EFFECT OF BIO-FERTILISERS ON MORPHO-ANATOMICAL AND PRODUCTIVITY OF BRINJAL (*SOLANUM MELONGENA* L.)

Student Project work sponsored by Hindu College Management

By

D. NIRUSHA

D. Esther Rani,

R. Priyanka,

R. Prabhavathi,

M.Sc. Botany

HINDU COLLEGE

P.G. COURSES, Guntur-522 003

Project Guide

Dr. G. RAMESH, *M.Sc., M.Phil. Ph.D.*

Asst. Professor, Department of Botany

Hindu College, Guntur

Submitted to

The Research Committee

HINDU COLLEGE, GUNTUR

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DECLARATION

The project work entitled **"Effect of Bio-fertiliser on Morpho-Anatomical and Productivity of Brinjal (*Solanum melongena* L.)**" has been carried out by us at Hindu College, Agricultural Farm, Pedakakani. This work is original and has not been submitted for any University.

(1)D.NIRUSHA	(2)D.ESTHER RANI	(3)R.PRIYANKA	(4)R.PRABHAVATHI
(Y20BO13002)	(Y20BO13004)	(Y20BO13010)	(Y20BO13011)

HINDU COLLEGE

(Re-accredited by NAAC, a Grade - A)

P.G.COURSES, Guntur-522 002

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CERTIFICATE

This is to certify that this thesis entitled, **"Effect of Bio-Fertilisers on Morpho-Anatomical and Productivity of Brinjal (*Solanum melongena* L.)"** is a *bona fide* Project work done by **Miss. D. Nirusha, (Y20BO13002),** in the Department of M.Sc. Botany, Hindu College, Guntur under my supervision. This Project work or any part thereof has not been submitted elsewhere for award of any Degree or Diploma. This work is found to be satisfactory.

Dr. G. RAMESH
Project Guide

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P.G.COURSES, Guntur-522 002

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K.V.S. DURGA PRASAD
***Head**, Department of Botany*
Phone: 9848110174
e-mail ID: durgaprasad.katrapati@gmail.com

Dt. ……..

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K.V.S. DURGA PRASAD
Head, Department of Botany
K.V.S. DURGA PRASAD M.Sc.,
Head of the Department of Botany,
HINDU COLLEGE, GUNTUR.

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INTRODUCTION

CONTENTS

EFFECT OF BIO-FERTILISERS ON MORPHO-ANATOMICAL AND PRODUCTIVITY OF BRINJAL (*SOLANUM MELONGENA* L.)

1.INTRODUCTION

The Solanaceae family comprises about 98 genera and 2,700 species with a wide distribution, mainly in the tropical and subtropical regions of the world (Olmstead and Bobs, 2007). *Solanum melongena* belong to the family Solanaceae (order-Solanales) is dicotyledonous plants bearing barriers with numerous seeds. According to Hunziker (1979) *Solanum* species are herbs, leaves are simple, pinnate and alternate. Flowers are radically or rarely bilaterally symmetrical, with hypogenous discs; sepals are usually coalescent for almost their full length, the calyx is persistent often enlarging in fruits, corolla ovate to tabular, carpel 2, the style 1, and the ovary usually 2 chambered or sometimes 3-5 through irregularities of the placenta, parental-axile, ovules numerous in each carpel, fruit berry.

Economically, members of *Solanum* used are for the production of drugs e.g. pharmaceutical steroids. The leaf juice is used in treating inflammationof the kidney and bladder and in gonorrhea, dropsy, heart diseases, hile and enlargement of the spleen (Pandey *et al*. 2000). *Solanum* species have indigenous medicinal uses which range from weight reduction to treatment of several ailments including asthma, skin infections and constipation. Various plant parts are used in decoction for curing ailments such as diabetes, leprosy, haemorrhoids (Bello *et al*. 2013). More so, the plants are known for their rich nutritional and mineral value.

The objective of this study is to elevate the growth, flowering, branching and productivity and nutrition and also to find out the anatomical variations in egg plant using biofertilisers as Jeevamrutha and panchagavya application.

India is regarded as a horticultural paradise (Saravaiya and Patel, 2005), with a vast array of vegetables being cultivated in our country, brinjal is considered as one of the leading and the second major vegetable crops next to tomato. Brinjal (*Solanum melongena*) is also called as eggplant, a popular vegetable crop and is native to India (Kiran *et al*., 2010). India contributes about 28% of the total world production (*Daunay et al*., 2001). It is highly productive and usually finds a place as "poor man's crop". Purple fruits have higher amino acid content. Brinjal fruits have medicinal properties (Rajan and Markose, 2002). Some medicinal use of eggplant tissues and extract include treatment of diabetes, asthama, cholera, bronchitis and diarrhea, its fruit and leaves are reported to lower certain levels of blood cholesterol. The growth, yield and fruit quality of brinjal are largely dependent on a number of interacting factors.

Egg plant is a long duration crop with high yield which removes large quantities of nutrients from the soil. An egg-plant crop yielding 60 t ha-1 of fruit removes 190 kg N, 10.9 kg P and 128 kg K from soil (Hedge, 1997). Now-a-days demand for brinjal as a vegetable is increasing rapidly among the vegetable consumers in view of its better fruit color, size and taste. Average productivity of brinjal crop is quite low and there exists a good scope to improve its average productivity in India to fulfill both domestic and national needs. The productivity of brinjal can be increased by using several techniques *viz.*, organic farming, integrated nutrient management and good hybrid seeds. Since the nutrient turnover in soil plant system is considerably high in intensive vegetable cultivation, neither the chemical fertilizer nor the organic manure alone can help achieve sustainable production (Khan *et al*., 2008). Moreover, the application of high input technologies such as chemical

fertilizers, pesticides, herbicides improve the production but there is growing concern over the adverse effects of the use of chemicals on human health, soil productivity and

