

BIOFERTILIZER FROM ALGAE

(Project-Report)

Submitted in partial fulfilment of the requirements for the award of
Bachelor of Science degree in Biochemistry.

By

T SWARNALATHA (38300019)

K RUTHRA (38070003)



**DEPARTMENT OF BIOTECHNOLOGY
SCHOOL OF BIO AND CHEMICAL ENGINEERING**

**SATHYABAMA INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)**

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JEPPIAAR NAGAR, RAJIV GANDHI SALAI, CHENNAI - 600 119

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SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY

(DEEMED TO BE UNIVERSITY)

Accredited with "A" grade by NAAC
Jeppiaar Nagar, Rajiv Gandhi Salai, Chennai –
600119

www.sathyabama.ac.in



DEPARTMENT OF BIOTECHNOLOGY

BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of T.SWARNALATHA (38300018) who carried out the project entitled **"BIOFERTILIZER FROM ALGAE"** under our supervision from October 2020 to March 2021.

Internal Guide
Dr. RENUGADEVI

Head of the Department
Dr. V Ramesh Kumar

Submitted for Viva voce Examination held on _____ .

Internal Examiner
Examiner

External

DECLARATION

T. SWARNALATHA (38300019) hereby declare that the Project Report entitled **“BIOFERTILIZER FROM ALGAE”** done by me under the guidance of **Dr. RENUGADEVI** at **Sathyabama institute of Science and Technology, Chennai** is submitted in partial fulfillment of the requirements for the award of Bachelor of Science degree in Microbiology.

DATE:

PLACE:

SIGNATURE OF THE CANDIDATE

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ABSTRACT

Sustainable agriculture is advantageous over conventional agriculture for its capacity to accomplish food demand by utilizing environment resources without negatively affect .Fertilizer play a major role in agriculture crops. Algae are the kind of widespread photosynthetic organism which have a ability to enrich soil nutrients and enhance utilization of macro and micro nutrients. Algae biofertilizer presence of a large group of microorganism which have benefits to enhance the soil productivity. Algae have naturally nitrogen fixation which help to grow the plant fastly. Three types Cyanobacterial algae biofertilizer Azolla as dried plant, Spirulina as extracted powder and Geitlerinema as liquid were used to grown five different plants(*Trigonella foenum-graecum*, *Brassica*, *Sesamum indicum*, *Capsicum frutescens* and *Vigna radiata*) for to know the early stage growth of the plant by measuring (cm). Algalization as been employed for observing the nitrogen ,potassium and phosphorus was taken by NPK test using NPK kit. Effect of Toxicity of algae biofertilizer on earthworm from there the length of the earth were observed ,the earthworm in normal and spirulina shown 0.5cm growth azolla remains same size and geitlerinema a earthworm size was reduced. Apart from three algae fertilizer Azolla shown a major growth and high nitrogen fixation, next is Spirulina biofertilizer moderate growth and Geitlerinema not showed expected result.

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LIST OF ABBREVIATION AND SYMBOLS:

cm	-	Centimeter
g	-	Gram
ml	-	Milliliter
mL	-	Milliliter
mg/kg	-	Milligram per kilogram
°C	-	Degree celcius
%	-	Percentage
BGA	-	Blue green algae
NPK	-	Nitrogen , phosphorous, potassium
CO ₂	-	Carbon-di-oxide
N	-	Nitrogen
K	-	Potassium
P	-	Phosphorous

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CHAPTER 1: INTRODUCTION

Fertilizer play a key role in agriculture crops. Biofertilizer is a substance which contain living microorganism , when applied to plant which colonize the rhizosphere the interior of the plant and promotes growth by increasing the supply or availability of primary nutrients to the host plant. Biofertilizer add nutrient through the natural process of nitrogen fixation, solubility phosphorous and stimulating the plants growth through the synthesis of growth promoting substance. Biofertilizer can be reduce the use of synthetic fertilizer and pesticide, but they are not yet able to replace their use. Since they play several roles a preferred scientific term for such beneficial bacteria “ plant - growth promoting rhizobacteria”. Biofertilizer provides the “eco - friendly “ organic agro - input. Biofertilizer such as rhizobium, azotobacter, azospirillum and BGA have been in use for long time.

