

Testing the Efficacy of Five Innovative Bio-fertilizers Developed by PBRI on Different Crops

Singh Sadhana*, Shant Viral**, Sharma Vijay***, Saini Ajay****

Author's Affiliation: *Head of Department (R&D), **Assistant Manager,*** Manager (QC), **** Research Associate (QC), Patanjali Bioresearch Institute Pvt. Ltd., Haridwar.

Abstract

Patanjali Bio Research Institute is a Biotechnology agriculture research enterprise unit involved in farmer based indigenous knowledge of local farmers. Five different bio fertilizers viz; Humic granules, Humic Liquid, Jiavic Khad, Zyme-G, and Sujeeva, were tested for their efficacy on bottle gourd, bitter gourd, and maize. In this admiration field experiments were performed during summer season at Patanjali Food and Herbal Park, Padartha Village Haridwar to assess the efficacy of above mentioned bio-fertilizers. Three different crops were chosen for testing the bio-fertilizers where every treatment has shown a varied effect. Highest yield of 21.22Kg was obtained for maize after treatment with Sujeeva (T₅), while highest yield of 297.08Kg was obtained for Bitter gourd after application of (T₅) Sujeeva and for Bottle Gourd the highest yield obtained was 196.19Kg. Among all the fertilizers under test Sujeeva have shown highest positive effect in case of all three crops put to test, although all treatments have shown positive effect on the yield but highest effect on yield was observed for T₅ Sujeeva.

Keywords

Humic-G; Fulvic Acid; Amino Acid; Jaivic Khad; Bio-fertilizer.

Introduction

The experiments have been performed on kharif crops mainly on Maize, Bottle gourd and Bitter Gourd. *Zea mays L* commonly known as maize is most adaptable crop capable of growing under most varied agricultural conditions. Maize has the highest

yield potential genetically among all cereals which names it as queen of cereals. In India maize is third most important kharif crop and is cultivated in approximately 8.7 m ha. It contributes to almost 9% of the total food produced from agriculture and adds approximately 100 million INR to the agricultural GDP. Uttarakhand produces approximately 14.67q/ha of maize (FAO Production Year Book, 2004) (B. Gangaiah, Senior Scientist IARI New Delhi). Bitter Gourd is a seasonal vegetable grown widely across India. It is most commonly used vegetable included in daily diets of the people. Several experiments have been conducted on field to determine the effect of PGPR on growth and yield of Bitter gourd and Bottle Gourd (Mulani et al 2007). A Randomised Block Design experiment performed showed increase in the yield of Bitter gourd after application of PGPR bio-fertilizer, increase in vine length, yield, early germination and number of maximum primary branches have been recorded (Kumar et al. March 2012). Increase in the yield was also observed in trials performed after application of nitrogen based bio-fertilizers with inoculation of *Azotobacter* and PSB (Prasad et al 2009).

Bottle Gourd is another vegetable consumed across India for throughout the year. The vegetable is available in kharifas well as Rabi season (Rahman A.S 2003). *Lagenariasiceraria* commonly known as Bottle gourd is considered to have medicinal

Corresponding Author: Sadhana Singh,

Head of Department (R&D), Patanjali Bioresearch Institute Pvt. Ltd., Patanjali Food and Herbal Park, Padartha Village, Laksar Road, Haridwar - 248001, Uttarakhand, India

E-mail: research@patanjali.bio.com

properties as well due to presence of high choline level and belongs to Cucurbits family (Rahman A.S 2003). Bottle gourd also has hepato-protective and antioxidant activity, while also has immune-modulatory and antihyperglycemic activity (Deshpande et al 2008).

PBRI manufactures Humic-G as humic granules and Humic liquid where the major contents are humic acid and fulvic acid. Humic acid (HA) and Fulvic (FA) have been reported by many research workers as beneficial for plant growth as a whole where it acts as plant growth enhancer as well as a soil conditioner (Rauthan and Schnitzer, 1981). According to the results published administration of FA increased height of shoots, length of roots, dry weight of shoots, roots and whole plants. When the research parameters were matched with control the increments in above mentioned parameters were highly significant (Sadatnia and Riahi, 2009). Humic acids have proven to be aneco-friendly and highly nutritious source for plant growth and soil conditioning (Abbas et al. 2013). According to the results obtained on application of HA there was a significant effects observed on reproductive attributes, physiological parameters, and increment in fruiting was observed (Abbas et al, 2013).