environment quality.(Sharma *et al*., 2012). Bio fertilizers improve the quantitative and qualitative features of many plants (Yousefi *et al*., 2011). In addition, biofertilizers stimulate plant growth, improve both soil structure and conditions, restore natural soil fertility and provide protection against drought and some soil borne diseases (Bashan *et al*., 2004). On the other hand, application of organics improves the soil physical, chemical and biological properties and has direct impact on moisture retention, root growth and nutrient conservation etc. (Kumar *et al*., 2011). Many countries have already introduced the organic production system with specific logo to provide individuality to the organic products in commercial trade (Sharma, 2011). Application of NPK, bio-fertilizers like *Azospirillum* and phosphate solubilizing bacteria (PSB) with micronutrients viz., ferrous sulphate, zinc sulphate and boron spray bring profound changes in various metabolic processes within the plant system, thereby influencing plant growth and yield considerably. In recent years, importance of combined use of these inorganic fertilizers, biofertilizers and micronutrients is being realized particularly in brinjal to boost up plant growth, productivity and also on seed quality. The application of high input technologies such as chemical fertilizers, pesticides, herbicides improve the production but there is growing concern over the adverse effects of the use of chemicals on human health, soil productivity and environment quality. The integrated management of nutrient, in its proper perspective, may be adopted to support enhanced productivity and quality of vegetables (Kiran *et al.*, 2010). Keeping in view the present investigation was carried out to study the effect of integrated nutrient management on the nutrient status and uptake of brinjal (*Solanum melongena* L.) in an inceptisol of West Bengal.

Aims Objectives of the Project Work

- To compare the morpho-anatomical and productivity of brinjal.

- To study the height and develop of plants between un-treated and treated plot.
- To study the branching and flowering behavior between the two plots.
- To study the anatomical variation of leaf and fruit between the two plots.
- To study the productivity and pulp of fruit between the two plots.

2.MATERIALS AND METHODS

Sources of Materials: Samples of *S. melongena* were collected from Agricultural Department, ARS, Amaravathi, Andhra Pradesh.

i) Anatomical analysis

Anatomy follows the methods of (Kadiri and Adeniran, 2016) with some modification. The root, stem, leaf and fruit were sectioned using Microtome blade and the thin slices obtained were kept in water before transferring onto a glass slide where a few drops of 99% ethyl alcohol were added for tissue hardening and then 2 drop of safranin solutions. Excess stain was washed off with water before a drop of glycerin was added. Slides were covered with cover slips and ringed with nail lacquer. However, all preparations were observed with an Olympus microscope and photographs were taken with a digitized camera (Nikkon).

Application of Jeevamrutha at different levels irrespective of different levels of panchagavya has recorded significantly higher growth parameters. Application of jeevamrutha @ 1000 lha^{-1} has recorded higher plant height (60 cm), number of branches (8), number of leaves (26), leaf area (18 cm^2), and leaf area index (1.54) compared to without application of Jeevamrutha 12 cms (Table 2).

Application of panchagavya irrespective of different levels of jeevamrutha has resulted in significantly higher growth. Foliar spray of panchagavya @ 7.5 per cent at 20, 40 and 60 days after sowing recorded significantly higher growth parameters like more number of branches (7), number of leaves (24), leaf are (14 cm^2) and leaf area index (1.38) (Table 2).

Significantly higher grain yield recorded with application of jeevamrutha 1000 lha^{-1} was due to better yield attributing characters like height, branches, leaves,

flowers, fruits (Table 5). Increased yield attributes might be due to beneficial effect of jeevamrutha which has reflected in the form of higher plant height (65.60) with more number of branches per plant (8) respectively at 45 days after sowing observed with jeevamrutha and panchagavya application.

In the present study, all the yield attributing parameters were significantly higher with jeevamrutha @ 1000 lha^{-1} which might be due to favourable effects of IAA, GA3, macro and micronutrients due to better availability of nutrients throughout the crop growth which might be the result of improved microbial activity in the soil. These findings are in accordance with Kasbe *et al.* (2009) and Dekhane *et al* (2011) where in, it is reported that higher nutrient status of Jeevamrutha formulation (2500 lha^{-1}) resulted in profused growth in the form of higher dry matter accumulation and yield parameters. Whenever liquid manures are applied at regular intervals (2 to 3 times), they act as a stimulus in the plant system and in turn increase the production of growth regulators in the cell system and growth hormones which in turn might have enhanced the soil biomass, there by sustaining the availability and uptake of applied as well as native soil nutrients which ultimately have resulted in better growth and yield of crops.

ii).Jeevamrutha:

Jeevamrutha was prepared by mixing 10 kg of cow dung, 10 litre of cow urine, 2 kg of local jiggery, 2 kg of pigeon pea flour and hand full of soil collected from farm. All these were put in 200 litre capacity plastic drum and mixed thoroughly and volume was made up to 200 litre. The mixture was stirred well in clock wise direction and kept in shade covered with wet jute bag. The solution was regularly stirred clockwise in the morning, afternoon and in the evening continuously for 10

days and it was used for soil application. Jeevamrutha and was applied when the soil was wet near the root zone of the crop as per the treatments.

Iii).Panchagavya:

Panchagavya was prepared by mixing 7 kg fresh cow dung and 1 kg ghee and incubated in a plastic drum for 2 days and it was mixed daily once. On third day, 10 litres cow urine and 10 litres of water were added and mixed thoroughly and incubated for fermentation for 13 days. Then, 3 litres milk, 2 litres curd, 100 gram yeast, 3 litres tender coconut water, 3 kg jiggery and 12 ripened Cavendish banana were added and contents were incubated for 6 days and the mixture was stirred thoroughly thrice a day. Plastic drum with all the contents was kept in shade and it was covered with wet jute bag. After 21 days of formentation, mixture was filtered through a cotton cloth and used according to treatments schedule.

Both liquid manures - jeevamrutha and panchagavya were applied to *S. melongena* crop at 20, 40 and 60 days after sowing. short duration (80-90 days) variety of *Solanum melongena* – AV5 was used for the field experiment. *S. melongena* crop was sown on January 2021 with seed rate of 30 kg ha^{-1} and seeds were sown at spacing of 45 cm and seed to seed spacing of 15 cm (45cm x 15cm).