Algae are a kind of widespread photosynthetic organism including eukaryotic green algae and prokaryotic blue algae. These fascinating organism can be used in modern agriculture for their ability to enrich soil nutrient and enhance utilization of macro and micro nutrients. This was to assess the effect of marine algae fertilizer on growth of plants. The algae treatment increased growth performance at the early stage of growth and improved yield characteristics. Thus marine algae exhibited high growth and yield revealed the potential of the marine algae as fertilizer in plants.

Cyanobacteria are one of the major component of agricultural field. The agricultural importance of BGA is related directly with their ability to fix nitrogen and other beneficial effects for plants and soil .

Spirulina is an organism that growth in both fresh and salt water. It is a type of cyanobacteria which is a family of single-celled microbes referred to as blue-green algae. Cyanobacteria can produce energy from sunlight through photosynthesis. Spirulina as a completely natural and healthy fertilizer. When compared to chemical fertilizer spirulina enhance the plant growth in terms of protein content.

Azolla is an aquatic fern consisting of a short , branched , floating stem, bearing roots, triangular or polygonal in shape and float on the surface of the water. The leaves are alternately arranged, each consisting of thick aerial dorsal lobe containing green chlorophyll. The most remarkable characteristics of azolla is its symbiotic relationship with the nitrogen-fixing-blue-green-algae (cyanobacteria) Anabaena Azolla. The fern provides nutrients and possibly other growth promoting substance.

Geitlerinema is the simple filamentous cyanobacteria genus geitlerinema is heterogoneous. Anoxygenic cyanobacteria that use sulphide as the electron donor for photosynthesis are a potentially influential. The thallus is thin, delicate, mostly bright blue green, rarely violet or brown, diffuse sometimes fascicle like, usually forming thin macroscopic mats.

Algae biofertilizer is a natural , organic and renewable energy source. They help to retain essential nutrients and water in the soil which is required for the

proper growth of the plants. When chemical fertilizer used they change the soil composition and causing contamination and pollution.

CHAPTER 2 : REVIEW OF LITRATURE

(Deepali chittora et al 2020), used cynobacterium as a source of fertilizer for sustainable agriculture. cynobacteria are the most successful and sustained prokaryotic organism during the course of evolution. BGA are emerging candidates for efficiently conversion of radiant energy into chemical energy. Cynobacterium are used in ecofriendly sustainable agricultural practices for production of biomass of very high value. They have done the cynobacterium under three cultivation method.

1. Open system cultivation using sunlight.
2. Close system cultivation using sunlight.
3. Close system cultivation using artificial light

At the process of (CSCUC) raceway or circular type shallow open ponds are used for the mass cultivation of cyanobacteria and microalgae. The advantage between this solar radiation is free of cost. Disadvantage is contamination by algae grazers and other microorganism are unpreventable which compromises net productivity. Contamination problem could be conditions which generally prevent the growth of other organism, however this strategy limits the application of open system for cultivation of only selected organism.

In this system solar radiation is a source of energy transparent material such as plastic or glass is used for making vessels which are placed outdoors in the natural light for illumination. Advantage of it is shown as preventing contamination of grazers and competitors provides a higher surface to volume ratio and cell densities obtained often higher than in open system. Cost of this system is increased it was appear as a disadvantage on this system of cultivation for fertilizer.

In this system source of radiation is artificial light. Photobioreactor is used for the cultivation of various organism. It serve as an important tool for the production of high-value products such as stable-isotope-labeled biochemicals. The disadvantage is the utilization of plastic or glass material for making the vessel and power consumption is costly. In this method, small pits are prepared in the field and lined with thick polythene sheets, for example : *Anabaena*, *Spirulina* some other algal sample etc, have been used for inoculum preparation.

