed the agricultural policy in India. The study identified agricultural policies in different periods. After independence India pursued a policy of food self sufficiency in staple foods like rice and wheat. The policies initially focused on expanding cultivated area, land reform, community development and restructuring rural credit institutions. During 1960s and 1970s adoption of high yielding rice and wheat varieties occurred, it promoted the use of chemical fertilizers and pesticides and improved access to institutional credit. During 1980s the input subsidies that had been put in place also began to strain government budgets. The macro economic reforms of the 1990s had two important impacts; they increased per capita income and strengthened the domestic demand. Then reduced industrial protection and improved the agriculture terms of trades. The overall policy goals are remunerative prices to farmers and to maintain stable prices for consumers. There are number of policy instruments to achieve these goals, like minimum support prices, food subsidies for consumers, regulated markets, input subsidies for producers and trade policy. The study identified some policy outcomes and challenges. The input subsidies have contributed to the excessive use of inputs and resulted in a number of agro environmental problems, such as soil salinity and ground water depletion. The growing cost of input and food subsidies have also contributed to fiscal deficit. The study suggests that the expenditure on subsidies could have been invested in research, education and infrastructure to improve productivity and competitiveness of the sector.
Bellu and Pansin (2009) examined the policy impact analysis in their study ‘Quantitative socio economic policy impact analysis’. The main objective of this study was to provide a picture of quantitative socio-economic policy impact analysis for decision making and also understand the how policy measures affect complex socio-economic systems. Policy measures affect a socio economic system by modifying the behaviour of economic agents, different policy measures have different impact on a socio-economic system. The study classified the agricultural and rural development policies into price policy, macroeconomic policies, public investment policies. Government interventions and public policies are important for the development process. The main reason for this was efficiency and equity. The study used the quantitative models for policy impact analysis to represent a complex socio-economic system. The study applied several quantitative analytical approaches to assesses policy impacts such as, Value Chain Analysis (VCA), Multi Market Models (MMM), Computable General Equilibrium Models (CGE), Integrated Macro-Micro Approaches (IMMA) etc.

Jha (2009) evaluated the price, technology and institution related policies of the government of India. This study has used the static linear programming model to evaluate the effect of changes in agricultural policy on farming systems in the North west region of India because that region has been in the forefront of commercialized agriculture and also farmers respond to policy changes in agriculture in a better way. A static linear programming model was used to arrive at farm plans in an alternate scenario. This study shows that average farm in the study area is largely allocating resource efficiently. The study observed that rationalization of agricultural prices of urea and power tariff for agriculture have increased the prices significantly. This has resulted in increase of cost and decrease of farm returns.

Kumar (2010) analyzed the performance, status and determinants of institutional credit to agriculture sector. The study was based on secondary data. The study observed that the structure of credit outlets has witnessed a significant change and commercial banks have emerged as the major source of institutional credit in recent years. But the declining share of investment credit in the total credit may constrain the sustainable agricultural growth. The study has suggested simplification
of the procedure for a better access to agricultural credit of smallholders and less-educated/illiterate farmers.

**Schuler and Sattler (2010)** attempted estimation of the impact of agricultural policy on soil erosion by using bio economic model MODAM (Multi Objective Decision support tool for Agri-ecosystem Management). The study shows how bio economic model can be used to describe and estimate the effects of policies on agricultural production and the risk of soil erosion with the example from north-eastern Germany. The model uses both an assessment tool that is based on a fuzzy-logic approach for the estimation of soil erosion risk of cropping practices and a linear programming model that simulates farmers economic behaviour under the assumption of gross margin maximization as the main goal of farmers actions. The result shows that policy changes can have an impact on soil erosion and targeted policy options are more cost-effective than non targeted programmes in terms of money spent per unit of reduced erosion.

**Acharya et al (2011)** analyzed the nature of crop diversification in Karnataka. The study used the secondary data for the period of 26 years from 1982-83 to 2007-08, Composite Entropy Index and Multiple Linear Regression analysis have been used to analyze the crop diversification in Karnataka. This study identified a number of infrastructural and technological factors influencing the crop diversification. The result shows that all categories of crops (except Oilseeds and Vegetables) had higher diversification in post WTO period, compared to pre WTO period. This paper suggested that creation of basic infrastructural facilities like supply of irrigation water, fertilizer availability, proper roads and transportation for creating proper conditions for crop diversification and agricultural development.

