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Use of fertilizers or importance of fertilizers in agriculture

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Abstract
It is very difficult to meet the demands of the increasing population with such fewer resources. Loss of soil fertility, pests, and lack of nutrients has resulted in a decrease in agricultural production. This has increased the importance of fertilizers in agriculture. Since the chemical fertilizers adversely affect soil fertility, biofertilizers were brought into use. These are substances that contain living or latent cells, and even micro-organisms. They provide the soil with the necessary nutrients and microbes for the growth of the plants. They help the soil to retain its fertility. They are environment-friendly and also destroy pathogenic components responsible for causing disease in plants. Acetobacter and Rhizobium are two such widely used biofertilizers. Fertilizers increase plants' tolerance towards pests. This has reduced their reliance on insecticides and herbicides, thereby, producing healthier crops. Consequently, diseases have reduced, providing aesthetic value to the crops. Fertilizers improve the water holding capacity of the plants and increase root depth. The potassium content present in the fertilizers strengthens the straws and stalks of the plants. The phosphorus present in the fertilizers helps in the faster development of roots and formation of seeds in the plants. Nitrogen in the fertilizers enhances the growth of the plants which can be characterized by the green colour of the plants.

Keywords: Fertilizers, soil fertility, agricultural production, nutrients

Introductions
Every living organism requires nutrients for their growth and other metabolic activities. For their survival, they follow a mode of nutrition [1, 12]. We humans and animals depend on plants for nutrients. Plants have an autotrophic mode of nutrition where they prepare their own food and obtain their nutrients via photosynthesis [13]. The soil is not fertile enough to provide essential macro and micronutrients to plants in sufficient quantity. Hence they need another source of nutrition. Manures and fertilizers are the alternatives used in agriculture for this purpose [23].

Manures are the natural source of nutrients obtained from cow dung, leaves, human excreta, and other wastes. Fertilizers are commercial products available in different forms like solid, gas or liquid. Both manure and fertilizers contain salts and organic chemicals which consist of essential plant nutrients such as nitrogen, potassium, phosphorus in known concentrations [14]. They make soil fertile and provide nutrients to plants for better growth and higher yield.

Unlike manures, fertilizers are very expensive and are used in large amounts in farming fields. As a part of crop production management, farmers largely depend on fertilizer. But they should only be used when it's necessary. Manure should not be replaced by fertilizer as constant use of it may lead to infertility of soil and pollution. During over-irrigation, fertilizers get washed along with excess water and are unavailable for absorption by plants which cause water pollution. Also, replenishment of organic substances in the soil get affected and microbes will be harmed due to clogging of fertilizers in the soil. Sometimes fertilizers cause various plant diseases. Therefore, the amount and frequency of their use need to be checked and controlled. It should always be optimum [17].

Due to these disadvantages, nowadays organic farming is much preferred over fertilizer. Organic farming is a new method of farming where crops are grown with the help of natural compost [22].

Research Aims and Objectives
Agriculture is the process of growing plants and animals for human needs. There are different types of agriculture are its main objective is to promote the quality of life, provide

employment opportunities, to encourage an awareness of agriculture, improve crop production, etc.

Advantages of Fertilizers

The advantages of fertilizers are mentioned below

1. They are easy to transport, store, and apply
2. For supplying a specific nutrient we can select a specific fertilizer due to its nutrient specific nature.
3. They are water-soluble and can easily dissolve in the soil. Hence, they are easily absorbed by the plants.
4. They have a rapid effect on the crops.
5. They are predictable and reliable.
6. They increase the crop yield and provide enough food to feed the large population [20].

Disadvantages of Fertilizers

Fertilizers have the following disadvantages

- They are expensive.
- The ingredients in the fertilizers are toxic to the skin and respiratory system.
- Excessive use of fertilizers damages the plants and reduces soil fertility.
- Leaching occurs and the fertilizers reach the rivers causing eutrophication.
- Long term use reduces the microbial activity and disturbs the pH of the soil [11, 19].

