CHAPTER-1
INTRODUCTION

Fertilizers are substances that supply plant nutrients or amend soil fertility. They are the most effective (30 -80 per cent increase in yields) means of increasing crop production and of improving the quality of food and fodder. Fertilizers are used in order to supplement nutrient supply in the soil, especially to correct yield-limiting factors.

Fertilizers are applied to promote plant growth; the main nutrients present in fertilizer are Nitrogen, phosphorus and Potassium (the 'macro-nutrients') and other nutrients ('micronutrients') are added in smaller amounts. Fertilizers are usually directly applied to soil, and can also be sprayed on leaves as a foliar feeding.

Organic fertilizers and some mined inorganic fertilizers have been used for many centuries, whereas chemically synthesized inorganic fertilizers were only widely developed during the industrial revolution. Increased understanding and use of fertilizers were important parts of the pre-industrial British Agricultural Revolution and the industrial Green Revolution of the 20th century.
Inorganic fertilizer use has also significantly supported global population growth — it has been estimated that almost half the people on the Earth are currently fed as a result of artificial Nitrogen fertilizer use¹.

Fertilizers typically provide, in varying proportions:

- The three primary macronutrients:
  Nitrogen (N), Phosphorus (P), and Potassium (K).
- The three secondary macronutrients:
  Calcium (Ca), Sulfur (S), Magnesium (Mg).
- And the micronutrients (trace minerals):
  Boron (B), Chlorine (Cl), Manganese (Mn), Iron(Fe), Zinc (Zn), Copper (Cu), Molybdenum (Mo) and Selenium (Se).

The macronutrients are consumed in larger quantities and are present in plant tissue in quantities from 0.2% to 4.0% (on a dry matter weight basis²). Micronutrients are consumed in smaller quantities and are present in plant tissue in quantities

measured in parts per million (ppm), ranging from 5 to 200 ppm, or less than 0.02% dry weight. The Nitrogen-rich fertilizer ammonium nitrate is also used as an oxidizing agent in improvised explosive devices, sometimes called fertilizer bombs, leading to sale regulations.

Role of fertilizer in increasing agricultural productivity and production during the last five and half decades has been well documented. A very close association is observed between growth of fertilizer and crop productivity in almost all the states of the country.

No input in agriculture has seen as much growth as witnessed in the use of fertilizer in the recent history of agriculture. Fertilizer consumption was around 67 thousand tonnes in early 1950s and it picked up very fast during mid 1950s. By early 1960s consumption of NPK crossed 400 thousand tonne and at the time of onset of green revolution consumption of fertilizer approached 1 million tonne. On per hectare basis, fertilizer consumption in India increased from 0.5 kg in early 1950s to 7 kg at the time of onset of green revolution in 1966-67. It is worth mentioning that in the pre green revolution post Independence period fertilizer consumption remained quite low but its growth rate was higher
than that of crop production. Average growth rate in crop production (index) during 1950-51 to 1966-67 was 2.48 percent whereas average growth rate in fertilizer consumption in the same period was 19.41 percent. This shows that even in the pre green revolution period fertilizer was used as an important input for raising agricultural production.

The main reason for low use of fertilizer in pre green revolution period was that the use of this input was confined to a few cash crops. Principal crops like cereals and pulses which occupied more than 70 percent of gross area under cultivation were hardly applied inorganic fertilizer. Such crops were grown mainly for subsistence purpose based on low input requiring technology. Traditional varieties of crops grown at that time were not responsive to chemical fertilizers. The traditional varieties and methods of their production were sustainable but output was not large enough to meet the requirement of country. New strains of wheat and paddy developed around mid 1960s were highly responsive to use of chemical fertilizers and offered much higher yield potential as compared to the traditional varieties. A big jump in use of fertilizer took place in the first two years of adoption of new varieties of paddy and wheat when fertilizer consumption increased from 784 thousand tonne during 1965-66 to 1539
thousand tonne during 1967-68. Since then fertilizer use in the country has moved on a continuously rising trend except a few short breaks.

Fertilizer use remained sluggish during the oil crisis around mid 1970s but again recovered to robust growth path which continued till 1990-91. After this, growth in fertilizer use in the country has not been smooth. There has been a progressive deceleration in growth rates in fertilizer consumption and even a decline in some years. The slowdown in fertilizer use has been accompanied by sharp slowdown in growth rate of crop sector after 1996-97. Growth in fertilizer consumption dropped below 2 percent during 1997-98 to 2005-06 and growth of crop sector went below 1 percent. This is causing a serious concern to policy makers and all others concerned with growth of agriculture sector.

