International Journal of Engineering Research-Online
A Peer Reviewed International Journal
Email:editorijoer@gmail.com http://www.ijoer.in ISSN: 2321-7758
Vol.4., S2., 2016

EPSDIC-2016

ISSN: 2321-7758

BIOFERTILIZERS –AN ECOFREINDLY APPROACH FOR SUSTAINABLE AGRICULTURE

N.PRAVEENA KUMARI[1], M.SANTOSH KUMARI[2,]
[1]Lecturer in Microbiology, [2]Lecturer in Botany
Email id: praveenasagar19@gmail.com[1] santoshkumarimsc@gmail.com[2]
Y.A. Govt Degree College, Chirala, Prakasam Dt

ABSTRACT

The most important constraint in good crop yield in developing nations worldwide, and especially among resource-poor farmers, is soil infertility. Current soil management strategies are mainly dependent on inorganic chemical-based fertilizers, which cause a serious threat to human health. Therefore, maintaining soil quality can reduce the problems of land degradation, decreasing soil fertility and rapidly declining production levels that occur in large parts of the world needing the basic principles of good farming practice. Minerals, organic components and microorganisms are three major solid components of the soil. They profoundly affect the physical, chemical, and biological properties and processes of terrestrial systems. Biofertilizertsare the products containing cells of different types of beneficial microorganisms. The eco-friendly approaches inspire a wide range of application of plant growth promoting rhizobacteria (PGPRs), endo-and ectomycorrhizal fungi, cyanobacteria and many other useful microscopic organisms led to improved nutrient uptake, plant growth and plant tolerance to biotic and abiotic stress. These potential biological fertilizers would play key role in productivity and sustainability of soil and also protect the environment as eco-friendly and cost effective inputs for the farmers. This paper discuss about how the biofertilisers effect the nutrition of plants and increase agricultural productivity in an ecofreindly way.

Keywords: biofertilizer, microorganism, potassium solubilizer, rhizobacteria (PGPRs), mycorrhiza, sustainable crop production

INTRODUCION

For optimum plant growth, nutrients must be available in sufficient and balanced quantities. The most important constraint limiting crop yield is soil infertility. Unless the fertility is restored in these areas, farmers will gain little benefit from the use of improved varieties and more productive cultural practices. Soil fertility can be restored effectively through adopting the concept of integrated soil fertility management (ISFM) encompassing a strategy for nutrient management-based on natural resource conservation, biological nitrogen fixation (BNF) and increased efficiency of the inputs . These potential biological fertilizers would play key role in productivity and sustainability of soil and they are cost effective, ecofriendly and renewable source of plant nutrients to supplement chemical fertilizers in sustainable agricultural system.

Biofertilizers when, applied to seed, plant surface or soil, colonize the rhizosphere or the interior of the plant and promotes growth by converting nutritionally important elements (nitrogen, phosphorus) from unavailable to available form through biological process such as nitrogen fixation and solubilization of rock phosphate. Beneficial microorganisms in biofertilizers accelerate and improve plant growth and protect plants from pests and diseases.

International Journal of Engineering Research-Online
A Peer Reviewed International Journal
Email:editorijoer@gmail.com http://www.ijoer.in ISSN: 2321-7758
Vol.4., S2., 2016

The term biofertilizer or called 'microbial inoculants' can be generally defined as a preparation containing live or latent cells of efficient strains of nitrogen fixing, phosphate solubilizing or cellulytic microorganisms used for application of seed, soil or composting areas with the objective of increasing the numbers of such microorganisms and accelerate certain microbial process to augment the extent of the availability of nutrients in a form which can assimilated by plant. In large sense, the term may be used to include all organic resources (manure) for plantgrowth which are rendered in an available form for plant absorption through microorganisms or plant associations or interact.

MAKING OF BIOFRTILISERS

There are several things need to be considered in biofertilizer making such as microbes' growth profile, types and optimum condition of organism, and formulation of inoculums. The formulation of inoculum, method of application and storage of the product are all critical to the success of a biological product. In general, there are 6 major steps in making biofertilizer. These includes choosing active organisms, isolation and selection of target microbes, selection of method and carrier material, selection of propagation method, prototype testing and large scale testing. The isolation of desired microorganism isolation is made to separate target microbes from their habitation and will be grown on Petri plate, shake flask and then glasshouse to select the best candidates. Selection of propagation method is mainly to find out the optimum condition of organism. After that, prototype made and tested. Lastly, biofertilizer is testing on large scale at different environments to analyze its effectiveness and limitability at different surroundings.

