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Importance of Biofertilizers in Agriculture Biotechnology

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ABSTRACT

Over the past few decades, many farmers have been involved in improving wild plants and animals by selection and breeding of their desirable characteristics. It has been estimated that by 2050, food supply has to be increased by 70 per cent to fulfill the demand of overgrowing population. Therefore, there is an urgent need to adapt biological sciences applications in agriculture field. Biotechnology is an amalgamation of variety of disciplines- molecular biology, bioinformatics, biochemistry, genetics and microbiology. The usage of combinations of these disciplines in agricultural field leads to generation of biotech crops with increased yield and enhanced quality. Agriculture biotechnology not only upgrades the quality but also utilizes the resources and livestock for the well-being of animals and wild plants. Some of the application of agriculture biotechnology encompasses genetic engineering, plant and animal tissue culture technology, hybridization, bioprocess and fermentation technology, gene selection through mutagenesis and biosensors for biological monitoring. New information technologies such as electronic communication systems, data processing and automation are gaining tremendous attention in order to improve the quality and efficiency of the farm work. This study mainly focuses on the improvisation and development of new varieties of crop plants through biofertilizers included in agriculture biotechnology.

Keywords: Agriculture biotechnology, biotech crops, breeding.

INTRODUCTION

Biotechnology is the term which uses living organisms to improve plants, modify the product and develop organisms for further uses. Agriculture biotechnology is defined as that is used for livestock and crop improvement. Some of the following biotechnology tools which play vital role in agriculture biotechnology are-

- Genetic engineering and genetically modified crops
- Molecular breeding
- Conventional plant breeding
- Molecular diagnostic tools
- Tissue culture and micropropagation

Conventional breeding techniques include altering genetic makeup of plants and further selection of desirable traits in them. Plant breeders use to artificially mate the crops to improve their characteristics. In late 1920s, mutation breeding came into existence. Pure line development and hybrid seed technology are also some of the important conventional plant breeding techniques. Many efforts have been done to improve the nutritional quality of crops by selection method and conventional breeding but still the improvements led to undesirable agronomic traits. Current advancements have offered new opportunities to improve quality, yield and production economics of the crops. It has allowed exploring and developing new technologies to correct the deficiencies thus improving food crops nutritional value. Agriculture biotechnology includes micropropagation and tissue engineering, molecular breeding, genetic engineered crops and marker-assisted selection techniques [1]. Regeneration and multiplication of entire plant from one fragment is micropropagation. It is used for developing high quality, disease free plant materials. Cultivation of plant cells, organs and tissues on formulated nutrient media comes under plant tissue culture technique. Scientists

created genetic linkage maps which give the detailed information on the possible traits, unique identity and parentage of the plant. Molecular marker-assisted breeding interrogate important genes into many crops such as submergence tolerance in rice, bacterial blight resistant rice and increased β-carotene in cassava, banana etc. Alteration of genetic makeup of the crop using recombinant DNA technology can be coined in a term known as gene manipulation or gene technology.

BIOFERTILIZERS

There has been tremendous use of insecticides, fungicides and pesticides to increase the productivity but these products are responsible for depleting essential minerals from the soil thus affecting it in a negative way. This problem has leads to the production of biofertilizers which are the cultures of microorganisms packed in a carrier material. Biofertilizers contain live or latent cells of efficient strains of phosphate solubilizing, nitrogen fixing or cellulolytic microorganisms used for the application to seeds, soil or composting areas [2,3]. The objective behind using biofertilizers is to increase the number of such micro-organisms and accelerating those microbial processes which are helpful for the availability of nutrients that can be easily assimilated by plants. They play a very important role in improving soil fertility by fixing atmospheric nitrogen and also produce plant growth substances in the soil. They promote root growth by producing hormones and antimetabolites. They help in soil mineralization and decomposition of nutrients [4-6]. They are cost-effective and can be used as a supplement to chemical fertilizers. Microorganisms like bacteria, fungi and blue-green algae are used as biofertilizers and to increase their shelf-life they are packed in carrier materials like peat and lignite powder. In this regard, biofertilizers have paramount significance in sustaining agricultural productivity and healthy environment [3]. They can be characterized into various categories like:

- Nitrogen fixing biofertilizers
- Phosphate solubilizing biofertilizers
- Phosphate mobilizing biofertilizers
- Biofertilizers for micro-nutrients
- Plant Growth Promoting biofertilizers