Types of Fertilizers

There are six different types of fertilizers that are mentioned below:

Inorganic Fertilizers

Inorganic fertilizers are chemical fertilizers that contain nutrient elements for the growth of crops made by chemical means. The inorganic fertilizers are of the following types:

Nitrogen Fertilizers

Nitrogen fertilizers contain nitrogen necessary for the development of crops. Nitrogen is the main constituent of chlorophyll that maintains a balance in the process of photosynthesis. It is also a part of amino acids in plants and constitutes protein. Nitrogen fertilizers improve the production and quality of agricultural products [8].

Phosphorus Fertilizer

The main nutrient in a phosphorus fertilizer is phosphorus. The efficiency of fertilizer depends upon effective phosphorus content, methods of fertilizing, properties of soil and crop strains. Phosphorus found in the protoplasm of the cell plays an important role in cell growth and proliferation. The phosphorus fertilizer is beneficial for the growth of roots of the plants [7, 8].

Organic Fertilizers

Organic fertilizers are natural fertilizers obtained from plants and animals. It enriches the soil with carbonic compounds essential for plant growth. Organic fertilizers increase the organic matter content of the soil, promotes the reproduction of microorganisms, and changes the physical and chemical properties of the soil. It is considered to be one of the main nutrients for green food [18].

Organic fertilizers can be obtained from the following products:

- Agricultural Waste
- Livestock Manure
- Industrial Waste
- Municipal Sludge

The Role of Nitrogen in Agricultural Production:

Nitrogen is an important component of many essential structural, genetic and metabolic compounds in plant cells. It is also an elementary constituent of numerous important organic compounds including amino acids, proteins, nucleic acids, enzymes, and the chlorophyll molecule.

Of all the essential nutrients, nitrogen is the one that is most often limiting for crop growth. Nitrogen is the nutrient which normally produces the greatest yield response in crop plants, promoting rapid vegetative growth and giving the plant a healthy green color (10.2). Roots take up nitrogen in its inorganic forms, nitrate (NO_3-) and ammonium (NH_4+) ions. Once inside the plant, NO_3 is reduced to the NH_2 form and is assimilated to form the organic compounds.

Adding nitrogen is not recommended for legume crops such as soybean, since they manufacture their own nitrogen supply. Nitrogen-fixing soil organisms (rhizobium) associated with the roots of legumes capture atmospheric nitrogen and make it available to the plant. (4.5)

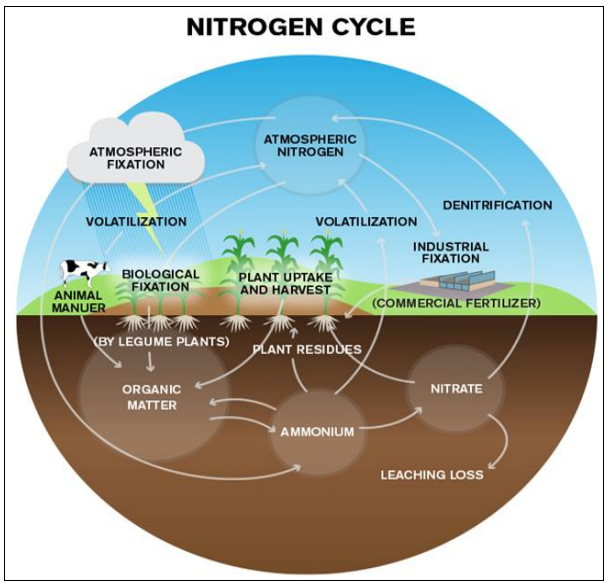

Fig 1: Nitrogen of Cycle

Symptoms of nitrogen deficiency

Plants lacking nitrogen have very slow growth and look weak and stunted. Older leaves have a light green or yellow color. As nitrogen is mobile in the plant and moves to where it is needed, these older and lower leaves are always first to show symptoms of deficiency [6].