Agriculture had been a field of intensive labor and business in order to obtain better and higher yield on the basis of quality and quantity. Every plant is considered as a single organism it needs nutrients in adequate amounts including micro and macro nutrients as well amino acids as the building blocks of proteins (Lisiecka et al 2011). Plants can synthesize amino acids from primary elements like carbon, hydrogen, oxygen, and carbohydrates synthesized from photosynthesis. The nitrogen taken by the plants combine with these elements to produce amino acid chains of proteins (Aoife et al 2013). Several reports have been published showing the requirement of amino acids in essential quantities to increase the yield and overall quality of the crops (Nirmala and Vadivel, 1999). PBRI manufactures a highly nutritive supplement for plants named Sujeeva which is a mixture of short proteins hydrolysed using alkaline hydrolysis process. This product has been used as a supplementing nutrient for the amino acids required by plants.

PBRI also has wide variety of Bio-fertilizers that are used to produce organic manure like Jaivic Khad (where Jaivic means Live and Khad is Manure). Combination of wide variety of organisms capable of providing nutritional amnesties to the plants by improving the soil quality is used to manufacture Jaivic Khad. The carrier used in vermin-compost

manure while large number of organic sources of Nitrogen, phosphorus, and potassium are added to fulfil the nutritional requirement of the plants. The basic source of nutrition in Jaivic khad is Phosphate Rich Organic Manure (PROM). Combination of different Phosphate solubilizing bacteria (PSB), potassium mobilising bacteria (KMB) and other rhizobacterial species like *Pseudomonas* and *Azotobacter* improve the quality of the Jaivic khad.

Materials and Methods

The objective of the experiment performed was to test the efficacy of the five different bio-fertilizers and organic manure and the treatments annotation given is shown in Table1.

Table1: Bio-fertilizers under test and the treatment annotation allotted.

Sr. No.	BF/OM	Treatment
1	Control	T ₀
2	Humic G	T ₁
3	Humic Liquid	T ₂
4	Jaivic Khad	T ₃
5	Zyme G	T ₄
6	Sujeeva	T ₅

Time and Place of the experiment

The experiment was conducted on an agriculture plot near Patanjali Bio Research Institute within the campus of industrial plant of Patanjali Food and Herbal Park, at Padartha Village, Haridwar. The time was in concurrency with summer agricultural season of Haridwar district for season of 2013-14. The treatment was performed for three seasonal crops of maize, bottle gourd and bitter gourd mainly grown during Kharif season. Date of sowing was 7th June 2013 for maize and 8th June for bitter gourd and bottle gourd respectively.

Land Treatment

The total extends of the land under cultivation was approximately 960 sq.mt with a distribution of 32 sq.mt per plot. The land was ploughed and harrowed manually and using tractor.

Soil Treatment

The soil was treated cow dung to improve the quality of the soil.

Design of Experiment

A modified Randomised Block Design (RBD) was used for design of the experimental plots. The experimental design had on control and five treatments (T_1 , T_2 , T_3 , T_4 , and T_5). Total 30 experimental plots were taken for each crop under test where 6 plots were allotted to control T_0 and treatments were performed in 24 plots.

Choice of Seed, treatment and sowing

To simulate the actual farming conditions seeds were purchased from local shop at Haridwar. The seeds were treated with a mixture of PSB, *Azotobacter*, *Trichoderma*, and *Psuedomonas*. The details of the seeds were as follows: Maize; hybrid Akashganga, Bottle Gourd; F-1 Roza variety, Bitter Gourd; F-1 AnchalAman. 3010 seeds of Maize were sowed while for bottle gourd and Bitter gourd 455 seeds and 503 seeds were sown respectively.

Spacing between plant to plant and column to column

The spacing between the plant to plant and column to column for maize was 60 x 25 while on the other hand for Bottle gourd and Bitter Gourd it was 90 x 180.

Irrigation

Canal irrigation was performed in different batches for different crops. For maize the irrigation

was done in two batches whereas five irrigation batches were performed for Bottle Gourd and Bitter Gourd.

Weeding Treatments

Weeding treatments were carried out manually. Different batches of weeding treatments were performed for different crops. 2 batches of weeding were done for maize while 5 batches were performed for bottle gourd and bitter gourd.

