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## A review on effects of chemical fertilizers and organic manures on soil fertility

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### Abstract

In this world need for good nutritional food demand is increasing day by day. But it is not possible for many farmers to grow crops without using any chemical fertilizers as, they increases the crop yield with the application of other chemicals. To grow healthy crops it is necessary to reduce the dependency on using chemical fertilizers and other chemicals on crops. Instead of using these chemical fertilizers, now it is time to grow crops using organic manures, so that soil fertility also maintains its stability and also nutritional food is available. But it is not possible to completely use organic manures in agriculture, as we don't see the increase in yield which previously expected. But with the help of using both methods means, using chemical fertilizers along with organic manures we can get good quality and good quantity of yield without disturbing the soil fertility and its physico-chemical properties.

**Keywords:** Chemical fertilizers, organic fertilizers, soil fertility

### Introduction

After post-Independence, Indian agriculture reached to a new height with the start of green revolution (1967). A great success is achieved in Indian agriculture and crop production has been increased to a maximum level by using with the help of high yielding varieties as one of the objectives of green revolution. During 1960s and 1970s the use of chemical fertilizers and other several inputs have been started and this change transformed Indian agriculture from subsistence to surplus. After the success of green revolution, a slow rate of decline in growth rate of crop production is noticed during past few years. After knowing the reason for decline in crop production, it is concluded that soil quality has been badly effected and this is due to the over use of chemical fertilizers than it required in the agriculture field. Normally, the soils of India shows poor infertility because of the leaching of nutrients due to the continuous cultivation for many long years, lack of agriculture knowledge, implementation of modern technologies in agriculture, imbalanced use of fertilizers and poor fertilizer use efficiency.

Fertilizer use efficiency means when a fertilizer is applied to the soil, all of its nutrients are not utilized by the crops only a small portion of nutrients is observed by the crop. So, to improve the status of the soil, it is necessary to develop new methods of farming which enable the soil to perform a vast range of functions. The organic carbon shows dominantly its impact on soil quality dictates biological properties greatly in comparison to chemical and physical ones. Numerous cropping systems and various management practices have a great influence on soil quality parameters. In India, organic farming is practiced from many thousand years but with chemical fertilizers coming in action, the soil fertility is declined. In the previous experiments which were operated in India for many years it is showed that with chemical fertilizers and organic manures the status of soil fertility is improved.

### About fertilizers

Fertilizers are defined as the chemical composition with organic and inorganic compounds in nature. They have the ability to provide the nutrients which are required by the plants in available forms. These fertilizers can be classified as organic made fertilizers and inorganic made fertilizers.

### Organic fertilizers

These fertilizers are made from agriculture by-products means naturally available plant residues, animal wastes including cattle manure, sheep and goat manure, poultry, green manures, household wastes, and composts. All of these influence the physical, biological and chemical properties of soil.

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**Role of organic fertilizers in soil**

- These fertilizers are the constituents of primary and secondary nutrients to the plants which they receive them in available form during the process of mineralization.
- Organic manures also contain organic matter through which the physical condition of the soil improves like aeration, soil structure, and water holding capacity.
- It also increases the activity of many soil microorganisms by providing energy.
- They enhance the soil's buffering and exchange abilities, as well as the solubility of soil minerals and mineral nutrients in the soil.
- Organic fertilizer promotes soil aggregates and improves Cation exchange capacity, resulting in increased root growth.
- Organic fertilizers provide plants with the biological processes they require while also reducing the populations of plant pests.

**Limitations of organic fertilizers**

- The major drawbacks of these fertilizers are the nutrient content which is not present in bulk amount which is required to the plants.
- It required in large quantity for the application in the soil as compared to chemical fertilizers.
- They also contain microorganisms which are harmful to human as they are developed from the animal manures.
- Due to the highly varied content of organic fertilizers, precise nutrient delivery to plant production is difficult.
- Temperature and soil moisture play a big role in the decomposition of organic matter, thus nutrients may be released when the plant doesn't require them.
- Organic manure contains faecal coliforms, heavy metals, and nutrients that enter water bodies and damage water quality, posing major environmental and public health risks.
- Surface and groundwater pollution can be increased by applying high rates of dairy manure or sewage sludge repeatedly.
- Organic fertilizers did not start working immediately after the application in soil as it can be observed in the chemical fertilizers immediately.
- If rainfall happens immediately after manure application, nutrient losses occur along the field's edge.

