



A REVIEW ON ROLE OF BIO-FERTILIZERS IN FRUIT CROPS

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Abstract

Bio-fertilizers are one in every of the most successful current tool of agriculture. Thus, it is present of the science of modern agriculture. Conventionally the fertilizers contain compost, house holding wastes and manures. Bio-fertilizers significantly contain different types of micro-organisms which are responsible for proper supply of required nutrients to the plant. Living micro-organisms are employed in the development of Organic/bio fertilizers. Such type of micro-organisms are used which have different functions to increase plant growth & reproduction rate. Thus it is observed that, Bio-fertilizer are essential elements of Organic farming which have important role in the management of soil fertility and status. Application of Bio fertilizers in agricultural field could be substitute to inorganic/chemical fertilizers which have different harmful effects. Bio fertilizers are friendly to the environment & play vital role in the production of the fruit crops. Thus by the use of biofertilizer is increasing day by day because of increase within the worth of Inorganic/chemical fertilizers and the useful result on health of the soil & improve production of the crops.

Keywords: Bio-fertilizers, Micro-organisms, Soil fertility, Inorganic fertilizers.

Introduction

Bio-logical fertilizers accommodate type of different micro-organisms, They have the capacity to mobilize the soil nutrients through bio-logical process. Bio-fertilizers are not harmful to the environment & play particular role in crop production of fruit crops. Bio-fertilizers are able to fix 50-200kg nitrogen (N)/hectare/year, solubilizing phosphorus (P) 20-60 killogram (P₂O₅)ha/year & also mobilize P, Zn, and Fe & Mo to disparate proportions. Bio-fertilizers are significantly utilize in the formulation of advantageous micro-organisms which are applicable to the roots, seeds & soil & also mobilize the feasibility of the nutrients especially by their bio-logical activity & useful to accumulate the lost micro-flora. On the other side, improve the health of soil in general. Different Bio-fertilizers like Azospirillum, Azotobacter, & Blue green algae (BGA), Rhizobium have been in practice a long time. Thus, these are extremely beneficial in enriching fertility of the soil & carry out plant nutrients requirements by providing organic nutrients via micro-organisms & their own byproducts. Now, Bio-fertilizers are obtaining momentum due to the wide benefits like maintaining health of soil & beneficial to environmental by using of the biological fertilizers in fruit crops. Higher yield of crop greatly depends upon the types of fertilizers used to increase plant nutrients for growth & development. For proper growth of plants, Nutrients are required in optimal and balanced composition, From soil only a slight portion of nutrients are delivered through bio-logical & chemical processes. Thus, aim of bio-fertilizers use is to addition of nutrients already present in the soil. On the other side, bio-fertilizers have various other advantages eg; control of soil-borne diseases, soil health improvement, properties of soil improvement & revealed maximum yield rates. Now, different varieties of commercial bio-fertilizer formulations are available, and disparate strategies have been approve to make sure maximum viability of micro-organisms utilize in such formulations. Bio-logical fertilizers thus include the following:

Different types of biological fertilizers

A) Nitrogen fixing bio-fertilizer

- i) Azospirillum.(Associative symbiotic)
- ii) Rhizobium, Anabaena azollae, Frankia (Symbiotic)
- iii) Azotobacter, Nostoc, Klebsiella, Clostridium, Anabaena, Beijerinckia (Free-living)

B) Phosphorus mobilizing bio-fertilizer (PMB)

- i) Rhizoctonia solani (*Orchid mycorrhiza*)
- ii) *Amanita* sp., *Boletus* sp., *Pisolithus* sp., *Laccaria* sp. (*Ectomycorrhiza*)
- iii) *Scutellospora* sp., *Gigaspora* sp., *Glomus* sp., *Acaulospora* sp. (*Arbuscular mycorrhiza*)
- iv) *Pezizella*ae. (*Ericoid mycorrhizae*)

C) Phosphorus solubilizing bio-fertilizer (PSB)

- i) *Pseudomonas striata*, *Bacillus megaterium* var. *phosphaticum*, *B. circulans*, *B. subtilis* (Bacteria)
- ii) *Aspergillus awamori*, *Penicillium* sp. (Fungi)

D) Plant growth promoting bio-fertilizer (PGPB)

- i) *Pseudomonas fluorescens* (*Pseudomonas*)

E) Bio-fertilizers for Micronutrients

- i) Silicate and Zinc solubilizers (*Bacillus* sp.)