In this context it is highly pertinent to find out how growth in agriculture output can be raised by increasing use of fertilizer. Use of fertilizer is quite low in most of the states of India and in most of the crops. Thus, considerable scope exists to raise agricultural production by raising fertilizer use. Further, use of plant nutrients in many parts of the country is highly concentrated towards Nitrogenous fertilizer and a large
imbalance has emerged between ratio of N, P and K as applied by farmers and the ratio that is considered optimum. This is raising all sorts of concerns regarding soil fertility, productivity and efficiency of fertilizer use. It is often contended that structure of subsidy on fertilizer is responsible for distortions in use of N, P and K which in turn is causing adverse effect on soil fertility and productivity. However, empirical evidence on this is missing. Besides, issue of subsidy on fertilizer is also being debated for its impact on fiscal resources. It is felt that due to rising bill of fertilizer subsidies resources are being diverted from investments in agriculture sector to meet subsidy bill. On one hand, the structure of fertilizer subsidy is alleged to cause distortions in soil nutrients and, on the other hand, these subsidies are considered deleterious for growth of agriculture sector due to their adverse impact on public sector investments in agriculture. The counter argument is that if subsidies are slashed it would cause adverse impact on agricultural production and food security and raise food and agricultural prices. These are all very complex but highly relevant issues. This paper makes an attempt to address such issues. It examines trend in fertilizer use at national and state level and estimates imbalances in use of plant nutrients in different
regions. The paper estimates regional disparities in fertilizer use and in benefits of fertilizer subsidy from different angles. Trend in fertilizer subsidy is presented in nominal and real terms and distortions caused by the subsidies are discussed at length. Productivity of fertilizer is compared across states to find out the pockets where fertilizer use needs to be promoted most to get the best return. Finally, implications of reduction in fertilizer subsidies are seen on growth of output and food security, and a way out is explored to contain subsidy bill without causing adverse impact on production.

**FERTILIZER TYPES**

Soil amendments are made by adding fertilizer to the soil but there are different types of fertilizers. There is bulky organic fertilizer such as cow manure, bat guano, bone meal, organic compost and green manure crops. And then there is also chemical fertilizer which is also referred to as inorganic fertilizer and is made up with different formulations to suit a variety of specified uses. Though many governments and agricultural departments go to great lengths to increase the

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supply of organic fertilizers, such as bulky organic manures and composting materials, there is just not enough of these fertilizers available to meet the existing and future fertilizer needs. Compared to organic compost, chemical or inorganic fertilizers also have the added advantage of being less bulky. Being less bulky makes chemical fertilizer easier to transport, both overland and from the soil into the plants itself, because they get to be available to the plant relatively quickly when incorporated as part of the plant-food constituents. Chemical fertilizer usually comes in either granular or powder form in bags and boxes, or in liquid formulations in bottles. The different types of chemical fertilizers are usually classified according to the three principal elements, namely Nitrogen (N), Phosphorous (P) and Potassium (K), and may, therefore, be included in more than one group.

**ORGANIC AND INORGANIC CHEMICAL NITROGENOUS FERTILIZER TYPES**

This type of fertilizer is divided into different groups according to the manner in which the Nitrogen combines with other elements. These groups are:

- Sodium Nitrates,
- Ammonium Sulphate and ammonium salts,
- Chemical compounds that contain nitrogen in amide form, and
- Animal and plant by products.

**SODIUM NITRATES**

Sodium Nitrates are also known as Chilates or Chilean nitrate. The nitrogen contained in Sodium Nitrate is refined and amounts to 16%. This means that the nitrogen is immediately available to plants and as such is a valuable source of nitrogen in a type of fertilizer. When one makes a soil amendment using Sodium Nitrates as a type of fertilizer in the garden, it is usually as a top- and side-dressing. Particularly when nursing young plants and garden vegetables. In soil that is acidic Sodium Nitrate is quite useful as a type of fertilizer. However, the excess use of Sodium Nitrate may cause deflocculation.