**Birner et al (2011)** analyzed the political economy of agricultural policy in India. This study examined the impact of input subsidies. According to this study more subsidies on the fertilizers leads to the unbalanced use of nutrients and it also leads soil degradation. On the other hand subsidies to the electricity leads to more use of ground water which leads to depletation of ground water. Both subsidies are burden to the government.

**Badr (2011)** studied the impact of agricultural policy on food security in Iran. This analysis is based on PEDA (Population, Environment, Development, and
Agriculture) model. PEDA model is about inter-relationship between population change, environmental change, socio-economic and agriculture. The result shows that policies have a positive impact on food security in rural and urban areas. But policies have more influence on urban food security.

Dhanabhakyan and Malarvizhi (2012) examined the Kissan Credit Cards (KCC) scheme in their study ‘A study on the awareness, utilization and problems of using KCC of Canara bank (with special reference to Coimbatore district)’. The main objective of this study was to analyses the awareness of the KCC holders and their attitude towards KCC, to review the extend utilization of KCC and to examine the practical problems faced by the KCC holders in Coimbatore district. The study is based on both primary and secondary data. The study observed that 41% of KCC holders came to know about the card through agricultural officers, 23% through bank employees. The study also focused that some of the bank employees are not polite in providing services.

Kragt (2012) analyzed the economic and environmental systems through bio economic model. Bio economic model is a combination of both economic and biophysical components. Traditionally bio economic models are used to analyze the human uses of ecosystems for production and consumption. The main aim of bio economic models is to link and integrate biophysical and economic models such as Fishery system, Forestry system and Agro economic system. Bio economic models offer a useful addition to existing biophysical/ ecological models by allowing through analyzes of socio economic values and making testable predictions about environment human interactions. Assessing the impacts of environmental management changes requires analyses of human welfare effects. Bio economic modeling allows this assessment by evaluating the costs and benefits associated with environmental resource use.

Harshan and Deshmush (2013) examined the agricultural subsidies in India. The major objectives of this study was to analyse the types of government agriculture subsidies and criteria for distribution in India and to find out allocation of funds for agriculture sector in five year plans and annual budget of India. The study was based on secondary data. It concentrated two subsidies i.e. fertilizer subsidy and food subsidy. The study observed that the government of India has taken serious measures
for the development of agriculture sector and agriculture subsidies are one of tools to help the development of agriculture sector in India.

**Uma et al (2013)** analyzed the impact of cropping pattern on food security in India, based on the primary data collected from individual households with a focus on Hassan District, in Karnataka. The major finding of this study is that there is a shift in cropping pattern from food crops to commercial crops and this will have a direct impact on food security in future.

**Rajmohan and Susha (2014)** analyzed the Kissan Credit Card (KCC) in the paper ‘Kissan Credit Card scheme in India; A facet of financial inclusion’. The main objective of this scheme was to provide a short term credit for the borrowers from the financial institutions and adequate and timely supply of credit to the farmers to meet their crop production requirements. The result shows that there is a significant increase in the number of KCC issued in each financial year by different agencies.

**Gandhimathi (2015)** analysed the role of KCC in agriculture credit in the study ‘Role of Kissan Credit Card system in India’. Multiple regression analysis was employed to identify the impact of kissan credit card system on financial inclusion in India. The study considered rural branches of the commercial banks, aggregate deposits, agricultural production, borrowing of commercial banks from the RBI and the KCC scheme were the variables considered for the analysis. The result shows that among the five variables, agricultural production and KCC scheme were statistically significant to determine financial exclusion. The amount of agricultural production has positive relationship with financial exclusion. The study observed that KCC played an important role in financial inclusion in agriculture sector.