Effect of Bio-fertilizers on growth, quality & yield parameter of several fruit crops

Mosa *et al.* (2018) Effect of bio-fertilizers for improving the yield, vegetative growth & quality of fruit of apple plant. The results shows that photosynthesis rate was improve by the application of some kind of bacteria like; Fertigo, Micosats, Humus & Humus Active + Aktywit pm as related to N, P & K. Thickness of the trunk was enhanced with application of Vinassa & Florovit Natura and Florovit Eko. which are richer in bacteria. By applying of bacterial strains we can increase the effect of Fertigo Manure, Humus and Humus Active+Aktywit pm, bio-feed Amin & Yeast etc.

to increase the no. and weight of the fruit of apple as compared to N, P, & K. Sourabh *et al.* (2018) Influence of organic growth amendments & Bio-fertilizers on yield & growth of guava during season of rain. The results revealed that by application of Vermicompost and FYM with the good composition of Bio-fertilizers at three levels Recommended Dose Of Fertilizers(RDF). i.e. 50%, 75% and 100% & Azotobacter + PSB inoculate with 100% Recommended Dose Of Fertilizers(RDF). + Vermicompost resulting with increase in plant height, maximum flowers per branch, fruit setting, total number of fruits, increase weight of the fruit & yield, On the other hand, Average plant spread was not much affected. By applying treatment fruit drop also reduced. Maskar *et al.* (2018) Influence of biofertilizers along with the Inorganic/chemical Fertilizers on quality, growth and yield of Sapota plant. (Manilkara achras (Mill.) Forseberg). (cv. Kalipatti). In this experiment the results shows that the treatment of N1B3 along with application of require composition of chemical fertilizers (100% N,P,&K) also combined with the Azospirillum (200gm) and Phosphate Solubilizing Bacteria (200gm) results good in growth and yield. Which results by the treatment with (75% N, P, & K.) chemical fertilizers along with the Azospirillum (200 gm) & Phosphate Solubilizing Bacteria (200gm) with the higher eco-nomical returns.

Kundu *et al.* (2011) Effect of the Bio-fertilizers & the Inorganic fertilizers on yield and growth in pruned Mango orchards. By combined the Inorganic fertilizers & Bio-fertilizers exhibited significantly effect on the growth & yield of the plant also on fruit quality apart from Inorganic fertilizers alone. On the other hand, the effectiveness of inorganic fertilizers at their level was higher when combined with Azotobacter & Vascular Arbuscular Mycorrhizal (VAM). More production was attained when trees were treated with N, P, & K (100%) + Azotobacter + Vascular Arbuscular Mycorrhizal (98.1 kg/plant) / 75% N, P, & K + Azotobacter + Vascular Arbuscular Mycorrhizal (93.54 kg/p) as related to less yield (60 Kg/p) along with N,P,&K (100%). It was also concluded that the treatments of N,P,&K (100%) + Azotobacter + Vascular Arbuscular Mycorrhizal & N, P, & K(75%) + Azotobacter + Vascular Arbuscular Mycorrhizal were advantageous & improve vegetative growth & production of fruits. Baraily *et al.* (2018) Influence of Integrated Nutrients Management on yield & growth of the pineapple. The result shows that the Growth & yield characteristics are consequently affected by disparate level of organic & inorganic treatment composition. Relating to disparate plant growth parameters such as height of plant, total number of leaves, D-leaf initiation day, D-leaf lengths, D-leaf widths & plant girth found advantageous with the application of T9 (7.5tonnes/hectare) vermicompost + 75% RDF of N, P, & K + bio-fertilizers). With all the treatments obtains (7.5t/ha) vermicompost, 75% RDF of N, P, & K and bio-fertilizers reported the more flowering and higher fruiting & maximum yield together with higher nutrients uptake.