**AMMONIUM SULPHATE**

This fertilizer type comes in a white crystalline salt form, containing 20 to 21% ammonia cal nitrogen. It is easy to handle and it stores well under dry conditions. However, during the rainy season, it sometimes, forms lumps. (When these lumps do occur you should grind them down to a
powered form before use.) Though this fertilizer type is soluble in water, its nitrogen is not readily lost in drainage, because the ammonium ion is retained by the soil particles. A note of caution: Ammonium sulphate may have antacid effect on garden soil. Over time, the long-continued use of this type of fertilizer will increase soil acidity and thus lower the yield. (It is advisable to use this fertilizer type together with bulky organic manures to safeguard against the ill effects of continued application of ammonium sulphate.)

The application of Ammonium sulphate fertilizer can be done before sowing, at sowing time, or even as a top-dressing to the growing crop. Do however take care NOT to apply it along with, or too close to, the seed, because inconcentrated form, it affects seed germination very adversely.

AMMONIUM NITRATE

This fertilizer type also comes in white crystalline salts. Ammonium Nitrate salts contains 33 to 35% nitrogen, of which half is nitrate nitrogen and the other half in the ammonium form. As part of the ammonium form, this type of fertilizer cannot be easily leached from the soil. This fertilizer is quick-acting, but highly hygroscopic thus making it unfit for storage. On a note of caution: Ammonium Nitrate also has an
acid effect on the soil, in addition this type of fertilizer can be explosive under certain conditions, and, should thus be handled with care.

**AMMONIUM SULPHATE NITRATE**

This fertilizer type is available as a mixture of ammonium nitrate and ammonium sulphate and is recognizable as a white crystal or as dirty-white granules. This fertilizer contains 26% nitrogen, three-fourths of it in the ammoniac form and the remainder (i.e. 6.5%) as nitrate nitrogen. Ammonium Sulphate Nitrate is non-explosive, readily soluble in water and is very quick-acting. Because this type of fertilizer keeps well, it is very useful for all crops. Though it can also render garden soil acidic, the acidifying effects is only one-half of that of ammonium sulphate on garden soil. Application of this fertilizer type can be done before sowing, at sowing time or as a top-dressing, but it should not be applied along the seed.

**AMMONIUM CHLORIDE**

This fertilizer type comes in a white crystalline compound, which contains a good physical condition
and 26% ammoniac nitrogen. In general, Ammonium Chloride is similar to ammonium sulphate in action.

**UREA**

This type of fertilizer usually is available to the public in a white, crystalline, organic form. It is a highly concentrated nitrogenous fertilizer and fairly hygroscopic. This also means that this fertilizer can be quite difficult to apply. Urea is also produced in granular or pellet forms and is coated with a non-hygroscopic inert material. It is highly soluble in water and therefore, subject to rapid leaching. It is, however, quick-acting and produces quick results. When applied to the soil, its nitrogen is rapidly changed into ammonia. Similar to ammonium nitrate, urea supplies nothing but nitrogen and the application of Urea as fertilizer can be done at sowing time or as a top-dressing, but should not be allowed to come into contact with the seed.

**AMMONIA**

This fertilizer type is a gas that is made up of about 80% of nitrogen and comes in a liquid form as well because under the right conditions regarding temperature and pressure, Ammonia becomes liquid (anhydrous ammonia).
Another form, 'aqueous ammonia', results from the absorption of Ammonia gas into water, in which it is soluble. Ammonia is used as a fertilizer in both these forms. The anhydrous liquid form of Ammonia can be applied by introducing it into irrigation water, or directly into the soil from special containers. Not really suitable for the home gardener as this renders the use of ammonia as a fertilizer very expensive.

ORGANIC NITROGENOUS FERTILIZERS

Organic Nitrogenous fertilizer is the type of fertilizer that includes plant and animal by-products. These by-products can be anything from oil cakes, to fish manure and even to dried blood. The Nitrogen available in organic nitrogenous fertilizer types first has to be converted before the plants can use it. This conversion occurs through bacterial action and is thus a slow process. The upside of this situation is that the supply of available nitrogen lasts so much longer AND the amounts of this type of fertilizer may contain small amounts of organic stimulants that contain other minor elements that might also be needed by the plants that are being fertilized. Furthermore, they may also small amounts of organic stimulants that they may contain, or of some of the minor elements needed by plant. Oil-cakes contain not only nitrogen
but also some phosphoric and potash, besides a large quantity of organic matter. This type of fertilizer is used in conjunction with quicker-acting chemical fertilizers.