**Hemavathy et al (2015)** analyzed the impact of Information and Communication Technology (ICT) on Indian agriculture in the study ‘Information and communication technology in Indian agricultural sector with special reference to Kissan Call Centre’. The main objectives of this study were to know about the different methods of using information and communication technology in agricultural sector, analyze the factors affecting ICT implementation in agricultural sector, study the operating mechanism and measure the performance of KCC. The study is based on secondary data, collected from KCC centres. Mobile phones, internet, email is used to know about market price, rainfall, weather condition etc. The major findings
of the study was that out of 30 states, Uttar Pradesh, Madhya Pradesh, Maharashtra, Rajasthan were in the first 5 places in passing the benefits to farmers through ICT and Andhra Pradesh, Goa, Diu and Daman, Nagaland, Lakshadweep, Dadar and Nagar and Haveli were the states in the least in use of KCC. Most of the rural area farmers are excluded under the ICT, because of illiterate and low income.

Another study by Venkatesh (2015) about ‘Access and impact of Kissan credit card scheme’ observed that the share of non institutional sources of credit has come down due to availability of Kissan Credit Card (KCC) and the cost of borrowing credit has decreased. This shows that KCC plays major role in reducing the rural poverty of Indian farmers.

Kundu and Malik (2015) analyzed the agricultural price policy in their paper ‘Issues related to agricultural price policy under WTO regime’. Agricultural prices shows fluctuating trends in India, because of relatively low price elasticity of demand for agricultural commodities, seasonal nature of the agricultural industry. The authors observed that agricultural price policy has brought out an integrated framework of all economic policies both domestic and external.

Kamble (2015) analyzed the impact climate changes on agriculture in India based on secondary data. Climate change and its impact has been calculated based on the data collected from different data bases. He observed that climate change affects the quantity and quality of crops which will have an impact on food production.

Kanaka (2015) applied Policy Analysis Matrix (PAM) for rice cultivation in India to evaluate the private and social profitability of farming systems. The study combined the policy analysis matrix techniques to model the analysis of profitability from farming. Policy analysis matrices are computed for a sample of rice growers located in the wetland of the Tamil Nadu. The result shows that the average farm makes losses both at private and social prices. When the opportunity costs of all the domestic factors involved in rice production are taken into account. The author observed that the survival of this system is clearly compromised in the long run because of its international competitiveness.

Lovo et al (2015) evaluated the agricultural policies in their paper ‘Green agricultural policies and poverty reduction’. Green Agricultural Policy include
payments for environmental services, unconditional incentives, community based natural resource management and trashing and extension services. Green Agricultural Policy highlights that it is essential to target policies at the poorest of the poor and it finds that local economic, social and cultural factors should be an important consideration when choosing to implementing them.

Nerella (2015) analyzed the usage KCC in the paper ‘The role of Kissan Credit Card (KCC) in agriculture in India’. The study observed that KCC is one of the most innovative banking product and it is beneficial to farmers. But no correlation between issues of KCC and increase in crop loan volumes is observed. However, according to the author KCC scheme plays a significant role to provide credit to farmers.

2.2.2 The studies On Fertilizer Policy and Fertilizer Consumption

Dasgupta et al (2001) examined the different trends in pesticide use in Brazil and documented the environment costs and human health hazards associated with pesticide use in Brazil. According to them agricultural trade liberalization has contributed to an increase in pesticide use in agricultural production. It is harmful to human health and also harmful to the environment and it affects soil fertility. The study identified higher income, higher levels of education attainment, size of the farmers as factors influencing the over use of pesticides. The study also identified the crops which consume more pesticides. They are Soyabean, Sugarcane, Cotton, Fruits and Tobacco. The study suggested some measures for reducing the effects of over utilization of pesticides. These measures are integrated pest management programs, farmers education and research on alternative pest control methods.

Sharma and Thaker (2009) examined the phases in fertilizer subsidy in India. Since self sufficiency of food grain was the main objective of the Indian government during 1960s. The government has decided to provide fertilizers at affordable or subsidized price to the farmers and introduced the Retention Price cum Subsidy scheme (RPS). According to the authors the RPS did achieve its objective of development of large domestic industry and near self-sufficiency in fertilizer production and increased consumption of chemical fertilizers but it was criticised for fostering inefficiency leading to huge burden of subsidy.
Ahmad et al (2010) in their study “Impact of cropping patterns and fertilizer treatments on the organic fertilizer of slightly eroded pirsabak soil series in NWFP, Pakistan” concentrated on soil fertility management practices in the study area. Field study methods have been used in this study. The experiment was conducted on farmers field for two years to investigate the cost effective fertility restoring measures on the slightly eroded pirsabak soil series in district swabi, NWFP, Pakistan. The result shows that mixed application of farm yard manure and mineral fertilizers improved the organic fertility of the slightly eroded pirsabak soil series. The cereal-legume crop rotation also led to the improvement in organic soil fertility of the eroded soils. Based on the study the authors recommended a strategy of combined use of fertilizers both from the organic and inorganic sources and cropping patterns including legumes in crop rotation methods to improve the soil fertility on sustained basis.

