CHAPTER-2
REVIEW OF LITERATURE

The available literature to present investigation has been reviewed as under:

Kanwar (1972) studied balanced fertilizer use for maximizing returns from wheat on cultivator’s field. The analysis showed that fertilizer responses and monetary returns favour the balanced use of plant nutrients (NPK). The economic returns were calculated for three different price levels of wheat and two price levels of plant nutrients. In any situation, NPK application was found to be more profitable than N application alone. With prevailing prices, 82 per cent of farmers hoped to make more than Rs. 500/- the net profit by using N120, P60, K60 in case of high yielding wheat.

Sirohi and Goel (1972) studied the optimum doses of fertilizers and their profit for barley and maize crops in India. They found that for barley, profit maximizing doses of nitrogen with no risk covered were comparatively high (80 to 150 kg/ha) at Hisar and Varanasi, but the doses of
phosphorus were zero at these centres. While at Pusa and Tonk centres, the phosphorus doses were high as compared to those of nitrogen which varied between 14 and 47 kg/ha. For maize, profit maximizing doses with no risk covered ranged between 75 to 150 kg/ha in about 70 per cent cases. The results showed that the yield maximizing doses for P2O5 were much lower than those of nitrogen.

Desai and Singh (1973) studied the dynamics of growth in fertilizer use at micro level in Andhra Pradesh for two years. The study indicated that in spite of a very favorable price situation, many farmers applied fertilizers in some crops only during one of two years. Apart from crop pattern changes, this was due to lack of irrigation, a fairly common practice of not fertilizing the small millets when grown in rotation with tobacco or chilies, relatively late spread of fertilizer use to pulses and coriander and uncertainty about returns from fertilizer use on unirrigated

Sankhayan and Sirohi (1972) examined the efficiency and impact of various fertilizer supply systems on production in Punjab. Specially, they examined the efficiency of fertilizer supply systems in terms of
distribution costs of various fertilizers, the impact of variations in the supply system of production at the farmer’s level and the problems faced by the farmers in obtaining necessary supplies of fertilizers through different systems with respect to timeliness, adequacy, quality and prices. The study concluded that the system of fertilizer supply through cooperatives is relatively more efficient in terms of distribution costs and pricing efficiency. The superiority of one system over the other could not be established, however with respect to their effect on agricultural production. In terms of difficulties faced by the farmers, greater difficulties were faced by them while obtaining their supplies from buying fertilizers from cooperatives. The study recommended the expansion of cooperative system for the distribution of fertilizers but cautioned that the system needs to be improved the streamlined to ensure timely supply.

**Sharma and Desai (1973)** examined the impact of delay, deficiency and dearness of fertilizers supply system in a village in Anantpur district in Andhra Pradesh. The study concluded that the supply system of fertilizers had
two inherent defects. First it led to hoarding on the part of dealers and secondly, there was an absence of proper distribution agencies. It was suggested that quantity budgets fertilizers be prepared at village, block and district level, fertilizers be supplied through also maintain adequate buffer stocks and provision should be made to supply fertilizers on credit to enable cultivators to pay for fertilizers on the production of crop.

**Patel (1973)** studied the fertilizer use in Gujarat. He analysed the factors determining the demand for fertilizers at the farm level, the factors inhibiting its use, the pattern and level of fertilizer use. The immediate problems found by him related to the low fertilizer use in irrigated areas and in some of the main commercial crops like cotton and groundnut.

**Singh and Ramachanderan (1973)** studied the impact of input supply system on crop production in district Moradabad, Uttar Pradesh. The study was done on the crops – sugarcane, wheat, paddy and maize to investigate farmer’s problems as regards availability of fertilizer under different supply systems.
Dahiya (1975) quantified the effect of fertilizer use on farm income level under certain assumed conditions. The simplex linear programming model was used as an analytical tool. The conclusions which emerged were that additional availability of fertilizers would improve the performance of Haryana’s agrarian economy in terms of farm income and output. The availability of fertilizers is vital for adoption of new hybrid technology. Allocation of fertilizers should be need based owing to different resource endowments and help should be extended to farmers whose requirements exceed the potential supply.

Singh (1975) studied the impact of fertilizer prices on the profitability of fertilizer use in cotton production in Northern India. It was found that cotton production potential with larger N use was much higher in south west zone comprising the districts of Sri-ganganagar in Rajasthan, Faridkot, Ferozpur and Bhatinda in Punjab and Hisar in Haryana. The total net return cover the fertilizer cost was higher in South West zone than in North East Zone.
Singh and Goel (1976) studied the impact of increase in the prices of fertilizers on the production and profitability of HYV of rice and wheat cultivation in India. The type of response was consistent over the two years in most of the districts. Assuming the total expenditure on fertilizers unchanged, the effect on production of an increase in the price of rice/wheat, the change in profit as a result of increased fertilizer price was worked out in the district, where the response was non-linear. The impact of fertilizer price rise on yield of HYV of rice and wheat was fairly stable over the years. If rise in price of fertilizer is compensated by a corresponding increase in the price of wheat/rice, the profit for farmers growing their HYV’s would increase considerable at all levels of application of fertilizers and under responses of different types. The increase in profit fluctuated more strongly for rice than wheat.

