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Department of Biomedical Engineering

Course Name: 19GET277 & BIOLOGY FOR ENGINEERS

IV Year : VII Semester

Unit I –HUMAN DISEASES

Topic : Biofertilizer

INTRODUCTION

- In the last century, chemical fertilizer were used in agriculture. FARMERS WERE HAPPY OF GETTING INCREASED YIELD IN AGRICULTURE IN THE BEGINNING.
- But slowly chemical fertilizers started displaying their ill-effects such as:-
- Leaching out
- Polluting water basins
- Destroying micro-organisms and friendly insects
- Making the crop more susceptible to the attack of disease
- Reducing the soil fertility and thus causing irreparable damage to the overall system.

BIOFERTILIZERS

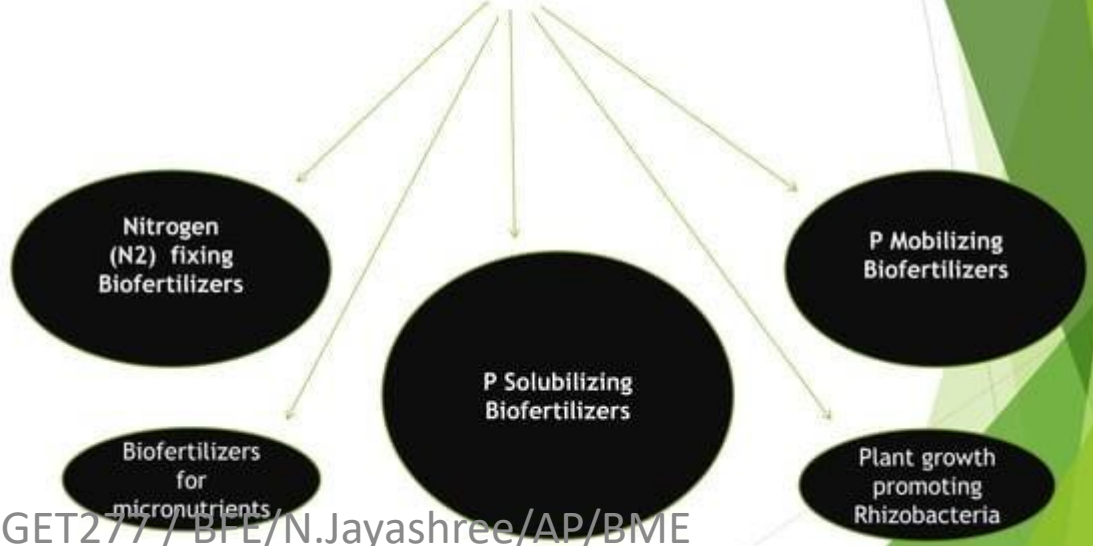
WHAT IS BIOFERTILIZERS?

Is a large population of a specific or a group of beneficial microorganisms for enhancing the productivity of soil.

Either by fixing atmospheric nitrogen or by solubilizing soil phosphorus or by stimulating plant growth through synthesis of growth promoting substance.

Bio fertilizer based on renewable energy sources are cost effective, eco friendly and can help to economize on the high investment needed for chemical fertilizer.

Types of biofertilizers



Nitrogen (N2) fixing Biofertilizers

1	Free-living	Azotobacter, Clostridium, Anabaena, Nostoc,
2	Symbiotic	Rhizobium, Frankia, Anabaena azollae
3	Associative Symbiotic	Azospirillum

P Solubilizing Biofertilizers

	1	Bacteria	Bacillus megaterium var. phosphaticum
			Bacillus circulans, Pseudomonas striata
	2	Fungi	Penicillium sp, Aspergillus awamori

P Mobilizing Biofertilizers

1	Arbuscular mycorrhiza	Glomus sp.,Gigaspora sp.,Acaulospora sp.,
		Scutellospora sp. & Sclerocystis sp.
2	Ectomycorrhiza	Laccaria sp., Pisolithus sp., Boletus sp., Amanita sp.

Biofertilizers for Micro nutrients

Silicate and zinc solubilizers	Bacillus

Plant growth promoting Rhizobacteria

Pseudomonas	Pseudomonas fluorenscens

BIOFERTILIZER ORGANISMS

NITROGEN FIXING BIOFERTIIZERS

SYMBIOTIC:-Rhizobium

This belongs to bacterial group and the classical example is symbiotic nitrogen fixation. The bacteria infect the legume root and form root nodules within which they reduce molecular nitrogen to ammonia which is reality utilized by the plant to produce valuable proteins, and other nitrogen containing compounds. The site of symbiosis is within the root nodules. It has been estimated that 40-250 kg N / ha / year

Table: Quantity of biological N fixed by Rhizobium in different crops

Host Group	Rhizobium Species	Crops	N fix kg/ha
Pea group	Rhizobium leguminosarum	Green pea, Lentil	62- 132
Soybean group	R.japonicum	Soybean	57- 105
Lupini Group	R. lupine orinthopus	Lupinus	70- 90
Alfafa grp.Group	R.meliliotMedicago Trigonella	Melilotus	100- 150
Beans group	R. phaseoli	Phaseoli	80- 110
Clover group	R. trifoli	Trifolium	130
Cowpea group	R. species	Moong, Redgram, Cowpea, Groundnut	57- 105
Cicer group	R. species	Bengal gram	75- 117

- NON SYMBIOTIC: AZOSPIRILLIUM

- Azosprillium -

It belong to family spirillaceae. The bacteria have been found to live within the root of sorghum bajara etc. They are chemoheterotrophic and association in nature secrete growth regulatory substance .The use of azosprillium inoculants help in the increasing the yield of millets. It significantly increase the growth , chlorophyll content and mycorrhyzal infection in roots.