Liverpool et al (2010) analysed the status of fertilizer sector in Nigeria. This study focused on key fertilizer issues in Nigeria, demand and supply environment, the role of subsidies, the regulatory environment, the use of voucher system to aid fertilizer distribution. The study observed that heavy emphasis on price subsidization is determinant to other approaches. The major recommendation of this report is that the Government should eliminate the dual fertilizer market (Subsidized market and free market) by establishing the primary private sector in fertilizer production, procurement and distribution and promoting policy stability by reducing the frequency of government intervention in preference to building capacity in the private sector.

Sachdeva (2011) examined the Nutrient Based Subsidy (NBS) impact on Indian agriculture. This study analyzed the positive and negative impacts. NBS is applicable only for N,P,K, Sulpher, Zinc, and Boron. According to this study industries raised the prices of DAP, MOP by Rs 600 per tonne after the introduction of NBS scheme. Nutrient Based Subsidy scheme has promoted balanced and integrated use of plant nutrients and also address the problem of multi-nutrient deficiency in Indian soils. The study observed that the subsidy helps to promote the efficient use of fertilizer and increase the agricultural production.
Mujeri et al (2012) analysed the effectiveness, efficiency and sustainability of fertiliser use in South Asia. This study was conducted in India, Bangladesh and Nepal. In the opinion of the authors the policies encourage efficient use of fertilizer in sustainable manner in combination with water, quality seeds etc. This study showed that increasing efficiency and effectiveness of fertilizer use in South Asia is possible by adopting right policies. Sustainable fertilizer use is very important for food production and security. Major recommendations of this study is to increase the fertilizer production through increasing fertilizer production plant unit, promotion of crop and soil specific fertilizer usage, encourage farmers to adopt more efficient fertilizer application techniques, enhancing efficiency in the fertilizer distribution system, expanding credit facilities to the farmers in right quantity and right time through the specific Banks and Micro Finance Institutions, redesigning fertilizer subsidy policy to ensure availability of quality fertilizers.

Kaushik and Paharia (2014) analyzed the fertilizer usage for different crops in Haryana state. The study was based on secondary and primary data. Primary data collected from the 200 sample farmers in eight villages on the basis of operational holdings. Production function analysis was used to estimate the response of fertilizers on major crops grown by the selected farmers both under irrigated and un irrigated conditions separately. The study identified that there is an inverse relationship between the size of holdings, irrigated area and per hectare expenditure on fertilizers, and the percentage of irrigated area in small farms is more as compared with large farms. Therefore the expenditure on fertilizer per hectare of net area sown is more for small farmers than the large farmers.

Majumdar (2015) analyzed the bio fertilizer usage in the study on ‘Bio fertilizer usage in Indian agriculture’. The main objective of this study was to analyze the impact of bio fertilizer use on agricultural production in India. Linear regression model was used to understand the relationship between production of bio fertilizer and agricultural output. The results show that there is a positive and significant relationship between the bio fertilizer use and agricultural output. The use of bio fertilizer in the place of chemical fertilizer is a good way for the sustainable agriculture.
Sheillah et al (2015) examined the impact of chemical fertilizers and organic manure, in their study on ‘An impact of chemical fertilizers and organic manures on the germination and growth of soybean’. The study revealed that organic manures is more beneficial than chemical fertilizers for the seed germination and growth of soybean. Vermicompost is an important type of organic fertilizer it most beneficial to enhance germination and growth of soybean by improving the physical, chemical, biological properties of the soil. The study shows that the use of chemical fertilizer has the negative effects in nearly all the parameters by deteriorating the soil quality.