The Role of Phosphorus (P) in Agricultural Production

Phosphorus (P) is an essential nutrient, both as a component of several key plant structural compounds, and as a catalyst in numerous key biochemical reactions in plants. Phosphorus is noted especially for its role in capturing and converting the sun's energy into useful plant compounds.

Phosphorus is a component of various enzymes and proteins. It is a vital component of DNA, the genetic "memory unit" of all living things. It is also a component of RNA, the compound that reads the DNA genetic code, to build proteins and other compounds essential for plant structure, seed production, and genetic transfer. The structures of both DNA and RNA are held together by phosphorus bonds. Phosphorus is a vital component of ATP, the "energy unit" of plants. ATP forms during photosynthesis, has phosphorus in its structure, and participates in processes from the beginning of seedling growth through to seed formation, and maturity [12].

Phosphorus is essential for the general health and vigor of all plants. Some specific growth factors that have been associated with adding phosphorus to the crop are: stimulated root development, increased stalk and stem strength, improved flower formation and seed production, more uniform and earlier crop maturity, increased nitrogen-fixing capacity of legumes, improvements in crop quality, and increased resistance to plant diseases [3].

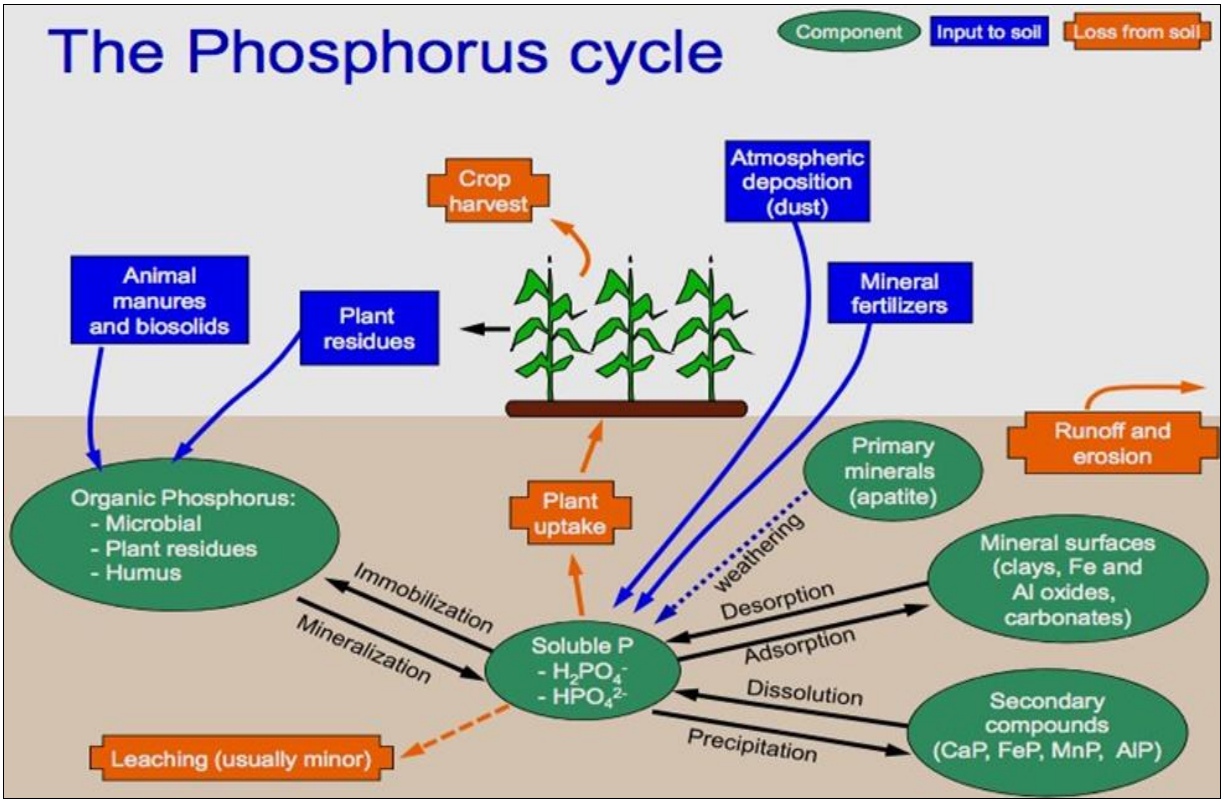

Fig 2: Phosphorus of Cycle

Symptoms of phosphorus deficiency

A crop deficient in phosphorus will show slow growth, appear stunted and be weak. Older leaves will have a dark green color and purple pigmentation. Since phosphorus is mobile in the plant, the bottom leaves are always affected first and show the earliest signs of deficiency [6, 12].

The Role of Potassium (K) in Agricultural Production:

Potassium (K), along with nitrogen and phosphorus, is one of the three essential plant macronutrients, and is taken up by crops from soils in relatively large amounts. Potassium increases yields and improves the quality of agricultural produce. Potassium also enhances the ability of plants to resist diseases, insect attacks, cold and drought stresses and other adverse conditions. It helps in the development of a strong and healthy root system and increases the efficiency of the uptake and use of nitrogen and other nutrients. In addition, potassium has an important role in livestock nutrition [5].

