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A Review on the Effect of Organic and Chemical Fertilizers on Plants

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Abstract*: The industrial revolution followed by green revolution caused an increase in yield per unit area in crop production, but they also increased the use of synthetic fertilizers in agriculture. Intensive inorganic fertilizer usage in agriculture causes so many health problems and unrecoverable environmental pollution. To reduce and eliminate the adverse effects of Synthetic fertilizers on human health and environment, new agricultural practices have been developed that all so-called organic agriculture. The organic fertilizers include peat, animal wastes, plant waste from agriculture, and treated sewage sludge whereas inorganic fertilizers include chemicals like ammonium nitrate, potassium chloride, urea, NPK etc. Inorganic fertilizers accumulate salt which expends more energy to draw water from the soil and cause them to appear wilted or dried out and if there is a rainfall shortly after they are applied them the fertilizers wash away and can pollute streams, ponds and other water bodies. It can also leach away from the root zone of the plant it may enter through the plant to the food chain and they get accumulated and harm us. The plants are an efficient source of basic nutrients such as nitrogen, phosphorus, potassium as well as secondary and micronutrients such as calcium, boron, magnesium, and manganese. High chlorophyll content, the high percentage of protein and carbohydrate indicates, better physiological and biochemical conditions. It is usually suggested that the use of organic fertilizers and amendments are eco-friendly. The effect of organic and chemical fertilizers occurs significantly on the biochemical performance like chlorophyll content, protein and carbohydrate concentration of the crop plant and highlights the prospects and potential of using organic fertilizers.
Keywords*: Inorganic fertilizers, organic fertilizers, plants.

I. INTRODUCTION

Less soil fertility is one of the most vital constraints on improved agricultural production (A.T. Ayoub, 1999). Fertilizers are used to improve soil fertility but intensive inorganic fertilizer usage in agriculture causes so many health problems and unrecoverable environmental pollution. Thus, to reduce and eliminate the adverse effects of Synthetic fertilizers on human health and environment, now-a-days a new agricultural practice have been developed called as organic agriculture, sustainable agriculture or ecological agriculture (Aksoy, 2001; Chowdhury, 2004). Organic fertilizers are primarily cost effective, easily available from locality products than chemical fertilizers (Solomon, *et al.,* 2012). Organic matter is the basis of soil fertility (Aboudrare, 2009). Microbial fertilizers are distinctly environment friendly, non- bulky, cost effective which plays a significant role in plant nutrition (Mahajan *et al.,* 2008). On the other hand, inorganic fertilizers are known for their high cost and their negative environmental effects if managed poorly (Morris *et al.,* 2007). All these give rise to reduced crop yields as a result of soil degradation and nutrients imbalance (Ojeniyi, 2000). Also, inorganic fertilizer differs from organic fertilizers in the way that they consist of simple chemical compounds of known composition (Lockeretz, 1995). Because of this issue, farmers create a “mix” of both organic and inorganic fertilizers for their crop. The choices of suitable fertilizer are usually governed by multi factors like climate, locality, natural conditions and soil variation with regard to their suitability for crops cultivation. The leafy vegetables, fruits and cereal crops are efficient source of basic nutrients such as nitrogen, phosphorus, potassium as well as secondary and micronutrients such as calcium, boron, magnesium and manganese. The present article reviews the effect of organic and inorganic fertilizers on varied aspects of plants.

II. IMPORTANCE OF FERTILIZER

The basic purpose of fertilizer application in soil is to improve the nutrient status and quality of soil by enriching it with nutrients which it lacks. Crop plants require nitrogen, phosphorous and potassium to maintain normal physiological function of the cell. In similar way according to Mani (2002) lack of nitrogen results in poor growth and slow growth, but the excess use of nitrogen results in delayed maturity and low quality of leaf (Ewulo *et al.,* 2008). Fertilizers have all the ingredients that are needed by plants to grow, so they are added to the soil in order to improve the physical, biological and chemical properties of the soil. A physical property includes soil friability, porosity and absorption. Biological properties are associated with the microorganisms living in the

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soil. The chemical properties are related to the soil pH (acidity level) and the availability of nutrient to the plants. It has been reported earlier that both organic and inorganic fertilizer which has been used by the farmers increases yield and sustain soil productivity (Chukwu *et al.,* 2012). The use of several organic materials especially cows dung, poultry droppings and farm yard manure as soil amendments are suitable for increasing crop production (Asadu and Unagwu, 2012). So fertilizers are required and thus applied to replenish nutrients taken away from the soil by crop harvest and so they are applied to supplement more nutrients to boost crop yield (Olatunji and Ayuba, 2012).

