



Research Article

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The Principal Role of Organic Fertilizer on Soil Properties and Agricultural Productivity -A Review



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Abstract

As a key component of agricultural sustainability, organic fertilizer contributes greatly to improving soil fertility. Therefore, the objective of this review is to revise the role of organic fertilizer on agricultural product and productivity. The newly sourced artificial fertilizer had a short-term benefit, but it had severe long-term side effect such as soil toxicity and decline soil fertility. Afterward, the idea of organic farming was acceptable to developed organic agriculture system. The use of organic fertilizers has advantage of being cheap, improving soil structure, texture and aeration increasing the soils water retention abilities and stimulating healthy root development. Organic fertilizer has many sources such as minerals, animal source, sewage sludge and plant. Vegetables, animals and residue materials had a contribution to improve soil organic matter content in soil. Therefore it is recommended that, using integrated nutrient management is a continuous improvement of soil productivity on longer term basis through appropriate use of organic fertilizers (i.e. animal manure, plants residue and sewage sludge) and their scientific management for increments of optimum growth, yield and quality of different crops.

Keywords: Organic fertilizer; Fertility; Agricultural productivity

Introduction

Among the problems inherent to tropical soils, soil acidity, characterized by low pH, excessive aluminium, deficient calcium, and low organic matter is the most serious. Tropical soils are often unproductive because some of these soils are prone to strong phosphate fixation that renders phosphorus unavailable to plant. Soils that are prone to strong phosphate fixation (adsorption to oxides and clay minerals) often require extremely high phosphate fertilization application in order to alleviate the effect of phosphate fixation. Soil acidity and mineral deficiencies can be corrected by lime and fertilizers. Unfortunately, lime and fertilizers are not always easy options available to small and resource-poor farmers. Agriculture was practiced for thousands of years without the use of artificial chemicals in the world. Artificial fertilizers were first formed during the mid-19th century. These organic fertilizers were cheap, powerful, and easy to transport in bulk. The new artificial fertilizer technology had a beneficial in the short term, had serious longer-term side effects such as soil compaction, erosion, and declines in overall soil fertility, along with health concerns about toxic chemicals entering the food supply. In the late 1800s and early 1900s, soil biologist began to seek ways to reme-

dy these side effects while still maintaining higher production [1]. Similarly, inorganic fertilizers were known for their high cost and their negative environmental effect if managed poorly [2]. The agricultural sector in Ethiopia was the major part for sustaining the growth and reducing poverty. However, lack of adequate nutrient, the depletion of soil organic matter and soil erosion are the major obstacles to sustained agricultural production. Since 1998, Ethiopia has included conservational tillage and compost as part of its extension package to reverse land degradation [3]. There exists ample evidence to show that compost and conservation tillage can result in higher and comparable yields, compared to chemical fertilizers [4]. The use of organic fertilizers which emphasizes maximum reliance on renewable local or farm resource. The advantage this fertilizer was cheap, improving soil arrangement, texture and airing, increasing the soils water preservation abilities and stimulating healthy root development [5]. In the developing world, many producers farm according to traditional methods that are comparable to organic farming, but not certified, and that may not include the latest scientific advancements in organic agriculture. In other cases, farmers in the developing world have converted

to modern organic methods for economic reasons. Therefore, the main objective of this paper is to overview the principal role of organic fertilizer on agricultural productivity.

Concept and Definition of Organic Fertilizer

Organic fertilizers were defined as materials having definite chemical composition with a high analytical value that supply plant nutrient in available form [6]. Organic fertilizers are fertilizers derived from animal matter, human excreta or vegetable matter (e.g. compost, manure). Organic fertilizers are made with natural raw material; it usually pertains to our biodegradable wet suit. Usually compost is made by decomposing biodegradable wastes. These wastes include paper, leaves, fruit peelings left over foods and even fruit juices. Organic fertilizers make a good addition to the soil. It makes the soil reach and ideal to planting.

Source of Organic Fertilizers

The main organic fertilizers were sourced from peat, animal wastes (often from slaughterhouse), and plant wastes from agriculture and sewage sludge. Naturally occurring organic fertilizers include animal wastes from meat processing, peat, and slurry. Organic fertilizers were carbon-based compounds that increase the productivity and growth quality of plants. Organic fertilizers, far from being purified and simplified chemicals, were complex compounds that add numerous secondary and micro-nutrients. Organics such as manures, powdered rocks (such as lime, rock phosphate, and greensand), blood meal, bone meal, wood ash and compost all contain important micronutrients, and their texture would improve soil quality rather than degrading it. Organic farmer's emphasis using only organic fertilizers for fertility maintains. In many aspects, organic farming was the way of life as it is a method of farming. Soil nutrient depletion and likely degradation have been considered serious threats to agricultural productivity and have been identified as major causes of decreased crop yields and per capita food production [7]. The positive effects organic farming has on the environment and quality of food, it also greatly helps a farmer to become self-sufficient in his requirements for agro-inputs and reduce his costs. Organic farming aspires to a combine mixture of organic, environmental, social and ethic objectives.