Vachhrajani (1976) called for a realistic distribution strategy for fertilizers and argued that a realistic distribution strategy should take into account historical development, use, availability and future potential of
specific fertilizer nutrients. He suggested that the distribution policy need not be uniform for all nutrients. While for nitrogen, the indigenous production, the country’s ability to import and the diversion of additional quantities so obtained to import and the diversion of additional quantities so obtained to areas where fertilizer are not being consumed, for phosphatic fertilizers a policy of more rational pricing and a persistent effort to balance it with nitrogen and potash will have to be adopted. A mere redistribution of nitrogen or phosphate from certain areas to others may lead to other serious problems.

Dhillon and Sidhu (1977) estimated the demand for nitrogenous fertilizers for Punjab state. The total demand for Punjab was estimated at 0.41 million tones of N as compared to 0.24 million tones of actual use in 1972-73 and 0.49 million tones of actual need. From the estimates of different elasticity, it was inferred that demand for fertilizer was inelastic with respect to its price. The availability of capital was found to be an important variable affecting the demand for fertilizer.
Sidhu (1978) conducted a study on fertilizer use and wheat yields. Fertilizer use was found to be a significant factor in increasing the level of wheat yields in wake of adoption of new farm technology particularly the Mexican varieties of wheat. In turn, fertilizers use was affected by relative price of wheat to fertilizers. Any increase in fertilizer prices was found to affect yields and production of wheat adversely. Reduction in fertilizer prices would induce the farmer to increase fertilizer use and thereby the production of wheat.

Hegde and Saraf (1979) worked out economics of phosphorus fertilization of intercropping systems in pigeon pea under dry land conditions. Quadratic production functions fitted to the total grain combination had the maximum yield potential and gave the highest net profit and higher phosphorus utilization efficiency. Sensitive analysis indicated that the optimum dose of P$_2$O$_5$ and expected response increased with increasing price of output at constant input cost and decreased with increasing cost of input at constant output value. The P utilization
efficiency was more sensitive to change in input prices than the changes in output prices.

Soni and Mukherjee (1979) studied the effect of fertilizer constraint on yield in crop sequence. The effect of fertilizer constraints on total grain yield was analysed, based on experimental data collected at different agronomic research centres in India during 1974-75 to 1976-77. The results indicated that on an average increase of 2-3 quintals in the total yield in the rice-rice sequence could be obtained by apportioning fertilizer resources in the two crop seasons, kharif and rabi. For any given quantity of fertilizer application for crop sequence, its proper phasing between the two seasons is of utmost importance to obtain higher returns.

Abeywardena (1979) worked out economics of the response in coconut to fertilizer application. He found that unfertilized coconut responded to fertilizer application in two stages. There was substantial response after one year, building up according to the law of diminishing returns, reaching a plateau by about the third year after manuring.
The economics of manuring based on this response have been worked out.

*Gangadharan (1980)* analysed quantitatively the effects of fertilizer and crop prices, farm credit and improvement in technological knowledge on the use of fertilizer in Kerla, using time-series data on these variables covering the period from 1966-67 to 1976-77. Simple linear and double forms were used to estimate study showed that fertilizer consumption was more elastic with respect to product price.

*Jha and Sarin (1980)* analyzed fertilizers consumption in the districts of the Semi-Arid Tropics of India SAT for the period 1969-70. Over 62 per cent of the total fertilizers consumed in the SAT districts were observed to be in the 78 irrigated districts which accounted for only 35 per cent of the SAT cropped area. Thus fertilizers consumption was mainly restricted to irrigated districts. The study also revealed wide differences in per hectare consumption of fertilizers between the irrigated (57 kg/ha) and unirrigated (15 Kg/ha) districts. Inter-district variations between the two categories of the
district were also conserved to be high. The growth in total fertilizers consumption, however, was better in the irrigated districts during the reference period.

**Jha and Sarin (1980)** studied fertilizer consumption and growth in semi-arid tropical India. The results suggest two hypotheses: irrigated areas with SAT India continue to control growth in fertilizer consumption. Even the high irrigated areas reach their saturation level, on going irrigation efforts would lead to diffusion of fertilizer use on unirrigated lands. Farmers in highly unstable SAT setting adopt fertilizers only when returns are relatively assured and high enough. Relatively low value food grain crops which do not respond significantly to fertilization and which occupy the bulk of unirrigated SAT cropped area, suffer on both these counts.

