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A Critical Review of Chemical and Organic Fertilizers

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ABSTRACT

Organic fertilizers these are biodegradable and environmentally friendly. They can support soil health by reducing erosion and nutrient runoff. However, improper use of organic fertilizers can lead to plant nutrient deficiencies or toxicities, salt burn, and water pollution while inorganic fertilizers are synthetically derived chemicals and minerals from the earth. They provide nutrients that plants can access quickly. However, prolonged use of inorganic fertilizers can lead to soil degradation, soil acidity or alkalization, and environmental pollution. Organic fertilizer references can be observed in the Vrikshayurveda also which is ancient Indian science.

This review paper summarizes effect of chemical and organic fertilizers on soil and its physical properties. The use of chemical or organic fertilizer alone has both positive & negative effects on soil characteristics, plant growth (yield) and nutrient presence. The combined application of chemical fertilizers and organic manures improved the physical properties and available nutrient status in soils.

KEYWORDS

Fertilizer, chemical, organic, soil, pollution, soil fertility, ayurveda , synthetic

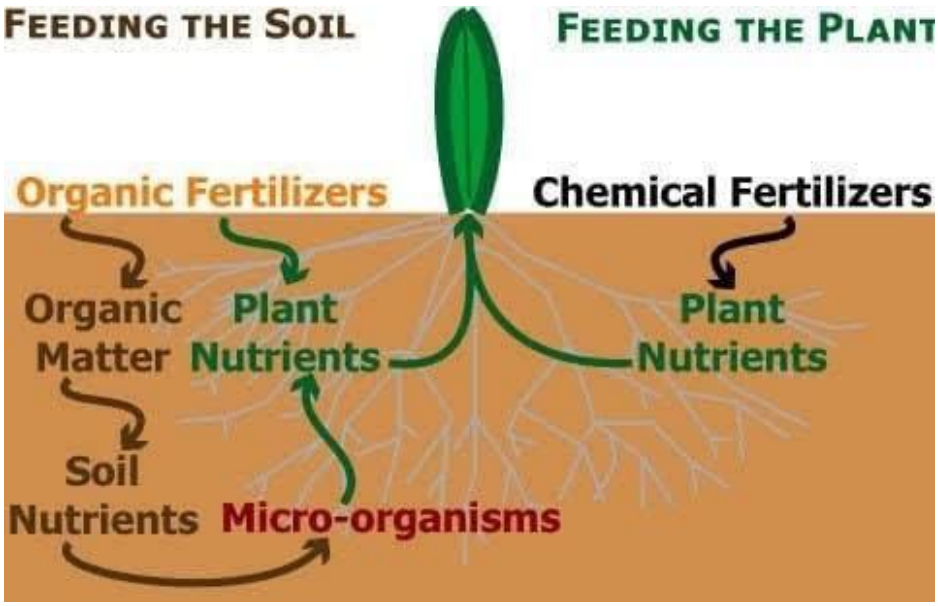
INTRODUCTION

A fertilizer is any material of natural or synthetic origin that is applied to soil or to plant tissues to supply one or more plant nutrients essential to the growth of plants.
Many sources of fertilizer exist, both natural and industrially produced.]Commercial fertilizers, are applied to agricultural crops to increase crop yields, Before the 1950s, most farming occurred on small family farms with limited use of chemicals. The shift since then to larger corporate farms has coincided with the use of chemical fertilizers in modern agricultural practices. The three major types of commercial fertilizer used are nitrogen, phosphate, and potash. Fertilizers enhance the growth of plants. This goal is met in two ways, the traditional one being additives that provide nutrients. The second mode by which some fertilizers act is to enhance the effectiveness of the soil by modifying its water retention and aeration.

MATERIALS AND METHODS

Three main macronutrients:
Nitrogen (N): leaf growth
Phosphorus (P): Development of roots, flowers, seeds, fruit;
Potassium (K): Strong stem growth, movement of water in plants, promotion of flowering and fruiting;
three secondary macronutrients: calcium (Ca), magnesium (Mg), and sulfur (S);
micronutrients: copper (Cu), iron (Fe), manganese (Mn), molybdenum (Mo), zinc (Zn), boron (B). of occasional significance are silicon (Si), cobalt (Co), and vanadium (V).

The nutrients required for healthy plant life are classified according to the elements, but the elements are not used as fertilizers. Instead compounds containing these elements are the basis of fertilizers. The macro-nutrients are consumed in larger quantities and are present in plant tissue in quantities from 0.15% to 6.0% on a dry matter (DM) (0% moisture) basis.
Plants are made up of four main elements: hydrogen, oxygen, carbon, and nitrogen. Carbon, hydrogen and oxygen are widely available as water and carbon dioxide. Although nitrogen makes up most of the atmosphere, it is in a form that is unavailable to plants. Nitrogen is the most important fertilizer since nitrogen is present in proteins, DNA and other components (e.g., chlorophyll). To be nutritious to plants, nitrogen must be made available in a "fixed" form. Only some bacteria and their host plants (notably legumes) can fix atmospheric nitrogen (N2) by converting it to ammonia. Phosphate is required for the production of DNA and ATP, the main energy carrier in cells, as well as certain lipids. The use of chemical fertilizers was very favourable for a long time. In fact, according to the FAO, more than 40% of today's population would not exist if such fertilizers had not been used.
For example, the famine and population decline that North Korea suffered in the 20th century was due to the fact that its neighbour and ally, the USSR, stopped providing any kind of fertilizer.As we can see, fertilizers are very necessary, especially today with the amount of people we are, we could not supply ourselves in any other way. Therefore, chemical fertilizers, being used in intensive agriculture, are the most popular. But it is important to bear in mind that a bad use of this type of fertilizer, or an excess of it, can cause severe problems in the long term.