2.2.3 The Studies about Soil Fertility Management Practices

Tchale and Wobst (2000) examined the factors that affect small holder farmers choice of soil fertility Management options in Malawi. This study is based on primary data collected from household at plot level. The authors used Tobit and Hurdle model for analysis. This model indicated that relative input cost, wealth indicators, farmer education, market and credit access, food security index and land pressure are the main factors influence to farmers choice and intensity of input investment. The result indicates that there is an inverse relationship between the input output ratio and both the probability and intensity of fertilizer application. Positive correlation between probability of adoption and intensity of fertilizer application was observed.

Norbu and Floyd (2001) examined the status trends and sustainability of soil fertility management and associated soil conditions in Bhutan. This study used national soil fertility management survey of 1999/2000, and a watershed farmyard manure survey of 1998/1999 for the analysis. In soil fertility management survey, a total of 32 villages were selected. It has used qualitative data and conducted survey of 12 households per villages. A total of 384 households were selected for this study. This survey was conducted to collect information about household SFM resources trends in yields. In Farm Yard Manure (FYM) survey, 23 households were selected in 1998/1999. This survey collected the information on socio-economic status of the households, resource base and SFM profile. This study identified the factors that influence the changing pattern of SFM practices. They are fertilizer availability and effectiveness, livestock numbers and management system and household labour availability etc. Soil fertility status was assessed based on the results of the analysis of
the soil samples from the SFM survey, household perceptions on yield and soil fertility changes in the last 10-15 years. The result shows that more than 50% of fields were receiving less N and P than what is recommended by a rice crop and estimated mean yield. Lack of sustainability was a concern on both wetland and dry land soils and among household identified as being less to manage soil fertility.

Indira (2002) in her study “Soil fertility management: A review”, analyzed the agricultural policy and its impact on soil fertility management in India with a focus on Karnataka and Andhra Pradesh. Soil fertility management decisions are essentially micro level decisions made at household level. But they are influenced by the general macroeconomic policies which affect the income levels of the household and sectoral policies like fertilizer subsidy and minimum support prices etc. Based on the review of literature the study identifies the factors influencing soil fertility management decisions. They are socio-economic background and motivation of the farmers, size of the area owned/ operated, ownership of the land and availability of inputs like credit, fertilizer, water etc, policies of the government, access to information and adoption levels, choice of crops, etc. Soil fertility management decisions could be related to short run productivity enhancing investments in the form of using more fertilizer and better management practices or long run conservation investments to maintain sustainability. According to this study 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, meso level, micro level and also general economic policies and the sectoral policies. Chemical fertilizer (NPK), organic manure (FYM, sheep penning, green leaves and residues of leguminous crops) are mainly used by the farmers for maintaining soil fertility. Farmers choice of practices depends on availability of these fertilizers, labour, crop choices, knowledge level and socio-economic status etc.

Desbiez et al (2004) studied the perceptions and assessment of soil fertility by farmers in the mid-hills of Nepal. The study was conducted from July to September 2001 in five wards of the Pakuwa village development committee in the Porbat district of western Nepal. Primary data was collected from 68 households through semi-structured interview. The primary survey was conducted to elicit the information regarding farmers perception of soil fertility and indicators to assess the
fertility status. Soil samples were collected from each selected fields. The results show that there are 62 indicators mentioned by farmers to assess or identify whether the soil is fertile or not, like soil colour, crop yield, water availability, colour of crop, crop height and growth rate, water holding capacity etc. The study clearly shows that farmers of mid-hill in Nepal have a well defined and comprehensive set of indicators to assess the soil fertility status.

Farouque and Takeya (2007) studied the farmers perception of integrated soil fertility and nutrient management for sustainable crop production in rural areas of Bangladesh. ISFM and NM are the new technique or methods for maintaining the soil fertility. This study was conducted in eight villages of Mymensingh, Jamalpur, Sherpur and Netrokona in Bangladesh. Major findings of this study are that landless, marginal and small farmers have either low or very low awareness about ISF and NM for sustainable crop production. Farmer’s education, farming experience had significant positive influence on farmer’s perception. Major recommendation of this study was that ISF and NM programme should be organized for all categories of farmers. The department of agriculture and other organizations should motivate their field level workers to conduct extension works. The study observed the need to increase the availability of information sources and new programmes to improve knowledge about ISF and NM for sustainable crop production.