**Kullarni (1980)** analysed the scope for increasing production of important oilseed crops under rain fed conditions through use of fertilizers and its economics. Out of 15 districts where experiments were conducted with groundnut, fertilizer application was beneficial in 14 districts. A dose of 20 kg N and 60 kg P$_2$O$_5$ per hectare in
Madurai, Krishna, Broach and Amrali districts. 30 kg N, 40 kg P₂O₅ and 30 kg K₂O per hectare in Mahaboobnagar, Ballary, Gulburga, Ananthapur and Dhulia districts, 20 kg N, 60 kg P₂O₅ and 30 kg K₂O per hectare in Prakasham district were remunerative. The yields of crops increased from 26-300 per cent with appropriate fertilizer dose for different oilseed crops.

Kulkarni (1980) showed that for Bengal Gram, a dose of 20 kg N, 40 kg P₂O₅ and 20 kg K₂O per hectare was found to be beneficial in districts of Bhatinda, Alwar, Ajmer, Indore and Gulburga. In ferozepur, Faridkot, Hamirpur and Chickmanglore, application of 20 kg N and 40 kg P₂O₅ per hectare was suitable. In Medak, application of 20 kg N/ha alone was adequate. For black Gram, application of 20 kg N, 40 kg P₂O₅ and 20 kg K₂O/ha was beneficial in East Godawari district while 20 kg N and 40 kg P₂O₅ was adequate in Ferozepur and Faridkot district. In case of red Gram, application of 20 kg N, 40 kg P₂O₅ and 20 kg K₂O/ha for Gulburga district of Andhra Pradesh was economical. The increase in yield with fertilizers ranged from 40 to 211 per cent.
Narayanan (1980) obtained that two complementary forces operate on fertilizers a “Push force” which drives fertilizers to farmers and a “Pull force” which attracts fertilizers towards him. The pull forces are the agro climatic soil cropping pattern systems, awareness, price, production credit and availability. The push forces comprise production, imports, transportation, warehousing distribution network, margins and distribution credit. The study emphasizes the importance of supply push, that is the ready availability of the right type of fertilizer material, in the right quantity at right time near the points of consumption in order to stimulate fertilizer consumption, since fertilizer requirements at the farm level are highly time-specific, it is recommended that large number of retail outlets need to be opened, especially in areas where they are now non-existent, with the aim being to have a retail outlet with in a 5 mile radius of each village in the country. This must be supplemented with transportation and storage facilities.
Sharma (1980) estimated the demand for fertilizers in A.P. The important variables were first identified and their data limitations were indicated.

The demand model was then specified. It was based on three statistical techniques—principal component analysis, pooling of cross section and time series data.

Sohbti (1980) defined the role of fertilizers in agriculture in India. The evolution of fertilizer use in India was traced through pre-independence phase and through subsequent five year plans. Four out of 14 major states accounted for more than 50 per cent of fertilizer consumption. Nearly 31 per cent of total fertilizer consumption was by small farmers with holdings up to 2 hectares.

Subrahmanyanam (1980) worked out economics of investment in fertilizers and pesticides. The issue was examined using data on vegetables and their response to N and P was used to calculate the additional costs and returns from fertilizer usage. The best results occurred when plant protection measures were adopted alongside fertilizer use.
Vyas et al. (1980) studied the response of some high yielding varieties of Wheat and their economics under low and moderate fertility levels. In trials on sandy loam soil in Rajasthan with 3 high yielding varieties of Wheat given 0-120 kg N and 0-50 kg P$_2$O$_5$ per hectare in addition to 40 kg K$_2$O per hectare, grain yield increased with increasing rates of N and P$_2$O$_5$. The next profit/unit investment on fertilizers was highest with 90 kg N/ha and 25 kg P$_2$O$_5$/ha.

Arora and Sharma (1981) attempted to estimate the potential economic consequences of such an allocation on regional cropping patterns and production levels. The methodology employed was outlined and results were presented under headings: 1) existing and planned allocation of fertilizer nutrients, 2) impact of optimal fertilizer allocation on regional cropping patterns and 3) impact of fertilizer allocation strategy on regional production levels.

Agro Economic Research Centre Delhi (1981) undertook a study and showed that although the level of fertilizer use in sample villages was less than optimum, it was considerably higher than the average level for the
region as a whole. The most important factor influencing fertilizer use was found to be the relative accessibility of fertilizer distribution points of farmers. Other factors, such as availability of irrigation, use of HYV seeds, cropping pattern etc. were seen to play a role.

