THE ROLE OF BIO-FERTILIZERS IN SUSTAINABLE AGRICULTURE

Solmaz Najafi1*, Mina Najafi2, Meric Balci2

1Department of Field Crops, Faculty of Agriculture, Uuzuncu Yil University, Van, Turkey

2Department of Soil Science, Faculty of Agriculture, Ankara University, Ankara, Turkey

*Corresponding author: Solmaznajafi.agri@gmail.com

ABSTRACT

Due to investigation in world scale, the total Nitrogen amounts which added to soil through biological fixation estimated about 175 million tons annually. Using of chemical fertilizers have been increased obviously due to increasing population as well as demands for foods resulted in over producing costs as well as unfavorable effects on soil and water resources pollution. In other hands, using of these chemicals causes imbalances in nutrients of soils, reducing the efficacy of agricultural products and threaten human and other living organisms health. So, application of bio-fertilizers with origin of bacteria, fungi, algae or other soil-borne organisms has been considered recent years. These compounds increase soil nutrients availability by host plant. They not only have more economic values but also conserve the soil resources sustainability, increase the potential of long term productivity as well as alleviating environmental pollution. Using of suitable strategies for host plant nutrient demands by soil-borne inhabiting living organisms especially bio-fertilizers are necessary to get the sustainable agriculture development. We summarized the status of bio-fertilizers in Iran as well as world has been reviewed and analyzed in sustainable agriculture and producing of high quality products.

Key words: Bio-fertilizers, Chemical fertilizers, Sustainable agriculture, Organic farming

INTRODUCTION

Bio-fertilizers are fertile compounds including several beneficial soil microorganisms in suitable preservative materials. These compounds increase the producing potential in surface area. Microorganisms convert nutrients in an absorptive form for host plants. Different environmental stresses such as drought, temperature, frost, over flooding as well as chemicals decrease beneficial soil microorganisms but with proper strategies it could be possible to increasing these organisms and use of them for bio-fertilizers production. Bio-fertilizers could be classified as bacterial, fungal, algal and actinomycetes fertilizers depend on kind of beneficial microorganisms and have different potential. Nitrogen fixative agents are common types of bio-fertilizers. Their activities could increase soil nitrogen. Mycorrhizal fungi are another groups of beneficial microorganisms which have a symbiotic association with host plant roots and make beneficial changes resulted in nutrient absorption by host plant roots. Phosphate solubilizing microorganisms also convert insoluble soil phosphate to absorptive forms. Some other soil bacteria are important as plant growth promoters. Some other microorganisms have important role in conversion of soil organic compounds wastes to compost which has a suitable nutrient source for host plants. Some of earthworms also considered as bio-fertilizers since producing special compost called as vermicompost. But the most important commercial bio-fertilizers are those with nitrogen fixation bacteria especially rhizobia. The first bio-fertilizer produced in last of 19th century. Organisms used in these fertilizers derived from soil and propagated in laboratory condition and applied. Azotobacter fertilizers are important and effective compounds which supply natural requirements of different field crops, vegetables and fruit trees. These fertilizers could be able to fix the atmosphere nitrogen so transfer this fixed nitrogen to host plant root system and cause a balance in nutrient absorption. Also they produce auxin hormone so increase root and shoot growth and development as well as yield. They also produce different compounds such as antibiotics, HCN … and protect host plant roots from soil borne plant pathogens.

EFFECTS OF BIO-FERTILIZERS

Studies showed that using of bio-fertilizer has been long history. In the past agricultural producers used from legumes for fertility of their soils and believed that these plants could increase soil fertility. Now we are know that this is due to soil microorganisms and its proved that using of bio-fertilizers could have beneficial effects on both soil and host plant. The main objective of bio-fertilizer usage is soil fertility improvement as well as host plant nutrient supply but their application has suitable effects on plant and soil. These fertilizers have natural origin and prepared normally from soil so resulted in soil structure improvement, increasing plant yield and decreasing soil contamination and soil pathogens. Considering microorganisms' adaptability with environmental conditions its important use of indigenous soil microorganisms for production of bio-fertilizers in each country. Productions of high quality foods by using bio-fertilizers make an agreement for consumers and also their health. So, bio-fertilizers application not only supply host plant requirements but also increasing agricultural products quality and consumers health. Supply of agricultural products is mainly depending on chemicals in recent years resulted in environmental problems. One way is using of long term strategies based on ecological agriculture principles for increasing of soil fertility and plant yield by using of bio-fertilizers (Wu et al., 2005). Studies showed that vermicompost caused suitable conditions for host plant growth due to physic-chemical changes as well as growing medium microbial and biological characteristics and also water capacity potential and regulation of acidity (Mcginnis et al., 2003). It was shown that several soil bacteria could be able to improve field crops growth. Among them Azospirillum and Azotobacter species have been considered specially since they have high potential for association with important field crops such as maize, sorghum and wheat (Mishra et al., 1998; Zaied et al., 2003). Several reports showed that positive effects of Azotobacter fertilizer application in combination of animal dungs in different crops such as wheat and maize (Meshram & Shende, 1982). Results showed that one month after adding green manures in soils there is an increasing of soil nitrate durability (Nedzinskiene et al., 2002). Almost of agricultural soils are poor in nitrogen rate due to instability of mineral forms of nitrogen so that it could be possible reducing chemical fertilizers needs with green manure treatment which is in sustainable agriculture program (Cordovil et al., 2007).

CHALLENGES AND STRATEGIES FOR BIO-FERTILIZERS APPLICATION

1. Application of bio-fertilizers in agricultural fields of Iran is necessary due to arid land soil conditions. Excessive using of nitrogen fertilizers results in decreasing products quality as well as accumulation of toxic materials which are threats for humans and other organisms so using of bio-fertilizers is necessary for environmental protection.

2. Study on optimal conditions for bio-fertilizers application in agricultural fields is also necessary.

3. Programming for supporting of production and application of bio-fertilizers in country.

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