Mined powdered limestone, rock phosphate and Chilean salt peter were inorganic (not of biological organs) compounds which can be energetically intensive to harvest. mineral fertilizers containing N, P, K and S not only increase crop yield but also improve nutritional quality of crop yields, such as protein, oil, starch, essential amino acids and vitamins in pulses, oil seeds, tubers, and vegetables respectively. Animal source materials include the product of slaughter of animal, blood meal, bone meal, hides, hoofs, and horns were typically precursors. Chicken litters, which consists of chicken manure mixed with sawdust, was an organic fertilizer that has been shown to better condition soil for harvest than synthesized fertilizers. Common form of animal manure includes farmyard manure or farm slurry. Farmyard manure also contains plant materials (often straw), which has been used as bedding for

animal and has absorbed the feces and urine. Agricultural manure in liquid form known as slurry is produced by more intensive livestock rearing systems where concrete or salt are used, instead of straw bedding. Manure from different animals had different qualities and requires different application rates when used as fertilizer.

Sewage sludge is materials that contain human excreta, as it is generated after mixing excreta with water and treatment of wastewater in sewage treatment plant. Green manure are crops grown for the express purpose of plowing them in those increasing fertility through incorporation of nutrients and organic matter into the soil. Leguminous plant such as clover is often used for this, as they fix nitrogen using rhizobia bacteria in specialized nodes in the root structure. Green manure, wherever feasible, is the principal supplementary means of adding organic matter to the soil. It consists in the growing of quick growing crop and ploughing it in order to incorporate it into the soil [6]. Decomposing crop residue (green manure) from prior years is another source of fertility. Nitrogen is required for the growth of vegetative parts such as the stems and the leaves, while your plants will have healthy roots if they get a sufficient amount of phosphorus. Phosphorus was also required for good flowers and fruits. Potassium makes the plant healthy by facilitating the circulation of nutrients within the plant. Moreover, plants also require other nutrients, such as calcium and magnesium. Since these were required, you need not add them separately unless in exceptional cases, if the soil was totally devoid of these minerals or the crop you wish to grow transforms organic substrates into a stable, humus-like material [8]. In addition to the carbon storage benefits of adding compost to agricultural soils, composting can lead to improved soil quality, improved productivity, and cost savings. For example, nutrients in compost tend to foster soil fertility [9].

Importance of Organic Fertilizer

Organic fertilizers were different from chemical fertilizers in that the materials were a by-product of vegetables, animals or minerals. The decomposing matter from these sources, break down naturally and would provide nutrient and minerals to the soil. When considering lawn maintenance, it was necessary to make sure that the lawn or garden gets the all of nutrients that it needed for health growth. Although nutrients were available in regular soil, fertilizers can provide and ensure that the plant had a balance and suitable access of nutrients, proper lawn care include providing for the health of the lawn and garden. One of the benefits of organic fertilizer was that the nutrients were related more slowly than chemical fertilizers. This slower process allows the plant to process the fertilizer in a more natural way and will not result in over fertilizing which could damage the plant [10]. The soil drainage and air circulation of the soil can also be improved. Having a compost pile was also a great way to get rid of food waste and still contribute to your lawn care and environment. It was an important valuable option that would help the soil and environmental be health and produce the best plants. Synthetic fertilizers

usually contain chemicals which were not easily biodegradable. These chemicals leach into the soil and eventually find their way into the water system where they were consumed by birds and other wildlife. In contrast, organic fertilizer had no such harmful compounds and therefore didn't pose this danger, even with increased use. In addition, when synthetic fertilizers were sprayed on plants and lawns, they pose an immediate danger to kids and pets that play in the garden and on the grass. Caution must be exercised when using these toxins, and exposure must be limited. Unlike chemical fertilizers, organic fertilizers reduce acidity in the soil and do not cause leaching. They do not kill beneficial microorganisms in the soil. Organic fertilizers also help improve the structure of the soil including the circulation of air, which sustains beneficial microorganisms that help release nutrients to the soil.