Biofertilizers are usually prepared as carrier based inoculants containing effective microorganisms. Incorporation of microorganisms in carrier materialenables easy-handling, long-term storage and high effectiveness of biofertilizers. Various types of material can be used as carrier or seed or soil inoculation. The properties of a good carrier material for seed inoculation are inexpensive and available in adequate amounts. It must non-toxic to inoculants bacterial strain and non-toxic to plant itself. Because it acts as carrier for seed inoculation, it shouldhave good moisture absorption capacity and good adhesion to seeds.

MICROORGANISMS USED AS BIOFERTILISERS

Organisms that are commonly used asbiofertilizers component are nitrogen fixers (N-fixer), potassium solubilizer (K-solubilizer) and phosphorussolubilizer (P- solubilizer), or with the combination of molds or fungi. Rhizobium has symbiotic interaction with legume roots, the phospho-microorganism mainly bacteria andfungi make insoluble phosphorus available to the plants. Several soil bacteria and a few species of fungi possess the ability to bring insoluble phosphate insoil into soluble forms by secreting organic acids. These acids lower the soil pH and bring about the dissolution of bound forms of phosphate. While Rhizobium, Blue Green Algae (BGA) and Azolla are crop specific, bio-inoculants like Azotobacter, Azospirillum,

Phosphorus Solubilizing Bacteria (PSB), Vesicular Arbuscular Mycorrhiza (VAM) could be regarded as broad spectrum biofertilizer. VAM is fungi that are found associated with majority of agriculture crops and enhanced accumulation of plant nutrients (Gupta, 2004). It has also been suggested thatVAM stimulate plant Examples of free living nitrogenfixing bacteria are obligate anaerobes (Clostridiumpasteurianum), obligate aerobes (Azotobacter), facultative anaerobes, photosynthetic bacteria (Rhodobacter), cyanobacteria and some methanogens. The example of Ksolubilizeris Bacillus mucilaginous while for P-solubilizer are Bacillus megaterium, Bacillus circulans,

NITROGEN

Nitrogen is one of the major important nutrients very essential for crop growth. Atmosphere contains about80 percent of nitrogen volume in Free State. The major part of the elemental nitrogen that finds its way into the soil is entirely due to its fixation by certain specialized group of microorganisms. Biological Nitrogen Fixation (BNF) is considered to be an important process which determines nitrogen balance in soil ecosystem. Nitrogen inputs through BNF support sustainable environmentally sound agricultural production. The value of nitrogen fixing legumes in improving and higher yield of legumes and other crops can be achieved by the application of biofertilizers. Nitrogen fixers are grouped into free-living bacteria (Azotobacter and Azospirillium) and the blue green algae and symbionts such as Rhizobium, Frankia and Azolla. The N2-fixing bacteria associated with nonlegumes includes Achromobacter, Alcaligenes, Arthrobacter, Acetobacter, Azomonas, Beijerinckia, Bacillus, Clostridium, Enterobacter, Erwinia, Derxia, Desulfovibrio, Corynebacterium, campylobacter, Herbaspirillum, Klebsiella, Lignobacter, Mycobacterium, Rhodospirillum, Rhodopseudomonas, Xanthobacter, Mycobacterium and Methylosinus .

Rhizobium inoculation is well known agronomic practice to ensure adequate nitrogen of legumes instead on-Fertilizers. In root nodules the O2 level is regulated by special hemoglobin called leg-hemoglobin. Thisgoblin protein is encoded by plant genes but the hemecofactor is made by the symbiotic bacteria. The plant root cells convert sugar to organic acids which they supply to the bacteroids. In exchange, the plant will receive amino-acids rather than free ammonia. Azolla biofertilizer is used for rice cultivation indifferent countries such as Vietnam, China, and Thailandand Philippines. Azobacter and Azospirillum can fix atmospheric nitrogen in cereal crops without any symbiosis while bluegreenalgae have been found to be very effective on the rice and banana plantation. Co-inoculation of some Pseudomonas and Bacillus strains along with effective Rhizobium spp. is shown to stimulate chickpea growth, nodulationand nitrogenfixation. Applicationof biofertilizer increased the number of leaves in believingand this could be due to properly colonized roots, increased mineral and water uptake from the soil and biological nitrogen fixation. It isalso due to the production theIAA, gibberellinsandcytokinins like substances produced by the bacterium