ORGANIC AND INORGANIC CHEMICAL PHOSPHATE FERTILIZER TYPES

The Phosphate fertilizers are categorized as natural phosphates, either treated or processed, and also by products of phosphates and chemical phosphates.

ROCK PHOSPHATE

As a type of fertilizer, rock phosphate occurs as natural deposits in some countries. This fertilizer type has its advantages and disadvantages. The advantage is that with adequate rainfall this fertilizer results in a long growing period which can enhance crops. Powdered phosphate fertilizer is an excellent remedy for soils that are acidic and has a phosphorous deficiency and requires soil amendments.

However, the disadvantage is that although phosphate fertilizer such as rock phosphate contains 25 to 35% phosphoric acid, the phosphorous is insoluble in water. It has to be pulverized to be used as a type of fertilizer before rendering satisfactory results in garden soil. Thus it is not
surprising that Rock Phosphate is used to manufacture superphosphate which makes the Phosphoric acid water soluble.

SUPERPHOSPHATE

Superphosphate is a fertilizer type that most gardeners are familiar with. As a fertilizer type one can get superphosphate in three different grades, depending on the manufacturing process. The following is a short description of the different superphosphate fertilizer grades:

- Single superphosphate containing 16 to 20% phosphoric acid;
- Di-calcium phosphate containing 35 to 38% phosphoric acid; and
- Triple superphosphate containing 44 to 49% phosphoric acid.

Triple superphosphate is used mostly in the manufacture of concentrated mixed fertilizer types.

The greatest advantage to be had of using Superphosphate as a fertilizer is that the phosphoric acid is fully water soluble, but when Superphosphate is applied to the soil, it is converted into soluble phosphate. This is due to
precipitation as calcium, iron or aluminum phosphate, which is dependent on the soil type to which the fertilizer is added, be it alkaline or acidic garden soil. All garden soil types can benefit from the application of Superphosphate as a fertilizer. Used in conjunction with an organic fertilizer, it should be applied at sowing or transplant time.

**SLAG**

Basic slag is a by-product of steel mills and is used as a fertilizer to a lesser extent than Superphosphate. Slag is an excellent fertilizer that can be used to amend soils that are acidic because of its alkaline reaction. For slag application to be an effective fertilizer it has to be pulverized first.

**BONEMEAL**

Bone meal as a fertilizer type needs no introduction. Bone-meal is used as a phosphate fertilizer type and is available in two types: raw and steamed. The raw bone-meal contains 4% organic Nitrogen that is slow acting, and 20 to 25% phosphoric acid that is not soluble in water. The steamed bone-meal on the other hand has all the fats, greases, nitrogen and glue-making substances removed as a result of high pressure steaming. But it is more brittle and can
be ground into a powder form. In powder form this fertilizer is of great advantage to the gardener in that the rate of availability of the phosphoric acid depends on its pulverization. This fertilizer is particularly suitable as a soil amendment for acid soil and should be applied either at sowing time or even a few days prior to sowing.

**ORGANIC AND INORGANIC CHEMICAL POTASSIUM FERTILIZER TYPES**

Chemical Potassium fertilizer should only be added when there is absolute certainty that there is a Potassium deficiency in your garden soil. Potassium fertilizers also work well in sandy garden soil that responds to their application. Crops such as chilies, potato and fruit trees all benefit from this type of fertilizer since it improves the quality and appearance of the produce. There are basically two different types of potassium fertilizers:

- Muriate of potash (Potassium chloride) and
- Sulphate of potash (Potassium sulphate).

Both muriate of potash and sulphate of potash are salts that make up part of the waters of the oceans and inland seas as well as inland saline deposits.
MURIATE OF POTASH

Muriate of potash is a gray crystal type of fertilizer that consists of 50 to 60% potash. All the potash in this fertilizer type is readily available to plants because it is highly soluble in water. Even so, it does not leach away deep into the soil since the potash is absorbed on the colloidal surfaces.

SULPHATE OF POTASH

Sulphate of potash is a fertilizer type manufactured when potassium chloride is treated with magnesium sulphate. It dissolves readily in water and can be applied to the garden soil at any time up to sowing. Some gardeners prefer using sulphate of potash over muriate of potash.