**Parikh and Moseley (1981)** studied fertilizer response in Haryana. Some evidence was found in support of following hypothesis: 1) Number of ploughings per acre has a significant effect on yield per acre for HYV, 2) The base yield of HYV without fertilizers is much higher than for local varieties, 3) Second application of nitrogenous fertilizers per acre has a significant role to play in explaining variations in yield per acre, 4) There does not seem to be any relationship between size of holding and fertilizer use per acre and 5) It is suspected that small farmers probably did not use fertilizers in 1970-71 but sold to large farmers, which explains the insignificant response coefficient with respect to fertilizers.

**Puri (1981)** examined the role of fertilizers in increasing aggregate agricultural production, and considered input and product pricing policy for increasing
the efficiency of fertilizer usage, the role of fertilizers in redressing the imbalances between various crops, the fertilizer distribution policy and the question of a more equitable balance in the agricultural production process between different farm households.

Singh (1981) studied the oilseed production functions and efficiency of fertilizer use in India. The study gave the results (1) the yield of all oilseeds are highly associated with fertilizer micronutrient application (2) per hectare yield of Raya, and Linseed were highest in Kanpur while Safflower gave the higher per ha yield at Anhigeri (3) at all the location Raya was found to be most profitable crop in terms of net revenue per ha at most efficient level of sulphur use with in same location.

Singh (1981) studied the crop productivity and fertilizer use efficiency in Haryana. He revealed that (1) crop yield are highly responsive to fertilizer application in assured and semi – irrigated regions (2) the spectacular increase in agricultural output in the state during last decade may be mainly attributed to increased application of fertilizers (3) with the increase in crop yield instability,
fertilizer use shows a declining tendency and (4) the creation of assured irrigation facilities and complementary infrastructure helps in increasing and stabilizing fertilizer application and consequently boosting agriculture production.

Tandon (1981) studied the fertilizer use in dry land agriculture. The paper presents some aspects of fertilizer use and research into significant responses of number of crops under dry land conditions in India. It emphasizes that the development and application of suitable fertilizers in dry land and technologies could benefit farmer involved in the cultivation of sorghum, millets and oilseeds by increasing their yields.

Desai (1982) examined the changes in shares of crops, diffusion of fertilizer use by crops and average rates of use on fertilized areas by crops for the period between early 1950’s and mid 1970’s to determine the forces behind past growth in fertilizer consumption in the 1980’s. The study found that past growth in fertilizer consumption was adversely affected by inadequate promotion efforts on food grains other rice and wheat, oilseeds other than groundnut
and unirrigated systems, shortfalls in domestic production and wide inter-year fluctuations in imports of fertilizer. Fertilizer use should be promoted on unirrigated lands and distribution networks be expanded in districts with low irrigation.

**Fertilizer Association of India (1982)** conducted a study on changing patterns of consumption of fertilizers. It was found that fertilizer consumption in India during the decade 1971-81 increased at the compound rate of 9.3 per cent per annum. There were violent fluctuations in fertilizer consumption from year to year as also between regions and states. Fertilizer consumption has grown more rapidly in states like Punjab, U.P., Haryana and west Bengal where a judicious mix of fertilizer distribution through various channels and these states were followed by Gujrat and Bihar where only marketing federations predominated. Balanced growth in fertilizer consumption is influenced by pricing mechanism and policies for fertilizers.

**Patil and Pandey (1982)** examined the demand for nitrogenous fertilizer in Indian Agriculture. The rate and
growth of fertilizer use were related to factors such as irrigation, high yielding varieties, and farmer’s receptiveness, price relationship between crops and fertilizers consumption levels within and between states. The impact of economic and agro climatic factor was examined in determining the level of consumption of N at macro level and the relationship of various factors in studied to gauge their relative contribution towards higher consumption of N through Cobb-Douglas production function. It was observed that irrigation was dominant factor, with other exhibiting varying degrees of significance in the selected study areas.

Sikder (1983) examined the importance of fertilizers and other inputs in rain fed areas of the country. Cultivation predominantly of pulses, oilseeds millets and coarse grains, limited resources of farmers, poor management skills, poor soil conditions, uncertain weather and inadequate extension services have all led to poor fertilizer consumption in such areas. The study concluded that it is necessary to strengthen infrastructure, arrange for easy and soft credit, improve extension activities and
expand retail distribution network to improve fertilizer consumption in the areas.

Singh (1982) evaluated crop response to micro-nutrients in India. The study concluded (1) use of micro-nutrients in crop production is inevitable as 87-99 per cent variation in crop yields is due to the application of micro-nutrients alone. (2) maximum reproduction per rupee of investment on micro-nutrients ranges between 3-5.8 kg in WH-147 and HD-2009 varieties on an all India basis. (3) Keeping N: P: K use fixed at 120: 60: 50 kg per ha in Bajra, Maize and Wheat crop per hectare net income is highly associated with levels of Zn application per hectare.