PHOSPOROUS

The fixed phosphorus in the soil can besolubilized by phosphate solubilizing bacteria (PSB), which have the capacity to convert inorganic unavailable phosphorus form to soluble forms HPO42- and H2PO4- through the process of organic acid production, chelationand ion exchange reactions and make them available toplants. Therefore, the use of PSB in agricultural practicewould not only offset the high cost of manufacturingphosphate fertilizers but would also mobilize insoluble inthe fertilizers and soils to which they are applied . Bacteria are more effective in phosphorus solubilization than fungi. Among the whole microbial population in soil, phosphate solubilizingbacteria (PSB) constitute 1 to 50%, while phosphorussolubilizing fungi (PSF) are only 0. 1 to 0. 5% in Psolubilization potential.

Among the soil bacterial communities, ectorhizospheric strains from Pseudomonas and Bacilli, andendosymbiotic rhizobia have been described as effectivephosphate solubilizers. Strains from bacterial genera Pseudomonas, Bacillus, Rhizobium solubilizers Bacillus megaterium, B. circulans, B. subtilis, B. polymyxa, B. sircalmous, Pseudomonas striata. Bacillussubtilis and Pseudomonas strata could be referred as the most important strains . A nematode fungus Arthrobotrysoligospora also has the ability to solubilize the phosphate. Population of PSBdepends on different soil properties (physical and chemical properties, organic matter, and P content and cultural activities. Some bacterial species have mineralization andsolubilization potential for organic and inorganicphosphorus, respectively . Inorganic P is solubilized by the action of organic andinorganic acids secreted by PSB in which hydroxyl and Carboxyl groups of acids chelate cations (Al, Fe, Ca) anddecrease the pH in basic soils. The pH of rhizosphere is lowered through biotical production of proton / bicarbonate release (anion /cation balance) and gaseous (O2/CO2) exchanges. Phosphorus solubilization ability

RHIZOBACTERIA

A group of rhizosphere bacteria (rhizobacteria)that exerts a beneficial effect on plant growth is referred toas plant growth promoting rhizobacteria or PGPR. PGPR Arthrobacter, Actinoplanes, Azotobacter, Bacillus, Pseudomonas. , Rhizobium, Bradyrhizobium, Erwinia, Enterobacter, Amorphosporangium, Cellulomonas, Flavobacterium, Streptomycesand Xanthomonas . PGPR increased recently as a result of thenumerous studies covering a wider range of plant speciesand because of the advances made in bacterial taxonomyand the progress in our understanding of the different mechanisms of action of PGPR Interactions, the competence to colonize planthabitats is important. . Steps of colonization include attraction, recognition, adherence, invasion (only endophytes and pathogens), colonization and growth, and severalstrategies to establish interactions . Plant roots initiate crosstalk with soil microbes by producing signals that are recognized by the microbes, Which in turn produce signals that initiate colonizationPGPR reach root surfaces by active motilityfacilitated by flagella and are guided by chemotacticresponses

CONCLUSION

Biofertilizer help in increasing crop productivity by way of increased BNF, increased availability or uptake of nutrients through solubilization or increased absorption stimulation of plant growth through hormonal action or antibiosis, or by decomposition of organic residues. Furthermore, biofertilizer as to replace part of the use of chemical fertilizers reduces amount and cost of chemical fertilizers and thus prevents the environment pollution from extensive application of chemical fertilizers. With using the biological and organic fertilizers low input system can be carried out, and it can be helped achievining Sustainability of crop production.

References:

1. Ahmed S. (1995) Agriculture — Fertilizer Interface in Asia Issues of Growth and sustainability, Oxford and IBH publishing Co, New Delhi.
2. Motsara M. R. , Bhattacharyya P. B. , Srivastava B. (1995) Biofertilizerstheir description and characteristics : A sourcebook-cum-Glossary, A Bhanot Corner, 1-2 Pamposh Enclave, New Delhi, 110048, India, pp. 9–18.
3. Zahir ZA, Arshad M, Frankenberger WT (2004) Plant growth promoting rhizobacteria: applications and perspectives in agriculture. Adv Agron 81:96–168
4. Altieri MA (1995) Agroecology: the science of sustainable agriculture. Westview Press, Boulder
5. Compant S, Clément C, Sessitsch A (2010) Plant growth-promoting bacteria in the rhizo- and endosphere of plants: their role, colonization, mechanisms involved and prospects for utilization. Soil Biol Biochem 42:669–678.