CONTRIBUTION:

Result in increase mineral and water uptake , root development, vegetative growth and crop yield.

RECOMMENDED FOR:

Rice, millets, maize, wheat, sorghum, sugarcane and co-inoculants for legumes.

RESPONSE:

Average increase in yield 15-30%

AZOTOBACTER

- It belongs to azotobacteraceae . It produce growth promoting substance which improve seed germination and growth of extended root system. It produces polysaccharides which improve soil aggregation. Azotobacter suppresses the growth of saprophytic and pathogenic. Micro organism near the root system of crop plants.
- CONTRIBUTION:
- Production of growth promoting substance like vitamins of B groups, indoleacetic acid and gibberllin acid.
- Biological control of plant disease by suppressing Aspergillus, Fusarium.
- Recommened for:
- Rice, wheat, millets, other cereals, cotton, vegetable, sunflower, mustard flower
- **INCREASE IN YIELD: 20 to 30%**

Azolla -

Azolla is a free floating water fern that floats in water and **fixes atmospheric nitrogen** in association with nitrogen fixing blue green alga Anabaenaazollae. Azolla founds consist of sporophyte with a floating rhizome and small overlapping bi-lobed leaves and roots. Azolla is considered to be a potential biofertilizer in terms of **nitrogen contribution to rice**.

Long before its cultivation as a green manure, Azolla has been used as a fodder for domesticated animals such as pigs and ducks. In recent days, Azolla is very much used as a sustainable feed substitute for livestock especially dairy cattle, poultry, piggery and fish

Phosphate solubilizing microorganisms (PSM)

AM fungi-

An arbuscular mycorrhiza (AM Fungi) is a type of mycorrhiza in which the fungus penetrates the cortical cells of the roots of a vascular plant.

Silicate solubilizing bacteria

- Micro organism are capable of degrading silicate and aluminum silicates. During the metabolism of microbes several organic acids are produced and these have a dual role in silicate weathering.

Plant Growth Promoting Rhizobacteria

- The group of bacteria that colonize roots or rhizosphere soil and beneficial to crop are referred to as plant growth promoting rhizobacteria(PGPR)

Applications of biofertilizers to crop

There are four types of methods for application of bio-fertilizers:

Seed treatment

Set treatment

Seedling treatment

Soil treatment

SEED TREATMENT:

- For inculation of cereals like rice , wheat , sorghum , maize etc. One packet (200g) is sufficient to treat 10-12 kg seed. On the basis the dose of biofertlizer per acre can be worked out , based on the seed rate.
- METHOD

SET TREATMENT:

This method is recommended generally for treating the sets of sugarcane , cut pieces of potato and banana suckers

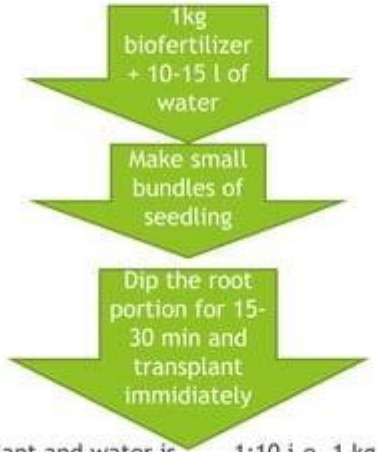
- Method

- NOTE: For set treatment , the ratio of biofertilizer to water in approximately 1:50.

SEEDLING TREATMENT

This method is recommended for crops like tobacco , tomato , chilly , onion etc

- Method



- Note :- the ratio of inoculant and water is 1:10 i.e. 1 kg , biofertilizer in 10 l of water.

SOIL APPLICATION:-

- This method vary crop to crop depending on it's duration. Generally , for a short duration (less than 6 month) crop, 10-15 packets (each of 200g) are mixed with 40-60 kg of well decomposed cattle manure , or 40-60 of soil for 1 acer land. The mixture of biofertilizer and cattle manure/ soil sprinkle with water is then broadcasted into soil at the time of sowing or at the time of irrigation in standing crop
- For long duration crop (perennial crop) 20-30 packet of biofertilizer (each containing 200g) are mixed with 80- 120 kg .cattle manure or soil per acer

Summary of methods

S.no.soil	CROPS	METHOD OF APPLICATION	DOSE/PACKETS/ACRE	WATER	RATIO BF WATER
1	All crops sown through seeds	SEED APPLICATION	200	400 ml	1:2
2	Sets of sugarcane, banana etc	SET APPLICATION	1-2 KG	50 or 100l	1:50
3	Rice, tomato chilly, cabbageetc	SEEDLING METHOD	1KG	10L	1:10
4	All crops	SOIL APPLICATION	2KG	FOR WETTING	***

BENEFITS FROM USING BIO FERTILIZERS

- Increase crop yields by 20-30%.
- Replace chemical nitrogen and phosphorus by 25%
- Stimulate plant growth.
- Activate the soil biologically.
- Restore natural soil fertility

Cost effective.
Supplements to fertilizers.
Eco-friendly.
Reduces the costs towards fertilizers use, especially regarding nitrogen and phosphorus.

REFERENCE:-

- WWW.krishisewa.com
- Soil Microbiology : N.S.Subba Rao

Thank you