Subbarao (1983) examined the prevailing delivery system for various inputs including fertilizer in India. The relative role of private and cooperative institution in different states was examined. The study revealed that interstate disparities in the physical access to rural retail outlets for fertilizers were on account of differences in infrastructure development. It concluded that, in general, the spread of rural retail network for inputs was unsatisfactory in regions with poorly endowed
infrastructure. Although cooperatives had penetrated into the interior areas, regional inequity in the retail network was found to be present. Cooperatives were observed to have a slight edge over private dealers in terms of performance.

Pitt (1983) conducted a study on farm level fertilizer demand. This study differs from other attempts to estimate the farm level demands for variables inputs. The choice of seed variety and demand for variables inputs was analyzed in a simultaneous equations framework. This model assumes that cultivators maximizing profits in joint determination of seed rate and fertilizer demand. A two stage procedure which adjusts for selectivity bias is used to estimate the model. At “t” test confirms the significance of selectivity bias in the estimation of HYV fertilizer equation and profit function.

Desai (1986) suggested that policies for future growth in fertilizer consumption should simultaneously aim at exploiting the remaining untapped potential and raising the economic potential of fertilizer use through improvements in the response function environment. Since most of the
unexploited potential was on unirrigated lands, research and extension activities to tap the potential of fertilizer use on such lands was essential. These require to be supplemented by adequate and timely flow of credit to farmers and the development of an efficient fertilizer distribution network. Larger distribution margins may be required to expend fertilizer distribution systems. Unexploited potential, it is suggested, can also be tapped by raising the rates of application on fertilized lands to optimum levels. Accelerated development of irrigation potential and its fuller utilization was also required to increase fertilizer use potential. Such non price policies, it is argued, will be more crucial in future for raising fertilizer consumption rather than price policies.

Kumar (1986) opined that through the increase in consumption of all inputs, including fertilizers, during the past 30 years had been impressive; to sustain and ensure further increases in inputs consumption a comprehensive strategy of inputs management was required. Integrated planning and positioning of inputs required by farmers was crucial as the consumption of inputs was largely dependent
upon their availability. Hence adequate stocking of inputs at convenient locations so that delays in supplies were eliminated, reductions in transport costs, especially to the interiors, and smaller packaging were suggested as the important prerequisites for effecting increases in consumption of inputs including fertilizers.

**Kundhavi (1986)** attempted to estimate the efficacy of retail outlets in serving consumers in terms of supplying the project of the farmer’s choice in Tamil Nadu. It was found that cooperatives offered limited varieties of fertilizers to farmers. On the other hand, greater range of varieties of fertilizers was offered by private dealers. This caused widespread dissatisfaction among farmers against cooperatives.

**Sundaramaman (1986)** examined the Government of India’s block-delivery scheme for fertilizers. Although the study supported the basic philosophy of the scheme it suggested certain changes in the method of implementation of the Block Delivery Scheme need not be uniform throughout of the country but should be modified from region to region depending upon such local conditions as
the development of village level outlets, transport networks retail outlet of manufacturers and the number and volume of business of cooperatives. Realistic distribution margins, which provide for periodic correction of costs of different functions are suggested for a viable distribution network.

Rajagopalan (1987) analysed the salient features of the retention pricing policy for fertilizers and argued that the policy meets the requirements of a normative pricing system. However, there may be some deviations from norms arising purely due to the heterogeneous character of the fertilizer industry and uncertain market behaviour. The author strongly recommended the need for exercising caution in handling the concept of long run marginal cost which, through theoretically sound, may prove harmful if not tackled properly.

Rao (1989) reviewed the fertilizer consumption pattern in India and estimated fertilizer consumption requirements of the population. The domestic availability of fertilizers and the required imports were also analysed and the study emphasized the need for self sufficiency in
fertilizer production to ensure the country’s food security. It concluded that throughout the eight plan the country will have to depend upon imports. As such, the need for a long term fertilizer policy and removing of constraints such as lack of knowledge of users, lack of adequate supplies, inadequate institutional credit and unattractive output prices to increase fertilizer consumption is emphasized, while the subsidy scheme is supported.

Singh (1989) examined the present system of fertilizer distribution and logistics. Additions in production capacities, changing pattern of fertilizer demand, improvements in rural communications, glut situation, unhealthy completely. As such, the study suggested that the entire distribution system, particularly logistics planning at the micro level should be reviewed.

Majumdar and Modi (1990) examined the relevance of retail network and credit in the growth of fertilizer consumption and its use in Gujrat. The study found that the number of retail points per hundred hectares had grown steadily in Gujrat. The growth was more rapid during the period 1984-85 to 1988-89 than in the number of retail
points were observed, with a high degree of positive correlation between the number of retail points were observed, with a high degree of positive correlation between the number of retail points and fertilizer use levels per hectare.