On this cyanobacterium have an emerged potential as biofertilizer. They have the ability to utilize CO_2 , water and nutrient to convert solar energy into biomass. Efficient application of cynobacterium have been reported in agricultural practices to reduce global warming by decreasing CO_2 gas. The overall study stated that the BGA biomass can be utilized for improving the quality of food products, physicochemical properties of soil. Controlling soil-borne disease added organic matter releases growth promoting substance, solubilize the insoluble phosphate, use

as nutraceuticals and also apply in pharmaceuticals. Hence, biofertilizer propered from cynobacterium are economical and environmental- friendly.

Azolla biofertilizer sustailly improved NUE and yield for rice crops. The efficient use of (N) in crop production is critical for melting the challengs of food security and environment integrity. The objective of this study was to determine the efficiency of partially substituted azolla biofertilizer for systhtic N fertilizer to improved NUE, reduce N loss and enhance rice cropping system, (Min Zhang et al 2018).

Therefore, 3 year field expriement was conducted with 5 treatment by them; CK (control without urea), FN (farmers' N Pratices), FNA (the farmer N combined with azolla biofertilizer); RN (reducing farmers N by 25%) and RNA (substituting azolla biofertilizer for 25% farmers N). The NUE, ammonia (NH₃) volatilization, rice yield and net economic benefit were assessed.

The results showed that in the RNA and FNA treatment, azolla biofertilizer produced higher recovery efficiency of fertilizer N by 69% and 59%, provide higher agronomic N are efficiency by 52% and 31% and achieved higher partial factor products of applied N by 43% and 13% then FN for 3 years, respectively. By these results it shows that fertilizer used field have more nitrogen then others. It was more helpful to understand the capacity of azolla and its working level on soil with plants. In addition, the RNA and FNA treatment achieved crop N recovery that was 64% and 49% higher than the FN treatment respectively. It has great power of converting soil nutrients and by promoting the atmosheric nitrogen to plant. The improved NUE under the azolla biofertilizer treatment were attributed to reduce N and enhance N uptake by rice plants.

The RNA & FNA treatment significantly reduced (N) loss by 48% and 26% as well as lowered NH₃ loss by 42% and 12% over FN, respectively. In this percentage of nitrogen and ammonia has easy to find the capacity of RNA on the field. In addition azolla could fix 52 and 4 kg N ha⁻¹ crop in the RNA and FNA treatment and thereby, azolla biofertilizer resulted in higher N uptake that was 17% and 33% higher in the RNA and FNA group than in FN, respectively. As a results the RNA and FNA treatment achieved higher rice by 8% and 14% over FN, respectively, but they attained similar and higher net economic benefit over FN for 3 year. Therefore, substituting azolla biofertilizer for 25% of urea N provides financially attractive option for farmer to substantially improved NUE and yield effectively reduce N loss in intensive rice cropping system.

Microalgal research has been an area of great interest as microalgae have higher productivity than land plants and can be used for the production of valuable commodities such as biofuel, animal feeds and agricultural fertilizer among others. The ability of spirulina-based fertilizer to enhance plant growth was demonstrated in leafy vegetable such as arugula (*Eruca sativa*), Bayam Red and pak choy, (Shy Chyi Wuang et al, 2016)

Microalgae biorefinery system have been extension studied from the perspective of resources, energy expenditure, biofuel production potential and high

added value products. The genus spirulina (*Arthrospira*) stands out among the microalgae of commercial importance. It accounts for over 30% of biomass produced globally because of high protein content and carotenoid and phycocyanin content. It was the most useful algae which grown on water as well as waste water. Spirulina cultivation can be used to reduce greenhouse gases and for efficient treatment furthermore, its cellular morphology facilitates biomass recovery, which contributes to the process cost reduction. (Jorge Alberto Vieira Costa, et al, 2019).

CHAPTER 3: AIM AND SCOPE

3.1 AIM:

To identify the effects of seed germination by using Spirulina, Azolla and Geitlerinema of algae bio-fertilizer.