Irrigation was provided at 10-15 days interval depending on the stage of crop and soil condition. Necessary aftercare operations were followed as per the recommendations. No major pest and disease incidences were noticed during crop growth. Observations on growth parameters were recorded at regular intervals – 30, 45, 65 days after sowing and at harvest. Experimental data collected was subjected to statistical analysis by adopting Fisher's method of Analysis of Variance (ANOVA) as outlined by Gomez and Gomez (1984). Critical Difference (CD) values were calculated whenever the 'F' test was found significant at 5 per cent level.

3. REVIEW OF LITERATURE

The fresh preparation of *Jeevamrutham* was moderate green in colour with mild foul odour. As the storage period progressed, the preparation became darker in colour with strong foul odour. Fermentation of ingredients of *Jeevamrutham* such as cow dung, cow urine, green gram has induced foul odour for the fresh preparation itself. It might be due to the production of volatile fatty acids, volatile amines, methane etc. during fermentation.

The freshly prepared *Jeevamrutham* was acidic in nature with a pH of 5.63. The preparation became highly alkaline while progressing to the end of storage period as evident from Table 1. The highest pH of 9.77 was noticed in S_{10}(20 weeks old preparation). Bibliography also observed an acidic pH of 4.92 in fresh preparation of *Jeevamrutham.* The change in pH during storage might be due to the lactic acid fermentation and alcoholic fermentation. The presence of methanol, propanol, butanol and ethanol as the fermentation by-products which possess a neutral pH, might have contributed towards an increase in pH of *Jeevamrutham* during storage.

The highest calcium content (66.4 ppm) was recorded in fresh preparation. There was no significant variation in the magnesium content of *Jeevamrutham* due to ageing and the value was in the range of 50.33 to 62.83 ppm. In general, the Mg content was slightly improved due to ageing. The sulphur content of *Jeevamrutham* was significantly influenced by ageing and the highest S content was recorded during 20th and 8th week (280.11 ppm) while the lowest value (81.62 ppm) was recorded in 2 weeks old preparation.

Few micronutrients *viz.*, Fe, Mn, Zn were also detected in *Jeevamrutham.* The content of these nutrients were significantly influenced by different storage intervals.

Four weeks old *Jeevamrutham* recorded the highest Fe content (104.16 ppm). Presence of zinc and manganese were detected during some stages of storage. The value was in the range of 0.40-7.50 ppm of Zn, l.70- 26.90 ppm of Mn. Copper was not detected during the entire storage period.

Jeewamrita is an organic fertilizer, which has been used by the Indian farmers. Jeewamrita immense biological activities in the soil and makes the nutrient available to the crop (Palekar, 2006). Jeewamrita as an organic fertilizer has been poorly investigated. When animal manure efficiently and effectively used, ensures sustainable crop productivity by immobilizing nutrients that are susceptible to leaching. Nutrient which containing organic manure are released more slowly and are stored for a longer time in the soil thus ensuring longer residual effects; higher crop yield and improved root development (Sharma and Mittra, 1991).

Integrated of organic and inorganic fertilizers are accepted in many countries under the soil management strategy. Apart from enhancing the crop yield the practice has a beneficial residual effect that can be derived from the use of either inorganic or organic fertilizers applied alone. Combination of organic nitrogen have increasingly received recognition as integral and indispensable components of sustainable soil fertility management and significant advances also have been made on their influence on the soil chemical and physical properties (Palm and Rowland, 1997).

Application of the Nitrogen not only increases the growth and fruit yield but also improves soil characters by affecting soil fauna and flora. The deficiency of soil Nitrogen in soil allow the poor plant growth due to decline in soil fertility status. Therefore, the Nitrogen is an important element in plant nutrition; plants take it in

significant levels. Sufficient Nitrogen improves the cell division, foliage production, and photosynthetic activity of plant, thus producing higher number of flowers and fruits (Sharma and Yadav, 1996). Knowledge about the integrated use of inorganic and organic fertilizers could enable the development of new agricultural approaches for improving Nitrogen management and contribute to developing models of sustainable agriculture (Seez *et al.*, 2012).

4.RESULTS AND DISCUSSION

i)Morphology

The application of biofertilisers has given significant flowering ranging from 10-20 task (Table 3). The number of fruits are more with the treated plot showing larger number (Table 4). The fruit size is showing prominent change in size 10-12 cms (Table 5). The plot treated with bio-fertilizer is showing good branches and wider area with larger canopy covering more number of fruits with larger size and healthy (Table 6).

ii)Anatomy

In the leaf anatomy of *S. melongena* (untreated) showing less trichomes, the collenchymas is also less in number (Fig. 11A). On the other hand, the primary growth parenchyma, collenchymas and hypodermis occupy larger in number of treated plant leaf (Fig. 11D). the treated plot showing fruit anatomy with prominent vascular bundle and larger cortical cells and more number of layers (Fig. 12D).

In the anatomy of *S. melongena*, the mid-rib showed stellate trichomes in the epidermis made of a layer of cells. The collenchymatous cells occupy the region of the hypodermis; parenchymatous cells occupy the ground meristem. The primary growth phase reveals 3 vascular traces with no rib bundle wings in both growth phases (Fig. 11B). On the other hand, the mid-rib of *S. melongena* (Fig. 11F). the mid-rib of *S. melongena* is made of a layer of cells in the epidermis the cell and tissue of a layer of cells in the epidermis the cell and tissue arrangements and a similar in mid-rib of both plants except that there are 2 to 4 rib bundle wings present in the mid-rib of *S. melongena* (Fig. 11D). Stem anatomy has an epicycle of many layers of cells

below the endodermis (inner-most part of the cortex) and large pith occupied by collenchymatous cells. Also, the root anatomy of *S. melongena* revealed epiblema made of one layer. The vascular bundles have radical symmetry.

Relatively, the mid-rib of trented showed numerous simple multicellular trichomes on the epidermal layer made of a roll cells. The hypodermis is made of few layers (Fig. 11C), of thick wall cells termed collenchymas. The vest of the general cortex is composed of parenchymatous cells which are larger and made of this wall.