Khalil *et al.* (2017) Effect of organic, inorganic/chemical & biological fertilizers on growth & yield of Strawberry. Results shows the advantage of treatments involving minerals, organic & biological fertilizer, in the leaf content of N, P, & K related to other treatments, Thus this composition of fertilizers increased leaf area (529.6) Cm². No. of Leafs (28.56), No. of fruits (33.7), & total productivity of the plants [367.24g]. Concentrations of

Anthocyanin was increased in the fruit (52.67 mg)/100 gm. Fresh weight, along with increase in ratio of the total soluble solids to Acidity, pH was 1.35. Mamta *et al.* (2017) Influence of integrated nutrients management on the growth, yield & nutrients uptake in papaya. The result shows that the highest plant growth was obtained when dual inoculation with the Azoto 3 + Pseudomonas straita as related to uninoculate treatments & control. Double inoculation with the Azoto 3 + Pseudomonas straita + 75 % (N, P) + 100 % (K) treatments produced the Maximum shoots dry biomass of 3.53 gm/seedling against 2.92gm and 2.67gm/seedling at RDF (100%) and control. N uptake by papaya plants increased from 25.62mg at control to 43.7mg per seedling. 32.2% increased in shoot dry bio-mass accumulation over control was found in papaya seedlings receiving Azoto 3+ + Pseudomonas straita + 75% (N,P) + 100% (K) at 120 DAT. Inoculate treatments with Azoto 3 & Pseudomonas straita along with 75 % (N,P) and 100% (K) considered most efficient & may be adopted to applicable to increase vegetative growth of seedling of papaya. Jugnake *et al.* (2017) Influence of bio-fertilizers & chemical fertilizers on the growth & yield of the sweet orange. [Citrus sinensis L. Osbeck]. Results revealed that out with 7 treatments having different composition of bio-fertilizers & chemical fertilizer (i.e. Pseudomonas straita, Azotobacter, 800:400:400gm N, P, & K & 50kg Farm Yard Manure) in RBD with 3 replications. The increase in the tree height (0.47metere), stem girth (4.16 centimeter), tree spreading (E-W 0.37metere & N-S 0.50 meters) was observed in the treatment of Recommend Dose Of Fertilizers (800gm:400gm:400gm N, P, & K+ 50kg Farm Yard Manure) + 80ml of Azotobacter + 80ml PSB. The increase in the plant volume (10.36m³) was reported in the treatment of Recommended Dose of the Fertilizers [RDF] (800gm: 400gm: 400gm N, P & K + 50kg Farm Yard Manure) + 80ml PSB. The highest increase in the no. of fruit [403.8], average yield (107.3kg) & good yield of fruits (105.46kg) was observed in the treatment of Recommended Dose Of the Fertilizers (800gm:400gm:400gm N, P & K + Farm Yard Manure) + 80ml of Azotobacter + 80ml of PSB.

