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Adverse Impacts of Synthetic Fertilizers on the Fertility of the Soil due to Various Changes in Soil Composition

Abstract

In the present scenario of agriculture the chemical fertilizers are the essential part of growing any kind of crop .They provide vital growth of the plants and secure food security of the World. The production of crop can be increased but plant growth do not attain developed roots and do not attain maturity .The excessive use of fertilizers is very dangerous and enter the water ,air and soil. The toxic substances absorbed by plants passes to human body. The toxicity start from the manufacturing process through products and by products containing harmful components. The release of gases like NH_3, CO_2 , and CH_4 etc produce adverse effects on the environment and ecosystem . The manufacturing units discharge their waste in the nearby water system lakes, ponds and water bodies and causes water pollution. The regular use of fertilizers is continuously deteriorating the quality of soil and producing excessive growth of aquatic plants and causes dumping of decayed plants and depth goes on decreasing day by day, called eutrophication. The adverse effects of chemical fertilizers can be reduced by applying new agricultural techniques and use of bio- fertilizers fo healthy crop free from any king of toxicity of metals in vegetables, and fruits etc. The chemical fertilizers directly harm the environment and ecosystem. It covers Water pollution, soil pollution and air pollution.

Keywords: **:** Maturity, Chemical fertilizers, Environment and ecosystem , Bio-fertilizers, Plant growth

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Introduction

The industrial revolution, also known as green revolution fulfilled the food deficiency by applying inorganic and organic fertilizers but also hindered the soil's natural fertility. The wide applications of inorganic and organic fertilizers have suppressed the Purity of crops. Mostly every seasonal crop/ fruits have high percentage of unwanted heavy metals , other toxic materials like , N, S etc.(Ayoub AT, 1999). It has increased health problems and unrecoverable environmental pollution.

It has been estimated that total consumption of N, P, & K has achieved 81, 4 and 18 Tg/yr respectively(Greidner,1997).Approximately 55% of chemical fertilizers are applied for cereal production , 12% for oil seeds crops, 11% for grass lands,11% for commodities (cotton, sugar, and coffee) , 6% for root crops and 5% for fruits and vegetable production. Till 1950 the consumption of chemical fertilizers was very small and nutrients needed for healthy crop were obtained from manures (Aksoy U**,**2001).By 2020, it has been

observed that 70% of crops depend upon the applications of chemical fertilizers.. The type of fertilizers is increasing continuously with respect to the population growth (Aboudrare A et.al., 2009). As per the studies by Keeney (1997) , the total population will increase about 2.2 billion and it will attain its double figure by 2050. The consumption of meat and food in developed countries is increasing and it may be triple till the mid of 21ist century (Mahajan Gupta RD,2008). The volume of agricultural land is decreasing day by day due to fast growing urbanization and agricultural land may less than the urban development . it is expected that food production must be more intensive and efficient than ever before.

To minimize the toxic effects of artificial fertilizers on human and environment, new approach has been adopted known as organic agriculture , sustainable agriculture or ecological agriculture (Omidire Niyi S et.al,2015) .Bio-fertilizers are cost effective and are easily available from locality products . The microbial fertilizers are eco-friendly and help to have healthy environment (Pandiselvi T et.al,2017). On the other hand inorganic fertilizers are also very expensive and show negative impacts on soil fertility. The application of artificial fertilizers causes degradation and nutrients balance (Singh MD,2017). The other advanced practices like integrated nutrient management, nano fertilizers may reduce the adverse effects of fertilizers. The plants need P, N, and K to maintain the normal physiological state of the plants (Trenkel Martin E, 1977). The deficiency of these basic nutrients causes weak growth and less production . On the other hand excessive applications of fertilizers lead to enter the food chain and become a big problem for the society . Ultimately it causes water pollution, soil pollution and air pollution.

Required nutrients

The synthetic / natural fertilizer are applied to soil and it must fulfill the basic requirement of a good fertilizer. A natural / synthetic fertilizer must contain 5% of N, P and K.The industrial fertilizers some time contain varying % of the three basic component along with minor % of Zn, Mn and Fe as impurities and other non essential Elements. Commonly gypsum and lime are used as soil conditioners to enhance the fertility of the soil. The fertilizers mainly provide nutrients in varying proportion. Primary Macronutrients are essential and effects on plants growth (Nelson DW,1984). Nitrogen is essential to produce more chlorophyll and causes leaf growth.