**Inorganic fertilizers**

Fertilizers are compounds that include a single or multiple nutritional elements, as well as any materials that are applied directly to the soil for the goal of encouraging plant growth, boosting crop yields, or improving crop quality. As the essential macronutrients are lost by many reasons like overgrazing by animals or leaching in soil, it is very essential to maintain the soil fertility as it directly affects the crop productivity. That's why the farmers are using inorganic fertilizers as they promote root growth by increasing organic matter through the application of these fertilizers.

**Role of inorganic fertilizers in soil**

- Organic matter in the soil can be increased through the application of inorganic fertilizers by increasing root mass.
- Increase in the crop yield and soil fertility can also be observed.
- Inorganic fertilizers start working of releasing nutrients

immediately after the application in the soil.

- Inorganic fertilizers are with huge amount of nutrients so only in less amount of its application is required for the crop.
- These fertilizers are constituted with macronutrients which are all in available forms to the plants.

**Limitations of inorganic fertilizers**

- Application of inorganic fertilizers more than recommended dose may lead to burning of plant like the tips and edge of leaf may turn to brown and appears as burnt.
- After the application of these fertilizers these may reach to areas where they are not supposed to be there through runoffs.
- They have the impact on the microbial activity of the microorganisms in the soil.
- These fertilizers also contaminate the groundwater and dilute the rivers and this leads to problem to wildlife and human.
- Sometimes the available form of nitrogen in the chemical fertilizers may evaporate into nitrous oxide.

**Impact of Inorganic fertilizers and organic manure on soil fertility and physico-chemical properties****Soil PH and EC**

Soil properties like PH, EC can influence the soil fertility, but it is observed that manure shows no effect on soil PH. The application of manure leads to increase in soil organic matter. By the application of farm yard manure increase in EC is observed due to the electrolyte released during the decomposition.

**Cation Exchange Capacity**

Application of chemical fertilizers with the organic fertilizers leads to increase in the cation exchange capacity of soil. Exchangeable  $Ca^{2+}$  content and C.E.C of soil is increased with application of organic sources either alone or with combination of inorganic fertilizers. The C.E.C of soil is reduced when only inorganic fertilizers are applied to soil.

**Soil organic carbon**

It has been known that soil organic carbon is one of the main factors which determine the soil fertility and the crop production. Organic carbon provides all the essential nutrients required to plants. But due to the use of inorganic fertilizers for a long time soil organic carbon is reduced. The other reason also for declined organic carbon is not application of organic manures for many years.

**Effect on N P K**

Soil fertility determines the overall health of the soil by judging the sustainability of the crop and index of the availability of plant nutrients. Chemical fertility of the soil is the function of different kinds of processes that happens in the soil biota.

Nitrogen plays an important role in the crop yield. It is affected by the fluctuations of the organic matter in the soil. Application of Nitrogenous fertilizers continuously for many years increases its availability in the soil. But however, if u move deep in the soil, there is a decline of Nitrogen concentration, but it can be achieved by application of extra doses of Nitrogen fertilizers. However, the available nitrogen is increased in the soil significantly by the application of farm

yard manure with green manuring. The application of NPK with FYM increases the availability of Nitrogen by 7-15kg/ha.

Without using any fertilizers for a long time the availability of phosphorous in the soil is declined. The maximum phosphorous concentration in the soil is observed when farm yard manure + NPK were combined. The FYM is required 10t/ha. By the application of other organic Amendments there may be possibility of increase in availability of phosphorous through competition for phosphorous binding sites. Long term application of inorganic fertilizers with organic fertilizers leads to a significant increase of available phosphorous in the soil compared to other treatments of fertilizer application.

Potassium is one of the three major macro nutrients essential for plants. Continuous farming using inorganic fertilizers, farm yard manure for many years, increases the availability of potassium in the soil. Combined application of farm yard manure and chemical fertilizers leads to more available form of potassium compared to other treatments in the soil. This is due to the following of different methods of application of farm yard manure and inorganic fertilizers in the soil.

### Conclusion

From the above literature it is concluded that the application of alone inorganic fertilizers to the soil may lead to imbalanced nutrients in the soil and, also affects the soil productivity and soil fertility. But the physico-chemical properties of the soil and soil organic carbon maintained significantly when the inorganic fertilizers are combined with the organic fertilizers. Here fertilizer use efficiency also plays an important role in the nutrient absorption by the plants. Integrated nutrient management is also the best option in maintaining both organic and inorganic fertilizer concentration in the soil. The effect on the environment and soil biota also can be controlled by following certain methods of application of fertilizers in the soil.

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