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# Effect of INM and Biofertilizers on Growth, Yield and Quality of Eggplant (*Solanum melogena*)

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***Authors' contributions***

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

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## ABSTRACT

This study aimed to determine the most effective combination of Integrated Nutrient Management (INM) and biofertilizers for enhancing the growth, yield, and quality of eggplants (Solanum melongena). A randomized block design with ten treatments was employed, incorporating various biofertilizers (Trichoderma harzanium, Azotobacter, and Rhizobacter) and INM components (vermicompost, farmyard manure, and poultry manure).The treatment combinations were $T_1$ (100% Recommended Dose of Fertilizer - RDF), $T_2$ (75% RDF + 25% Vermicompost + Azotobacter), $T_3$ (50% RDF + 50% Vermicompost + Azotobacter), $T_4$ (25% RDF + 75% Vermicompost + Azotobacter), $T_5$ (75% RDF + 25% FYM + Trichoderma harzanium), $T_6$ (50% RDF + 50% FYM + Trichoderma harzanium), $T_7$ (25% RDF + 75% FYM + Trichoderma harzanium), $T_8$ (75% RDF + 25% Poultry manure + Rhizobium), $T_9$ (50% RDF + 50% Poultry manure + Rhizobium), and $T_{10}$ (25% RDF + 75% Poultry manure + Rhizobium). The findings revealed that $T_1$ exhibited the best

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performance in terms of growth parameters, while $T_{10}$ demonstrated the highest yield. Regarding quality, $T_7$ exhibited the most favourable outcomes. These results suggest that the appropriate combination of biofertilizers and INM components can significantly impact the growth, yield, and quality of egg plants. The significance and implications of these findings lie in their potential to enhance eggplant production through sustainable agricultural practices.

*Keywords: Integrated nutrient management; biofertilizers; eggplant; trichoderma harzanium; azotobacter; rhizobacter.*

## 1. INTRODUCTION

Eggplant (*Solanum melongena*), also known as aubergine or brinjal, is a popular vegetable cultivated and consumed worldwide. It belongs to the Solanaceae family. Eggplant is characterized by its glossy, elongated fruit, which can vary in colour from deep purple to white, green, or even striped varieties. In addition to its culinary appeal, eggplant also offers several nutritional benefits. It is low in calories and fat while being a good source of dietary fibre. Eggplant contains a variety of vitamins and minerals, including vitamin C, vitamin K, vitamin B6, potassium, and manganese. Moreover, it is rich in antioxidants, particularly anthocyanins, which contribute to its vibrant purple colour and offer potential health benefits. The cultivation of eggplant faces numerous challenges, including the need to maintain soil fertility, optimize nutrient availability, and mitigate pests and diseases. INM involves the judicious combination of organic and inorganic fertilizers to optimize nutrient availability, improve soil health, and enhance crop performance [1-3]. By integrating organic sources such as farmyard manure, compost, and green manure with chemical fertilizers, INM aims to achieve balanced nutrient supply, reduce fertilizer dependency, and mitigate the negative consequences associated with excessive synthetic fertilizer use.

In addition to INM, the application of biofertilizers has gained significant attention in sustainable agriculture. Biofertilizers are microbial inoculants containing beneficial microorganisms that colonize the plant root system, promoting nutrient uptake, stimulating plant growth, and enhancing overall plant health. Among the prominent biofertilizers, Trichoderma harzianum, Azotobacter, and Rhizobium have shown remarkable potential in enhancing the growth and productivity of various crops [4-7].

Trichoderma harzianum, a well-known biocontrol agent, not only suppresses soil-borne pathogens but also enhances nutrient availability through the secretion of enzymes that mobilize nutrients from organic matter. Azotobacter, a nitrogen-fixing bacterium, has the ability to convert atmospheric nitrogen into plant-available forms, thereby reducing the reliance on nitrogen fertilizers. Rhizobacter, a symbiotic bacterium, forms a mutually beneficial association with leguminous plants, enabling nitrogen fixation and improved nutrient assimilation [8-10].

Given the increasing demand for sustainable agricultural practices and the potential benefits offered by INM and biofertilizers, The findings of this research will contribute to a better understanding of the sustainable management practices for eggplant cultivation, with potential implications for enhancing crop productivity and reducing environmental impacts.

## 2. MATERIALS AND METHODS

The experiment was conducted at the Vegetable Research Farm, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology & Sciences, Prayagraj (UP), in the year 2022-23. The experiment was conducted on Eggplant *(Solanum melogena*) Var. snowball F1 hybrid with Ten treatments including three replications in a Randomized Block Design. The result of the investigation concerning the effect of control release fertilizers on 10 treatments, i.e., $T_1$ (100 % RDF), $T_2$ (75 % RDF + 25 % Vermicompost + Azotobacter), T3 (50 % RDF + 50 % Vermicompost + Azotobacter), $T_4$ (25 % RDF + 75 % Vermicompost + Azotobacter), $T_5$ (75 % RDF + 25 % FYM + Trichoderma harzanium) $_{25}T_6$ (50 % RDF + 50 % FYM + Trichoderma harzanium) $T_7$ (25 % RDF + 75 % FYM + Trichoderma harzanium) $T_8$ (75 % RDF + 25 % Poultry manure + Rhizobacter) T9 (50 % RDF + 50 % Poultrymanure + Rhizobacter) T10 (25 % RDF + 75 % Poultry manure + Rhizobacter). To find out the best performance in terms of growth, yield and quality.

## 2.1 Soil

The mechanical and chemical analysis of soil was done before the start of the experiment to obtain the initial fertility gradient and chemically and procedures are as follows. The soil samples were taken from different places of the experimental field from the surface to 12-15cm depth. These soil samples were mixed together, air dried, powdered and thoroughly mixed again. A representative soil sample of five gram for each and every analysis was drawn and subjected to mechanical and chemical analysis. The mechanical analysis was done by "International Dispersion Method" and sampling by "Pipette method'' as described by Wright (1939). The result of the analysis is as follows, sand, silt, clay 59.60, 19.10, 21.30 respectively. The chemical analysis was carried out for nitrogen, phosphorous, potash, organic matter and pH of the soil. Nitrogen was estimated by Kjeldohls method (A.O.A.C., 1970). The phosphorous and potash were estimated by "Pemberton" and "piper methods". The soil organic carbon was estimated by Walkley and Black method (1971). The pH was determined by pH meter (Elico pH meter model L.112).