Marwaha and Gaur (1993) examined decontrolling of phosphorus and potassium fertilizers by the Government of India has meant a withdrawal of earlier of subsidies to manufacturers, leading to no control on their prices, distribution and movement. Manufacturers are now free to sell these fertilizers before the sowing seasons at a price jointly determined by themselves and the market. These materials will therefore be sold where it is most profitable for fertilizer manufacturers to sell. This will lead to both abundant availability and scarcity, resulting in non-availability of fertilizers, which will affect agricultural production. The prices of phosphorus and potassium fertilizers after decontrol are still higher, despite the subsidy. Price variations in different states and local market have created regional imbalances. Wheat is an important crop in India; this study assessed the fertilizer
use pattern of wheat and studied farmer’s perceptions of decontrolling phosphorus and potassium fertilizers. Findings showed that under the changed socio-economic environment due to decontrol, farmers in general are not prepared to absorb the increase in prices of the two fertilizers. Greater emphasis needs to be placed on the promotional efforts for the education and motivation of the farmers, to result in an improvement in the crop response ratio and generation of a higher marketable surplus.

Tandon (1993) analysed the impact of decontrol fertilizer policies on nutrient balance, soil health and yield sustainability in India. It argues that present policies are not in the medium long term interest of Indian agriculture, soil health or the well being of farmers. It advocated a more agro economically sound and balanced approach to government policies on subsidy, such as a reduction of the subsidy on N to the benefit of P and K, such a strategy would correct the distortion created by heavily subsidizing N while leaving P and K to free.

Gupta (1995) revealed that despite the decontrol and decanalization of phosphatic and potassic fertilizers in
India, there have been state interventions, particularly in respect of pricing. Nonetheless the forces of demand and supply have started operation in the market place and a differential pricing system has been established. The mounting burden of subsidized for urea and the follow up of the policy of liberalization made the decontrol of urea inevitable. The urea deficit will result in adequate supplies but at higher prices. Cooperatives will have to improve their operations significantly to secure their survival in the fertilizer business. Innovative systems like private traders inviting bids from manufactures and manufacturers inviting bids for ex factory disposal of their material may be introduced in the market.

Singh (1995) observed that fertilizer has been a major factor behind advances in agriculture. The liberalization of the economic policy adopted by the Govt. of India in the early 1990’s severely jolted the fertilizer sector as partial decontrol and decenalization were absorbed into the industry. A review of the situation over the past three years indicates that the fertilizer sector is not in a stable situation. Further policy changes, perhaps heading towards
total fertilizer decontrol, are expected. The fertilizer industry will have to adopt its marketing strategy to the new environment. Advertising and sales promotion are the major factors which decide the place of the product in the market. The need for location and situation specific, commercially viable advertising and sales promotion are required under the decontrolled scenario.

Shyam (1995) observed changes in the inter crop allocation of area during both Rabi crops in 1991-92 and Kharif crops in 1992-93 which could be attributed partly to price rise and partly due to local conditions and resource position of the farmers. In addition there was a general increase in fertilizer doses in favour of cash and cereal crops while fertilizer use declined in the case of pulses and minor crops. The Dual Fertilizer Price Policy failed to render benefits to the weaker farmers. The study suggested measures such as strict supervision, increase in sale points, adequate stocks, payment of subsidy in kind, prior information about price rise, growth in domestic industry, crop insurance and simplified procedures to ensure smooth functioning of the fertilizer policy.
W. Mwangi. (1996) studied the factors related to the low use of fertilizers and the resulting low agricultural productivity in sub-Saharan Africa is reviewed. The importance of inorganic fertilizers and agricultural research to improving soil fertility and increasing agricultural productivity are outlined. Particular attention is devoted to the following factors that influence farmers' adoption and intensity of fertilizer use: the economics of fertilizer use, the availability of fertilizer, price policies and credit, pricing environment and distribution costs, the privatization of supply, and infrastructural development.

Rai (1997) examined impact of changing economic policies, since the economic reforms of 1991, in the Indian fertilizer industry are discussed in terms of the changing price ratio between urea and the phosphatic and potassic fertilizers. Government policy coupled with changing prices of imported raw materials and feedstock prices have all conspired to detrimentally affect the phosphate and potassium fertilizer industries in India.

Demke, Mulat et al. (1998) reported that this paper examines how the fertilizer sector in general, and farmers’
demand for fertilizer in particular, has evolved since the introduction of fertilizer sector reforms in Ethiopia. There is much debate in the agricultural development literature about whether fertilizer use in Africa is constrained primarily by poor input distribution systems, by farmers’ lack of knowledge concerning the benefits and correct use of fertilizer, or by lack of effective demand because the product is simply not profitable enough. This paper looks at each of these issues in an effort to understand the relative importance of the different constraints and how well current policies are addressing the problems. It attempts to identify additional policy measures needed to sustain expanded use of fertilizer and thus enhance food security in Ethiopia.