Adesanwo et al (2009) examined the traditional Soil fertility management practices for rice cultivation in south western Nigeria. The study identified the soil fertility management methods and their impact on soil properties south western Nigeria. The study was based on primary data collected from 55 randomly selected rice farmers under the Orgun state agricultural development project. The study using participatory technology development approach to motivate farmers to use low input soil fertility management practices. The result shows that 91% of the sample farmers used the fertility status of soil as a major criteria for selecting farm land. Each and every farmer agreed the importance of soil fertility management for crop production and 90% of farmers agreed that soil testing programme is a tool for good soil fertility management practices.

Mugwe et al (2009) attempted to give empirical explanation of ISFM technologies in central highlands of Kenya based on primary data. Primary data
collected from 106 households. The results show that 46% of farmers adopted ISFM, 54% farmers did not adopted ISFM technology in study area. This study identified age of household head, farm management, ability to hire labour, number of mature cattle owned etc. as important factors influencing the adoption of ISFM technologies in the study region.

**Adeolo (2010)** in a study “Influence of socio-Economic Factors on the adoption of soil conservation measures in Ibadan/Ibarapa agricultural zone of Oyo state”, analysed the factors that influence the adoption of soil conservation in Nigeria based on primary data. Tobit Regression model was used for analysis. The study shows that the main soil conservation measures in the study area are contour ridging, cover crops, mulching, contour vegetative hedges of vetiver, multi purpose tree hedgerous and minimum tillage. Educational level, contact with extension agent, farming experience and farm size were the socio-economic factors found to have significant influence on the adoption of soil conservation measures among the farmers in the study area.

**Baah et al (2011)** examined the soil fertility management practices of cocoa farmers in the eastern region of Ghana. Three cocoa districts, Anyinam, Akoase and Akin Oda were randomly selected. Farmers were interviewed at their convenience on one-on-one basis using standardized questionnaires in January 2009. This study identify that the farmers are using chemical and organic fertilizer application, control of erosion and mulching etc. as SFM practices. The result shows that those who are the members of farmers associations used fertilizer correctly and at the right time and effectively controlled the blackpod disease, capsids and judicious pruning and shade management.

**Reddy (2011)** studied the soil fertility management in semi arid regions of Andhra Pradesh. The study compared the soil fertility management practices in highest irrigated area and irrigated area. The study is based on three districts namely Mahabubnagar, Anantpur and Prakasam. These districts are having different socio-economic and ecological characteristics. Primary data was collected from 360 sample farmers through personal interview, using a structured schedule. The study used both qualitative and quantitative methods for understanding the farmers soil fertility management practices and the conditions under which they adopt them. Battese and
Coelli model (1988) was used for estimating stochastic frontier production for paddy, groundnut and sunflower crops. This study strongly recommended that subsidies and credit policies should allow farmers to buy fertilizers according to their requirements. The study recommends for appropriate credit programmes to enable farmers to obtain crop loans for mixed farming systems, including organic input, such as farm yard manure etc.

Vondolia (2011) examined the impact of fertilizer subsidies on soil and water conservation in Ghana. The study was based on primary analysis collected during 2010. Cross sectional data for the analysis was collected through a survey of small holder rice farmers. The sample size of 460 farmers were randomly selected. The results indicate that beneficiaries of the fertilizer subsidy programmes do not invest more in soil and water conservation. They suggested that in order to achieve increased investment in soil and water conservation for sustainable agricultural development, more comprehensive measures that include investments explicitly and integrated soil fertility management programmes should be adopted.

Ayuya (2012) analyzed the Organic Soil Fertility Management (OSFM) of small scale farmers in Kenya producing maize. The multinominal logit model was used to analyze the factors influencing choice of OSFMP in study area. The study considered education, age, gender, household size, farmer size, farming experience, land ownership, credit access, extension on training, slop erosion, farm distance from household, farmer perception towards organic farming activities as explanatory variables influencing OSFM. Introduction of policies to promote organic soil management was suggested. The study identified gender, age and education as significant factors influencing OSFM.

