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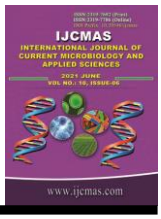

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Efficacy of Cyanobacteria and PSB on Viral Sensitivity and Productivity of Eggplants and Chilly Plants under FAITH Gardening

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A B S T R A C T

In Indian most of the farming techniques utilization of chemical fertilizer is largely prevalent. Which is not as environmentally safe as other methods and techniques like organic farming and FAITH gardening. Use of liquid bio-fertilizers like nitrogen fixing cyanobacteria phosphate solubilizing bacteria is gradually gaining importance as they are being proved to be eco-friendly. Augment the availability of nutrients the availability of nutrients. To promote the use of liquid bio-fertilizers with practices like FAITH gardening among the local people and communities, a comparative analysis of effects of cyanobacteria and PSB on the growth, viral tolerance and vegetable yields of plants was studied. It was observed in the study that use of liquid bio-fertilizers like cyanobacteria and PSB had greatly enhanced the germination, growth rate, viral tolerance, flowering and fruiting in plants. Studies have demonstrated that in place of conventional chemical fertilizers, liquid fertilizers are much better alternatives and practices like FAITH (Food Always In The Home) gardening can help families and communities to reduce their daily food expense Considering the high cost of vegetables and the rate of malnutrition in the country today. Home gardening should be taken seriously by families with low income and by those where members are nutritionally at risk.

Introduction

Agricultural land refers to the share of land area that is arable, under permanent crops, and under permanent pastures. India faces a declining percentage of land available for agriculture (Vivek, 2015). The food security index in 1999 was 105.58 and in 2008 it was 105.98 In order to feed the ever growing populations, India has to increase the per unit area productivity (Bhattacharjee, 2015). According to United Nations Food and Agriculture Organization (FAO) estimations, the average demand for the agricultural commodities will be 60% higher in 2030 than present time and more than 85% of this additional demand will be from developing countries (Mia and Shamsuddun, 2010). The issue can be addressed through a non-conventional gardening scheme known as "Food Always In The Home" (FAITH).

FAITH, a type of backyard gardening, yields the necessary protein, vitamins and mineral requirements needed by a small family. It is designed in such a way that it requires minimum labor and reduces a farmer's heavy reliance on chemical fertilizers and pesticides which pose health hazards and wreak havoc on the environment (Tacio, 2009). FAITH gardening heavily relies on organic farming utilizing components and techniques such bio fertilizers, green manure, compost, and biological pest control. Biofertilizers are substances which contain living microorganisms which, when applied to seed, soil or plant surfaces, colonize the rhizosphere and promote growth by increasing the availability of primary nutrients to the host plant (Vessey, 2003).

FAITH (Food Always In the Home) Garden

In 1974, to promote home gardening, the Asian Rural Life Development Foundation in Davao Del Sur, Philippines commenced to develop a practice unit farm which is a simple but effective vegetable growing technology called FAITH or Food Always in the Home. FAITH gardening ensures availability of vegetables throughout the year. It mainly deals with the backyard gardening of vegetables and fruits that could help alleviate the problem of malnutrition in low income families. It has been found that home gardening can reduce by about 20% an average family's daily food expenditures (Tacio, 2015). Considering the high costs of vegetables and the rate of malnutrition gardening should be taken seriously by low income families.

The main objectives of this study includes to study the effect of Phosphate Solubilising Bacteria and Cyanobacteria treatments against viral infection in Eggplants and Chilly plants grown in FAITH garden.

To compare between the germination, fruiting and yield of eggplants and Chilly plants treated with PSB and Cyanobacteria respectively in FAITH Garden

Materials and Methods

Location

The field trials were carried out at the medicinal garden behind the JSBB building at SHIATS campus, Allahabad. As Basic criteria for an optimal site for FAITH Gardening should have proper water supply, good drainage facility, good initial soil fertility, sufficient sunlight and aeration.

Spacing

The size of the garden was 100 sq. meters. As this was taken to be enough to provide vegetables each day for a family of six. This garden was maintained so that it could supply enough vegetables every day.

Preparation of the plots

For vegetable cultivation the soil was prepared before planting. As vegetables grow and yield better in well prepared soil. The site was Cleaned and grasses and weeds were cut for composting later on. The land was dug to a depth of 20cm and pulverized clods. There were two choices, the first choice was to dig the garden into the ground and the second choice was to build one or more raised beds in which to grow vegetables.