Yanggen, David et.al. (1998) reported that this research addresses two questions: Why is fertilizer not yet fulfilling its potential as a major stimulus to agricultural productivity in SSA? What can be done to improve the situation? The answers are based on an extensive review of fertilizer response, profitability, and policy literature as well as some analysis of crop budgets and aggregate
national statistics on fertilizer consumption. Much of the debate about fertilizer use in SSA focuses on two issues: whether the profit incentive is adequate and, if so, whether farmers have the capacity to access and use it.

**Mehra (1999)** argued that there is a need to make the farmer treat farming as a business and to develop entrepreneurial skills to make judicious use of all the available resources, be it the land, manpower, finance, animal wealth or machinery, or to optimize returns from his assets. To achieve this goal, the role of agro-input industry and its market development strategy would need reorientation. The efforts need to be directed to create adequate awareness among the farmers towards the significance of non-monetary inputs, mixed farming, post harvest technology in increasing income and improving social life. Indeed the initiative on this front should come from the farmers and they should draw upon knowledge from various extension agencies including the fertilizer industry, to their advantage, in improving their lot. To achieve this, the means and quality of communication in the rural areas needs a radical change so that farmers have
a ready access to farm experts, without always having to visit them.

Minot et.al. (2000) studied the fertilizer market reform and the determinants of fertilizer use in Benin and Malawi and conclude that most countries in sub-Saharan Africa have reduced or eliminated fertilizer subsidies and liberalized input marketing as part of the reform process that began in the early 1980s. The effect on fertilizer prices and use is one of the most frequently mentioned criticisms of liberalization. The effect of these reforms, however, has varied widely across countries. For example, in Benin fertilizer use has increased ten-fold since 1982, while in Malawi it has risen just 30 percent, less than population growth over the period. This paper explores the factors behind these widely different experiences with input market reform. It relies in part on household survey data collected by IFPRI and collaborating institutions in 1998. The two surveys used nationally representative samples of 800-900 farmers and covered a variety of topics. A Heckman model is used to identify the determinants of fertilizer use.
Marrit van den Berg (2002) concluded that this paper investigates the possibility of using public works to stimulate farmers' fertilizer use in India's SAT. Inadequate replenishment of removed nutrients and organic matter has reduced fertility and increased erosion rates. Fertilizer use, along with other complementary measures, can help reverse this process, which ultimately leads to poverty, hunger, and further environmental degradation. In a high-risk environment like India's SAT, there may be a strong relation between off-farm income and smallholder fertilizer use. Farmers can use the main source of off-farm income, wage income, to manage risk as well as to finance inputs. Consequently, the introduction of public works programmes in areas with high dry-season unemployment may affect fertilizer use. This study confirms the relevance of risk for decisions regarding fertilizer use in two Indian villages. Nevertheless, governments cannot use employment policies to stimulate fertilizer use. Public works even decrease fertilizer use in the survey setting.

Sule et al. (2002) examined the factors such as per farm total quantity of bio-fertilizer used, size of farm (ha),
quality of fertilizer used (kg) and annual family gross income (rupees) and the proportions of cash crops and education were analysed. Based on multiple regression analysis, the size of holding, the quantity of chemical fertilizer used, and the gross family income jointly explained 52 per cent of the total variation in the use of biofertilizers on the sample farms. It was observed that the use of bio-fertilizers increases with an increase in the size of the holding. The farm use of Rhizobium, Azotobacter, Azospirillum and Cynobacteria were 4.490, 60166 and 16.770 kg at the overall level, respectively. The consumption of phosphate solubilizing bacteria was maximum (8.040 kg) in large size and minimum (6.125 kg) in small size farms.

**Gregory and Batabyal (2004)** studied the frequency with which a crop can be harvested on a cleared parcel of forest land (CPFL) before this land must be fallowed depends in part on the decision to use or not to use fertilizers to improve soil fertility. Therefore, the researchers firstly, construct a mathematical model of fertilizer use by a shifting cultivator when this cultivator
can decide whether or not to improve soil fertility by using fertilizers. Secondly, two different policies (fertilizer use and no fertilizer use) were studied for overseeing the problem of soil fertility impairment on the CPFL. Thirdly, identification of a specific probability function and then researchers demonstrate that whether the problem of soil fertility deterioration is best addressed with a fertilizer use policy or with a no fertilizer use policy depends fundamentally on this probability function.