**Table 1. Treatment details**

| Ingredients | Contents | Ingredients |
|---|---|---|
| Organic carbon (%) | 0.489 | Organic carbon (%) |
| Organic matter (%) | 0.639 | Organic matter (%) |
| Nitrogen (kg/ha) | 320 | Nitrogen (kg/ha) |
| Phosphorous (kg/ha) | 14.3 | Phosphorous (kg/ha) |
| Potash (kg/ha) | 160 | Potash (kg/ha) |
| Ph | 7.1 | Ph |

## 2.2 Statistical Analysis

The Data recorded throughout the course of investigation was subjected to Statistical analysis by using analysis of variance (ANOVA) for randomized block design (RBD) by Fischer and Yates (1963). Whenever 'F' test was found significant for comparing the means of two treatments, a critical difference (C. D. at 5%) was worked out.

# 3. RESULTS AND DISCUSSION

## 3.1 Growth Parameters

Data pertaining to growth parameters which are Plant height, (30, 60 and 90 days) Number of Leaves, Number of Branches, Days taken for 1$^{st}$ flowering, Days for 50% flowering and Days for 1$^{st}$ Fruiting.

### 3.1.1 Plant height at 30 days

There was a significant difference observed with the application of INM and Biofertilizers on plant height at 30 days. The mean performance was recorded statistically analysed in table and represented. The maximum plant height was recorded in treatment $T_1$ 100%RDF was used i.e., 18.13cm at 30 days, followed by 17.53cm in treatment $T_5$ (75 % RDF + 25 % FYM + Trichoderma harzanium) and minimum in treatment $T_8$ (75 % RDF + 25 % Poultry manure + Rhizobacter) i.e., 17.6cm.

### 3.1.2 Plant height at 60 days

There was a significant difference observed with the application of INM and Biofertilizers on plant height at 60 days. The mean performance was recorded and statistically analysed in table and represented. The plant height maximum was recorded in treatment $T_1$ (100% RDF) i.e., 31.54cm followed by 31.13cm in $T_9$ (25 % RDF + 75 % Poultry manure + Rhizobacter) and Minimum plant height was recorded in $T_8$ (75 % RDF + 25 % Poultry manure + Rhizobacter) i.e. 26.06cm.

### 3.1.3 Plant height at 90 days

There was a significant difference observed with the application of INM and Biofertilizers on plant height at 90 days. The mean performance was recorded statistically analysed in table and represented. The maximum plant height was recorded in treatment $T_1$ 100 % RDF was used i.e., 68.08cm at 90 days, followed by 62.63cm in treatment $T_9$ (50 % RDF + 50 % Poultrymanure + Rhizobacter) and minimum in treatment $T_8$ (75 % RDF + 25 % Poultrymanure + Rhizobacter) i.e., 51.63cm.

### 3.1.4 Number of leaves at 60 days

There was a significant difference observed with the application of INM and Biofertilizers on number of leaves at 30 days. The mean performance was recorded and statistically analysed in table and represented. The maximum number of leaves was recorded in treatment $T_1$ (100%RDF) i.e., 6.26, followed by $T_2$ (75%RDF+25%Vermicompost+Azotobacter) i.e., 5.4. The minimum number of leaves was recorded at 60 days was in $T_{10}$ (25% RDF+ 75% Poultry manure+Rhizobacter) i.e., 1.88. Study found that the application of INM and Biofertilizers had a positive effect on the number of leaves of eggplant, which is similar to the findings of El-Nady et al. [11] and Mondal et al. [12] who reported an increase in the number of leaves per plant with the increase in the application rate of Poultry manure and rhizobacter in eggplant.

#### 3.1.5 Number of branches at 60 days

There was a significant difference observed with the application of INM and Biofertilizers on number of branches at 60 days. The mean performance was recorded and statistically analysed in table and represented. The maximum number of branches was recorded in treatment $T_5$ (75 % RDF + 25 % FYM + Trichoderma harzanium) i.e., 7.66, followed by $T_4$ (25 % RDF + 75 % Vermicompost + Azotobacter) i.e. 5.4. The minimum number of branches was recorded at 60 days was in T10 (25 % RDF + 75 % Poultrymanure + Rhizobacter) i.e., 5.33. Study found that the application of INM and Biofertilizers had a positive effect on the number of branches of eggplant, which is similar to the findings of Singh et al, [13] who reported an increase in the number of branches per plant with the increase in the application rate of FYM and Trichoderma in eggplant.

#### 3.1.6 Days taken for 1st flowering

There was a significant difference observed with the effect of application of INM and Biofertilizers on Days taken for 1$^{st}$ flowering. The mean performance was recorded and statistically analysed in table and also graphically represented. The minimum of 36.66 days taken for 1st flowering in Treatment $T_2$ and Maximum 41.00 days taken in $T_7$ for 1$^{st}$ flowering.

It can be concluded that the days taken for 1st flowering in eggplant can be reduced by using Trichoderma which has enhanced the nutrient uptake efficiency of eggplant leading to delayed flowering a study by Singh *et al., (*2018) found that the application of Trichoderma harzanium to eggplants increased their vegetative growth and delayed their flowering, resulting in higher fruit yields. Similarly, a study by Bhat et al., (2015) reported that the use of Azotobacter as a biofertilizer.

#### 3.1.7 Days taken for 50% flowering

There was a significant difference observed with the effect of application of INM and Biofertilizers on Days taken for 50% flowering. The mean performance was recorded and statistically analysed in table and also graphically represented. The minimum of 48.33 days taken for 50% flowering in Treatment $T_8$ and Maximum 51.33days taken in $T_7$ for 50% flowering.

It can be concluded that the days taken for 50% flowering in eggplant can be reduced by using Trichoderma harzanium in the first treatment has stimulated the growth of beneficial microbes in the soil, which has led to improved soil health and nutrient availability for the eggplants. This may have resulted in a slower but more sustained growth rate, leading to a delay in flowering. Conversely, the use of Rhizobacter in the second treatment may have facilitated the uptake of nutrients by the plants, leading to faster growth and earlier flowering.