Plantation of the selected vegetables

The garden was divided in three sections. In the first section vegetables seeds were planted that could be harvested between 2-4 months such as eggplant and green chilli. A part of the section was kept for relay planting. The farm was divided into three individual plots i.e. A, B and C. Plot A was used for planting seeds which were to be treated with Phosphate Solubilizing Bacteria and plot B with Cyanobacteria. Phosphate Solubilizing Bacteria Bio-fertilizer was sprayed on the plants of plot A every 15 days post germination. Cyanobacteria Bio-fertilizer was sprayed on the plants of plot B every 15 days post germination The third plot C was set aside for a control experiment and was sprayed with Distilled Water every 15 days post germination. The dimensions of the plots were 30 x 40 m^2, each divided into 8 rows and 4 columns.

Pre-treatment of Soil and Seeds

Seed Pre-treatment

After tilling and weed removal, the soil was left undisturbed for around 6 days to check the growth of any further weed. By the end of 1 week PSB, cyanobacteria and tap water was poured into plot A, B and C respectively, specifically around the designated individual plots of the farm where seeds were to be sown and allowed to percolated for an 2-3 days. Bio fertilizers (cyan bacteria and PSB) were diluted in the ratio of 1:3 i.e., 1 part bio fertilizer and 3 parts of water in a watering can Prior to sowing, the seeds were soaked into the PSB, cyanobacteria and distilled water for 5-6 hour after which they were directly sown into their designated plots.

Sowing to Harvesting Period

For PSB 5 vegetable seeds were used. Sowing was followed by regular irrigation. After 20-25 days of sowing, when small plants of about 10-15cm length were seen, transplanting was done. Unhealthy and diseased plants were removed and the young and healthy plants were transplanted back into the field. Before transplanting, roots were dipped into PSB for about 10 minutes. Weeding was done at regular interval of 10-12 days for about 5-6 times. Also, soil was treated with diluted PSB at ever 10-12intervals.

Preparation of Cyanobacteria liquid bio-fertilizer

Requirements1 kg Fish head, ½ kg Papaya, 7-10 Litre water and Bacterial Culture

Procedure

First of all 1kg fish heads were crushed into pieces along with the ½ kg papaya. Crushed pieces of fish heads and papaya pieces were boiled in water separately and they were kept overnight for cooling. After keeping the pieces overnight for cooling, then the Fish Heads and Papaya pieces were mixed with 7-10 litres of water and also the bacterial culture (photosynthetic) was added. The above mixture was prepared in a transparent tank through which sunlight can easily pass through. After mixing the contents properly in the tank, it was kept in sunlight for about 30 to

35 days for allowing the fermentation to take place. The temperature around the tank was maintained at 30°C. The final product obtained i.e. cyanobacteria had a reddish brown colour and strong odour. With the proper care cyanobacteria can be stored for very longer duration and can be diluted during the time of application to the field and also to the crops.

Plant Treatment with Water

As for the control same seeds were used for sowing. Soil was tilled properly before sowing. Before sowing, the seeds were first dipped in distilled water for about 5-6 hours. Then seeds were sown at appropriate distance. Irrigation was done using normal tap water regularly.

Weeding was done 5-6 times at interval of 10-12 days to remove undesired, unwanted plants that can suppress the growth of target plants. Distilled water was sprayed over plants at regular interval of 10-12 days.

Results and Discussion

In the present study the farm was divided into three individual plots i.e. A, B and C. Plot A was used for planting seeds which were to be treated with Phosphate Solubilizing Bacteria and plot B with Cyanobacteria.

Phosphate Solubizing Bacteria Bio-fertilizer was sprayed on the plants of plot every 15 days post germination. Cyanobacteria Bio-fertilizer was sprayed on the plants of plot B every 15 days post germination The third plot C was set aside for a control experiment and was sprayed with Distilled Water every 15 days post germination. The dimensions of the plots were 30x40m^2, each divided into 8 rows and 4 columns.

Treated in eggplant seedling

In Figure 1.1,the seeds of eggplants treated with cyanobacteria bio-fertilizer showed the maximum number of germinated seedlings. The seeds of the eggplants treated with phosphate solubilising bacteria bio-fertilizer gave rise to comparatively lesser number of seedlings. The control plants, which were treated with distilled water showed the least number of germinated seedlings.