III. ORGANIC FERTILIZERS

Organic fertilizers are derived from biological or living materials. These fertilizers take longer time to release the nutrient in the soil. In contrast, Inorganic fertilizers are classified as those fertilizers that are synthesized artificially or mined from non-living materials. Also known as chemical fertilizers, inorganic fertilizers are absorbed by the plants relatively fast. Organic fertilizers come in the different forms such as:

Manure derived from livestock such as cows, chickens, goats and others.

Green manure which are obtained from young plants, especially different type of legumes.

Compost derived from agricultural that is waste organic material such as straw, corn stalks or decomposed waste.

IV. ADVANTAGES OF ORGANIC FERTILIZERS

Organic farming is one of the fastest growing sectors of the agriculture worldwide and its main objective is to create a balance between the inter-connected system such as soil organism, plants, animals and humans (Berova, *et al.,* 2010). The organic fertilizers offer the biological process necessities of plants and conjointly suppress the plant pests' populations (Heeb *et al*., 2005a; Heeb *et al*., 2005b; Heeb *et al*., 2006; Liu *et al*., 2007; Tonfack *et al*., 2009). Additionally, they increase the microorganism activity in soil, anion and cation exchange capability, organic matter and carbon-content of soil. Organic fertilizers increase the quality and yield of agricultural crops in ways similar to inorganic fertilizers (Bulluck and Ristaino, 2002; Bulluck *et al*., 2002; Arancon *et al*., 2004), however it does not cause environment pollution. Some of the important advantages of organic fertilizers include improved soil texture, water retention and resistance to erosion. Organic fertilizers provide nitrogen in a usable form, which will help plant to improve plant growth while at the same time neither cause burning of roots nor destroying beneficial micro-organisms in the soil. Organic fertilizers help to prevent diseases by meeting the plants 'nutritional needs and enhancing plant tolerance. This action removes a serious source of stress. Plant wastes such as wood ash, spent grain, rice bran, and sawdust were effective as fertilizers (Ogbalu, 1999). According to Ogbalu (1999) ancient sources of nutrients are accessible to farmers and therefore the use of chemical fertilizers by villagers isn't common.

V. DISADVANTAGES OF ORGANIC FERTILIZERS

Organic fertilizers improve the structure, chemistry, and biological activity of the soil by providing nutrients and contribute to the quality of soil. They are known for the gradual release of nutrients, and they increase soil organic matter content (Sarkar *et al*., 2003). Soil organic components are favoured when decomposition is slow. However, decomposition of organic material is strongly affected by temperature and soil moisture thus nutrients may be released when the plant does not need them. Because the nutrient content is low in organic fertilizers, and only a limited amount of organic material is available in many regions and it is generally difficult to meet crop nutrient demands through organic fertilizers alone (Morris *et al.,* 2007). This implies that crops can suffer initial starvation from nutrient immobilization prior to mineralization. They are also required in large quantities which may not be readily available to small scale farmers (Agbede and Kalu, 1995; Okigbo, 2000; Adekiya *et al.*, 2012).

VI. TYPES OF INORGANIC FERTILIZERS

Different types of inorganic fertilizers include nitrogen fertilizer, potash fertilizer, phosphorus fertilizer, fertilizer, compound fertilizers and leaves.

The category of Nitrogen fertilizers includes the followings:

ZA(Zwavelvuur Ammonium) 20.5 to 21% nitrogen level

Urea or $CO(NH_2)$ 45-46% nitrogen content

Chile saltpetre with 15%nitrogen

Ammonium nitrate or NH_4NO_3 who had higher levels of nitrogen by 35%

The category of phosphorous fertilizers includes the followings

Superphosphate multiple (DS=Double superphosphate) who had levels of 30% P_2O_5.

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Triple superphosphate (TS=Triple Superphosphate) 45% P_2O_5 . It is most widely used by the people.

The category of potassium fertilizers includes the followings:

Potassium chloride or KCl which had levels of 50%K_2O

Potassium Sulphate (ZK=Zwavelvuur time) with a grade of 50%K_2O.