Several studies have investigated the effects of biofertilizers on eggplant growth and yield, but findings regarding the effect on flowering time are inconsistent. For example, a study by Kumar et al. (2014) reported that the use of Trichoderma harzanium led to earlier flowering and higher yields in eggplants, while a study by Gholami et al. (2017) found that the use of Rhizobacter led to delayed flowering but higher fruit yields.

#### 3.1.8 Days taken for 1st fruiting

of INM and Biofertilizers on Days taken for 1$^{st}$ fruiting. The mean performance was recorded and statistically analysed in table and also graphically represented. The minimum of 42.00 days taken for 1st fruiting in Treatment $T_9$ and Maximum 48.00 days taken in $T_7$ for 1$^{st}$ fruiting.

Use of Trichoderma harzanium in the has stimulated the growth of beneficial microbes in the soil, which has led to improved soil health and nutrient availability for the eggplants. This may have resulted in a slower but more sustained growth rate, leading to a delay in fruiting. Similar studies have investigated the effects of biofertilizers on eggplant growth and yield, for example, a study by Savitha *et al.,* (2017) found that the application of Trichoderma harzanium to eggplants led to delayed fruiting but higher fruit yield, while a study by Yadav *et al.,* (2018) reported that the use of Rhizobacter as a biofertilizer led to earlier fruiting and higher yield in eggplants.

**Table 2. Effect of INM and biofertilizer on growth of eggplant**

| Treatment | Plant height at 30 days | Plant height at 60 days | Plant height at 90 days | Number of leaves at 60 days | Number of branches at 60 days |
|---|---|---|---|---|---|
| T1(RDF) | 18.13 | 24.53 | 68.8 | 6.26 | 7.66 |
| T2 | 17.53 | 29.46 | 61.13 | 5.4 | 6.33 |
| T3 | 18.2 | 31.06 | 57.8 | 4.86 | 7.06 |
| T4 | 20.4 | 29.4 | 57.5 | 5.3 | 7.5 |
| T5 | 17.53 | 26.6 | 54.66 | 6 | 7.6 |
| T6 | 17.73 | 29.66 | 57.96 | 5.5 | 6.4 |
| T7 | 17.6 | 27.73 | 51.63 | 5.4 | 6.46 |
| T8 | 18.3 | 29.5 | 54.93 | 2.76 | 6.86 |
| T9 | 19.8 | 31.13 | 63.6 | 2.45 | 6.23 |
| T10 | 18.86 | 31.53 | 56.2 | 1.88 | 5.53 |
| F-Test | S | S | S | S | S |
| SE.d(+) | 1.87 | 1.04 | 5.60 | 2.01 | 0.63 |
| C.D at 5% | 2.45 | 2.45 | 4.09 | 1.47 | 0.46 |
| C.V | 4.38 | 1.53 | 4.08 | 18.95 | 4.03 |

**Table 3. Effect of INM and biofertilizer on growth of eggplant**

| Treatments | Days to 1st flowering | Days to 50% flowering | Days to 50% fruiting |
|---|---|---|---|
| T1(RDF) | 40 | 51 | 48.00 |
| T2(75%RDF+25%Vermicompost+Azotobacter) | 37.66 | 48.66 | 42.33 |
| T3(50%RDF+50%Vermicompost+Azotobacter) | 39 | 49 | 46.00 |
| T4(25%RDF+75%Vermicompost+Azotobacter) | 39 | 49.33 | 46.00 |
| T5(75%RDF+25%FYM+Trichoderma harzanium) | 39 | 49 | 42.33 |
| T6(50%RDF+50%FYM+Trichoderma harzanium) | 39.66 | 51 | 45.67 |
| T7(25%RDF+75%FYM+Trichoderma harzanium) | 41 | 51.33 | 48.00 |
| T8(75%RDF+25%Poultry manure+Rhizobacter) | 37.66 | 48.33 | 43.33 |
| T9(50%RDF+50%Poultry manure+Rhizobacter) | 38.33 | 51.33 | 42.00 |
| T10(25%RDF+75%Poultry manure+Rhizobacter) | 37 | 50.66 | 44.00 |
| F-Test | N.S | N.S | S |
| SE.d(+) | 5.68 | 3.46 | 2.85 |
| C.D at 5% | 4.15 | 2.52 | 2.08 |
| C.V | 6.23 | 2.95 | 2.17 |

