AgriCos e-Newsletter
ISSN: 2582-7049
AgriCos e-Newsletter
Open Access Multidisciplinary Monthly Online Magazine
Volume: 05 Issue: 07 July 2024 Article No: 22

Need of Organic Fertilizers in Agriculture

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SUMMARY

Gradually the area under organic farming is increasing and farmers are more attracted to organic farming due to various negative impacts associated with chemical fertilizers on soil as well as human health. But, while promoting the area under organic farming the main constraints that the farmers use-to face is lack of proper source, availability of adequate quantity of organic fertilizers for better crop production. For ages, although FYM and compost is the predominant source of organic agriculture, but the bulk requirement of the same discourages the farmers many a times. Now lot of organic fertilizers including liquid organic fertilizers is in use which is very cost effective and easy to apply. Therefore, an attempt has been made to review the different organic source, their nutrient content and their effect of different crops as well as on soil health.

INTRODUCTION

Organic fertilizers are derived from natural sources such as animal and plant matter. Unlike synthetic fertilizers that release nutrients quickly, organic fertilizers release nutrients slowly over time. Organic fertilizers promote the growth of beneficial microorganisms in the soil, which help break down organic matter and release nutrients into the soil. This, in turn, leads to healthier and more productive crops. Another benefit of organic fertilizers is that they have a reduced environmental impact compared to synthetic fertilizers. Organic fertilizers are derived from natural sources and do not contain harmful chemicals, which can pollute waterways and harm wildlife.

Need of organic Fertilizers

The Food and Agriculture Organization of the United Nations predicted that the world population will be over 9.1 billion people by the middle of the 21st century. Accordingly, food production will have to rise about 70% above current levels to maintain pace with demand. One plausible method for obtaining this enhancement in food production would be to increase the amount of land available for agriculture. However, the conversion of natural forests and/or other wild habitats engenders a number of well-known negative impacts on climate change and global bio-diversity. Furthermore, it is accepted worldwide that such an expansion of agriculture could be responsible for approximately 12% of global warming. Regardless of its implications, sustainable agriculture must be based on providing optimal growing conditions for plants in order to achieve optimal crop production from the land over a season. To not only optimize crop yield but also to reduce the negative impacts that agriculture can exert on the environment, it is mandatory that farmers adopt the best agricultural practices. Agriculture in the 21st century faces several challenges, including: better irrigation management for agricultural processes, the development of genetic engineering for drought-tolerant and higher-yielding crops, the improvement of agricultural precision and aquaculture, the sustainable development of biofuels, and the promotion of organic agriculture around the world. However, intensifying food production must be achieved in an environmentally safe manner through ecological intensification to increase the yield per unit of land, approaching the maximum available yield of farming systems, with minimal or no negative environmental impact. It is evident, then, that fertilizer selection, as well as its rational use, is key to meeting this challenge. Perhaps the most important of the major objectives of farmers, members of National Administrations, and the suppliers of agricultural inputs is to both stimulate the use of appropriate agricultural practices and to guarantee the availability of suitable fertilizers in the market. Techniques such as crop rotation, minimum tillage, and crops grown under cover tend to maintain the structure and quality of soils. The correct selection and application of fertilizers is directly determined by the correct dose, the right place , and the right time to use the product. By definition, a fertilizer is the name given to any material, either of natural or synthetic origin, that is applied to soils or to plant tissues to supply at least one, but often more, of the nutrients essential for plant growth. The majority of fertilizers employed in commercial farming provide the three main soil fertilizers (namely, nitrogen, phosphorus, and potash). These fertilizers are extracted from minerals (e.g., from phosphate rock) or produced industrially (e.g., ammonia). In contrast, the other type of product employed is the organic fertilizers, which are derived from animal matter, animal excreta

(manure), human excreta, and vegetable matter (e.g., compost and crop residues). Naturally-occurring organic fertilizers include animal wastes from meat processing, peat, manure, slurry, and guano. Dependence on organic nutrient sources is a central characteristic of organic agriculture, which uses nutrients derived from sources such as livestock and green manure and even several types of compost to meet crop demands in intensive cereal production. One of the advantages of the use of organic fertilizers is that they provide crops with nutrients over a long period of time in a slow and extended release process. Accordingly, more research on improving efficiency and minimizing losses from organic natural resources is needed to determine their costs and benefits, and to develop optimal agricultural practices to avoid the use of synthetic inorganic fertilizers.