The category of Compound fertilizers includes NPK. Nitrogen phosphorus and potassium fertilizers are single because it contains only one type of primary nutrients whereas compound fertilizer contains more than one kind of primary nutrients. NPK fertilizers consist of Potassium Chloride (KCl) Ammonium dihydrogen phosphate ($NH_4H_2PO_4$) and ammonium nitrate (NH_4NO_3) (Cooke, 1982). For Example: fertilizer NPK 10-15-20 means it contains 10% nitrogen, 15% phosphorus (P_2O_5) and 20% Potassium (K_2O). Another form is Leaf manure in which Foliar fertilizers are given to the plants by spraying the leaves and they are absorbed by osmosis or diffusion through stomata. Examples of foliar fertilizers are Wuxal, Baypolan and so many more.

VII. ADVANTAGES OF INORGANIC FERTILIZERS

There are certain advantages of inorganic fertilizers which makes them a potent candidate to enhance agricultural productivity. Some of the major benefits are listed below:

There is no need of direct decomposition as the nutrients in mineral fertilizers are relatively high, and the release of these nutrients is quick.

Inorganic fertilizers increase the growth rate and plant's overall productivity more rapidly.

There are abundant evidences that inorganic fertilizers can improve yield of crop significantly (Ojeniyi, 2002). According to Cooke (1982) fertilizers raise soil fertility so that the yield of crops is independent and no longer be limited by the deficient amounts of plant nutrients

VIII. DISADVANTAGES OF INORGANIC FERTILIZERS

But in spite of all benefits there are serious major disadvantages of inorganic fertilizers which inculcates less desirability for them and some of the chief shortcomings are:

Inorganic fertilizers are Human carcinogens: According to the EPA's Office of Pesticide Programs, most of the pesticides have ingredients which known to cause cancer. Organic fertilizers are guaranteed to be safe for the environment, the body and are free of pesticides.

Water pollution: Inorganic fertilizers accumulates salt which expend more energy to draw water from the soil and cause them to appear wilted or dried out and if there is a rainfall shortly after they are applied them the fertilizers wash away and can pollute streams, ponds and other water bodies. It can also leach away from the root zone of the plant it may enter through plant to the food chain and they get accumulated and harm us.

Nutrient Imbalance: The reckless use of inorganic fertilizers can create nutrient imbalance that limits the uptake of other essential nutrients and cause soil acidity leading to low crop yields. According to Ojeniyi (1995, 2002) there are problems that arise due to continuous use of inorganic fertilizers as most farmers apply fertilizer without soil test. Deficiency of secondary and micronutrients occur in soil and crop, if the common NPK type is consistently used. Total dependence on inorganic fertilizers leads to fall in soil organic matter, increased soil acidity, degradation of soil physical properties and structure and increased erosion Ojeniyi (1981).

Dependence on fossil fuel: Agricultural chemicals have contaminated ground and surface waters, harmed fish and wildlife and greatly increased agricultural dependence on fossil fuel resources. Thus there is a need to evolve an alternative method by which we can reduce the use of chemicals.

IX. FUTURE PROSPECTS

The present review focuses on the effect of synthetic chemical and organic fertilizers on the performance of crop plant. It is expected that organic and chemical fertilizers both effects morphological, physiological and biochemical performance of different crop plants. This review suggests that the use of organic fertilizers and amendments are eco-friendly and has got an upper edge as compared to inorganic synthetic fertilizers which causes environment pollution and also might get accumulated in the soil leading to human health hazards. Micro- organism based fertilizers can be applied to plants globally as now the deleterious effects of excessive use of chemical fertilizers are known to us. As done earlier with chemical fertilizers, for organic fertilizers also, bio-fertilization programs, having recommended type and dose of fertilizers most suited for the varied crop growth stages of the crop, should be implemented.

