FACULTY OF AGRICULTURE
VALUE ADDED ELECTIVE COURSE

VAAG-011: Microbial Inoculant Production Technology (3+0)

Objective

To study the basic principles and application methodologies of different microbial inoculants in order to improve the soil fertility and productivity.

Unit – I: Concepts of microbial inoculants

Biofertilizers – Definition - types, importance of biofertilizers in agriculture – *Rhizobium* - characters and classification – *Rhizobium* - legume symbiosis - nodule formation - Factors affecting nodulation and nitrogen fixation.

Unit-II: Nitrogen fixing biofertilizer

Characteristics and classification of *Azospirillum, Azotobacter*, *Gluconacetobacter*.- Actinorhizal plants (*Frankia*) and Algal biofertilizers - Blue green algae – Azolla.

Unit –III: Phosphate solubilizing/mobilizing biofertilizer

Problems of phosphorus uptake - fixation of phosphorus - microbial transformation of phosphorus- Phosphate solubilizing microorganisms, K, Zn and silicate solubilizing microorganisms – factors affecting phosphate solublization– AM fungi – characteristics and types of mycorrhizae - Plant Growth Promoting Rhizobacteria (PGPR) – *Pesudomonas.*

Unit –IV: Formulations of biofertilizer

Different formulations of biofertilizers – Types and characters - carrier – beads – pellets and liquid formulation – preservatives and additives-shelf life of different formulations- quality control of different formulations - BIS.

Unit-V: Production technology

Mass Production technology of bacterial biofertilizers, Azolla , Algal biofertilizers and AM fungi – problem and constrains in production- method of application **–** Marketing and monitoring field performance-Economics of microbial inoculants.

Theory Schedule

1. Microbial inoculants in Agriculture.
2. Biofertilizers-definition-Development of the concept-
3. Contribution and importance of microorganisms to soil fertility.
4. Different groups of biofertilizers-bacterial,
5. Different groups of algal
6. Different groups of fungal biofertilizers etc.
7. Nitrogen fixing microorganisms-Phosphate solubilising microorganisms etc.

8. Symbiotic nitrogen fixing bacteria-*Rhizobium* classification-Cross inoculation groups- characteristics.
9. Infection-root nodule formation-leghaemoglobin-nitrogen fixation.
10. Assay of nitrogen fixation-Nitrogen assimilation.
11. Transfer of fixed nitrogen in symbiotic systems.
12. Associative symbiosis-*Azospirillum*-species distribution-Characterization.
13. Importance of *Glucoacetobacter* and its distribution.
14. Non-symbiotic nitrogen fixation-*Azotobacter*- Characterization.
15. Actinorhizal association-*Frankia*-Importance-location, biochemistry and physiology of actinorhizal nodules.
16. Phosphate solublization by microorganisms-bacteria and fungi involved general characters and importance.
17. Algal biofertilizers - Blue green algae-distribution-occurrence.
18. Morphological variation-Characteristics.
19. Azolla-*Anabaena* symbiosis-Importance- Azolla growth behavior-multiplication- sporulation etc.
20. **Mid Semester Examination**
21. Mycorhhiza- types -Ectomycorrhiza –
22. Mycorhhiza- types -Endomycorrhiza.
23. Role of mycorrhiza in crop production.
24. Microbial inoculants for solublization of potassium sulphur and trace elemnts.
25. Carrier materials-Types and quality characteristics of an ideal carrier, preparation of inoculant packets.
26. Different formulations of inoculants- carrier, gel, liquid formulations etc.
27. Principles of mass production-Large scale production of bacterial biofertilizers-growth characteristics.
28. Fermentation-Principles and techniques-inoculum preparation.
29. Shelf life-quality control of biofertilizers-BIS specifications.
30. Field performance of biofertilizers.
31. Method of application –Economics.
32. Algal multiplication-large scale production-application methods
33. Azolla-Mass multiplication and method of application etc.
34. Mycorrhizae-VAM-Mass scale production-field performance-problems and prospects of biofertilizers.

References Books

1. S. Gianinazzi, Hannes Schüepp, J.M. Barea, K. Haselwandter.2012. Mycorrhizal Technology in Agriculture: From Genes to Bioproducts. Birkhäuser publisher
2. Umesh Chandra Mishra.2015. Facts for Liquid Biofertiliser. Partridge Publishing, Singapore. S.G.Borkar.2015. Microbes as Bio-

fertilizers and their Production Technology .Wood head publisher. New Delhi.
3. P.Hyma. 2017. Biofertilizers: Commercial production Technology and quality control. Random publishers. New Delhi.
4. Bhattacharyya..,P and Tandon HLS.2002.Dictionary of Biofertilizers and Organic Fertilizers. Fertilizer Development and Consultation Organization, New Delhi. 1 – 165.
5. Motsore, M. R., P. Bhattacharayya and Beena Srivastava, 2001. Biofertilizer Technology,Marketing and usage – A source Book – cum – glossary – FDCO, New Delhi, P. 584.

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1. https://www.ncbi.nlm.nih.gov/pmc
2. https://www.researchgate.net
3. https://www.sciencedirect.com/science/

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