ROLE OF DIFFERENT TYPES OF MICROBES

Rhizobium spp. is the nitrogen fixing bacteria formed in the roots of leguminous and some nonleguminous plants [7]. These are the gram positive soil bacteria which assimilate atmospheric nitrogen and fixes in the root nodule. They can comprise up to 10^{11} microbial cells per gram of root thus improving the plant productivity. Microbiome is the collective genome of rhizosphere microbial community which is larger than plants and whose interactions determine the crop health in natural agroecosystem thus providing numerous services to crop plants like nutrient acquisition, nutrient recycling, organic matter decomposition, weed and bio control. Research findings have proved that microbiome transfer therapy can play a significant role in managing plant diseases for different crops. Rhizosphere microbial communities have become a subject of great interest regarding sustainable agriculture. Cyanobacteria also known as blue green algae are photosynthetic, free living and prokaryotic organisms such as Nostoc, Anabaena, Plectonema etc. They produce nitrogenase and nitrogen fixation occurs in heterocysts which act as oxygen proof compartments. Preparation of cyanobacterial biofertilizers-

- Construction of open tanks made up of galvanized iron sheets or bricks and cement.
- Addition of sodium molybdate, super phosphate, sieved soil and water and allowed to stand for 24 h
- Cyanobacteria starter culture is sprinkled on the surface of water.
- Collection of thick serum of algal mass and allowed to dry.

Azotobacter are free living, non-symbiotic nitrogen fixing bacteria that can increase yield upto 50% and it also produces certain substances which are good for the growth of the plants. They produce antibodies, plant hormones, B-vitamins, gibberellic acid to kill root pathogens and improve seed germination. *Pseudomonas, Aspergillus, Bacillus*, etc are some of the phosphate solubilizing microorganisms. They provide phosphate which can be further utilized by the crops. They protect the plants by chelating the iron in the root zone. Mychorrhiza fungi enhances water uptake, increase resistance towards pests and pathogens and increase the survivability towards heavy metal toxicity and high temperatures [4].

National Project on Development and use of Biofertilizers (NPDB) is a central scheme implemented by government of India to attain the production targets. The amalgamation of smaller new units with larger units has led to the

introduction of variations in industries. Liquid fertilizers are also gaining attention nowadays. They are termed as special liquid formulation which contains microorganisms, their nutrients, cell protectants for longer shelf life. These biofertilizers are tolerant to high temperatures and UV radiations. They can be applied to the field by hand sprayers, fertigation tanks, power sprayers and as a mixture of basal manure and FYM.

Synthetic fertilizers usage has led to environmental pollution and soil contamination. They are quite expensive and also a threat to sustainable agriculture. In contrast to them biofertilizers are eco-friendly, economical productive, efficient and accessible to small farmers. Major research should be focused upon the production of sustainable and efficient biofertilizers. Further research is needed regarding-

- Establishing "Bio-fertilizer Act"
- Evaluation of bio-fertilizers based on agronomic, soil and economic concerns.
- Quality control systems to explore the benefits of plant micro-organisms symbiosis.
- Selection of multi-functional biofertilizers.

Despite tremendous improvement in biofertilizer technology over past few years, there are still, many constraints on the usage of biofertilizers- it may be either related to production or marketing strategies. Some precautions should also be taken under consideration while dealing with biofertilizers such as biofertilizers packets should be kept away from sunlight and heat, they should be crop specific and they should always be used with organic manures and chemical fertilizers.

CONCLUSION

Recent techniques include the encouragement to use pellets for direct soil application and methylcellulose for seed coating. There are various environmental factors responsible involved such as type of soil, inadequacy of organic matter, high temperature and soil water deficit. Plant growth and crop yield can be enhanced by mixing biofertilizers therefore; farmers should have knowledge about the benefits of synergistic effects of biofertilizers. Chemical fertilizers should be applied to the soil with the gap of 15-20 days for better nitrogen fixation. At district level, cold storage should be provided for timely availability of biofertilizers even after the expiry date. Biofertilizers will not only have a great impact on sustainable agriculture economic development but they will contribute the holistic well-being and sustainable ecosystem.

REFERENCES

[1] Vikas Kumar *New Academic Publishers*, New Delhi Editors **2016**.
[2] Paula García-Fraile, et al. *AIMS Bioengineering*, **2015**. 2(3): p. 183-205.
[3] Deepak Bhardwaj, et al. *Microbial Cell Factories* 2014. 13: p. 66.
[4] H. A. Rather, et al. *J Phyto*. **2010**, 2(10).
[5] Rakesh Kumar, et al. *Popular Kheti*. **2017**. 5(4).
[6] Boraste A, et al. *Int J Micro*. **2009**. 1(2): p. 23-31.
[7] Govind Gupta et al. *J Microb Biochem Technol* **2015**. 7(2): p. 96-102.