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Rhizobium Natural Biofertilizer for Leguminous Crops

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SUMMARY

Nitrogen is an essential nutrient for plant growth and development. Legumes play an important role in sustainable management of dry arid regions. Most legumes can provide enough nitrogen for their physiological needs. Intensive farming practices that accomplish high yields need chemical fertilizers, which are not only costly, effective and also create environmental problems. Each major legume crop is nodulated by different species of Rhizobium. It is a fast growing bacteria which is a rich source of nitrogen to the crop. Increasing and extending the role of biofertilizers such as Rhizobium would decrease the need for chemical fertilizers and reduce adverse environmental effects.

INTRODUCTION

Nitrogen is one of the essential elements required for the synthesis of amino acids which, in turn, are used by the plant to form protein. Leguminous plants are also able to utilize nitrogen derived from the symbiotic relationship they form with root nodule bacteria. Legumes play an important role in sustainable management of dry arid regions. Rhizobia are the gram negative bacteria which have been widely used in agricultural systems for enhancing the ability of legumes to fix atmospheric nitrogen. These inhabit the root nodules of most legumes which can provide enough nitrogen for their physiological needs. Each major legume crop is nodulated by different species of Rhizobium. Intensive farming practices that accomplish high yields need chemical fertilizers, which are not only costly but also create environmental problems. The extensive use of chemical fertilizers in agriculture is currently under debate due to environmental concern and fear for consumers' health. Consequently, there has recently been a growing level of interest in environment friendly sustainable agricultural practices and organic farming systems which include the use of biofertilizers as a substitute of chemical fertilizers[. Thus, in the development and implementation of sustainable agriculture techniques. Biofertilization is of major importance in decreasing environmental pollution and the conservation of nature .

Biofertilizer:-

Bio-fertilizers are commonly referred to products containing microbial cells directed for maintenance and efficient yield of crop, and increased nutrients uptake when mixed with soil. The bio-fertilizers are not only cost effective but also important for management system. The bio-fertilizer moves important nutrient between soil and various plants tissues. Thus, microbes plays important role in maintaining plants and soil health. Until now various microbes are studied for bio-fertilizer production. Some of the important microbes and bio-fertilizers are presented here: Rhizobium, azotobacter, azospirillum, phosphate solubilizing microorganisms and agricultural fertilizers.

Rhizobium:-

Rhizobium is a gram negative bacterium which inhabits the root nodules of most leguminous crops. Rhizobia are soil bacteria that fix N2 (diazotroph) after becoming established inside root nodules of legumes (Fabaceae). There are several different genera of rhizobia, all of them belong to the Rhizobiales, aprobably-monophyletic group of proteobacteria and they are soil bacteria characterized by their unique ability to infect root hairs of legumes and induce effective N2 –fixing nodules to form on the roots. They are rod shaped living plants which exist only in the vegetative stage. Unlike many other soil microorganisms, rhizobia produce no spores and they are aerobic and motile. Rhizobia (species of *Rhizobium*, *Mesorhizobium*, *Bradyrhizobium*, *Azorhizobium*, *Allorhizobium* and *Sinorhizobium*) for intimate symbiotic relationships with legumes by responding chemo tactically to flavonoid molecules released as signals by the legume host. These plants compounds induce the expression of nodulation (nod) genes in rhizobia, which in turn produce lipo chitooligio saccharide (LCO) signals that trigger mitotic cell division in roots, leading to nodule formation .The legume *Rhizobium* symbiosis is a typical example of mutualism. The *Rhizobia*, which are widely used in agricultural systems, are represented by 7 genera containing about 40 species. Although rhizobia naturally infect legumes as host plants, some *Rhizobium* strains can form symbiotic relationships with non-legumes species such as *Parasponia.*

The cross-inoculation groups include:

- Clover groups - R. trifolii infects and nodulates plants of genus Trifolium (clovers/trefoil)
- Alfalfa groups - R. meliloti infects and nodulates the roots of medicago, melilotus and medicago
- Bean group - R. phaseoli infects and nodulates plants of genus Phaseolus (e.g. beans)
- Lupine group - R. lupine nodulates lupines and serradella (Ornithopus)
- Pea group - R. leguminosarum infects and nodulates pea, sweet pea, lentil, and vetch
- Soybean group - R. japonicum nodulates Glycine such as soybean
- Cowpea group - Rhizobium sp. nodulates cowpea, pegionpea, lespedza, groundnut and kudz among a few others.

Biochemical attributes of Rhizobia

The bacteria Rhizobia are grow aerobically using various sugar types like pentose, and hexoses as a source of carbon. Similarly, they use nitrogen in the form of nitrates (NO3) or ammonia (NH3). However, molecular nitrogen (N2) is believed to be a causative in utilization by this specie and so their multiplication does not occur. However, Rhizobium in nodule undergoes transformation. Hence, adopted a larger, may appear in X and Y shaped and may possess the ability to reduce molecular nitrogen and that's why called as bacteroid (Blondeau, 1981). In order to get reasonable biomass of this bacterium, vitamins and some growth promoting factors are needed by different strains of Rhizobium. On morphological perspective, Rhizobia are rod shaped (2 µm) long and 0.5-1 µm wide, motile and gram negative in free living form. For isolation and characterization of Rhizobium in the soil is done through the host legume (Blondeau, 1981).

CONCLUSION

Information from the various literatures depicts that association between *Rhizobium* and legumes or some non-leguminous plants is a natural phenomenon. Progressive knowledge of this area may bring benefits for using this technology. Therefore, more research is needed on the interaction between crops and rhizobia or rhizobia-like bacteria.

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