3.2 OBJECTIVE:

- 1.To assess the effect of Spirulina on seed germination of Trigonella foenum-graecum, Brassica, Sesamum indicum, Capsicum frutescens, Vigna radiata.
2. To assess the effect of Azolla on seed germination of Trigonella foenum-graecum, Brassica, Sesamum indicum, Capsicum frutescens, Vigna radiata.
- 3.To assess the effect of Geitlerinema on seed germination of Trigonella foenum-graecum, Brassica, Sesamum indicum, Capsicum frutescens, Vigna radiata.
- 4.To estimate the NPK value of the control soil and algae added soil.
- 5.To study the effect of algae on earthworm.

CHAPTER 4 : MATERIALS AND METHODOLOGY

4.1 MATERIALS

- 1.Pots
- 2.Soil
- 3.Water
- 4.Grating scale

4.1.1 SELECTED SEEDS:

Seeds are collected from Chennai market

- Trigonella frenum-graecum (fenugreek)
- Brassica (mustard)
- Sesamum indicum (sesame)
- Capsicum frutescens (chilli)
- Vigna radiata (green gram)

4.1.2 SELECTED ALGAE:

1. Spirulina
- 2.Azolla
- 3.Geitlerinema

4.2 METHODOLOGY

4.2.1 SAMPLE COLLECTION :

Spirulina : collected from online , Amazon.

Azolla: Collected from online , Amazon.

Geitlerinema:Collected from the department of Biotechnology, Sathyabama university.

4.2.2 SAMPLE PREPARATION:

Spirulina : Directly collected as the extracted powder, given in fig 4.2.2.1.

Azolla: Collected as a plant and dried that plant at 21°C in the shadow region for 3 to 4 days.Then used to be a fertilizer, given in fig 4.2.2.2

Geitlerinema: Collects water from the sea in Chennai and boil the water at 100°C . Pour the water into the clean container and add that collected algae into it.Grown the algae for 20 days , then squeeze the algae to extract its juice, given in fig 4.2.2.3.

FIG 4.2.2.1 EXTRACTED SPIRULINA POWDER



FIG 4.2.2.2 AZOLLA



FIG 4.2.2.3 GEITLERINEMA LIQUID



4.2.3 METHODS OF PLANTING :

Taken three types of fertilizer Spirulina as powder, Azolla as dried plant and Geitlerinema as liquid. From the day of seeding every 5 days measure the shoot and root of the plant using Grating scale. And every 7-8 days mentioned level of fertilizer were added

SPIRULINA: 250 g of soil was mixed with 10-20 g of extracted Spirulina powder , transfer to a pot filled with half of sand. Spread evenly over to that normal soil. Filled the base same as in 4 pots .30 - 40 Trigonella foenum-graecum seed, 50-60 Brassica seeds, 20 - 30 Sesamum indicum seeds and 10 -15 Capsicum frutescens seeds are planted on this 4 pots. Then 10-20g of extracted spirulina powder is of water and this liquid mixed with 250g of soil and transfer to a pots like other seeded 40 - 60 Vigna radiata seeds .Finally poured sufficient water and leave to grow.

AZOLLA: 250g of soil mixed with 10g of Azolla plant and transfer to a pot filled half of soil . Spread evenly over to the normal soil..25-30 Trigonella foenum-graecum seed, 40-60 Brassica seeds, 40-60 Sesamum indicum seeds and 10 -15 Capsicum frutescens seed and 30 - 40 Vigna radiata seeds are planted in five different pots . Poured the sufficient water and leave to grow.

GEITLERINEMA: Same 250g of soil mixed with 10-15ml of squeezed Geitlerinema liquid and transfer to a pot filled with half of soil. Planting the same amount of seeds as taken from the above mentioned Azolla. Poured the sufficient water and leave to grow.

4.2.4 NPK TEST:

Using the ready made kit for this. Soil was collected from the planting pots. Use the pipette to transfer 2.5 mL of the clear soil extract to the test tube. Add the entire contents of the Nitrogen (N) reagent to the test tube and replace the cap on the test tube , shake gently for 30 seconds to dissolved the reagent. Allow the test tube to stand for 30 seconds. Compare the colour of the solution in the test tube with colour screen given in the kit. Note down the Nitrogen content in the soil.