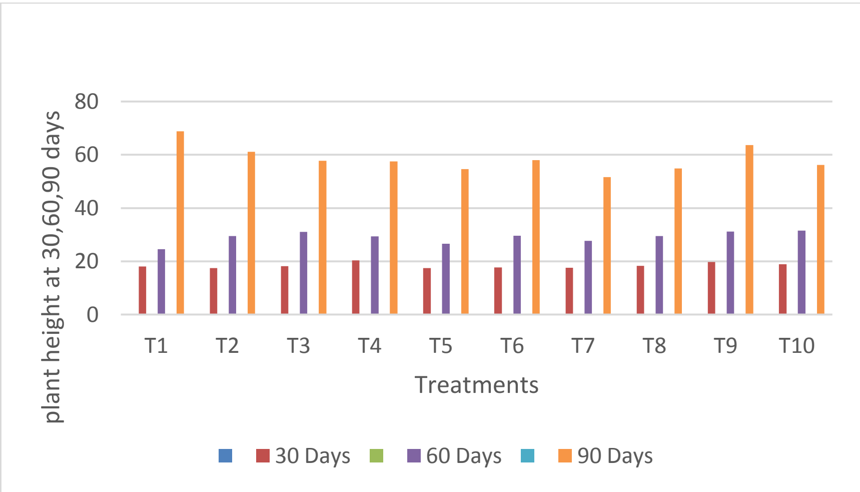


**Fig 1. Effect of INM and biofertilizer on plant height at 30, 60 and 90 days in eggplant**

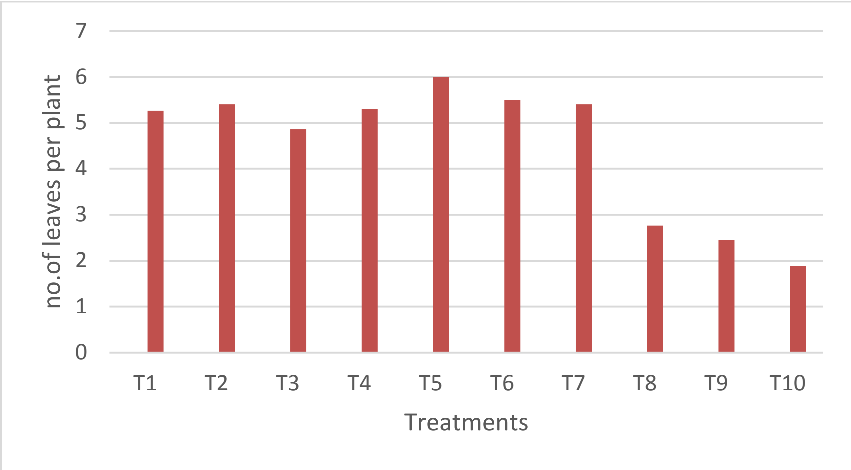


**Fig. 2. Effect of INM and biofertilizer on number of leaves at 60 days in eggplant**

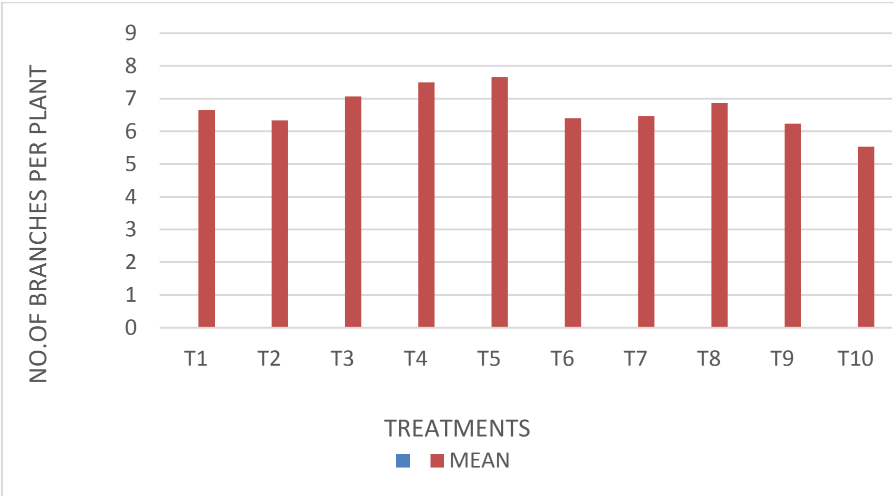


**Fig. 3. Effect of INM and biofertilizer on number of branches at 60 days in eggplant**

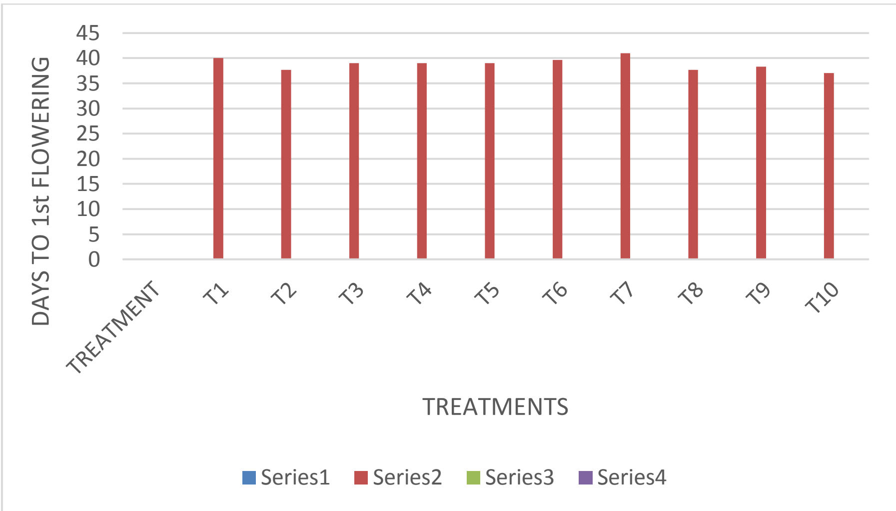


**Fig. 4. Effect of INM and biofertilizer on days to 1st flowering in eggplant**

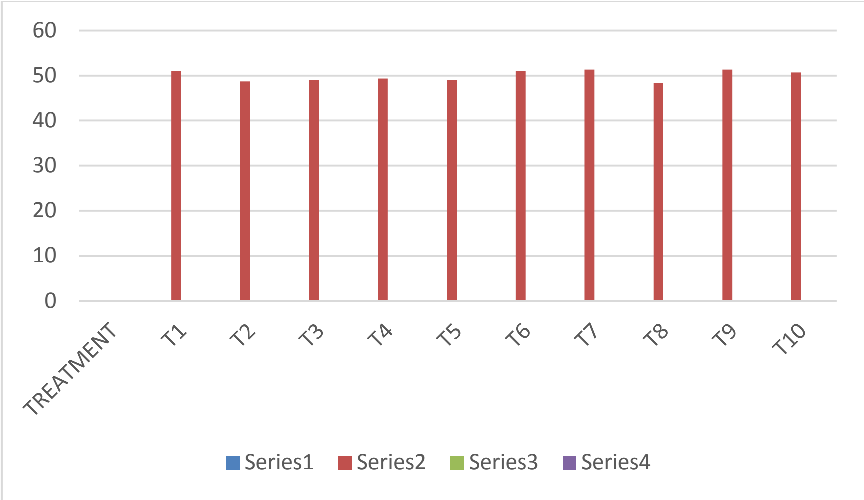


**Fig 5. Effect of INM and biofertilizer on days to 50% flowering in eggplant**

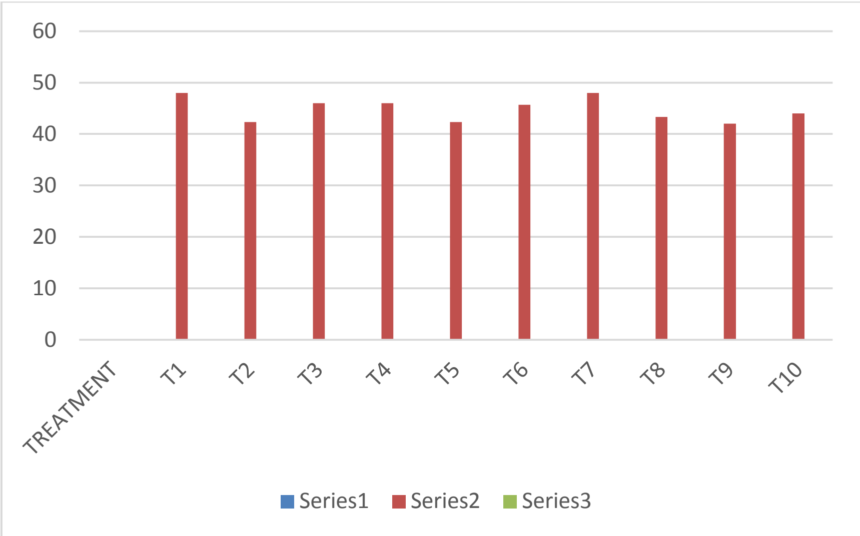


**Fig. 6. Effect of INM and biofertilizer on Days to 1st fruiting in eggplant**

## 3.2 Yield Parameter

Data pertaining to Yield parameters which are Number of fruits per plant, Fruit weight Per plant, Single fruit weight, Fruit Yield Per Ha, Fruit Weight, Length, Diameter respectively.

### 3.2.1 Number of fruits per plant

There was a significant difference observed with the Effect of INM and biofertilizers on Number of fruits per plant. The mean performance was recorded and statistically analysed in table and also graphically represented. The maximum numbers of fruits were recorded in $T_5$ i.e., 11.80 fruits, Followed by $T_8$ i.e., 11.08 fruits and the minimum numbers of fruits was recorded in $T_2$ i.e., 6.82 per plant. this increase in number of fruits per plant is due to the application of Trichoderma harzanium which plays a role in promoting the growth and development of eggplant plants, leading to an increase in the number of fruits produced. Similar result was found by Zia *et al*. [14] stating that the use of Trichoderma harzanium in combination with chemical fertilizers significantly increased the number of fruits per plant and the overall yield of eggplant.

### 3.2.2 Single fruit weight (g) of egg plant

There was a significant difference observed with the Effect of INM and biofertilizers on Single fruit weight (g). The mean performance was recorded and statistically analysed in table and also graphically represented. The maximum fruit weight was recorded in $T_1$ i.e., 86.13 g, Followed by $T_3$ i.e., 86.05 g and the minimum fruit weight was recorded in $T_9$ i.e., 61.36 g. The increase in fruit weight in $T_1$ is recorded as that $T_1$ (100% RDF) provided the highest level of nutrients, resulting in larger fruit weight. On the other hand, $T_9$ (50%RDF+50% poultry Manure + Rhizobacter) may not have provided sufficient nutrients or may have had imbalanced nutrient ratios, leading to lower fruit weight. Similar studies have been conducted by Alam *et al.* (2018) found that the use of chemical fertilizers resulted in higher fruit weight compared to organic fertilizers.

#### 3.2.3 Fruit yield per hectare(t/ha) of eggplant

There was a significant difference observed with the Effect of INM and biofertilizers on Fruit yield per hectare (t/hec). The mean performance was recorded and statistically analysed in table and also graphically represented. The maximum yield was recorded in $T_{10}$ i.e., 28.09 t, Followed by T1 i.e., 27.75 t and the minimum yield was recorded in $T_2$ i.e. 17. 51t. These differences in the yields obtained is recorded as the higher fruit yield per hectare in T10 where (25% RDF+75% poultry manure+ Rhizobacter) was used could be due to the fact that poultry manure is a good source of nutrients, especially nitrogen, which is essential for plant growth and yield. Similar findings of the following studies are given by Kumar et al. (2016) on the effect of biofertilizers on eggplant yield found that the combination of poultry manure and Rhizobium significantly increased the yield compared to other treatments.