Organic Fertilizers

“Organic fertilizers” can be described as those fertilizers with an organic — biologic — origin—that is, fertilizers derived from living or formerly living materials. Organic fertilizers can also describe commercially available and frequently packaged products that strive to follow the expectations and restrictions adopted by “organic agriculture” and ”environmentally friendly" gardening — related systems of food and plant production that significantly limit or strictly avoid the use of synthetic fertilizers and pesticides. The “organic fertilizer” products typically contain both some organic materials as well as acceptable additives such as nutritive rock powders, ground sea shells (crab, oyster, etc.), other prepared products such as seed meal or kelp, and cultivated microorganisms and derivatives.
Fertilizers of an organic origin (the first definition) include animal wastes, plant wastes from agriculture, compost, and treated sewage sludge (biosolids).

Cow dung manure is rich in N-P-K value and contains important micro-organisms that help in improving soil health and plant growth. This compost manure has several benefits in the plantation or farming. Compost cow dung manure adds a good amount of organic mass into the soil. By mixing cow dung manure into the soil, we can improve the moisture-holding capacity of the soil. It also improves the aeration of the soil by loosening the soil. Compost manure has many beneficial bacterias that convert nutrients into an easily accessible form for plant roots to absorb easily.

Cow dung manure produces very few greenhouse gases, making it environment friendly. Cow dung manure acts as an excellent organic fertilizer to promote the growth of the plants. When fed to plants and vegetables it becomes nutrient-rich fertilizer. Cow Dung Manure is an excellent all-purpose fertilizer. It's low in nitrogen so it won't burn your tender plants, and it has a good balance of nutrients. Moreover, since a cow's four stomachs digest its food so thoroughly, very few weed seeds make it through, so you don't have to worry about them.

1. Completely organic and does not contain any harmful chemicals.
2. Cow dung manure for plants. It is the best organic fertilizer for home plants.
3. It contains micro and macronutrients.
4. It has good water holding capacity.
5. Its antifungal property helps plants to grow healthy.

Solution

1. Disadvantages of cow dung cakes as fuel:
2. The cow dung cakes have low calorific value.
3. They produce a high residual of ash after burning.
4. Cow dung produces high smoke during burning.

Better uses of cow dung:

1. Cow dung can be used to produce biogas.
2. The slurry of cow dung has a rich amount of Nitrogen and Potassium that can be used for fertilizer.
3. It is used as manure after the extraction of biogas.

Characteristics of polluted Soil as per Ayurveda

देशं पुनः प्रकृतिविकृतवर्णगन्धरसस्पर्शं क्लेदबहुलमुपसृष्टं (३);

Any land having abnormal colour, odour, taste and touch, that which is excessively damp.

The ancient Indian science of plant life, Vrikshayurveda, describes several organic fertilizers, including:

- **Kunapa Jala**: A liquid manure made from animal waste, including flesh, brain, bone marrow, and excreta, mixed with water and stored underground. It's then boiled, mixed with husk, and stored in an oiled pot. Kunapa Jala can improve soil health and plant growth, and help crops resist insects and disease.
- **Sasyagavya**: Made from cow dung and green weeds.
- **Amritapani**: Made from cow dung and jaggery.
- **Bhasmapani**: Made from cow urine and wood ash.
- **Jaivik tika**: Made from cow urine and cow dung.
- **Dhanagavya**: Made from cow dung, water, and paddy husk.

Sr, No.	Advantages of Chemical fertilizers	Disadvantages of Chemical fertilizers	Advantages of Organic fertilizers	Disadvantages of Organic fertilizers
1	Higher production per hectare	Soil degradation	natural nitrogen source and a soil conditioner	Slower in results
2	Soil adjustment	Groundwater contamination	Promotes Healthy Soil Structure (Provide Nutrients to the Soil)	Contamination
3	Reaction to critical cultivation scenarios	Salt burns/ Burning of plants,	-----	Ammonia Content
4	Adaptability to specific needs	Excessive growth	Pest Control and Environmental Benefits	Unpleasant Smell
5	Quick solution to problems: as they act in the short term	Increased acidity level and Damage to living beings	soil's ability to retain water, making it more porous for roots	-----
6	Increased productivity	Acceleration of climate change	Improves Soil Fertility	-----
7	Low costs	-----	Expensive	Comparatively Expensive
8	Easily applicable & easily formulated	Need for more reapplication	Fewer reapplication	Low and inconsistent

DISCUSSION AND RESULT

Manure is a natural resource that is a great source of organic materials, nitrogen, and phosphorus, aiding in the production of healthier plants and crops. It can also help reduce soil erosion and improve soil structure, leading to increased water retention and nutrient availability in the soil.
However, it also has a few drawbacks. Manure can contain hazardous contaminants, such as heavy metals, pharmaceuticals, and pathogens, that can harm human health. It can also attract pests, such as flies and rodents, if not managed properly. Additionally, improper application of manure can lead to water and air pollution.
So by keeping in view and balancing its advantages and disadvantages Manure can be put to optimum use.

CONCLUSION:

There are currently more than 8 billion of us on the planet and, for our survival, the use of fertilizers is necessary as an extra aid to our food supply. However, as we explained, using chemical fertilizers in excess can be a problem in the very long term. Therefore, for a proper use of these fertilizers, the right thing to do would be to complement them and even in some cases to replace them completely with organic or bio fertilizers. Using a combination of organic and inorganic fertilizers can improve soil properties and increase productivity without negatively affecting soil health.

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