AgriCos e-Newsletter
ISSN: 2582-7049
AgriCos e-Newsletter
Open Access Multidisciplinary Monthly Online Magazine
Volume: 03 Issue: 09 September 2022 Article No: 12

Role of Biofertilizers in Vegetable Crops

Neha M Arolkar[1], Amol K Jadhav[2] and S. J. Syed[3]
[1]Ph.D. Scholar, Division of Vegetable Science, VNMKV, Parbhani, (M.S.)
[2]Ph.D. Scholar, Division of FHT, ICAR- IARI, New Delhi
[3]SRA, Department of Horticulture, VNMKV, Parbhani, (M.S.)

SUMMARY

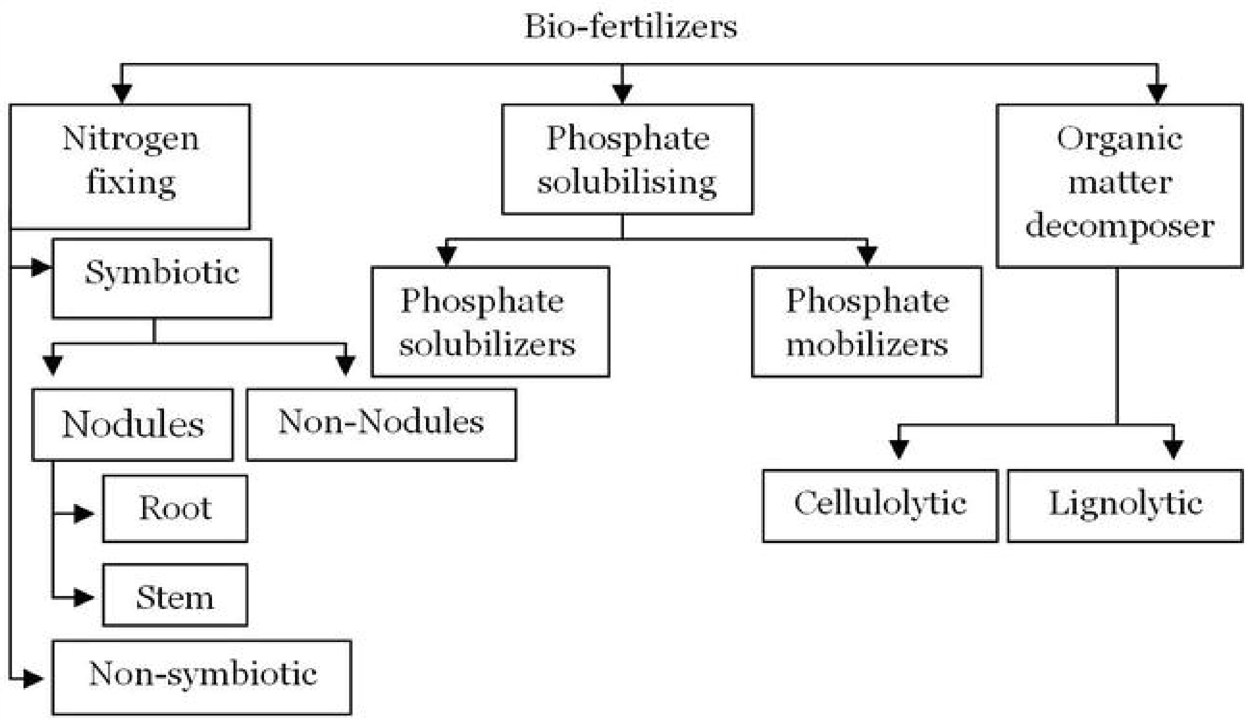
Vegetables are most important component of a balanced diet and act as a protective food. India occupies a prime position in the world in vegetable production and 2nd largest producer of vegetable next to China. India produces about 7.9 million tons of vegetables from an area 4.6million hectares, and productivity 17t/h (Anonymous, 2018) which are far below to the desired requirement (300g/capita/day) to fulfil the need of the growing population (Sachdeva et al., 2013). Farmers are continuously using inorganic fertilizers to increase their productivity but the environment and the soil health is continuously depleting which will ultimately affects the vegetable production in coming years. Also, the cost of inorganic fertilizers has been enormously increased. It has become impractical to apply such costly inputs to the crop of marginal returns. So, use of biofertilizers in vegetable production is a sustainable and eco-friendly approach to minimize the use of chemical fertilizers, Improve soil fertility status and for enhancement of crop production by their biological activity in the rhizosphere. The biofertilizers are microbial preparations that contain live cells from various microorganisms and have the capacity to biologically mobilise inert plant nutrients in soil into useable form. Among the biofertilizers, Phosphate Solubilizing Bacteria contributes about 55%, Azotobacter 30%, Rhizobium 9% and Azospirillium 6%.