Phosphorus is essential for energy transfer, development of roots , flowers and and seeds / fruits.Potassium serves as an activator of enzymes used in photosynthesis and respiration , strong stem growth , moment of water , promote flowering And fruits.

Secondary Macro- nutrients are Ca, Mg and S.Calcium(Ca) regulates the transport of other nutrients in to the plant. It activates Several enzymes**.** It help in photosynthesis and plant growth.Magnesium (Mg) is the major constituent of chlorophyll molecule.It also act as activator for enzyme reactions.Sulphur(S) is main structural component of some of the amino acids and Vitamins . It also promote chloroplast growth and function .It is present in Iron –Sulphur complexes to activate electrons transport chain in photosynthesis .Sulphur is also essential for nitrogen fixation by legumes . It convert nitrates in to amino acids and finally to proteins.

The variety of Micro-nutrients are also present in fertilizers which are very essential for plant growth. Copper(Cu) is important for grain production, photosynthesis, and manufacture of Lignin wall. Iron(Fe) is major constituent for photosynthesis and also present in enzymes. Manganese(Mn) help in chloroplast formation and promote photosynthesis in plants. Molybdenum(Mo) help in the synthesis of amino acids in plants.Zinc(Zn)- is essential component of enzymes and act as DNA transcription.Boron(B)- promote flowering , pollen germination and fruits formation.Silicon (Si)- strengthen the cell walls and production of crop.Cobalt(Co) is essential for nitrogen fixation in legumes .Vanadiun (V) is a substitute for Mo and act in low concentration for healthy growth of the plants.

Various Types of Fertilizers

The fertilizers are needed for the supply of macro and micro nutrients and to give strength to the plants. They are applied as supplements to flourish the crops for better yield (Savci S .2012). Fertilizers also boost healthy crops. This way fertilizers are help full to increase the production(Keeney D.1990).The function and nature of organic and inorganic fertilizers is quite different and both have their own importance in farming and plant's growth and huge crop. Hence a set strategy must e applied to balance the major and minor nutrients for healthy growth of the plants, to enhance stem growth and more crop(Ruiting T et.al., S.2017). The classification of fertilizers is an important part of this to understand the chemical composition and their effects on soil fertility and ultimately for huge crop production to satisfy the world food demand.

Firstly they are classified based on their nature – e.g. Inorganic fertilizers, Chile saltpeter,which give 15% nitrogen , Organic fertilizers , e.g . Urea give 45% nitrogen and Bio-fertilizers , the product that contain micro-organisms e.g. A. M. fungi, N-Fixer, P-soluilizer and potassium solubilizer.

Secondly they are classified based on the form of the fertilizers-The different types of fertilizers exist in various forms e.g. Powder (Single superphosphate), Crystals(Ammonium sulphate) , Prills (Urea, superphosphate diammonium phosphate,)Granules and super granules(Holland granules , Urea super granules). The liquid Fertilizers are also applied through irrigation.

Third Classification is based on the composition and complexity of chemical fertilizers

These are of three types (a) Single nutrient eg. Urea, ammonium sulphate , Potassium Chloride, and potassium sulphate (b) Multi nutrients eg. DAP, Nitro phosphate and Ammonium phosphate. (c) These fertilizers consists of two or three primary nutrients.

Fourth classification is based on application of fertilizers- (a) Foliar fertilizers are the Water soluble nitrogen fertilizers and directly sprayed on leaves.(b) Controlled and slow released fertilizers are ammonium nitrate , urea, ammonium Phosphate , potassium chloride etc.(c) These are nitrogen based fertilizers mixed with

Certain chemicals which stop nitrification and help to convert ammonia to nitrates .e.g. Nitrapyrin ,DMPP etc.

Natural resources and fertilizers

The agriculture has attain its advancement through out the world and large number of fertilizers , pesticides ,herbicides, are applied to get maximum production . The use of excessive fertilizers and cause soil pollution , air pollution and water pollution and harm the environment and ecosystem .It directly decrease the food quality and crop/fruits are contaminated with unwanted nutrients . All these chemical substances are very harm full and produce acute toxicity in aquatic life, pollute the air and soil. The application of bio-fertilizers will definitely

bring quality and different types of diseases among the animals and human beings could be controlled . This way the environment could be saved and green revolution can be achieved by the application of bio-fertilizers for growing wheat, rice , cereals, fruits etc. Despite the benefits , fertilizers have negative effects on the environment.