Yield and yield attributes were improved due to application of both jeevamrutha and panchagavya to *S. melongena*. Significantly higher grain yield (1478 kg ha^{-1}) was recorded with the soil application of jeevamrutha @ 1000 lha^{-1} and foliar spray of panchagavya @ 7.5 per cent. Haulm yield did not differ significantly. However, higher haulm yield (5183 kg ha^{-1}) was recorded with the soil application of jeevamrutha @ 1000 lha^{-1} and foliar spray of Panchagavya @ 7.5 per cent. Yield increased significantly due to better yield attributing characters viz., significant increase in number of flowers per plant (15-18), fruits (18-20), fruit length (10 cm).

Crop yield is the complex function of physiological processes and biochemical activities, which modify plant anatomy and morphology of the growing plants. days after sowing compared with no foliar spray of panchagavya might be due to presence of IAA and GA present in panchagavya which could create stimuli in the plant system and increased the production of growth regulators in plant system which in turn stimulated the necessary growth and development of crop. This might be due to favorable effect of panchagavya on vegetative growth (plant height, number of leaves and branches per plant)and reproductive growth (fruits per plant, fruit length) which

were considered as the important yield attributes having significant positive correlation with cortex and haulm yield. These findings are in line with the findings of Devakumar (2014).

Improvement in yield and yield attributes might be due to stimulation in root growth by inorganic nutrients as well better absorption of water and nutrients due to soil application of Jeevamrutha which further also supported the synergistic and complementary effect of Jeevamrutha and Panchagavya after fermentation which favour the higher yield. These findings are in line with those reported by Avudaithai *et al.* (2010) and Kumar *et al.* (2011).

Thus, combined application of jeevamrutha and panchagavya results in better growth and yield attributes resulting into 59 per cent increased grain yield over without application of jeevamrutha and panchagavya *Solanum melongena.* Liquid organic formulations can effectively and efficiently be used to get higher grain yield in *S. melongena*. Hence, this study has shown the advantages with organic liquid formulations and thus they can be exploited extensively in crop production.

5.CONCLUSION

Combined application of jeevamrutha and panchagavya resulted in better growth attributes and contributed for improved fertility status of soil. It has resulted in 59 percent increased grain yield (1478 kg ha' over control (601 kg ha"). Hence, these liquid formulations are efficient organic substitutes and they can be applied along with organic manures in an integrated approach for obtaining higher crop yield besides improving the nutrient status of the soil.

The results reveal that the egg plants show better response with bio-fertilisers.

7.TABLES

Table 1. Height of plant (cm^2)

Plants	15 Days	25 Days	35 Days	45 Days	60 Days
Ut 1	7	16	20	29	42
Ut 2	6	16	20	29	45
Ut 3	5	17	19	27	45
Ut 4	5	15	19	28	46
Ut 5	6	15	20	27	46
T 1	8	18	23	34	58
T 2	9	17	24	34	62
T 3	8	16	23	35	62
T 4	8	16	23	34	63
T 5	8	16	23	35	42

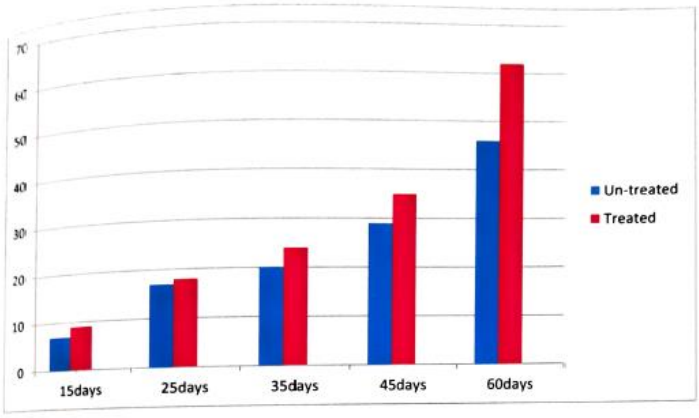
Ut: Untreated; T:Treated

Table 2. Number of Leaves

Plants	15 Days	25 Days	35 Days	45 Days	60 Days
Ut 1	2	4	5	8	9
Ut 2	2	3	5	8	12
Ut 3	3	2	4	7	10
Ut 4	2	3	3	8	8
Ut 5	2	4	3	8	10
T 1	3	4	6	8	16
T 2	3	4	4	8	14
T 3	2	6	4	10	16
T 4	4	5	5	8	15
T 5	2	4	5	9	15

Ut: Untreated; T:Treated

Height of the plant CM



Number of leaves

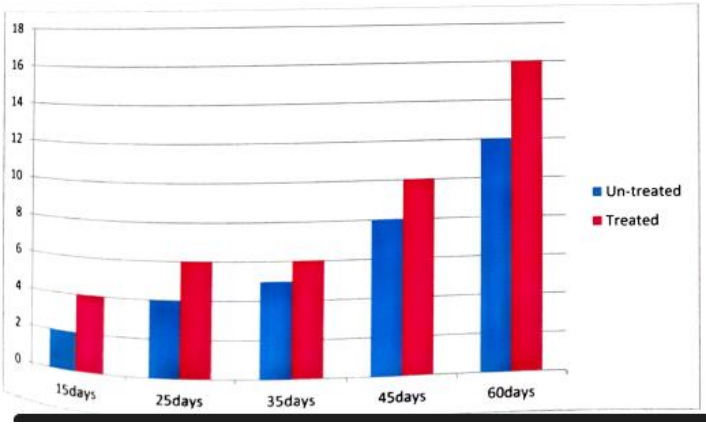


Table 3. Number of Flowers

Plants	15 Days	25 Days	35 Days	45 Days	60 Days
Ut 1	0	0	2	4	10
Ut 2	0	0	3	2	11
Ut 3	0	0	1	5	10
Ut 4	0	0	0	1	8
Ut 5	0	0	1	3	9
T 1	0	0	5	10	19
T 2	0	0	5	10	20
T 3	0	1	4	9	19
T 4	0	0	5	10	20
T 5	0	0	3	8	21

Ut: Untreated; T:Treated

Table 4. Number of Fruits

Plants	15 Days	25 Days	35 Days	45 Days	60 Days
Ut 1	0	0	3	5	10
Ut 2	0	0	2	5	8
Ut 3	0	0	0	4	10
Ut 4	0	0	1	3	9
Ut 5	0	0	1	4	9
T 1	0	0	5	10	20
T 2	0	1	6	8	17
T 3	0	0	4	9	12
T 4	0	0	5	10	19
T 5	0	0	4	9	18