The modernization of agriculture along with the "Green Revolution" transforms the agriculture practices in a new dimension where the traditional knowledge and techniques were replaced by the new technology to increase the productivity to feed the growing population. However, inappropriate use of these chemical/synthetic fertilizers, unscientific management, over-utilization, etc. lead to soil and environmental pollution as well as deterioration of the soil quality. Moreover, continuous use of these fertilizers leads to toxicity as well as deficiency of some major and minor nutrients. In the scenario of global climate change, the unscientific use of these chemical inputs are major threats to environment. To reduce or minimize these ill effects, it is high time to shift the agriculture system from inorganic to organic mode to sustain the soil and environments for a longer period.

Role of Organic Fertilizer for Agriculture

The increased consumer demand appears to be driven primarily by the perception that organically grown produce was safer and more nutrients to eat than produce grown conventionally. Similarly, the use of inorganic fertilizer has been observed to cause the destruction of soil texture and structure, which often leads to soil erosion and acidity as a result of the leaching effect of nutrients. All these give rise to reduced crop yields as a result of soil degradation and nutrients imbalance. Edmeades concluded that manured soil had higher organic matter levels, lower bulk density, higher porosity and hydraulic conductivity, and greater aggregate stability than soils fertilized conventionally Karlen and Stott. Improvements in all of these soil quality indicators would optimize crop growth. Thus, one of the most significant benefits of manure as an organic nutrient source was the potential to maintain or increase soil organic matter levels. Power and Doran, Microbial biomass and labile organic matter pools were often greater in organic than conventionally managed soils. Higher organic matter content, N mineralization potential, and microbial biomass were observed in organically farmed plots than in those receiving commercial fertilizers. Liebig and Doran, found greater total C and N, microbial biomass, soil respiration, and mineralizable N in organically managed farms than in conventional farms. In general, tissue dry matter content was reported to be higher in organically grown leafy vegetables, but not in fruit. Similarly, Heaton stated that dry matter produce from organic systems was higher than in conventionally grown produce.

Different Types of Organic Fertilizers

The basis for classification is the source from which organic fertilizer is derived. Raw materials for natural plant feed mostly come from crop residues and horticulture byproducts, livestock husbandry and slaughterhouse byproducts, and naturally occurring minerals. As a result, three organic fertilizer types are distinguished: plant-based, animal-based, and mineral-based, which will be discussed in the following sections.

Animal-Based Organic Fertilizers

Animal manure and slaughterhouse byproducts are the main sources of animal-based natural fertilizers. Compared to products made from plants, these ones enrich soil with more nitrogen. Hence, they work best for growing corn and leafy vegetables. Cow manure has become the go-to natural plant feed due to its well-balanced nutritional profile. Other examples of animal-based organic fertilizers include:

- Blood meal is a great source of nitrogen, promoting robust foliage development.
- Bone meal provides plants with calcium and phosphorus, which they need for root growth and flowering.
- Feather meal is a source of slow-release organic nitrogen.
- Bat guano comprises all the macronutrients and has an NPK ratio of around 8–5–1.5.
- Poultry (chicken) litter has a high NPK content and, in total, contains 13 essential nutrients for plants.
- Horse manure is an organic crop fertilizer high in nitrogen.
- Urine contains all the macronutrients, with an average NPK ratio of 11–2–4.

- Fish emulsion and enzymatically digested hydrolyzed liquid fish are both organic liquids that work quickly and are high in macronutrients and trace elements.
- Fish meal is a rich source of nutrients, especially nitrogen and phosphorus.
- Fish powder is high in nitrogen while also being a source of phosphorus, potassium, and trace elements.