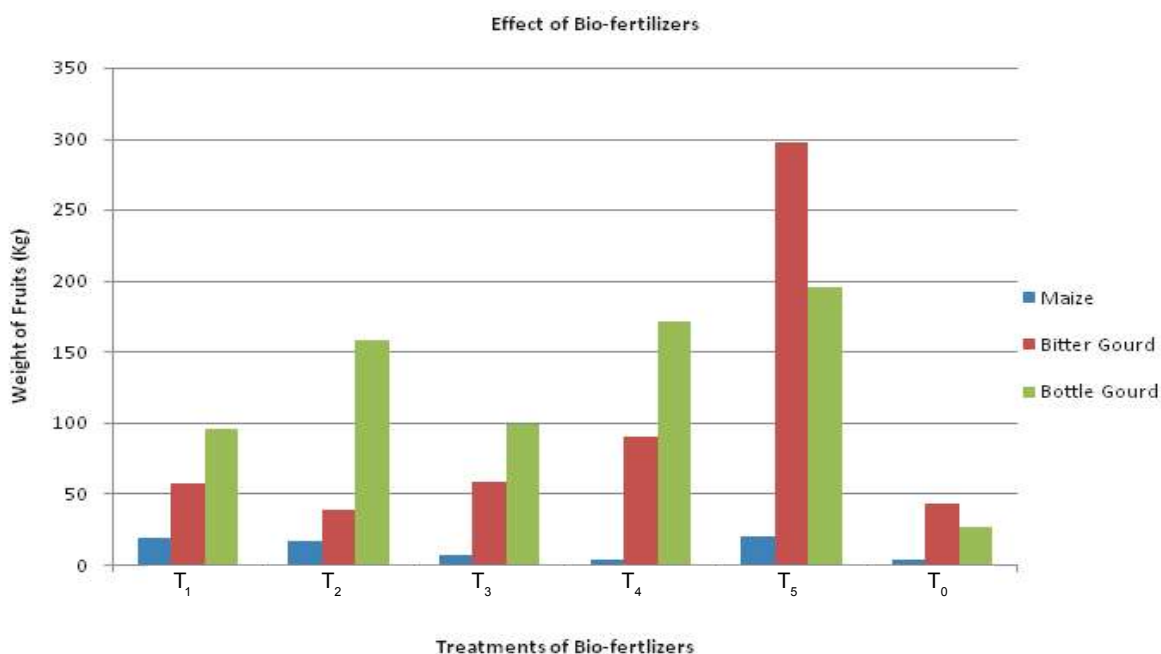
Bio-pesticide treatment

Maize was treated with indigenously developed bio-pesticides by PBRI named Suraksha which is a mixture of *Psuedomonas* and *Trichoderma*, and was also treated with neem oil based bio-pesticides. Bottle gourd was treated with Neem oil, and Cow urine spray, while Bitter gourd was treated with only Neem Oil.

Table2: Effect of five different bio-fertilizers on three different crops.

	T_1	T_2	T_3	T_4	T_5	T_0
Maize	20.2	17.91	8.11	4.43	21.22	4.3
Bitter Gourd	58.22	39.82	59.41	91.23	297.08	43.8
Bottle Gourd	96.52	158.36	99.23	171.61	196.19	27.17

Fig. 1: A bar graph representing yield of three different crops in terms of kilograms after treatment with 5 different bio-fertilizers.



Treatment of Bio-fertilizer

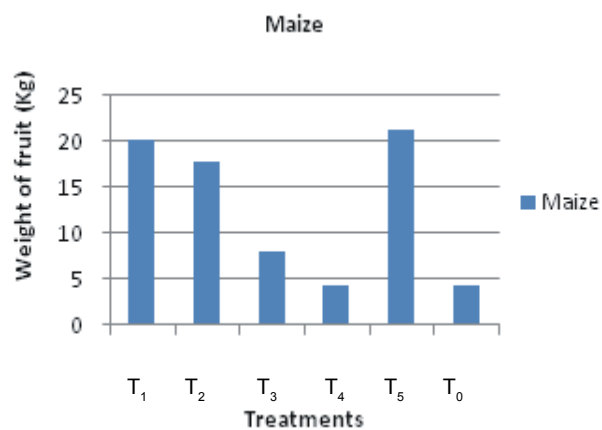
The fertilizers under test were applied to the crops in two different treatments for all the crops used in the experiment.

Results and Discussion

Every crop under test was harvested at different times. Maize was harvested twice where first fruiting was observed in month of July. Whereas first fruiting for Bitter gourd and Bottle gourd was observed in end of July. Bitter gourd was harvested 15 times during the season while bottle gourd was harvested more than 15 times during the same season. The fruits obtained in kilograms for every treatment applied are shown in Table2.