The importance of potassium stems from its multiple roles in the plant: it is involved in the activation of more than sixty enzymatic systems in the plant cell, and in the synthesis of proteins, vitamins, starch and cellulose which ensure normal plant metabolism, plant growth and formation of strong tissues. Potassium helps photosynthesis, the process through which the sugars and energy that the plant needs for its development are formed and converted. Potassium also controls the opening and closing of the leaf stomata, which regulate the water status in the plant. It plays an essential part in the formation of starch and in the production and translocation of sugars. Potassium is, therefore, of special value to carbohydrate-rich crops such as sugarcane, potato and sugar beet. The production of starch and sugar in legumes boosted by potassium benefits

the symbiotic bacteria living on the roots and thus improves the fixation of nitrogen [11].

Potassium not only increases yields but also enhances crop quality. It improves the nutritive value of grains, tubers and fruits by increasing the contents of protein and oil in seeds, of starch in tubers and seeds, and of vitamin C and sugar in fruits. With an adequate supply of potassium, cereals produce plump grains and strong stalks. Potassium also improves the flavor and color of fruits and increases the size of tubers and fruits. In addition, it increases the resistance to various injuries during storage and transportation, thus extending shelf life.

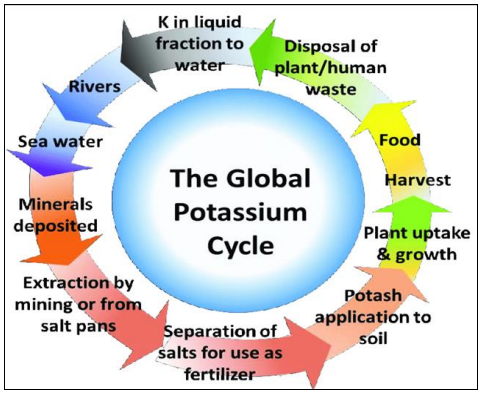

Fig 3: Potassium of Cycle

Symptoms of potassium deficiency

Plants deficient in potassium 'lodge' or bend over at ground level making them difficult to harvest. Potassium deficiency makes a plant susceptible to disease.

The edges of older leaves appear to have burned edges (scorching) and, since potassium is mobile in the plant, the bottom and older leaves show deficiency symptoms first.

The Role of Sulphur (S) in Agricultural Production

Sulphur (S) is an essential element in forming proteins, enzymes, vitamins, and chlorophyll in plants. It is crucial in nodule development and efficient nitrogen fixation in legumes.