Negative effects of Artificial fertilizers- Although the fertilizers are back bone to huge production of various types of crops but the nutrients level of soil is continuously decreasing and natural fertility of soil has been deteriorated to larger extent . This is leading to barren land , the quality of water , soil and air is changing and it is harmful for the next generation. The use of slow and controlled released fertilizers , prilled or radulated fertilizers, nitrification inhibitors are promising options to have safe environment for every living being. The application will be help full to increase the crops(Neue HUW. !993).

Cause of water pollution- The nutrient value of fertilizers is very less and hence. These are applied in bulk and develop unfavorable conditions for the environment by different ways .There may be leaching , drainage or surface flow . The nitrogen is mostly oxidized to nitrates by micro-organisms and ultimately it reaches to underground water system . Even when these fertilizers are applied in ideal conditions, 50% of it is consumed by plants and rest of the nitrogen flows to water system. Approximately 2.5 –21% get catalized, 16-26% get reaction with other compounds present in the soil. 2.6-10% flow to under ground water, wells , ponds and rivers . They show excessive growth of aquatic plants and causes Eutrophication and ponds , rivers become shallow. When nitrate concentration increases in water more than 50mgll the chances of gastric cancer become more prominent and goiter , birth defects , heart disease , increases . Both Nitrogen and Phosphorus are responsible for Eutrophication of surface water.Eutrophication causes killing of aquatic life , proliferation of unwanted species and Loss of recreation due to bad odour (Dal lake).

Air Pollution due to fertilizers- To enhance crop's production , numerous harmful Green house gases are produced and they are depleting the the ozone layer. The ultra violetRays are very harm full for fauna and flora. The agriculture accounts 60% N_2O emission The green house gases like CO_2, CH_4 , N_2O are produced during the manufacturing Of nitrogenous fertilizers .The excessive use of nitrogen fertilizers results in emission Of NO, N_2O and NO_2 and these gases are enough to cause severe air pollution. In global warming the presence of NO is very dangerous and causes 300times more global warming than CO_2. The air pollution is a very serious problem which has happened Due the applications and manufacturing process of various chemical fertilizer**s.**

Soil pollution due to fertilizers-The soil is the best medium for plant growth . It Provide nutrient recycling system and serve as habitat for micro-organisms . It support other ecosystem for small population in the soil. The use of fertilizers lead to Acidification of soil and reduce the organic content in the soil for the good growth of the plants. The excess of fertilizers also kills beneficial organisms. The earth Warms are also reduced and fertility of soil has been deteriorated to a larger extent(Shaviv A, 2000).The soil testing is a very important tool to control the fertility of soil , The pH plays a very important role for plant's growth and production of grains and fruits.

This way the degradation of soil take place(Savci S .2012). Other harmful effects of fertilizers are,**a-**Excess use of N, causes lower leaf yellowing,the roots may be blacken . These symptoms occur due to salt deposition in the

soil.**b**-Excess of nitrogen in barley crop produce undesirable effect on quality of beer. **c**-Excess of fertilizers spoil the plants and leaves become brown. Excess of nitrates causes severe problem as in case of water. **d**-Over fertilization reduce the biodiversity in forest and land.

Importance Of Bio-fertilizers- Bio-fertilizers differ from chemical and organic As they do not supply Nitrogen directly to the plants, bacteria and fungi. The production of bio-fertilizers is simple and within 30 days , it can be prepared by spraying Liquid solution of micro-organisms. They are safe and balance the fertility of the Soil. They allow to develop more earth warms , micro-organisms in soil which Are asset for the soil quality and maintain natural strength of the soil.

Conclusion

The application of fertilizers is of utmost important for proper food production . To reduce the hazardous effects of fertilizers the application of bio-fertilizers are essential. To safeguard the agriculture , the excessive use of chemical fertilizers must be stopped otherwise a day will come the green planet will change to poisonous environment. It will be very difficult to have safe drinking water, safe food, fruits on this beautiful planet . Now this is the duty of every one to protect the environment by using bio-fertilizers which can be made from agro waste, kitchen waste and city waste,. This way a safe and congenial environment can be attained for the well being of lives on the earth.

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