INTRODUCTION

Fertilizer prices are increasing day by day so becoming unaffordable by small and marginal farmers, also depleting soil fertility due to widening gap between nutrient removal and supplies, growing concern about environmental hazards and increasing threat to sustainable agriculture. Besides above facts, the long-term use of biofertilizers is economical, sustainable eco-friendly, more efficient, productive and accessible to marginal and small farmers over chemical fertilizers (Subba Roa, 2001).

Biofertilizers (Microbial inoculants)

A biofertilizer is a substance that contains living microorganisms, which, when applied to seed, soil, colonizes the rhizosphere or the interior of the plant and promotes growth by increasing the supply of primary nutrients to the host plant.



Types of Biofertilizers

Biological N fixing bacteria

Biologically N fixing microorganisms helps in reduction of atmospheric nitrogen N2 in NH3. Biological nitrogen fixation is one way of converting elemental nitrogen into plant usable form (Gothwal *et.al*., 2007)**.** The N fixing organisms such as *Rhizobium* spp. which live in symbiotic association with roots of leguminous vegetables, forming nodules and free-living fixers *Azotobacter* spp. and *Azospirillum spp*. which live in association with root system of plants.

Rhizobium and *Bradirhizobium*

They symbiotically fix N with leguminous plants increasing the amount of available N for uptake for plant. An increase in yield about 10 to 20 % has been observed in pulses treated with *Rhizobium.* The Rhizobium legume association can fix up to 100-300 kg N/ha in one crop season and in certain situation can leave behind substantial nitrogen for following crops (Dahama,1997).

Azola

Azola symboiotically can fix 30-100 kg N/ha and increase yield up to 10 to 25% and also survive at high temperature in flooded field.

Azotobacter.

The genus *Azotobacter* includes 6 species, with *A. chroococcum* most commonly used in soils all over the world (Mahato *et al.*,1997)*. Azotobacter* is a free-living aerobic bacterium can fix 10-25 kg N/ha/season. 50 % of N requirement of crop can be reduced through Azotobacter inoculation along with FYM. *A. choococcum* is a dominant species in arable soils.

Azosprillum

Azospirillum is growth promoting Rhizobacteria (PGPR) capable of colonizing the root and stimulating root growth thus enhancing mineral and water uptake plants (Puente *et.al.,* 2009). *Azosprillum* inoculation helps in fixing nitrogen from 15 to 40 kg/ha. Azospirillum does well in soils with organic matter and moisture content, and requires a pH level of above 6.0.

Acetobacter

Endophytic N_2 fixer mainly used in sugar rich crops like sugarcane, sugarbeet, sweet sorghum and sweet maize. Save 40-50 % nitrogen in sugarcane crop.

Blue-green algae

Blue-green algae or cyanobacteria are free-living nitrogen- fixing photosynthetic algae that are found in wet and marshy conditions. They are easily prepared on the farm but can be used only for rice cultivation when the field is flooded and do not survive in acidic soils.

Mycorrhiza

Mycorrhiza is a sweeping term for a number of species of fungi which form a symbiotic association with the plant root system. Out of these, the most important in agriculture is vesicular- arbuscular mycorrhiza or VAM. VAM strands acts as root extensions and bring up water and nutrients from lateral and vertical distances where the plant root system does not reach.

Phosphate solubilizing and mobilizing micro-organisms

Researchers in the few decades established that PSB Treatment could improve plant growth through increased uptake of phosphorus, especially in the soils of low fertility. Arbuscular mycorrhizal fungi (AMF) are also responsible for converting fixed Phosphorus into available phosphorus through inoculation of efficient strain of AMF, 25 to 50% of P fertilizer can be saved.

Potash solubilizing micro-organisms

As reported by previous researchers, inoculation with KSB also exerted beneficial effects on growth of eggplant, pepper and cucumber (Han and Lee, 2005). Inoculation of seeds and seedlings of different plants with KSB generally showed significant enhancement of germination percentage, seedling vigor, plant growth, yield, and K uptake by plants under greenhouse and field conditions. Inoculation with KSB also exerted beneficial effects on growth of eggplant, pepper, cucumber, Okra, Brinjal and potato.