Isheke (2012) examined the economics of soil conservation practices in Abia state of Nigeria. Soil degradation was one of the major problem in Nigeria. The major objective of this study was to examine the socio-economic characteristics of farmers and cost structure in soil conservation. Data was collected by using structured questionnaire. The result showed that farm size, number of farm locations, years of formal education, extension, ownership status of farm land and farm income are the significant factors influencing the invest with in soil conservation measures. The study observed that majority of the respondents are between 25-45 years of age. So
these farmers are still energetic and also highly productive capacity. The authors opined that the level of education of a farmers helps not only to increase farm productivity but also understanding and adopting the new production technologies. The study recommends for educating the farmers in crop production and environmental conservation.

**Muchai et al (2012)** analyzed the influence of education levels on dissemination of soil fertility management information in the central highland of Kenya. Cross-sectional survey approach was used to collect data by using schedule consist of both open ended and close ended questions. The result shows that the most commonly used SFM practices are crop rotation, animal manure etc. Use of compost and green manures are least used technologies. Majority of the farmers had attained primary education (59.6%). The major findings of this study shows that the education is quantitatively important in predicting the dissemination of soil fertility management information. Extension agents showed interest to increase their communication with farmers, mainly with more educated farmers.

**Singh and Tiwari (2012)** studied the challenges of managing soil fertility depletion and its management practices in Uttarakhand. This study analyzed the problems of soil depletion and suggested some measures for improving soil fertility. This study was based on both primary and secondary data. Primary data were collected from scientists and farmers interaction. The study selected 200 soil sample surveys and then the findings were interpreted by comparing with earlier results. The soil samples collected were mainly from fields following rice-wheat, rice vegetables pea – rice vegetables, pea sugarcane-ratoon wheat cropping. This study identified imbalanced use of fertilizers in rice-wheat cropping, depletion of organic matter and ground water and humus, more use of pests and pathogens as the reasons for soil fertility depletion. The study suggested training programmes, deep ploughing, green manuring, organic farming, crop residue management, crop diversification, balance use of fertilizer etc. as measures for maintaining soil fertility.

**Geta et al (2013)** studied about the “Determinants of farmers decision on soil fertility management options for maize production in Southern Ethiopia”. This study examined the farmers decision on soil fertility management options for maize production in Wolaita and Gamo Gofa zones of Southern part of Ethiopia. The study
developed a conceptual framework for analysis of soil fertility management decisions based on the approach of consumer theory developed by Lancaster. This study identified different soil fertility management practices applied by farmers. Some of them are applying mineral fertilizer, farmyard manure, compost and Integrated Soil Fertility Management (ISFM). The result shows that training played a significant role in farmer decision to use mineral fertilizer, farmyard manure and integrated soil fertility management for maize production. The application of mineral fertilizer, farmyard manure and integrated soil fertility management were found to be less in the case of women headed households. The agro-ecological location of household had a significant influence on the use of mineral fertilizer and integrated soil fertility management.

Kannan et al (2013) examined the effect of integrated nutrient management on soil fertility and productivity in maize. The study was based comprising field experiments. 1. Absolute control, 2. Recommended dosage 3. FYM 4. Vermi compost 5. Recommended dosage of inorganic+ FYM 6. Recommended dosage of inorganic fertilizer + vermi compost. Integrated Nutrient Management (INM) practices including vermi compost and recommended dose of NPK showed its best results with respect to plant growth parameters. INM practice including vermi compost and recommended dose of NPK showed best results with respect to yield parameters. Organic carbon was recorded maximum in INM treatment including vermin compost and recommended dose of NPK.

Mishra and Rai (2013) studied the use of indigenous soil and water conservation practices among farmers in Sikkim. This study was conducted in Papung- Ben Khola watershed area, located in the south district of Sikkim during 2009-10. Farmers adopted several conservation methods as practiced by their forefathers. One way ANOVA analysis was applied to analyse the significant difference in indigenous soil and water conservation practices among different ecological zones of the watershed. The study identified some soil and water conservation measures like terraces, bunds, gully control, alley cropping, mulching, stone barriers, crop rotation, mixed cropping, green manure, crop residues and weed burning and application of FYM. The result shows that indigenous soil and water conservation practices are widely used by the farmers of the watershed area.
Sannappa and Manjunath (2013) analyzed the soil fertility status in the Western Ghat of Karnataka covering five regions Viz. H.D Kote, Madikeri, Sakaleshpura, Shimogga and Sirsi along with Mysore. The result shows that PH and EC of soils ranges from 5.25 (Sirsi) - 7.83 (Madikeri) and 0.03 (Sirsi) - 0.28m.mhos/cm (Shimogga). Organic carbon and available nitrogen content are significantly more in H.D.Kote and Sakaleshpura regions. Madikeri region’s soil contains higher available phosphorus content. Both Madikeri and Sakaleshpura region recorded highest potassium content.