#### 3.2.4 Fruit weight (g)

There was a significant difference observed with the application of control release fertilizers on Fruit Weight(g). The mean performance was recorded and statistically analysed in table and also graphically represented. The maximum Fruit weight was recorded in treatment $T_7$ i.e., 1006g followed by $T_4$ 989g and the minimum fruit weight was recorded in treatment $T_2$ 814.16g. The above obtained result is due to application and use of Trichoderma harzanium in the $T_7$ has stimulated the growth of beneficial microbes in the soil, which has led to improved soil health and nutrient availability for the eggplants. This may have resulted in a higher fruit weight due to increased nutrient uptake and more efficient utilization of fertilizers. Similar findings of the concerned studies are conducted by Karmakar et al. (2016) found that the application of Trichoderma harzanium to eggplants led to higher fruit weight and yield.

#### 3.2.5 Fruit length (cm)

There was a significant difference observed with the application of control release fertilizers on Length(cm). The mean performance was recorded and statistically analysed in table and also graphically represented. The maximum Fruit length was recorded in treatment $T_{10}$ i.e., 14.03 cm followed by $T_9$ 12.56cm and the minimum fruit weight was recorded in treatment $T_2$ 9.73 cm. The above result is due to use of Rhizobacter in the $T_{10}$ has facilitated the availability and uptake of nutrients from the poultry manure, resulting in improved growth and elongation of eggplant fruits. This may have led to the longer fruit length observed in this treatment. Similar findings of the concerned studies are conducted by Kundu et al. (2017) and found that the application of Rhizobacter led to higher yield and fruit length in eggplants.

#### 3.2.6 Fruit diameter (mm)

There was a significant difference observed with the application of control release fertilizers on Fruit Length (mm). The mean performance was recorded and statistically analysed in table and also graphically represented. The maximum Fruit diameter was recorded in treatment $T_{10}$ i.e. 80.33 mm followed by $T_4$ 71.66 mm and the minimum fruit diameter was recorded in treatment $T_9$ 62mm.

### 3.3 Quality Parameter

Data pertaining to quality parameter which is total soluble solids (TSS)

#### 3.3.1 TSS (°B)

There was a significant difference observed with the application of control release fertilizers on TSS (°B). The mean performance was recorded and statistically analysed in table and also graphically represented. The maximum TSS was recorded in treatment $T_8$ i.e., 5.48 followed by $T_3$ 5.13 and the minimum TSS was recorded in treatment $T_1$ 4.13. This suggests that the use of poultry manure as a source of organic matter at specific level can positively affect that can lead to an increase in soil organic matter content, which can improve soil fertility, nutrient availability, and plant growth. This is justified by a study conducted by Kundu et al. (2013) on the effect of different organic manures and biofertilizers on the yield and quality of eggplant reported a significant increase in TSS with the application of poultry manure and rhizobacteria.