In Figure 1.2, The eggplants of plot A were sprayed with phosphate solubilising bacteria bio-fertilizer every 15 days post germination and eggplants in plot B were sprayed with cyanobacteria bacteria bio-fertilizer every 15 days post germination. Eggplants in plot C were sprayed with distilled water every 15 days post germination.

The seedlings of eggplants treated with cyanobacteria bio-fertilizer showed moderate level of viral infection. The seedlings of the eggplants treated with phosphate solubilising bacteria bio-fertilizer showed the least number of viral infections. The control plants, which were treated with distilled water showed the highest number of viral infection.

In figure 1.3, Maximum number of plants yielded fruits on treatment with Cyanobacteria. Plants treated with PSB yielded less number of fruit. Least number of fruiting plants observed in case of Control.

Treated in green chilli seedling

In figure 1.4, the Green chilli plants of plot A were sprayed with phosphate solubilising bacteria bio-fertilizer every 15 days post germination and green chilli plants in plot B were sprayed with cyanobacteria bacteria bio-fertilizer every 15 days post germination.

Fig.1 Seeds of eggplant were treated with cyanobacteria bio-fertilizer, phosphate and distilled water

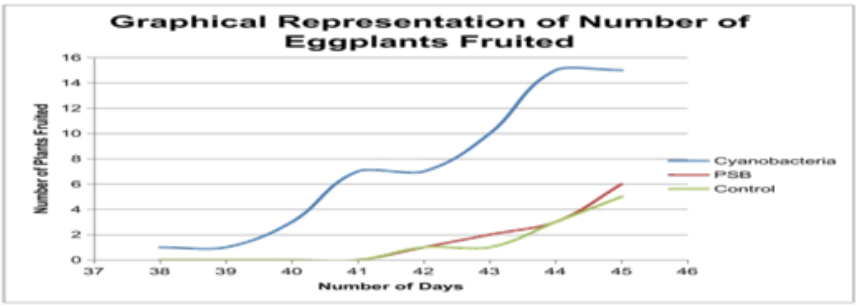


Fig.2 Seedlings of eggplant were sprayed with cyanobacteria bio-fertilizer, phosphate solubilising bacteria and distilled water.

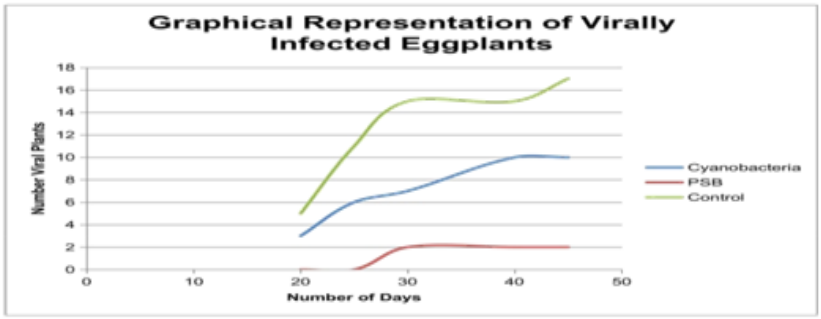


Fig.3 After 15 days seedling of eggplant were sprayed with cyanobacteria bio-fertilizer and phosphate and distilled water.

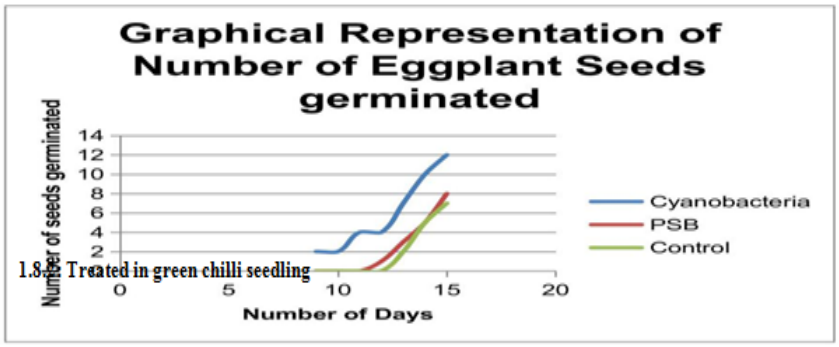


Fig.4 Seedlings of green chilli were spray with cyanobacteria bio-fertilizer, phosphate solubilising and distilled water.