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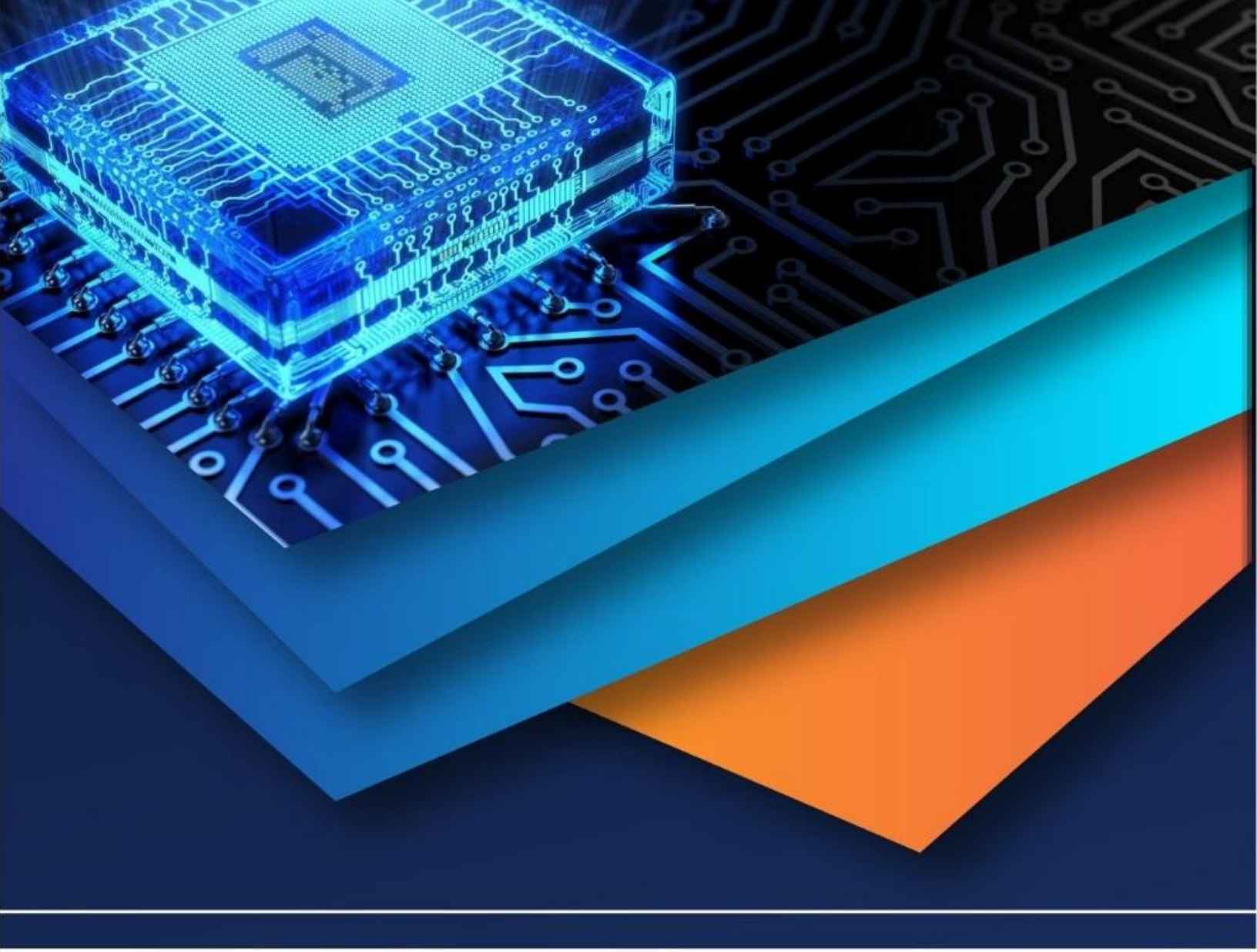
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REFERENCES