Use the pipette to taken 2-5 mL of the clear soil extract to the test tube. Add the entire content of the Phosphorus (P) reagent to the test tube and replace the cap on the test tube , shake gently for 30 seconds to dissolved the reagent. Allow the test tube to stand for 30 seconds. compare the colour of the solution in the test tube with colour screen given in the kit. Note down the Phosphorus content in the soil.

add 0.5 mL of the clean soil extract to the test tube. Add the Potassium (P) 1 reagent to the test tube until the mark. Add the entire content of the potassium (K) 2 reagent to the test tube and replace the cap on the test tube, shake gently for 30 seconds to dissolved the reagent . Allow the test tube to stand for 30 seconds. Compare the colour of the solution in the test tube with colour screen given in the kit. Note down the Potassium content in the soil. This NPK test taken in National Argo Foundation Laboratory Service Division in chennai.

4.2.5 TOXICITY TEST OF ALGAE ON EARTHWORM:

4 earthworm was taken and measured its length separately with grating scale. Taken 4 container first one contain normal soil used, second one contain soil with Azolla fertilizer, third one contain Spirulina with soil and last one contain soil with Geitlerinema. Add one-one earthworm to each container and leave the earthworm to eat that algae. Finally seen the size of the earthworm.

CHAPTR 5: RESULT AND DISCUSSION

5.1 EFFECT OF ALGAE ON PLANT GROWTH:

Three type of algae biofertilizer were used Spirulina as extracted powder, Azolla as dried plant and Geitlerinema as liquid. From this bio-fertilizer five different plants were used. The result and number of seed used in normal soil were givn in table 5.1.1. The amount of seed used in biofertilizer were mention in 4.2.3. the result of seeds grown in normal were given in table 5.1.1. The result of seeds grown in Azolla biofertilizer were given in table 5.1.2 . The result of seeds grown in Spirulina were given in table 5.1.3 on this Brassica were grown and Sesamum indicum was affect

by fungal formation after 8 days. The result of seeds grown in Geitlerinema were given in 5.1.4 .

TABLE 5.1.1 SEED GROWN IN NORMAL SOIL

S NO.	NAME OF SEEDS	NUMBER OF SEEDS USED	NUMBER OF SEEDS GROWN
1	Trigonella foenum-graecum (Fenugreek)	20 - 30	22
2	Brassica (Mustard)	20 - 25	6
3	Sesamum indicum (Sesame)	25 - 30	20
4	Capsicum frutescens (chilli)	5 - 10	3
5	Vigna radiata (Green gram)	20 - 30	24

TABLE 5.1.2 SEEDS GROWN IN AZOLLA BIOFERTILIZER

S NO.	NAME OF SEEDS	NUMBER OF SEEDS USED	NUMBER OF SEEDS GROWN
1	Trigonella foenum-graecum (Fenugreek)	25 - 30	27
2	Brassica (Mustard)	40 - 50	43
3	Sesamum indicum (Sesame)	40 - 60	49
4	Capsicum frutescens (Chilli)	10 - 15	12
5	Vigna radiata (Green gram)	30 - 40	37

TABLE 5.1.3 SEEDS GROWN IN SPIRULINA BIOFERTILIZER

S NO.	NAME OF SEEDS	NUMBER OF SEEDS USED	NUMBER OF SEEDS GROWN
1	Trigonella foenum-graecum (Fenugreek)	30 - 40	35

2	Brassica (Mustard)	50 - 60	0
3	Sesamum indicum (Sesame)	20 - 30	23
4	Capsicum frutescens (Chilli)	10 - 15	13
5	Vigna radiata (Green gram)	40 - 60	53

TABLE 5.1.4 SEEDS GROWN IN GEITLERINEMA BIOFERTILIZER

S NO.	NAME OF SEEDS	NUMBER OF SEEDS USED	NUMBER OF SEEDS GROWN
1	Trigonella foenum-graecum (fenugreek)	25 - 30	0
2	Brassica (mustard)	40 - 50	0
3	Sesamum indicum (sesame)	40 - 60	0
4	Capsicum frutescens (chilli)	10 - 15	0
5	Vigna radiata (green gram)	30 - 40	0