Krishan *et al.* (2017) Influence of variety & biofertilizers on yield and growth of pineapple (*Ananas comosus*). The results revealed that there was an increase in no. of leafs from four MAP to sixteen MAP after that there was a decline of leafs no. at twenty MAP. Kew was advantageous in respect of the fruit yield & plant growth. Increase in leafs area, Leaf Area Index & Leaf Size Index were recorded in subsequent growth of the pineapple plant. Biofertilizers with the composition of biomix-1 + biomix-5 shows maximum leaf area leaf size index and leafs area index in pineapple plant. Significantly, the hihger fruit yield was observed due to the application of biomix-1 + biomix-5 in Kew the variety i.e. V1B1 (31 t/ha) & the lowest yield was by applying of biomix-5 in the Mauritius variety i.e. V3B3 (14.4 t/ha).Santana *et al.* (2016) Quality & fruit production of guava as the function of nitrogen fertigation & bio-fertilizers in semiarid region of brazil. This experiment was design in the blocks which are randomized with treatments distribution in factorial arrangements {5 x 2} referring to bio-fertilizers concentrations [0, 2.5, 5.0, 7.5 & 10%] & the mineral fertilization with Nitrogen (fertilization with 50 percent & 100 percent of recommended Nitrogen), with 4 replications of 5 plants each. Thus the quality of fruit & guava production depend on bovine bio-fertilizers & Nitrogen fertilization. Possibly recommend fertigation with the bio-fertilizers at

5.6%, independently of Nitrogen fertilization with 50% & 100% recommended dose of Nitrogen. Bovine bio-fertilizer is important to the productivity of guava under semiarid climate. Hazarika *et al.* (2015) Effect of biological fertilizer & bio regulators on yield, growth & quality of strawberry plant. (*Fragaria × ananassa*). Quality characters of fruit like TSS & ascorbic acid, titrable acidity, total sugar and total reducing sugar were also affected by combined use of inorganic, organic & bio-logical source of nutrient. Efficient to highly efficient positive co-relation was recorded among different yield and growth allocating characters with yield. Kumar *et al.* (2015) Influence of Bio-fertilizers & Organic manure on the quality & Yield Parameters of Strawberry plant. Every treatment composition has its disparate effects on most of the fruit parameters, however the composition of PSB & vermicompost revealed maximum height of plants [23.59 cm], leaves/plant [12.76], primary branches/plant [10.50], secondary branches /plant [26.3] and first flowering [61 days], flowers/ plant [15.31], 1st fruit set [72.8 days] & fruit /plant [8.31]. Alike, every treatments composition of PSB & vermicompost effects the total soluble solids [TSS], [10.7° B], titrable acidity [0.82] and vitamin C [57.2 mg/100gm fruit], total sugar [5.9 %] & content of juice [80 %].

Kumar *et al.* (2013) Influence of Bio-fertilizers on yield, growth & fruit quality in the low-chilling pear. (*cv gola*). The results revealed that the application of *Azotobacter* at the rate 30 gm incorporated was most significantly effective for improving tree's vegetative growth, yield & fruit's physical quality. Fruit's chemical composition is improved by the treatment of 90 gm Vascular Arbuscular Mycorrhizae incorporated. Treatment of 62-65 gm *Azotobacter* improve the P content in leaf more effectively. Omotoso *et al.* (2013) Influence of N fertilizer on yield, growth & quality of fruit parameters in pineapple plant. [*Ananas comosus* L. Merr.] Results revealed that Nitrogen fertilizer application up to 200kilogram Nitrogen /ha. The maximum yield of 23 t /ha., Average fruit weight of 1.63gm/ plant, were recorded at 150kilogram Nitrogen/ha, & beyond which there was decline. Yield of fruit components (length of fruit, diameter of fruit & core diameter) increased, but quality of fruits (Total soluble solid, acidity % & Vitamin C) decreased with increasing rate of Nitrogen application. Application of 150kilogram Nitrogen/ha, is required for higher fruit yield & quality parameters.

Influence of bio-fertilizers to control different diseases & disorders in various fruit crops

Chandra *et al.* (2014) Diseases Index of Papaya inoculated with the *Pseudomonas straita* [PSM] & Inorganic Fertilizers. The result revealed that the trends of Plant Disease Index (PDI) was decrease by [51.36%] with T1, PSM (T1) alone followed by T3 (27.89%), combination with N, P, & K (T3). Kupper *et al.* (2006) Influence of Biofertilizer for controlling *Guignardia citricarpa*, the causal agent of citrus black spot. The result revealed that the greatest no. of micro-organisms was present in aerobically produced bio-fertilizer. It was observed that application of Copper oxychloride along with applications of copper oxychloride and with carbendazim + mancozeb helps to control the disease significantly. Thus possibility of use of bio fertilizer as a protective bio fungicide to replace with copper oxychloride, specially in organic agriculture.