INORGANIC FERTILIZER (SYNTHETIC FERTILIZER)

Fertilizers are broadly divided into organic fertilizers (composed of enriched organic matter—plant or animal), or inorganic fertilizers (composed of synthetic chemicals and/or minerals).

Inorganic fertilizer is often synthesized using the Haber-Bosch process, which produces ammonia as the end product. This ammonia is used as a feedstock for other Nitrogen fertilizers, such as anhydrous ammonium nitrate and urea.
These concentrated products may be diluted with water to form a concentrated liquid fertilizer (e.g. UAN). Ammonia can be combined with rock Phosphate and Potassium fertilizer in the Odda Process to produce compound fertilizer.

The use of synthetic Nitrogen fertilizers has increased steadily in the last 50 years, rising almost 20-fold to the current rate of 100 million tonnes of Nitrogen per year. The use of Phosphate fertilizers has also increased from 9 million tonnes per year in 1960 to 40 million tonnes per year in 2000. A maize crop yielding 6-9 tonnes of grain per hectare requires 31–50 kg of Phosphate fertilizer to be applied, soybean requires 20–25 kg per hectare.

APPLICATION

Synthetic fertilizers are commonly used to treat fields used for growing maize, followed by barley, sorghum, rapeseed, soy and sunflower. One study has shown that application of Nitrogen fertilizer on off-season cover crops can increase the biomass (and subsequent green manure value) of these crops, while having a beneficial effect on soil Nitrogen levels for the main crop planted during the summer season. Nutrients in soil can be thrown out of balance with high concentrations of fertilizers. The interconnectedness
and complexity of this soil ‘food web’ means any appraisal of soil function must necessarily take into account interactions with the living communities that exist within the soil. Stability of the system is reduced by the use of Nitrogen-containing fertilizers, which cause soil acidification⁶.

Applying excessive amounts of fertilizer has negative environmental effects, and wastes the growers’ time and money.

To avoid over-application, the nutrient status of crops should be assessed. Nutrient deficiency can be detected by visually assessing the physical symptoms of the crop. Nitrogen deficiency, for example has a distinctive presentation in some species. However, quantitative tests are more reliable for detecting nutrient deficiency before it has significantly affected the crop. Both soil tests and Plant Tissue Tests are used in agriculture to fine-tune nutrient management to the crops needs.

**INORGANIC FERTILIZER IS ECONOMICAL⁷**

Inorganic fertilizer is the only economical way to supply enough nutrients to increase food production. Several studies have noted that Africa cannot hope to produce enough food to
feed its growing population without using inorganic fertilizer. One study indicated that per-hectare annual nutrient losses exceeded 10 kg N, 4 kg P, and 10 kg K in nearly all of the 38 SSA countries studied. Depletion rates were highest in East Africa, exceeding 40 kg N, 15 kg P, and 40 kg K. Offtakes in crops are normally several times these numbers, which include fallow periods with no offtake. Organic sources cannot overcome these nutrient deficits. It has been estimated that two ha of land planted to leguminous plants are needed to provide the nitrogen for one ha of maize. As much as 120 to 360 ha of land are required for grazing animals to provide sufficient manure to 1 ha of maize land to sustain the nitrogen balance. Africa does not have enough land or soil nutrients to devote to producing organic nutrients to replace soil deficits.

MAJOR ISSUES CONCERNING THE NEED FOR AND USE OF FERTILIZERS

The use of chemical fertilizers integrated with sound crop nutrient management practices is the key to increased yields per unit area and the maintenance of these yields in a sustainable manner. Increased yields in themselves reduce the pressure for extension of cultivated areas and thus the encroachment of agriculture into marginal areas and fragile
environments; in this light, fertilizer is not only essential but also environmentally beneficial. Careful use of fertilizer based on sound soil and crop-production knowledge can reduce any adverse environmental effects these products may have.

**WHAT CONSTITUTES INAPPROPRIATE FERTILIZER USE?**

Inappropriate fertilizer use may result from farmers not raising the level of other management practices (variety, tillage, crop establishment, pest control) in balance with fertilizer use, or not following recommended agronomic practices. Fertilizer may be applied at the wrong rate, applied in the wrong way, or at the wrong time. As long as complementary integrated soil management practices are followed (including incorporation of organic matter and water harvesting), there appears to be little if any environmental risk associated with increasing chemical fertilizer use from 10 kg/ha to 30 kg/ha. Threshold parameters for problems may exist, but the economics of fertilizer use under African conditions will constrain fertilizer use long

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before environmental problems arise. Environmental problems can be avoided quite easily if farmers have access to and understand relevant information about effective and efficient fertilizer use.