**Table 4. Effect of INM and biofertilizers on yield parameters**

| Treatment | Number of fruits per plant | Single fruit weight (g) | Fruit yield per hectare (t/ha) |
|---|---|---|---|
| T1(RDF) | 8.70 | 86.13 | 27.75 |
| T2(75%RDF+25%Vermicompost+Azotobacter) | 6.85 | 69.02 | 17.51 |
| T3(50%RDF+50%Vermicompost+Azotobacter) | 7.70 | 86.05 | 24.54 |
| T4(25%RDF+75%Vermicompost+Azotobacter) | 8.45 | 77.45 | 24.23 |
| T5(75%RDF+25%FYM+Trichoderma harzanium) | 11.80 | 72.58 | 26.34 |
| T6(50%RDF+50%FYM+Trichoderma harzanium) | 9.62 | 68.26 | 24.32 |
| T7(25%RDF+75%FYM+Trichoderma harzanium) | 10.53 | 73.32 | 20.44 |
| T8(75%RDF+25%Poultry manure+Rhizobacter) | 11.09 | 74.75 | 25.16 |
| T9(50%RDF+50%Poultry manure+Rhizobacter) | 9.58 | 61.36 | 21.77 |
| T10(25%RDF+75%Poultry manure+Rhizobacter) | 10.11 | 83.28 | 28.09 |
| F-Test | S | NS | S |
| SE.d(+) | 0.66 | 6.95 | 3.31 |
| C.D at 5% | 0.48 | 5.07 | 2.41 |
| C.V | 21.3 | 5.25 | 2.47 |

**Table 5. Effect of INM and biofertilizers on yield parameters**

| Treatment | Fruit length (cm) | Fruit weight (g) | Fruit Diameter (mm) |
|---|---|---|---|
| T1(RDF) | 11.03 | 944.1 | 66.66 |
| T2(75%RDF+25%Vermicompost+Azotobacter) | 9.73 | 814.16 | 66 |
| T3(50%RDF+50%Vermicompost+Azotobacter) | 10.63 | 969.83 | 67.33 |
| T4(25%RDF+75%Vermicompost+Azotobacter) | 10.03 | 989.53 | 71.66 |
| T5(75%RDF+25%FYM+Trichoderma harzanium) | 10.63 | 954.72 | 66.33 |
| T6(50%RDF+50%FYM+Trichoderma harzanium) | 10 | 939.71 | 72 |
| T7(25%RDF+75%FYM+Trichoderma harzanium) | 10.13 | 1006 | 69.33 |
| T8(75%RDF+25%Poultry manure+Rhizobacter) | 10.56 | 880.09 | 66.66 |
| T9(50%RDF+50%Poultry manure+Rhizobacter) | 12.56 | 943.11 | 62 |
| T10(25%RDF+75%Poultry manure+Rhizobacter) | 14.03 | 857.27 | 80.33 |
| F-Test | S | S | S |
| SE.d(+) | 0.65 | 98.79 | 4.86 |
| C.D at 5% | 0.47 | 72.10 | 3.55 |
| C.V | 2.52 | 4.52 | 2.97 |