Ut: Untreated; T:Treated

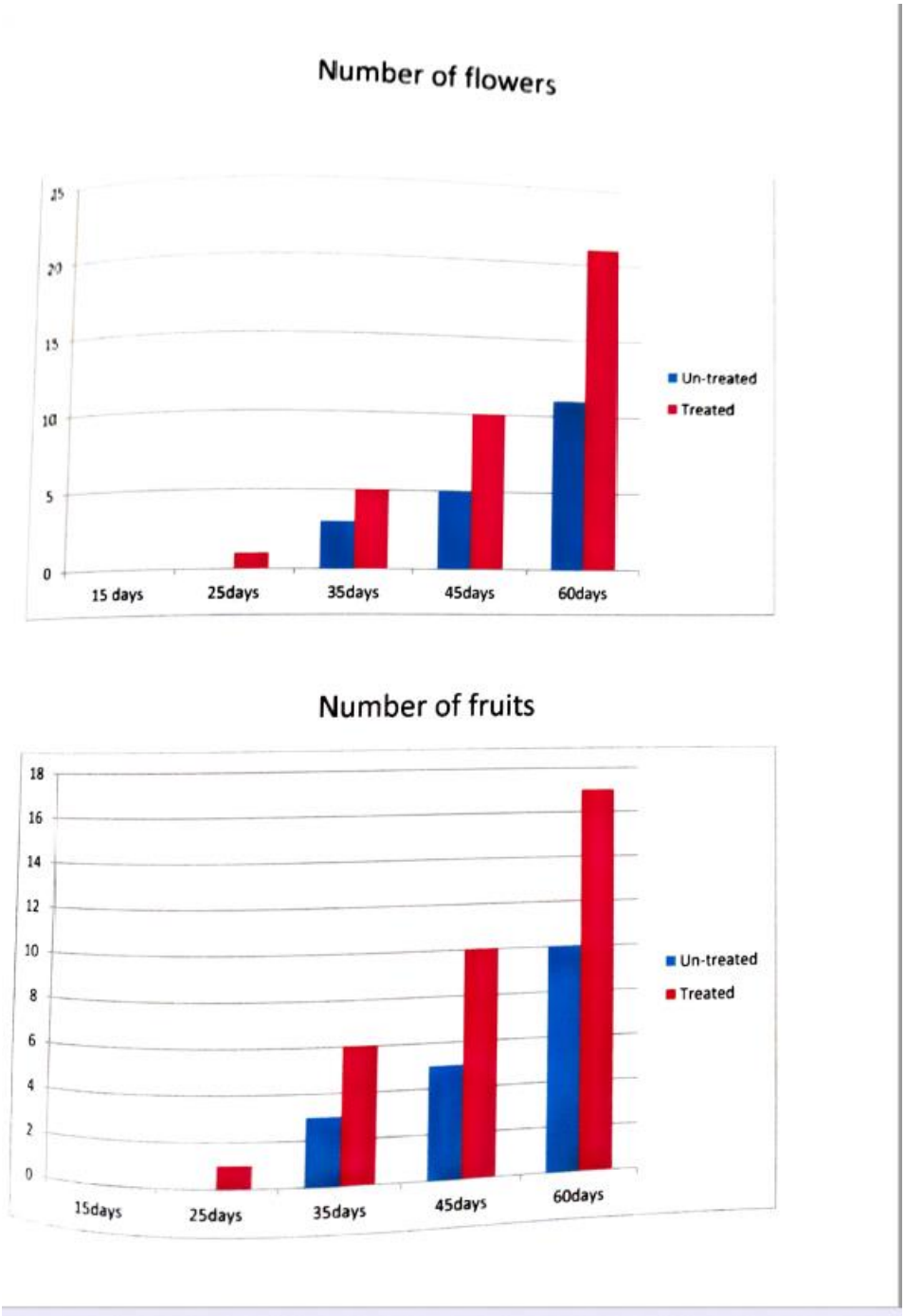


Table 5. Fruit size cm^2

Plants	15 Days	25 Days	35 Days	45 Days	60 Days
Ut 1	0	0	2	4	6
Ut 2	0	0	1	3	7
Ut 3	0	0	0	4	5
Ut 4	0	0	2	2	7

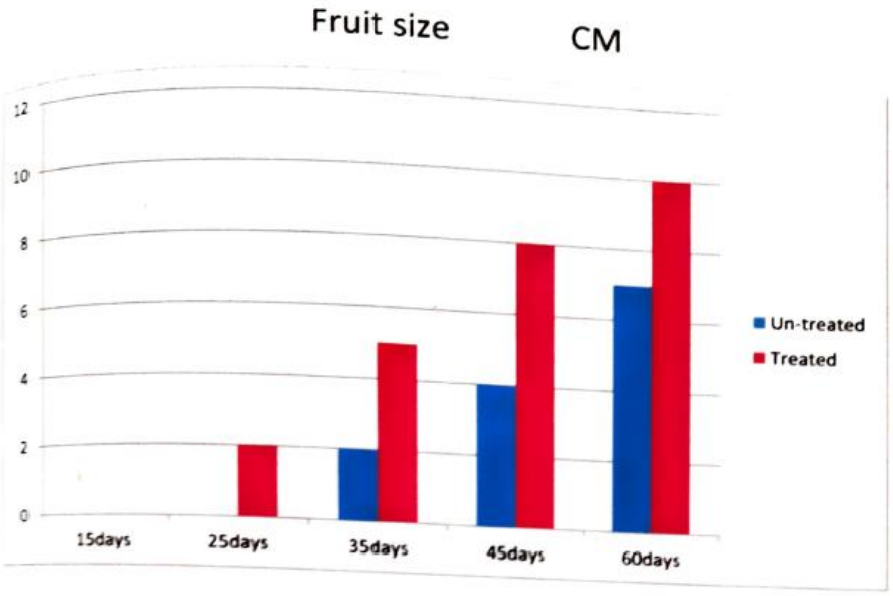
Ut 5	0	0	2	4	6
T 1	0	2	5	8	10
T 2	0	2	4	7	8
T 3	0	2	4	6	9
T 4	0	2	3	8	10
T 5	0	2	4	7	10