Fertilizers are a kingpin in the process of agricultural production; is an established fact. It is generally assumed that 70 to 80 per cent of the increase in food grains production could be credited to fertilizer use alone. A variety of data dating from 1965 onwards is available to indicate the response of high yielding varieties of crops to different doses of fertilizers. Trail conducted in India provide examples of increases in yield and profitability through the use of high-yielding varieties, application of optimum balanced doses of fertilizers and adoption of improved practices. The studies conducted on the economics of fertilizer use reveal the importance of profit maximizing levels of fertilizer application and the scope for substantial improvement in fertilizer use efficiency and agricultural productivity, not only in irrigated areas, but also in the rain fed areas. Optimum utilization of available resources, complementarity and supplementarity of organic manures, bio-fertilizers, and the adoption of a host of other simple measures which need hardly and additional investment but which provide good economic
returns were all of vital importance, particularly in the case of small and marginal farmers.

The use of fertilizer depends largely on the availability of irrigation facilities and availability of working capital with the farmers for acquiring the purchased inputs. As the small farmers have inadequate capital base, the non available of adequate credit may be a problem in exploiting the production potentials by them. The farmers may also have different attitudes to different crops grown on the farm regarding to application of fertilizer. This may be influenced by the relative profitability of the crops, degree of yield and price risks involved and the personal likings and consumption needs of the farm family. Thus, institutional, financial and behavioral constraints condition the farmer’s decisions concerning his farm practices in general and use of fertilizer in particular. These constraints must be evaluated for the level of their incidence and their impact of fertilizer use at farm level. Such a study is all the more important to keep up our farm production targets.

The present study was undertaken in the Hisar district of Haryana where the consumption of fertilizers per hectare of
cropped area is very high, to examine the pattern and efficiency of fertilizer use in the major crops of the district.

AIMS AND OBJECTIVES:

Keeping in view the importance of the fertilizers use in agriculture the present study will be undertaken with the following objectives:

1. To study the pattern of fertilizer use on major crops grown in the district.
2. To work out the marginal productivity of the fertilizer application for major crops of the district.
3. To identify the determinants of fertilizer use at farm level.
4. To find out the reasons for not using recommended doses of fertilizers.

RATIONALE OF THE STUDY

Agriculture production mainly depends upon the rational use of inputs like seeds, irrigation, fertilizers, pesticides etc. Fertilizer used by the farmers play most important role which decides the production of the crops. If the farmers didn’t get the fertilizer in any season then the
production of the crops suffers directly. The farmers want to increase their crop production by any way, so they use more and more fertilizer for the same. The farmers should know about the best use of fertilizers, they should know about the pattern of fertilizers use in major crops, the farmers should have the sufficient knowledge about the marginal value productivity of main fertilizer nutrients in major crops that’s why the need was felt to make economic analysis of fertilizer use in Hisar district so that the pattern of fertilizers use, its determinants, factors affecting the recommended dose of fertilizers can be known. From the results the farmers may be able to know the pattern of fertilizer use, its best use in the crops and various reasons for not using recommended dose in crops. The results may be helpful to make various schemes by the agricultural university and agricultural department for the farmers in concern with fertilizer use.

**LIMITATIONS OF THE STUDY**

Though all possible efforts were made to make the study objective precise but still certain limitations are there. This study is based on the behavioral approach of the farmers hence it may be treated as suggestive rather than as diagnostic and prescriptive.
PLAN OF THESIS

- The study has been reported in five chapters, Chapter-I is the detailed introduction which highlight the fertilizer, its classification, forms etc. The objectives of the study are spelt out in this chapter.
- Chapter-II presents the review of some of the important literature available on the analysis, economics, and consumption of fertilizers in Haryana, India and abroad.
- Chapter-III discusses the methodology adopted for the study and analytical framework of the study.
- In Chapter-IV the detailed discussion on results and findings of the study is presented.
- In Chapter-V summary of the study and results along with the conclusions is presented.
- Abstract, Bibliography and Schedule/Annexure are given at the end of the thesis.