Sulphur mobilizing micro-organisms

Present in soluble sulphur form at 30-35 cm deep in soil and are associated with oxides of iron and aluminium. *Acetobacter pasteurianus* helps in converting this non- usable form. The use of 625 g/ha of A. *pasteurianus* influenced the levels of sulphur in crops like vegetables, cabbage, turnip and onion, etc.

Arbuscular mycorrhizal fungi (AMF)

AMF improve growth through better uptake of nutrients like P, Zn, Cu etc. and make the plant root more resistant to pathogens, improve soil texture, WHC, disease resistant to pathogens, improve soil texture, disease resistance and better plant growth. AMF saves 25-50 kg P/ha in addition increase the yield up to 10-12%.

Growth promoting substance erecting microorganisms.

The specific strain of plant growth promoting *rhizobacteria* (PGPR) could colonize roots of crops like potato, beet root, apple and legumes.They enhance plant growth indirectly by depriving the harmful microorganisms. PGPR belongs to many genera including *Agrobacterium, Arthrobacter, Azotobacter, bacillus, Pseudomonas, Cellublomonas, Rhizobium* etc.

Advantages and Disadvantages of use of biofertilizers

Advantages

- Germination increases up to 20 percent, improved seedling emergence and growth.
- Improve the quality of produce and their shelf life.
- Saving up to 25 to 35 percent inorganic fertilizers.
- Increase the availability and up take of N and P in plants.
- Improve the status of soil fertility maintain good soil health.
- It is safe to handle and easy to apply.
- Leaves no harmful residues in plants or soil.
- Suppress harmful and pathogenic soil micro-organism.
- They are compatible with organic manures, inorganic fertilizers and agro-chemicals.
- They are non- polluting and eco-friendly.
- Biofertilizers may also produce growth promoting substances.

Disadvantages

- Biofertilizers require special care for long-term storage because they are alive.
- They must be used before their expiration date.
- If growers use the wrong strain, they are not as effective.
- The soil must contain adequate nutrients for biofertilizer organisms to thrive and work.
- Biofertilizers complement other fertilizers, but they cannot totally replace them.
- Biofertilizers lose their effectiveness if the soil is too hot or dry.

Application Methods of Biofertilizers

Seed Treatment

- The seed treatment can be done with any of two or more bacteria. There is no side (antagonistic) effect.
- The important things that have to be kept in mind are that the seeds must be coated first with *Rhizobium*, *Azotobacter* or *Azospirillum*.
- Suspend 250 gm N biofertilizer and 250 gms Phosphotika in 300-400 ml of water and mix thoroughly. Mix this paste with 10kg seeds & dry in shade. Sow immediately.

Seedling Root Dip

- For vegetables 1 kg each of two biofertilizers be mixed in sufficient quantity of water.

- Mix biofertilizers in water and dip the roots of seedlings suspension for 30-40 min before transplanting.

Soil Treatment

- Mix 4 kg each of biofertilizers in 200 kg of compost and leave it overnight.
- Apply this mixture in the soil at the time of sowing or planting.
- In plantation crops apply this mixture near root zone and cover with soil.

REFERENCES

Anonymous, Department of Horticulture, Haryana, 2018. http://hortharyana.gov.in/en.

Dahama A K. Organic Farming for Sustainable Agriculture, Ashila Offset Printers, Daruagung, New Delhi, India, 1997.

Gothwal R K, Nigam V K, Mohan M K, Sasmal D, Ghosh P. Screening of nitrogen fixers from rhizospheric bacterial isolates associated with important desert plants. *Applied Ecology and Environmental Research*, 2007; 6(2):101-109.

Han H S and Lee K D. Phosphate and Potassium Solubilizing Bacteria Effect on Mineral Uptake, Soil Availability and Growth of Eggplant. *Research Journal of Agriculture and Biological Sciences*, 2005; 1(2):176-180.

Mahato P, Badoni A, Chauhan J S. Effect of Azotobacter and Nitrogen on Seed Germination and Early Seedling Growth in Tomato. *Researcher*, 2009; 1(4):62-66

Puente M L, García J E and Alejandro P. Effect of the bacterial concentration of Azospirillum brasilense in the inoculum and its plant growth regulator compounds on crop yield of corn (*Zea mays* L.) in the field. *World Journal of Agricultural Sciences*, 2009; 5(5):604-608.

Sachdeva S, Sachdeva TR, Sachdeva R. Increasing fruit and vegetable consumption: challenges and opportunities. *Indian Journal Community Medicine*, 2013; 38(4):192- 197.

Subba Roa N. S. An appraisal of biofertilizers in India. The biotechnology of biofertilizers, (ed.) S. Kannaiyan, Narosa Pub. House, New, 2001.