Ut: Untreated; T:Treated

Table 6. Width of plant (canopy) cm^2

Plants	15 Days	25 Days	35 Days	45 Days	60 Days
Ut 1	2	5	7	8	9
Ut 2	3	5	5	7	9
Ut 3	2	3	4	7	8
Ut 4	3	4	2	8	7
Ut 5	3	5	4	8	8
1	4	6	10	14	16
2	5	7	8	14	17
3	4	6	11	13	16
4	4	7	9	10	16
5	5	5	9	12	15

Ut: Untreated; T:Treated


Fruit size
CM
12
10
8
6
4
2
0
15days
25days
35days
45days
60days
Un-treated
Treated

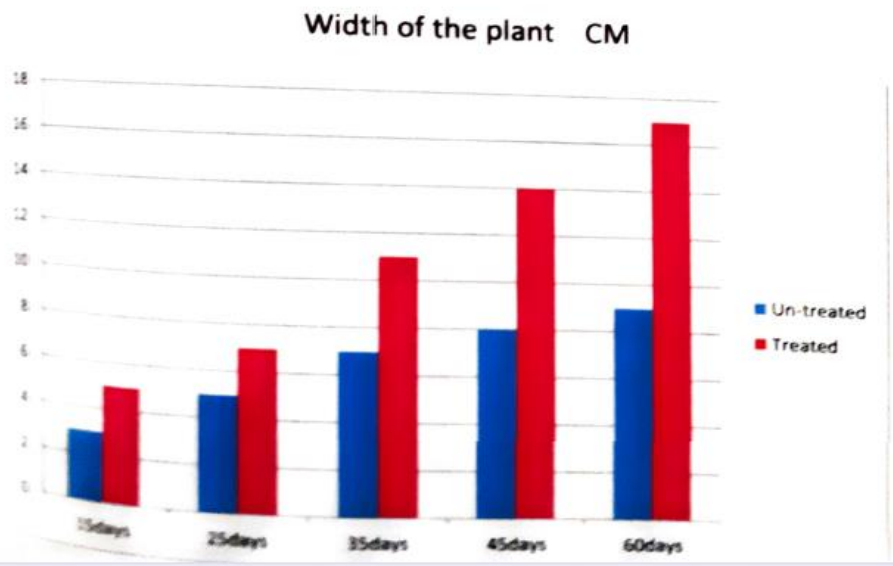

Width of the plant
CM
18
16
14
12
10
8
6
4
2
0
15days
25days
35days
45days
60days
Un-treated
Treated

Fig.1. Study area is taken in Hindu College Agricultural Farm, Pedakakani

Study area: A Plot of 50x50 is taken

10 rows are taken

5 rows are treated with biofertilisers

5 rows are un-treated

Each row containing 10 plants

study area

Fig 1

Fig.2 Watering

A. Watering by R. Priyanka

B. Watering by D. Nirusha

C. Watering by D.Esther Rani

D. Watering by R. Prabhavathi

The soil is properly leveled and watered from time to time, for easy sowing the seeds