Protein synthesis requires large amounts of sulphur, especially in the formation of oils within the seed, and sulphur is a constituent of several amino acids and vitamins found in both plants and animals. Thus, sulphur is an important factor in determining the nutritional quality of foods.

Sulphur is also important in photosynthesis and contributes to crop winter hardiness. An adequate supply of sulphur is very important, not only for crops with high sulfur requirements - such as legumes (alfalfa, clover, soybean etc.) and Cruciferae (canola, rapeseed) - but also for crops with high nitrogen requirement (corn, cotton), which without sulphur cannot optimize their utilization of nitrogen [23].

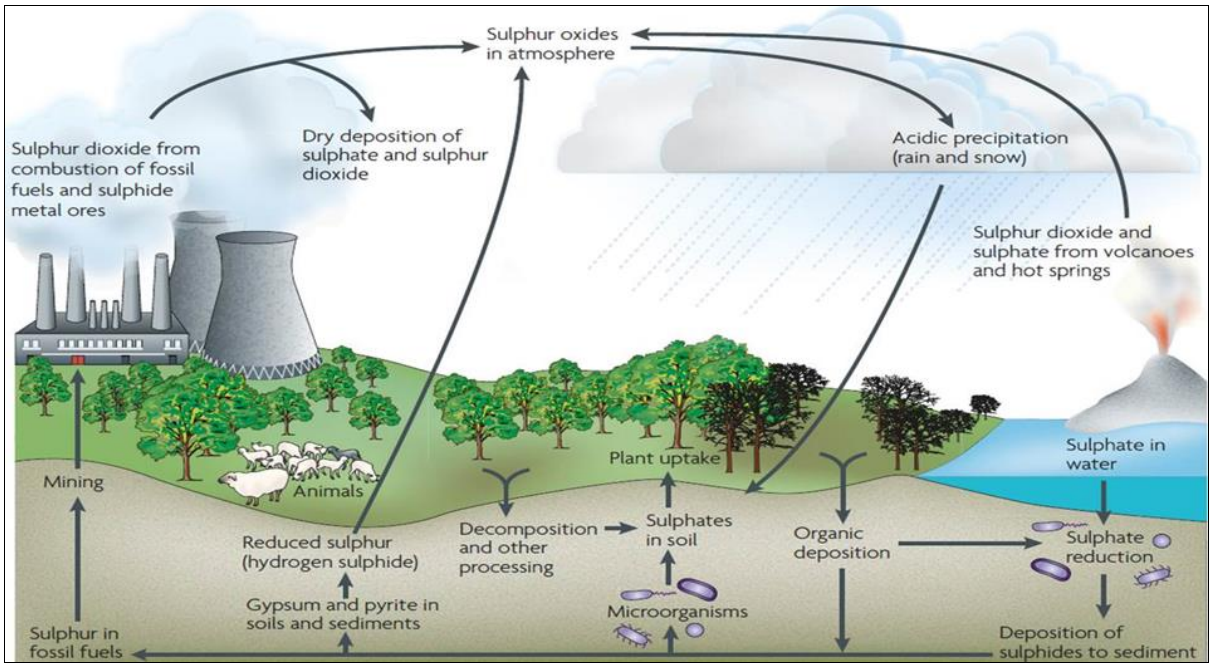

Fig 4: Sulphur of Cycle

Symptoms of Sulphur deficiency

Plants deficient in sulphur have leaves that are pale green color, beginning first on younger leaves. Eventually, the whole plant can have a light yellow-green appearance.

The Role of Magnesium (Mg) in Agricultural Production

Magnesium (Mg) is needed by all crops to help capture the sun's energy for growth and production through photosynthesis. Photosynthesis takes place in chlorophyll, the green pigment in plants, and magnesium is the central atom of the chlorophyll molecule, with each molecule containing 6.7% magnesium [7].