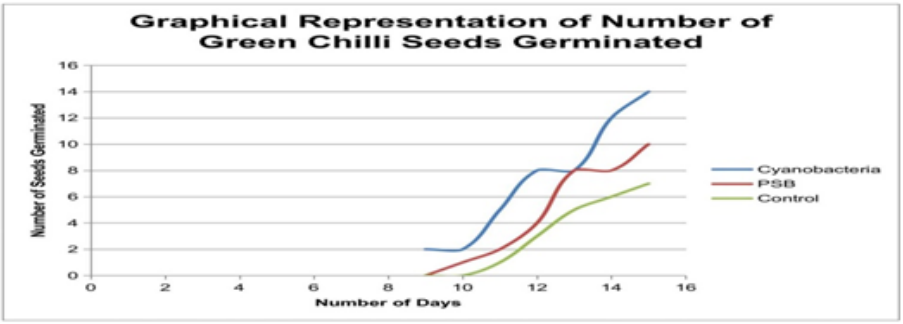
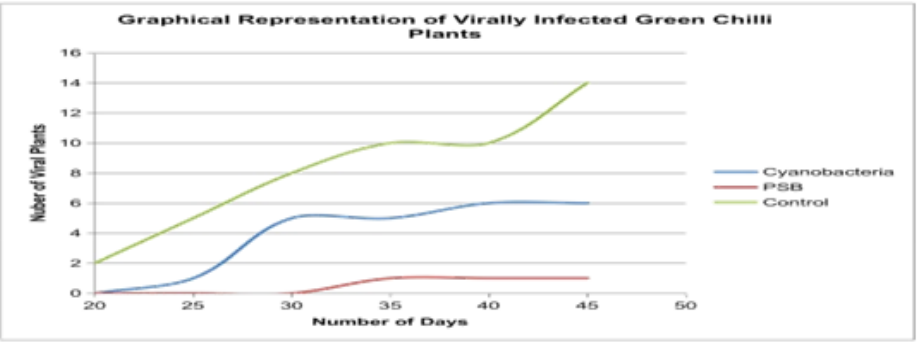


Fig.5 After 15 days seedling of green chilli were sprayed with cyanobacteria bio-fertilizer and phosphate and distilled water



Green chilli plants in plot C were sprayed with distilled water every 15 days post germination. Seedlings treated with Cyanobacteria gave rise to maximum number of germinated seedlings. In comparison to Cyanobacteria treated plants, Plants treated with PSB gave rise to lesser number of germinated seedlings. Least number of germinated seedlings was seen in the case of the Control seedlings.

In figure 1.5, the Green chilli plants of plot A were sprayed with phosphate solubilising bacteria bio-fertilizer every 15 days post germination and green chilli plants in plot B were sprayed with cyanobacteria bacteria bio-fertilizer every 15 days post germination. Green chilli plants in plot C were sprayed with distilled water every 15 days post germination. Plants treated with Phosphate Solubilising Bacteria showed least number of viral infections. Plants treated with cyanobacteria bio-fertilizer showed comparatively higher number of viral infection. Whereas the control plants treated with distilled water showed the highest number of viral infection.

According to the data obtained and field observations, Cyanobacteria showed the highest number of seed germination, growth, yield value and quality of vegetables but was not able to infer viral resistance to plants. On the other hand PSB showed highest viral tolerance but was not able to increase the yield. Whereas Control showed least germination, stunted growth, least viral tolerance, late is flowering. Liquid bio-fertilizers can greatly enhance the quality and quantity of the vegetables yield. Since they are

organic, environmentally safe and beneficial for the soil their use should be promoted commercially. Moreover, depletion of soil fertility, low fertilizer-use efficiency and growing environmental pollution are some of the major concern to agriculture, in terms of crop productivity. Bio-fertilizers, such as cyanobacteria and PSB can prove to be a better replacement to the chemical fertilizers and 'organic farming' can become a reality in the future. Traditional conservation based method with modern technology can reduce farmers' dependence on chemical fertilizers and pesticides, as well as reduce the farming costs and environmental hazards. Use of cyanobacteria and PSB along with practices like FAITH gardening should be encouraged amongst the local families and communities as well. For future study it would be interesting to develop techniques so that cyanobacteria bio-fertilizers can also in part viral resistance to plants.

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