watering

Fig 2

Fig.3 Sowing

A. Water sprinkling by R.Prabhavathi

B. Water sprinkling by D. Esther Rani

C. Sowing seeds by D. Nirusha and R. Prabhavathi

D. Removing the debris by R. Prabhavathi

E. Sowing seeds in row

F. Explaining the process of sowing by project guide

seed sowing

Fig 3

Fig.4 Manuring

A. After 15 days planning developed, this is not treated and showing less growth.

B. This is treated with biofertilizers and showing variation is height

C. Not treated

D. Treated

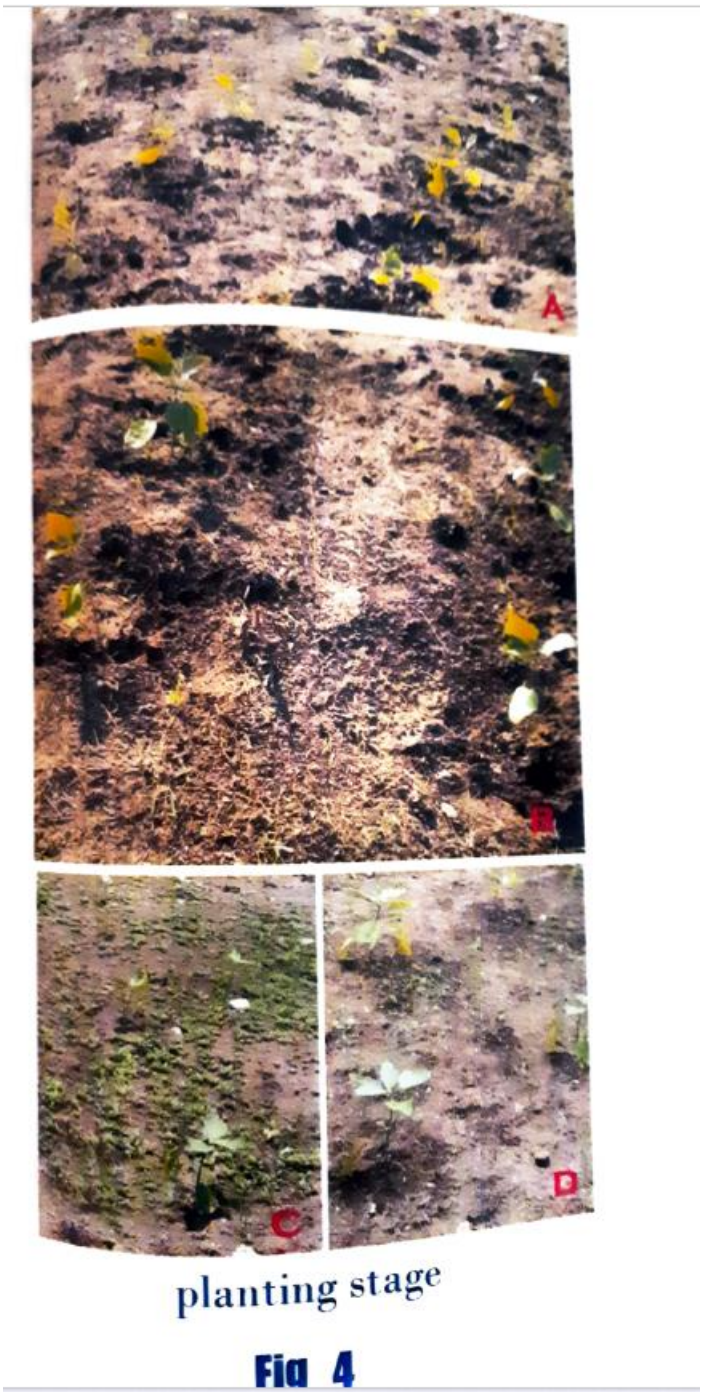


Fig.5 Manuring

A. Preparing the liquid manure to the given formula 50ml/1L

B. Stirring the liquid for proper melting.

C. Applying the liquid manure for leaves (foliar spray)

D. applying the liquid for roots

Fig. 6 Weed Removing

A. Removing the weed in untreated

B. Removing the weed in treated plot

C. Untreated plot showing less growth

D. Treated plot showing more leaves and healthy growth

E. Untreated plot with less growth

F. Treated plot showing more growth

weed removing

Fig. 7 Flowering

A. Treated plot showing flowering

B. Untreated plot with less flowers

C. Treated Plot with fruiting stage

D. Treated plot showing more flowering

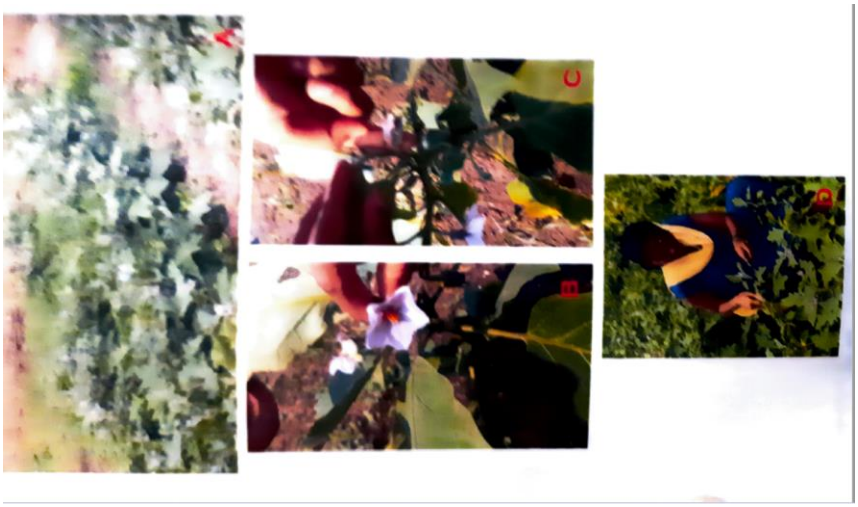


Fig. 8 Measuring

A. Untreated plot showing less canopy

B. Treated plot showing good canopy

C. Treated plot showing good growth and canopy

measuring canopy

Fig 8

Fig. 9 Fruiting

A. Untreated plot showing small fruits

B. Treated plot showing larger fruits

C. Untreated plot showing less flowering and fruits

D. Treated plot showing more and large fruits

E. Untreated plot showing less harvest

F. Treated plot showing more harvest

fruiting stage

Fig. 9

Fig. 10 Entrepreneurship

A. Project guide and students are happy in showing the harvest of treated plot

B. Harvest of treated plot

C,D &E. Student entrepreneurship

Fig. 11. Leaf Anatomy

A. Untreated leaf showing smaller epidermal cells

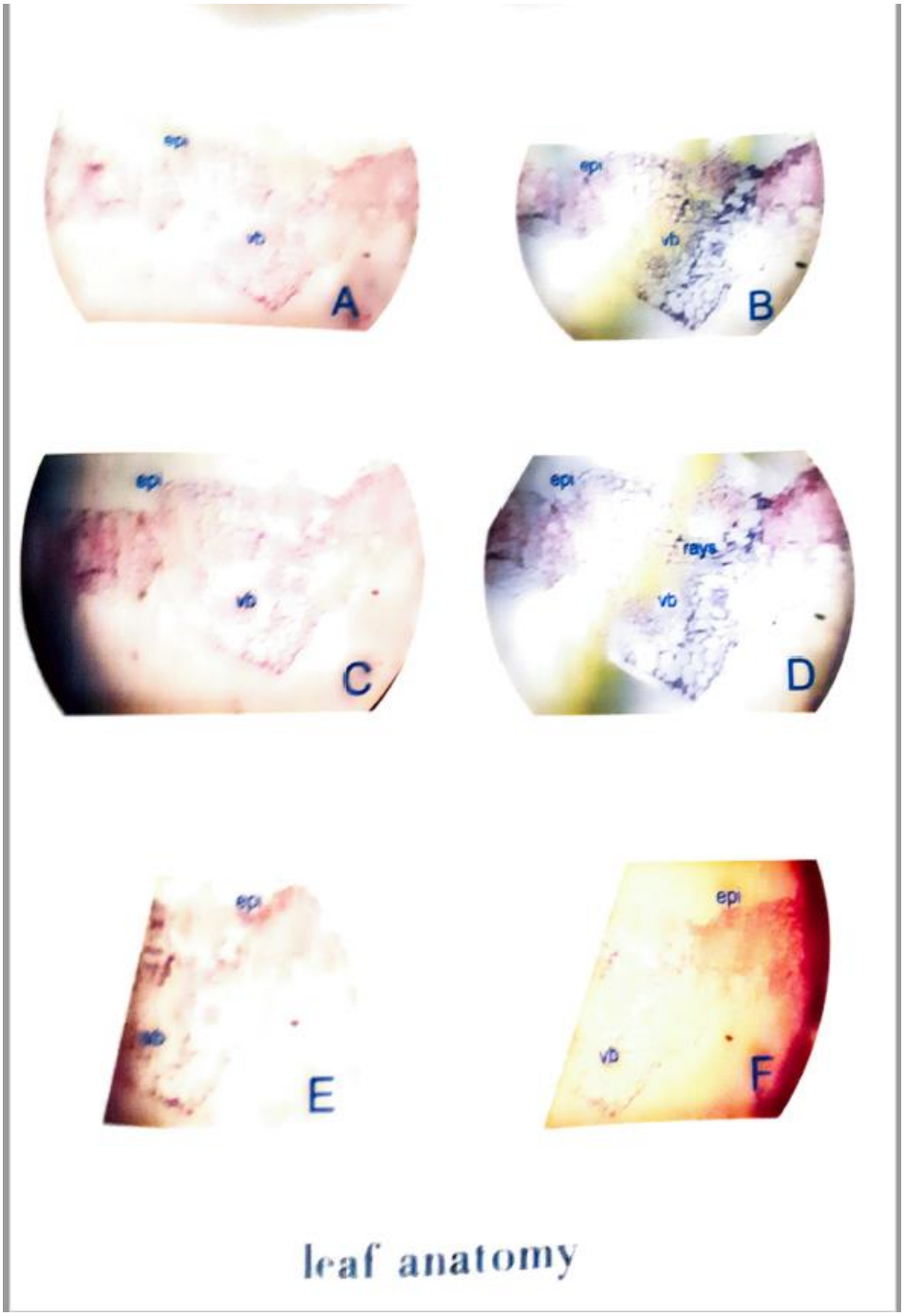
B. Treated leaf showing prominent epidermal cells