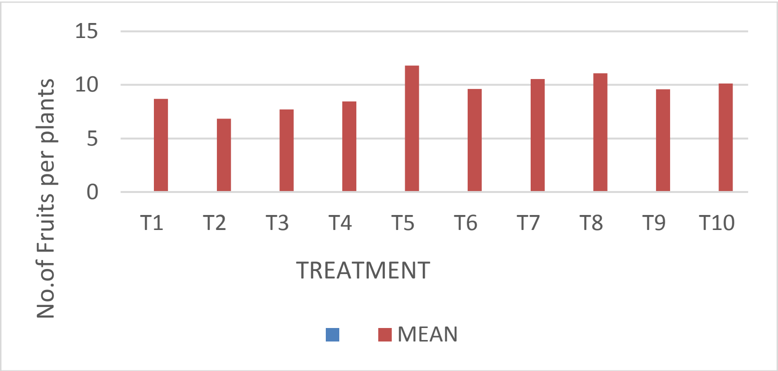


**Fig. 7. Effect of INM and biofertilizers on no. of fruits per plant**

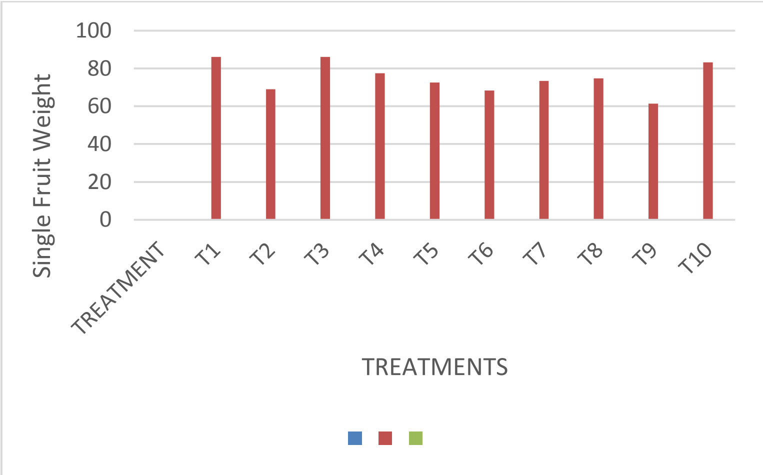


**Fig. 8. Effect of INM and biofertilizers on single fruit weight of plant**

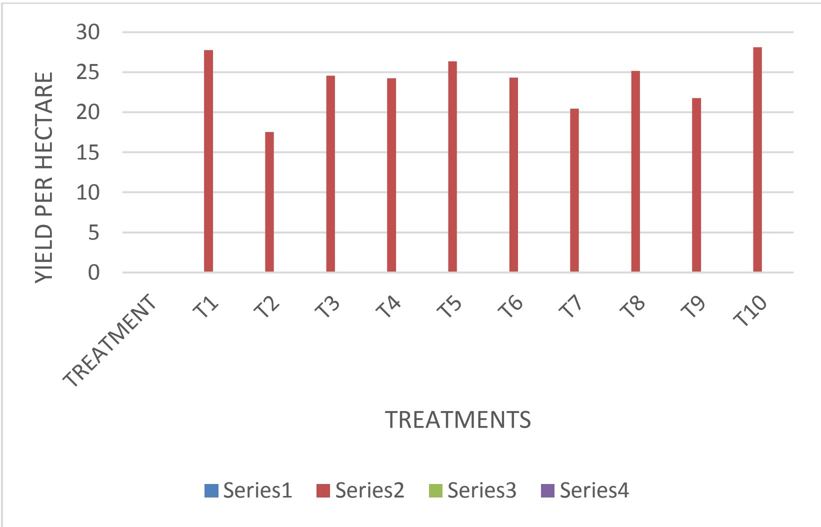


**Fig. 9. Effect of INM and biofertilizers on fruit yield per hectare**

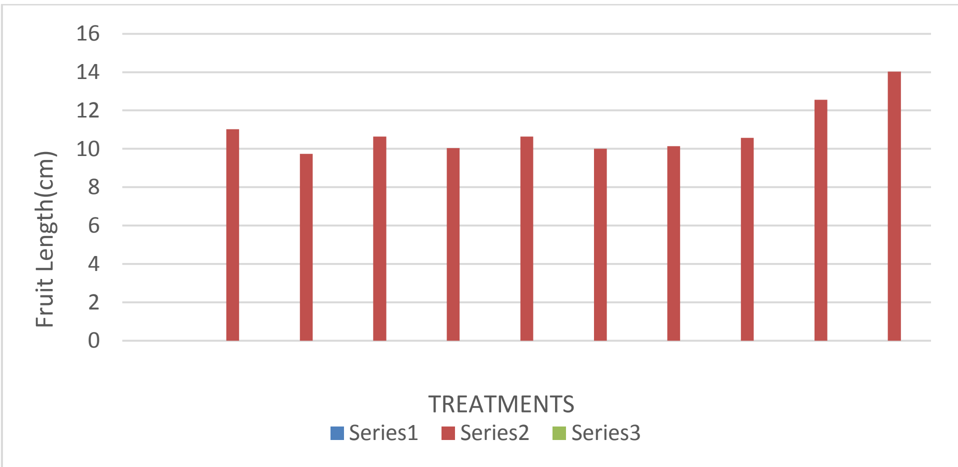


**Fig. 10. Effect of INM and biofertilizers on fruit length (cm)**

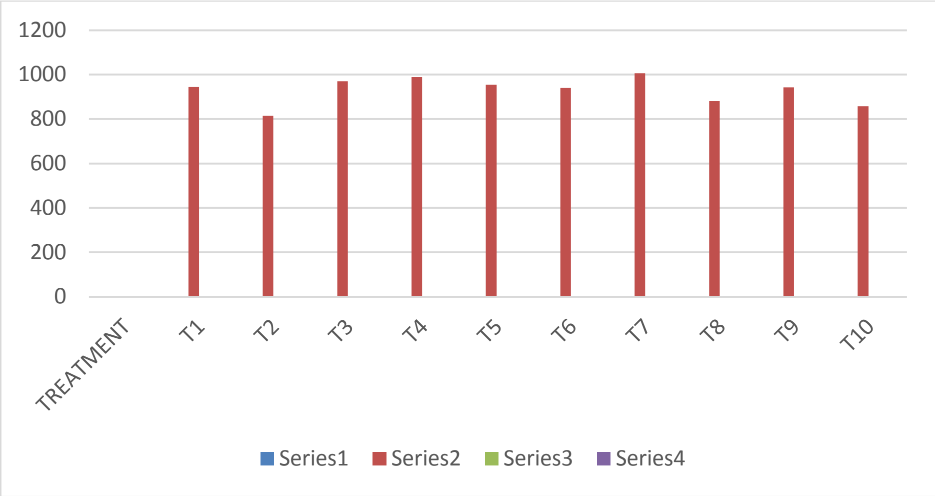


**Fig. 11. Effect of INM and biofertilizers on fruit weight (g)**

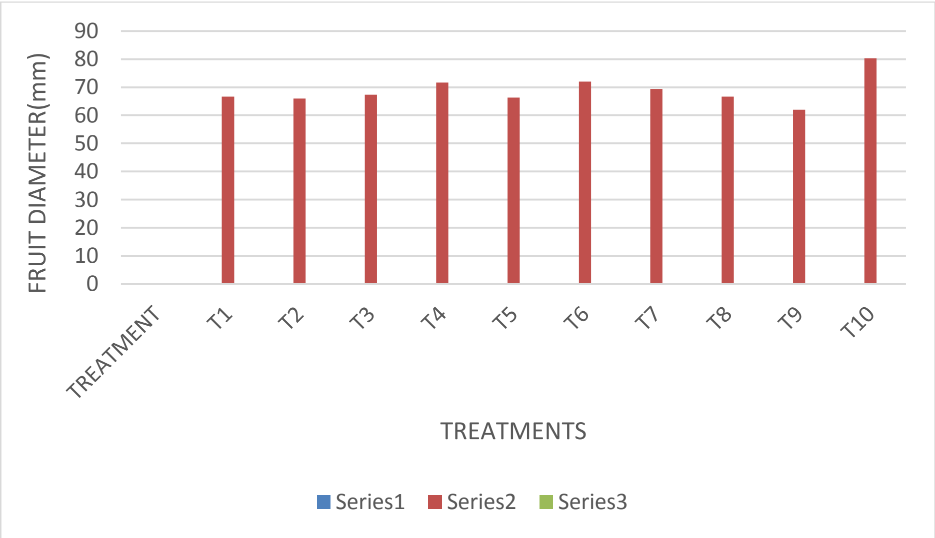


**Fig. 12. Effect of INM and biofertilizers on fruit diameter (mm)**

**Table 6. Effect of INM and biofertilizers on Total Soluble Solids (TSS) of eggplant**

| Treatments | Total Soluble Solids (TSS) |
|---|---|
| T1(RDF) | 4.13 |
| T2(75%RDF+25%Vermicompost+Azotobacter) | 4.39 |
| T3(50%RDF+50%Vermicompost+Azotobacter) | 5.13 |
| T4(25%RDF+75%Vermicompost+Azotobacter) | 4.37 |
| T5(75%RDF+25%FYM+Trichoderma harzanium) | 4.61 |
| T6(50%RDF+50%FYM+Trichoderma harzanium) | 5.44 |
| T7(25%RDF+75%FYM+Trichoderma harzanium) | 4.98 |
| T8(75%RDF+25%Poultry manure+Rhizobacter) | 5.48 |
| T9(50%RDF+50%Poultry manure+Rhizobacter) | 5.24 |
| T10(25%RDF+75%Poultry manure+Rhizobacter) | 5.40 |
| F-Test | NS |
| SE.d(+) | 6.95 |
| C.D at 5% | 5.07 |
| C.V | 5.25 |