Torshiz *et al.* (2017) Influence of biological fertilizers on sunburning and cracking of pomegranate & infestation to pomegranate fruits moth *Ectomyelois Ceratoniae* (Lepidoptera: Pyralidae). Results revealed that plant treated by a combination of humic have higher levels of macronutrients and micronutrients & biofertilizer related with untreated plants, Completely, that biological fertilizers when combine with organic fertilizers, like granular humic, are advantageous to pomegranate plants orchard for the management and prevent from crop losses due to cracking, nutrient deficiency and infestation of E.

Zhang ZhiHong *et al.* (2010) Effect of Bio-fertilizers to control the banana wilt disease. Results revealed that 3 kinds of fertilizers had disparate effect on the biological control of banana wilt disease significantly. The Disease index of BOF & BCF treatment was lower than that from the single Foc. Thus, Control effect of BOF & BCF on banana wilt disease were 53.9% & 61.4%. Related to BOF & BCF with OF. It was observed that bacteria which are functional played significantly role in the disease inhibition.

Zongzhuan *et al.* (2015) Influence of combination of *amyloliquefaciens* *Bacillus* NJN-6 and biological fertilizers to control *Fusarium* wilt disease of Banana. Result shows that actinobacteria, culturable bacteria & *Bacillus* populations, Bacteria which is culturable to fungi (B/F) control the *fusarium* wilt disease of Banana. All the results revealed that 2-year continuous with the application of BIO containing *amyloliquefaciens* *Bacillus* NJN-6 ,2-year continuous significantly controlled *Fusarium* wilt disease of banana & also increase the fruit yield.

Future perspectives

In our country affordability, availability and of fossil fuel based chemical/Inorganic fertilizers at Indian farm level have been ensured through subsidies and by imports. Now days, bio fertilizers/ organic fertilizers have appear as a highly strong alternative to the chemical fertilizers due to their non-toxic ,eco-friendly, easy to apply, and cost effective in nature (Mohd mazid *et al.*, 2014). No doubt, use of the chemical fertilizers (e.g. urea, ammonium sulphate, calcium nitrate, di-ammonium phosphate etc.) plays vital role in the world's food production and also works as a fast food for plants make able them to grow more rapidly & efficiently, but dangerous effects are being observed due to the higher & imbalanced application of these chemical fertilizers. Due to this reasons, bio-fertilizers or organic substances, which make use of the micro-organisms to improve or increase the soil fertility, and also help in safeguarding health of the soil & also the quality of fruit crops. Bio-fertilizers manage the nutrients by the natural processes like solubilising phosphorus, nitrogen fixation & plant growth stimulation through the synthesization of growth promoting hormones (Meenakshi *et al.*, 2016), In India, government has been trying to increase the application of agrochemicals along with bio fertilizers in modern agriculture. India needs high degree of innovation & actively takes part in the scientific researches. public awareness programmes also play great role to enhance the extra-potential of sustainable agriculture, and also encouraging the private organization & policy makers to take notice in this field.

Conclusion

Significant use of bio-logical fertilizers is beneficial for the growth, yield and quality of different fruit crops. Bio-fertilizers also maintain the fertility and status of the soil as compared to chemical fertilizers. It is more beneficial to use of biological fertilizers because they provide different growth promoting hormones. Bio-fertilizers are also used for the control of different diseases of the fruit plants. By the application of organic & biological fertilizers we can increase the productivity of the fruits and also improve physical as well as chemical status of the soil. Hence the use of Biological-fertilizers could be the actual option for sustainable agriculture.

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