[1] Aboudrare A (2009). Agronomie Durable. Principes et Pratiques. Rapport de Formation Continue. FAO 2009, pp 49.[6] Adekiya AO, Ojeniyi SO and Agbede MT (2012). Poultry manure effects on soil properties, leaf nutrient status, growth and yield of cocoyam in a tropical Alfisol. Nigerian JournSoil Science. 22(2): pp 30 – 39.
[2] Agbede OO and Kalu BA (1995). Constraints of small-scale farmers in increasing crop yield: farm size and fertilizer supply. Nigerian Journal of Soil Science. 11:pp 139 – 159.
[3] Aksoy, U (2001). Ecological Farming. II. Ecological Farming Symposium in Turkey. 14-16 December. Antalya.
[4] Asadu CLA and Unagwu BO (2012). Effect of combined Poultry Manure and inorganic fertilizer on maize performance in an ultisol of south-eaNigeriNigeria Journal of Soil Science. 22(1): pp 79 – 87.
[5] Ayoub, AT (1999). Fertilizers and the Environment. Nutrient Cycling in Agroecosystems. 55: pp 117-121.
[6] Berova M, G Karanatsidis, K Sapundzhieva and V Nikolova (2010). Effect of organic fertilization on growth and yield of pepper plants (Capsicum annuum L.). Folia Horticulturae Ann. 22: pp 3-7.
[7] Bulluck LR, Brosius M, Evanylo GK, Ristaino JB (2002). Organic and synthetic fertility amendments influence soil microbial, physical and chemical properties on organic and conventional farms. Appl. Soil Ecol. 19(2): pp 147-160.
[8] Chowdhury, R (2004). Effects of chemical fertilizers on the surrounding environment and the alternative to the chemical fertilizers IES- Envis Newsletter. (3): pp 4-5.
[9] Chukwu LI, Ano AO and Asawalam, DO (2012). Effects of Poultry Manure and NPK fertilizer on soil properties and Nutrient uptake of maize (Zea mays L.) plants growth in an ultisol. Proceedings of the 36th Annual Conference of the Soil Science Society of Nigeria (SSSN) on 7th – 11th March, 2012 University of Nigeria Nsukka.
[10] Cooke GW (1982). Fertilizing for maximum yield. Third Edition English Language Book society/Collins. pp 457.
[11] BS, SO Ojeniyi, and DA Akanni. (2008). Effect of poultry manure on selected soil physical and chemical properties, growth, yield and nutrient status of tomato. African J. Agriculture Research. 3(9): pp 612-616.
[12] Heeb A, Lundegardh B, Ericsson T, Savage GP (2005a). Effects of nitrate- ammonium- and organic-nitrogen-based fertilizers on growth and yield of tomatoes. J. Plant Nut. Soil Sci., 168(1**)**: pp123-129.
[13] Heeb A, Lundegardh B, Ericsson T, Savage GP (2005b). Nitrogen form affects yield and taste of tomatoes. J. Sci. Food Agric.85: pp 1405-1414.
[14] Heeb A, Lundegardh B, Savage GP, Ericsson T (2006). Impact of organic and inorganic fertilizers on yield, taste, and nutritional quality of tomatoes. J. Plant Nut. Soil Sci. 169: pp535-54.
[15] Lockeretz W (1995). Organic farming in Massachusetts: An alternative approach to agriculture in an urbanized state. Journal of soil and water conservation 50(6): pp 663-667.
[16] Mahajan, RD Gupta, and R Sharma (2008). Bio-fertilizers-A way to sustainable agriculture. Agrobios Newsletter.6: pp 36-37.
[17] Mani J(2002). Early events in environmental stresses in plants: Induction mechanisms of oxidative stress. In: D. Inzè and M.V. Montague (eds.) Oxidative stress in plants. Taylor and Francis, New York. pp 217-246.
[18] Morris M, VA Kelly, RJ Kopicki and D Byerlee (2007). Fertilizer Use in African Agriculture: Lessons Learned and Good Practice Guidelines. Washington, DC: The World Bank. The Rain Forest Area of Nigeria. Applied Tropical Agriculture 5: pp 20-23.
[19] Ojeniyi SO (2002). Soil management, national resources and environment. Oke-Ado: Adeniran press. pp 24.
[20] Oje
[21] niyi SO (1981). Effect of long term NPK application on secondary and micronutrient content of cofffea carephora. Plant and soil. 60: pp 477-480
[22] Ojeniyi, SO (2000). Effect of Goat Manure on Soil Nutrients and Okra Yield in the Rain Forest Area of Nigeria. Applied Tropical Agriculture 5: pp 20-23.Okigbo I (2000). Application of organic and inorganic fertilizers and the response of maize crop. Nigerian Journal of Soil Science. 18 (2): pp 22.
[23] Olatunji O and Ayuba, SA (2012). Effect of combined applications of poultry manure and NPK 20-10-10 fertilizer on soil chemical properties and yield of maize (Zea mays L.). Proceedings of the 35th Annual Conference of the Soil Science Society of Nigeria (SSSN). 7th – 11th March, 2011, FeUniversity of Technology Minna.
[24] Sarkar S, SR Singh, and RP Singh (2003). The Effect of Organic and Inorganic Fertilizer on Soil Physical Condition and the Productivity of Rice-Lentil Cropping Sequence in India. Journal of Agricultural Science. 140 (4): pp 419-425
[25] Solomon, WGO, RW Ndana, and Y Abdulrahim (2012). The Comparative study of the effect of organic manure cow dung and inorganic fertilizer NPK on the growth rate of maize (Zea mays L.). International Research Journal of Agricultural Science and Soil Science. 2: pp 516-519.

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