C. Untreated leaf showing smaller midrib vascular bundle

D. Treated leaf showing larger and prominent vascular bundle with commissural vascular bundle rays, which help in more photosynthetic rate.

E. Untreated leaf showing lesser lateral vein

F. Treated leaf showing larger lateral veins



leaf anatomy

Fig. 12. Fruit Anatomy

A. Untreated fruit showing less epidermal cells

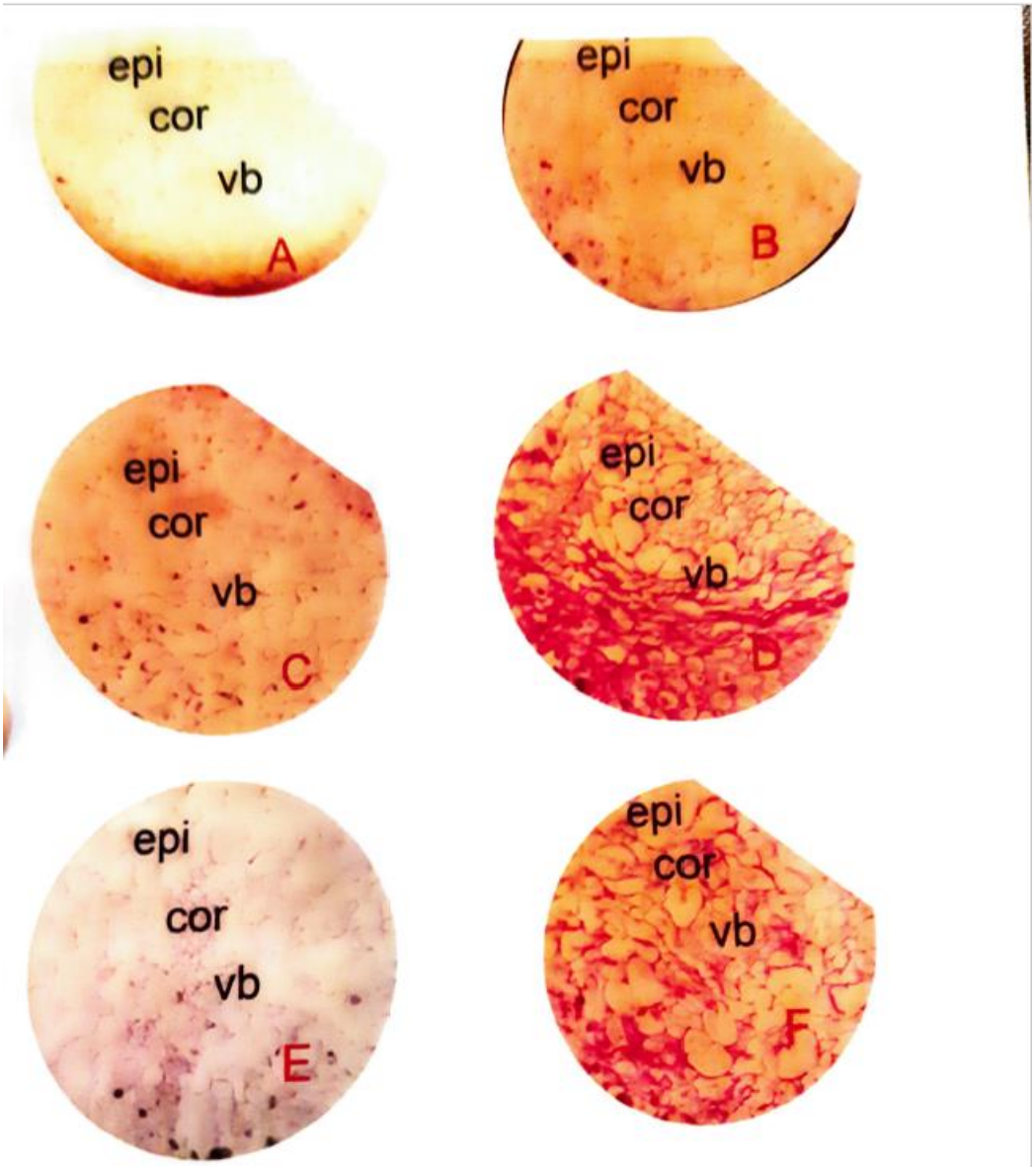
B. Treated fruit showing prominent and larger epidermal cells

C. Untreated fruit showing lesser cortex with thin cell, less protein fibre

D. Treated fruit showing larger cortex and more fibre tissue

E. Untreated fruit showing less vascular bundles

F. Treated fruit showing larger and more conspicuous vascular bundle.



fruit anatomy

Fig 12

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