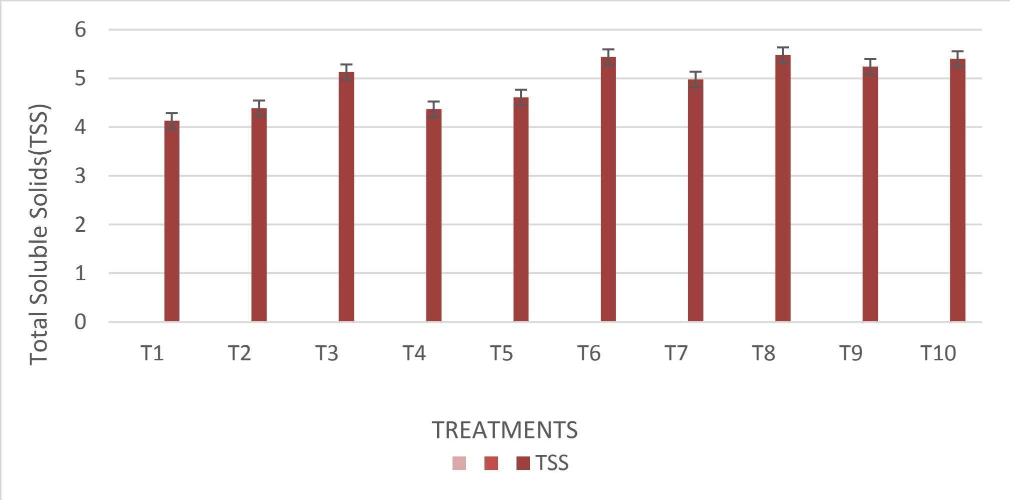


**Fig. 13. Effect of INM and biofertilizers on Total Soluble Solids (TSS) of eggplant**

## 4. CONCLUSION

From the present investigation, it is concluded that treatment T1 performed best in terms of plant growth, however, treatment $T_{10}$ gave higher yield and on the treatment $T_{10}$ was best in terms of quality of eggplant. The highest benefit- cost ratio was at 3.93 in treatment $T_{10}$.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

## REFERENCES

1. Bhattacharya P, Ray S, Biswas AK. Effect of organic manure and biofertilizers on yield and quality of brinjal (*Solanum melongena* L.). International Journal of Chemical Studies. 2018;6(4):1130-1134.
2. Singh RK, Singh RP, Singh PK, Kumar V, Kumar A. Effect of farmyard manure and Trichoderma harzanium on growth and yield of brinjal (Solanum melongena L.). Progressive Agriculture. 2014;14(1):94-98
3. Kumar M, Singh V, Rana DK, Shah KN. Effect of integrated nutrient management on various horticultural traits of knol-khol (*Brassica oleracea* var. gongylodes) cv. White Vienna under Garhwal Hills. Journal of Pharmacognosy and Phytochemistry. 2018;7(1):2285-2288.
4. Singh SK, Yadav RS, Yadav BK, Singh M. Effect of organic and inorganic sources of nutrients on yield and quality of brinjal (*Solanum melongena* L.). International Journal of Chemical Studies. 2016;4(5):32-35.
5. Kundu S, Ghosh B, Banik P. Influence of different organic manures and biofertilizers on yield and quality of brinjal (*Solanum melongena* L.). Journal of Crop and Weed, 2013;9(2):89-92.
6. Manna S, Bhattacharyya P, Manna B.. Effect of integrated nutrient management on soil fertility, productivity and quality of brinjal (*Solanum melongena* L.). International Journal of Agriculture. Environment and Biotechnology. 2015;8(3):697-704.
7. Khoo HE, Azlan A, Tang ST, Lim SM. Anthocyanidins and anthocyanins: colored pigments as food, pharmaceutical ingredients, and the potential health benefits. Food & Nutrition Research. 2012;56(1).
DOI: 10.3402/fnr.v56i0.6340
8. Spaepen S, Vanderleyden J, Remans R. Indole-3-acetic acid in microbial and microorganism-plant signaling. FEMS Microbiology Reviews. 2007;31(4):425-448.
9. Rashid MM, Rahman MM, Alam MS, Islam MR. Effect of poultry manure and Trichoderma harzanium on the growth and yield of eggplant. International Journal of Natural and Social Sciences. 2017;4(1):22-29.
10. Sarkar D, Chaudhuri S. Effect of organic and inorganic fertilizers on the growth, yield and quality of brinjal (*Solanum melongena* L.). International Journal of

Current Microbiology and Applied Sciences. 2017;6(7):2406-2411.

11. El-Nady MF, Youssef HH, El-Mogy MM, El-Mougy NS, El-Din MAS. Biofertilizers as a replacement for chemical fertilizers to improve growth, yield and quality of eggplant. Plos One. 2020;15(11): e0242192.
12. Mondal S, Sikdar SR, Nag SK. Effect of vermicompost and biofertilizers on growth and yield of eggplant (*Solanum melongena* L.). Communications in Soil Science and Plant Analysis. 2018;49(1):104-113
13. Singh R, Prasad SM, Singh UP, `Kumar S, Singh R. Evaluation of biofertilizers and their combinations on growth and yield of eggplant (*Solanum melongena* L.). Journal of Pharmacognosy and Phytochemistry. 2019;8(2):2839-2842.
14. Zia MH, Ullah S, Ali M, Iqbal M. Impact of Trichoderma harzianum on the growth and yield of eggplant. International Journal of Agriculture and Biology. 2017;19(5):1207-1212.



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