**Fufa & Hassan (2006)** Factors influencing the extent and intensity of fertilizer adoption on maize production in Ethiopia were analyzed. A Weighted Endogenous Sampling Maximum Likelihood estimator was used in the specification of a Probit and Tobit fertilizer adoption models. The results have important implications for the formulation of policies and programs targeted to promotion of fertilizer use in small-scale maize production. Those include improved road infrastructure, consideration of weather related crop failure insurance programs, development of drought tolerant cultivars and targeting particular farmer groups.
Ariga and Jayne (2008) studied the trends and patterns in Fertilizer use by Smallholder farmers in Kenya during 1997-2007 and reported that this study uses nationwide household panel survey data from 1996/97 to 2006/07 to examine trends in fertilizer use on maize by smallholder maize growers. The paper also compares these findings with fertilizer use rates according to other recent surveys in Kenya to assess comparability. The correlation was also examined between household fertilizer use and indicators of welfare such as wealth and landholding size. In addition, econometric techniques was applied to household survey data to identify the main household and community characteristics associated with fertilizer purchases. Lastly, the study considers alternative policy strategies for maintaining smallholders’ access to fertilizer in the current context of substantially higher world fertilizer prices.

Eric (2009) concluded that Atmospheric nitrous oxide concentrations have been increasing since the industrial revolution and currently account for 6% of total anthropogenic irradiative forcing. Microbial production in
soils is the dominant nitrous oxide source; this has increased with increasing use of nitrogen fertilizers. However, fertilizer use alone cannot account for the historical trends of atmospheric concentrations of nitrous oxide. Here, the researcher analyse atmospheric concentrations, industrial sources of nitrous oxide, and fertilizer and manure production since 1860. Before 1960, agricultural expansion, including livestock production, may have caused globally significant mining of soil nitrogen, fuelling a steady increase in atmospheric nitrous oxide. After 1960, the rate of the increase rose, due to accelerating use of synthetic nitrogen fertilizers. Using a regression model, the researcher show that 2.0% of manure nitrogen and 2.5% of fertilizer nitrogen was converted to nitrous oxide between 1860 and 2005; these percentage contributions explain the entire pattern of increasing nitrous oxide concentrations over this period. Consideration of processes that re-concentrate soil nitrogen, such as manure production by livestock, improved 'hind-casting' of nitrous oxide emissions. As animal protein consumption in human diets increases globally, management of manure will be an important
component of future efforts to reduce anthropogenic nitrous oxide sources.

**Malik, R. S. et. al. (2009)** expressed his results that a systematic survey was done to collect soil, plant, pond and tube well water samples from Karnal, Panipat and Kurukshetra districts of Haryana under paddy-wheat cropping system. The quality analysis of ponds and tube well waters indicated that all the pond waters had one or the other characteristics above permissible limits. The heavy metal concentration of tube well waters varies from 0.03 to 0.15 mg/liter Cd, Tr to 0.46 mg/liter Pb; Tr to 0.4 mg/liter Ni 0.15 to 0.29 mg/liter and Co from 0.34 to 0.39 mg/liter whereas in pond waters it ranges from 0.01 to 0.16, Tr to 0.44, 0.27 to 0.29 and 0.15 to 0.41 mg/liter of Cd, Pb, Ni and Co, respectively. Mostly the accumulation of heavy metals in soils confined to surface layer. Crops under study area were found to accumulate toxic in order of oilseeds > oilseeds > cereals > fodder but the concentration was found within the permissible limits.

**Afua B. Banful et. al. (2010)** reported that Fertilizer consumption rates in Nigeria remains among the lowest in
the world despite decades of aggressive subsidization. The extension service in Nigeria has a double-edged impact on fertilizer use in the country; not only can their activities increase farmers’ demand for fertilizer, but also the organizational framework of the service, Agricultural Development Programs, is the major source of fertilizer for farmers. To provide insights on the reasons for the low fertilizer use in Nigeria, this paper presents an analysis of the extension service as well as some perspectives of village extension agents. The researchers find that the reach of the extension service is severely limited by low staff. The main technology transmitted is the use of improved seeds. Fertilizer technology is seldom transmitted and very rarely is irrigation taught. Furthermore, extension agents are found to have gaps in their knowledge of fertilizer technology. Extension agents routinely distribute agricultural inputs and many see their advisory role as secondary to this function. Extension agents identified the primary constraint to fertilizer use in Nigeria as the physical absence of the product at the time that it is needed, rather than lack of affordability or
farmers' lack of knowledge about the benefits or the use of fertilizer.

The review of the above mentioned studies reveal that only few studies have been conducted to study the patterns of fertilizer use, and to estimate the marginal productivity of fertilizers in different crops in irrigated as well as rain fed conditions. The findings of the present study will provide useful information on the future use of fertilizers in different crops in areas where the existing level of fertilizer use in a particular crop is low compared with the state as a whole.