In many agriculture areas, pollution of groundwater causes with synthetic fertilizers and pesticides. Organic fertilizers through the use of greater biodiversity, enhancing soil structure and water infiltration. Well managed organic systems with better nutrient retentive abilities, greatly reduce the risk of groundwater pollution. Organic agriculture contributes to mitigating the greenhouse effect and global warming through its ability to sequester carbon in the soil. Many management practices used by organic agriculture increase the return of carbon to the soil, raising productivity and favouring carbon storage. Combinations of plants and animals optimize nutrient and energy cycling for agricultural production. The provision of structures providing food and shelter, and the lack of pesticide use, attract new or re-colonizing species to the organic area, including wild flora and fauna (e.g. birds) and organisms beneficial to the organic system such as pollinators and pest predators [11]. If households are endowed with sufficient labour to apply manure, then the probability to opt for expensive fertilizers decreases. Other than reciprocally affecting one another, manure and fertilizer uses are also affected by other factors in similar or in different directions. It reveals that the likelihood of applying both fertilizer and manure increases within increase in parcel size [12].

Impacts of Organic Fertilizer Application on Soil Properties

Declines in organic matter content of soils due to cultivation and erosion have been a major concern related to sustainability of agriculture. Therefore, management practices that increase the organic matter content were deemed desirable to soil quality and productivity. Moreover, soil organic matter increases following repeated applications of solid cattle manure. The effect of manure on soil pH is variable. Repeated applications of N fertilizer may lead to soil acidification due to acidity produced in the nitrification process, while organic matter added as manure can act to help buffer the soil against a decrease in pH, manure that is low in organic matter and high in ammonium nitrogen may result in a decrease in pH due to acidity produced when the ammonium is oxidized to nitrate in the soil [13]. Moreover, Whalen et al. [14] stated that an immediate increase in the pH of two acid soils fol-

lowing fresh cattle manure application and concluded that the effects of manure on soil pH would depend on the manure source and soil characteristics. Manures of high organic matter and carbonate content would be most effective in raising the pH of an acid soil and also buffering against changes in pH once in the soil. The content of organic matter was an essential indicator of soil quality and fertility [15]. Organic matter was one of the three soil components that are crucial for its physicochemical properties, such as its sportive and buffer abilities as well as its biodiversity and biological activity. Because of the positive influence of organic matter on soil functionality, it was imperative that its resources be maintained or improved [16]. Soils that received repeated applications of cattle manure were more friable to the feel and less compacted under foot than those of the unmannered plots Campbell et al. [17]. Farmyard manure has long been known to improve soil structure, increase porosity and water holding capacity and decrease evaporation rates, that cattle feed manure applications to soils increased water infiltration into the soil while reported that additions of manure decreased crust strength. Improvements in physical soil quality characteristics were generally indicated by increases in water infiltration, macro porosity, aggregate size and stability, and soil OM.

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 nutritious to eat than produce grown conventionally [18]. 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 [19]. Edmeades [20] 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, [21]. 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, [22] 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 [23], 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 [24]. Similarly, Heaton [25] stated that dry matter produce from organic systems was higher than in conventionally grown produce. High rates of K fertilization have been reported to reduce dry matter content in some crops [26-41].

Summary and Conclusion

Organic and synthetic fertilizers had a role in on soil properties and agriculture and the good points of each should be acknowledged. But inorganic fertilizer had more demerit than organic fertilizer. Organic fertilizers are fertilizers derived from animal matter, human excreta or vegetable matter (compost, manure). Organic farming is a production system that avoids or largely excludes the use of synthetic fertilizers, pesticides, growth regulators and livestock feed additives and rely on crop rotation, crop residues, animal manures, legumes, green manures, off-farm organic wastes and mineral bearing rocks. Organic farming aspires to a combine mixture of organic, environmental, social and ethic objectives. For instance, compost provides air, water, organic matter, and microorganisms to your plants, thus enhancing their growth. It also maintains a healthy atmosphere for the soil and hence keeps insects, plant diseases, and weeds away. Many organic materials serve as both fertilizers and soil conditioners; they feed both soils and plants. Microbial biomass was often greater in organic than conventionally managed soils. Organic fertilizers are carbon-based compounds that increase the productivity and growth quality of plants. The majority of organic fertilizers can be prepared locally or on the farm itself. Use of these organic fertilizers ensures that the food items produced are free of harmful chemicals. Therefore, it is recommended that the use of organic fertilizer or combined application is more beneficial than artificial fertilizers in order to preserve soil properties and increase the soil productivity.

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