Alexander et al (2014) identified the factors influencing Integrated Soil Fertility Management (ISFM) in their study on ‘Describing adoption of integrated soil fertility management practices in Northern Ghana’. The study was based on primary data with a total sample size of 225 households producing maize. The study used probit model for identify the factors influencing ISFM in Ghana. The study considered education level of head of the household, association with the project, labour land ratio, proportion of males in the household, credit, ownership of livestock, per capita income as factors influencing fertility management. The result shows that education, extension, per capita income, income from off farm activities are influencing ISFM of sample farmers.

Kebeney et al (2015) analyzed the soil fertility management programmes in their study ‘Socio economic factors and soil fertility management practices affecting sorghum production in Western Kenya’. The study attempts to find the underlying factors responsible for low production and establish farmers perceptions on soil fertility management. Gender disparity, social norms and education level are the demographic factors associated with the experienced low sorghum yield. The study revealed that Soil Fertility Management (SFM) aspects, minimal fertilizer use, perception of the farmers on SFM options and inaccessibility to advisory services have an impact on sorghum production in the country. Inter cropping of cereals with nitrogen fixing legumes and residues management these are the methods suggested to improve soil fertility and enhance the crop yields.

Lal (2015) analyzed the importance of soil fertility in agriculture in the study ‘Restoring soil quality to mitigate soil degradation’. The main aim of this study was to identify the strategies for improving soil quality to mitigate risks of soil degradation.
The study identified creating a positive soil or ecosystem budget, improving availability of macro and micro nutrients, increasing soil biodiversity especially the microbial process, enhancing rhizospheric process as important strategies to restore soil fertility and reducing environmental damage.

Groundnut was one of the important oilseed crop, this crop cultivated by resources poor small holder farmer under rain fed areas. Patil et al (2015) identified the soil fertility management methods in their study ‘Modern tillage and integrated nutrient management practices for improving soil fertility and productivity of groundnut under rain fed farming system’. The study showed that mechanical tillage followed by inter cultivation helps in improving the soil fertility status in producing of groundnut. The study observed that deep tillage with tractor drawn implement is associated with maximum disturbance of soil resulted in lower organic carbon status in soil. Usage of Farm Yard Manure (FYM) to improve the soil fertility and integrated application of organic and inorganic fertilizers is suggested to improve in soil fertility and productivity of groundnut.

Roopa et al (2014) analyzed the soil fertility status in different cropping systems of different farmers in Doddaballapura talluk of Karnataka coming under Doddabelavangala Raitha Samparka Kendra (RSK). In this study 140 surface (0-15cm) soil samples were drawn from different cropping systems of both irrigated and rain fed conditions. These samples were tested for PH, EC, OC, available nitrogen, available phosphorus, available potassium and micronutrients. Based on the overall assessment the nutrient status of the soils were found to be optimum.

Ullah et al (2015) identified the factors affecting the adoption of organic farming in their study ‘Factors affecting the adoption of organic farming in Peshawar-Pakistan’. Four different agricultural areas are selected from Peshawar. The main aim of this study was to find the fertilizer usage and adoption or non adoption of organic farming. Binary logistic regression analysis was used to categorize the organic farming into adoption and non adoption. The results show that the adoption of organic farming has a positive and significant impact on the farmers in the form of reduced cost increased profitability, compatibility and efficiency. The study suggested that the adoption of organic farming is essential to farmers. Therefore comprehensive strategies to create awareness about the benefits of organic farming is needed.
2.3 CONCLUSIONS

The above review shows that soil fertility management practices are essential for sustainable agriculture. Several methods are adopted by the farmers to improve soil fertility. The empirical literature shows that a number of issues like problems of agriculture policy making, policy impact on cropping pattern and food security, input policies and impact on soil fertility, factors influencing soil fertility management were analysed at the international level and also national level. While some of these studies have observed the positive impact of the policy, some of the studies have observed policy failure.