Plant-Based Organic Fertilizers

Plant-based fertilizing products, often derived from agricultural leftovers, might help farm businesses approach more self-sufficiency. These fertilizing products decompose relatively quickly and supply crops with many important nutrients. If your field is not good in terms of drainage and retaining soil moisture, plant-based fertilizing products can be a beneficial choice as they encourage soil structure improvements.

Here's a list of popular plant-based organic fertilizers:

- Alfalfa meal or pellets contain large amounts of potassium and nitrogen and typically are weed-free.
- Corn gluten meal is a slow-release N-fertilizer highly beneficial for leafy vegetables.
- Cottonseed meal provides macro- and micronutrients while lowering soil pH.
- Soybean meal has a high nitrogen content for an organic plant fertilizer, frequently hitting 7%.
- Ash is an excellent source of potassium and trace elements, which can also treat overly acidic soils.
- Peat maintains a healthy soil pH and is rich in macronutrients and secondary nutrients like magnesium and calcium.
- Compost is a slow-releasing fertilizing product that contains low levels of nitrogen, potassium, and phosphorus and is applied in large quantities.
- Seaweed and kelp fertilizing products contain macronutrients, micronutrients, and growth hormones.

Mineral-Based Organic Fertilizers

Mineral-based fertilizers are made from minerals that are already present in nature. The slow-release characteristic of mineral-based plant feed is a major benefit because it guarantees a consistent supply of nutrients for a long time. This improves plant absorption and reduces the likelihood of nutrients leaking. Furthermore, organic-based fertilizers made of natural minerals enhance soil texture and water retention and encourage the growth of beneficial microbes.

The most common mineral-based natural fertilizing products include the following:

- Greensand is an excellent potassium source, both as an amendment on its own and as an additive to fertilizing mixtures.
- Limestone, thanks to its high calcium carbonate content, helps boost the fertility of the soil by improving its chemical properties (for example, reducing acidity).
- Rock phosphate (phosphorite) is a low-priced natural source of slow-releasing soluble phosphorus.
- Langbeinite provides easily accessible potassium, magnesium, and sulfur for plants.
- Rock dust can be manufactured by grinding any sort of mined rock into a fine, mineral-rich powder that may greatly improve soil health.
- Unprocessed natural potassium sulfate, rich in potassium and sulfur, is widely used on potatoes, legumes, avocados, and other crops sensitive to chloride in soils.

CONCLUSION

In the past few decades, intensive farming (use of various kinds of chemical fertilizers, pesticides and insecticides) has undesirable effects on the soil environment, both structural and microbial, and there is urgent need to restore it. Large-scale intensive farming has resulted in several physical and physiological problems in the soil and is also responsible for soil and environmental pollution. There is excess of chemical fertilizers in the unavailable form that are left in the soil, and these residuals cannot be absorbed by the plant. If there is a rainfall soon after the chemical fertilizers are applied in the fields, they get washed away and are accumulated in water bodies and cause water pollution, resulting in algal bloom. To minimize this adverse effect of chemical fertilizers, organic fertilizers are being promoted now, giving rise to the concept of organic culture. Organic fertilizers include compost (village compost, town compost, water hyacinth compost and vermicompost), farmyard manure (cattle manures, sheep penning and poultry manures), green manures (leguminous plant and non-leguminous plant), biofertilizers (algal biofertilizer, fungal biofertilizer, bacterial biofertilizer or plant growth–promoting rhizobacteria (PGPR), etc.). Organic fertilizers have long since been known to improve physical properties viz.

declining sodicity, reducing bulk density, water infiltration rate, increased porosity and aeration, improved saline water leaching and chemical properties, that is, decreasing acidity. On increasing the humus content, there is a change in biological properties of soil that help in flourishing of beneficial macro- and microorganisms. Organic amendments increase soil carbon and nitrogen content, which results in enhanced soil fertility and crop productivity and it is also eco-friendly and cost-effective.

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