From the graph shown in figure1, and with comparison of figures in the table1 the highest yield was obtained for T₅ for Bottle gourd and Bitter gourd with 297.08 and 196.19 Kg respectively. Similarly T₅ have also shown a major effect on maize but the effect is not as large as that on other two crops. T₅ being a source of growth promoters and major source of essential proteins required by plants have shown a major and substantial effect on yield on all three crops (Lisiecka et al 2011). Significantly all the treatment have shown a positive effect on all three crops as

Fig. 2: Effect of 5 treatments of maize crop during kharif season.



compared to control but T₅ have shown the highest positive effect among other treatments tested.

While considering the effect of treatments on crops individually, all the treatments have shown a varied effect on every crop.

From Figure 2 it can be seen that the effect of all treatments except T₄ (Jaivic Khad) have shown a

Fig. 3: Effect of Bio-fertilizers on Bottle gourd.

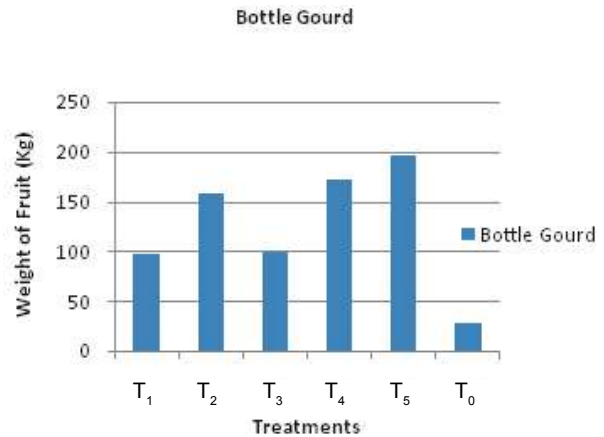
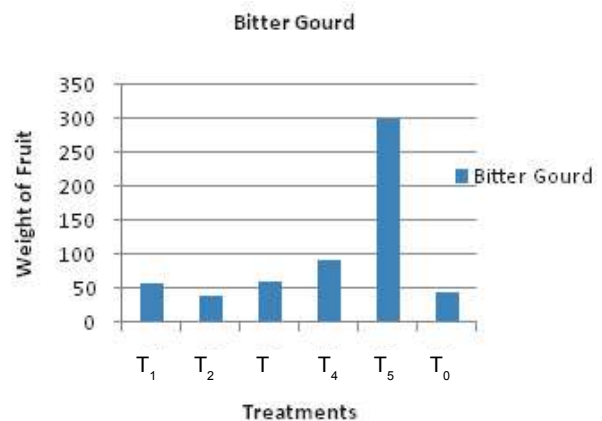


Fig. 4: Effect of Treatments of Bitter gourd yield.



positive effect on the yield. The highest positive effect could be seen for Sujeeva (T₅) while similar effect could be seen for T₁ and T₂ i.e. Humic granules and Humic Liquid. Comparatively lower effects are seen for T₃ and T₄ i.e. Jaivic Khad and Zyme G.

From figure 4 it can be seen that highest effect is of T₅ Sujeeva, while a substantially lower effects were seen for all other treatments.

The highest yield obtained for Bitter gourd was 297Kg while the lowest yield of 39Kg was obtained for T₂ Humic liquid. Similarly the highest yield for Bottle gourd was 196Kg while the lowest yield was of 96Kg. Similarly the highest yield for maize was 21Kg while the lowest was 4.43 Kg.

Humic acid products Humic granules and Humic Liquid with treatment annotation T₁ and T₂ respectively have also shown positive effect on overall yield of all the crops whereas the effect substantiality remains same as that of Sujeeva. Literature review has revealed that positive effects have been observed for Humic acid based products and there has been increase in overall yield of the products (Sadatnia and Riahi, 2009). The effect might be also due to

presence of fulvic acids that are added to the product to improve the quality of the product where there are studies which have revealed improvement in fruit size and fruit number and weight after harvest (Abbas et al, 2013).

It can be seen that all the treatments have shown positive effect on the yield. Highest positive effect was seen on treatment with Sujeeva (T₅) while a slightly lower effect was observed for T₂ and T₄. The yield was lower than 10kg for T₁ and T₃ i.e. Humic granules and Jaivic Khad.

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