Magnesium plays an important role in activating enzymes involved in respiration, photosynthesis and nucleic acid synthesis. It aids in phosphate metabolism, serving as a carrier of phosphate compounds through the plant. Magnesium facilitates translocation of carbohydrates (sugars and starches) and enhances the production of oils and fats.

Symptoms of Magnesium deficiency

In plants suffering magnesium deficiency older leaves show interveinal chlorosis (dark green veins with yellow areas between them). These yellowed or chlorotic leaves develop spotted areas of dead tissue and the leaf edges curl. Since magnesium is mobile in the plant, the lower or older leaves are always affected first.

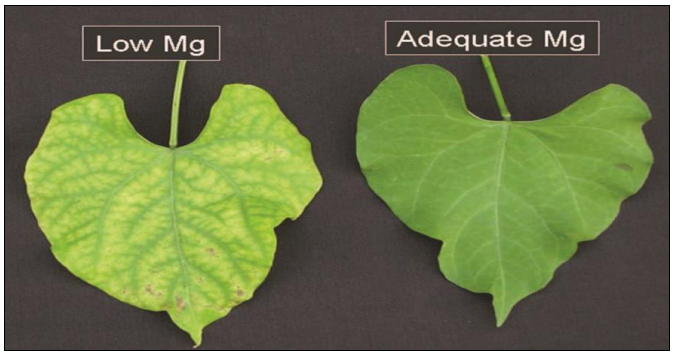

Fig 5: Symptoms of Magnesium deficiency

The Role of Calcium (Ca) in Agricultural Production

Calcium (Ca) plays an extremely important role in producing plant tissues and it enables plants to grow better. Calcium is responsible for holding together the cell walls of plants. It is also crucial in activating certain enzymes and to send signals that coordinate certain cellular activities.

It is calcium that is key to normal root system development. Calcium also increases resistance to outside attack and increases the feed value of forage crops to livestock.

Symptoms of Calcium deficiency

Calcium deficiency results in poor root growth and the root tips die.

Shortage of calcium makes the crop vulnerable to diseases. These diseases can include blossom end rot in tomatoes, tip burn in cabbage and black heart in celery.

As calcium is immobile within the plant, as supply of calcium ceases deficiency symptoms appear on younger leaves. New leaves are distorted, with curled edges and the growing tip may die [10].

Fig 6: Symptoms of Calcium deficiency

Micronutrients: Iron, Zinc

Even though micronutrients are used by plants in very small amounts, they are just as essential for plant growth as large amounts of primary and secondary nutrients. They must be maintained in balance in order for all nutrients and water to be used efficiently. On turf grass there are three micronutrients that are particularly important in order to maintain green color and plant vigor:

Iron (Fe)

Yellowing of grass (Iron Chlorosis) is often due to iron deficiency. Iron is required for the formation of chlorophyll in the plant cell (causes turf to maintain a healthy green color). It serves as a catalyst for biological processes such as respiration, symbiotic fixation of nitrogen and photosynthesis. Applications of iron can correct iron deficiency, but it may be temporary in high pH soils, due to tie up with calcium. This may require acidification of the soil with elemental sulfur or the use of ammonium forms of nitrogen or some other acidification agents. As ammonium converts to nitrate in the soil, it has an acidifying effect. This acidifying effect makes iron and many other elements more available in high pH soils.

Zinc (Zn)

Zinc is an essential component of several plant enzymes. It is a part of auxins and controls the synthesis of indoleacetic acid which regulates growth compounds. Zinc also affects the intake and efficient use of water by plants.

Conclusion

Manure is the organic matter obtained naturally from decaying plants and animals. It is also obtained from animal and human faeces and also, from domestic wastes such as vegetable peels. Manure is better than fertiliser. Manure is derived naturally and adds a lot more than just nutrients to the soil. They increase the activity of the microbes in the soil and increase its fertility. On the other hand, fertilisers harm these microbes and cause health issues in the consumers since they are synthesised chemically.

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