FIG 5.1.1 EARLY GROWTH OF TRIGONELLA FOENUM-GRAECUM



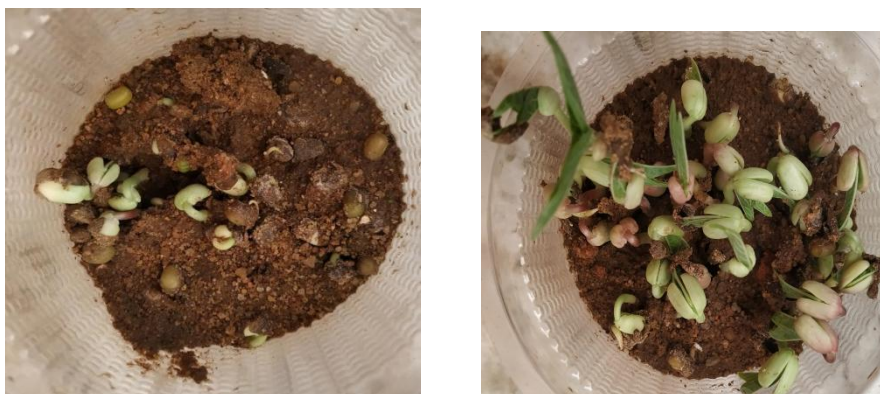
FIG 5.1.2 EARLY GROWTH OF BRASSIA



FIG 5.1.3 EARLY GROWTH OF CAPSICUM FRUTESCEN



FIG 5.1.4 EARLY GROWTH OF VIGNA RADIATA



5.2 READING OF PLANTS:

From the day of seeding every 5 days shoot and root size were measured with grating scale. The result of reading of the normal plant were given in table 5.2.1, Spirulina were given in table 5.2.2, Azolla were given in the table 5.2.3 and Geitlerinema were not grown so 0% of the result. over all Compared to normal plant

growth azolla resulted more growth, spirulina resulted moderate and brassica and sesamum indicum were affected by fungi after 10 days and doesn't show growth further and geitlerinema resulted no growth.

TABLE 5.2.1 READING OF PLANT GROWN IN NORMAL PLANT

DAY	Trigonella frenum- graecum (fenugreek)	Brassica (mustard)	Sesamum indicum (sesame)	Capsicum frutescens (chilli)	Vigna radiata (green gram)
DAY 5	Shoot- 1cm Root-0.7cm	Shoot-0 Root-0	Shoot-1cm Root-1.8cm	Shoot- 0 Root-0	Shoot-4.4cm Root-4cm
DAY 10	Shoot- 2.9cm Root-2.4cm	Shoot-1.5cm Root-0.9cm	Shoot-1.6cm Root-2.5cm	Shoot-0 Root-0	Shoot-5cm Root-4.9cm
DAY 15	Shoot-4cm Root-3.4cm	Shoot2.9cm Root-3cm	Shoot-3.2cm Root-4cm	Shoot-2.2cm Root-1.3cm	Shoot-5.7cm Root-5.3cm
DAY 20	Shoot-4.5cm Root-3.9cm	Shoot-3.8cm Root-3.8cm	Shoot-3.9cm Root-4.3cm	Shoot-2.7cm Root-1.9cm	Shoot-6.1cm Root-5.7cm
DAY 25	Shoot-5.3cm Root-4.3cm	Shoot-4.2cm Root-4cm	Shoot-4.2cm Root-4.6cm	Shoot-3cm Root-2.3cm	Shoot-6.5cm Root-5.9cm

DAY 30	Shoot-6cm Root-4.9cm	Shoot-4.8cm Root-4.8cm	Shoot-4.9cm Root-4.7cm	Shoot-3.3cm Root-2.5cm	Shoot-6.9cm Root-6cm
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TABLE 5.2.2 READING OF PLANT GROWN IN SPIRULINA BIOFERTILIZER

DAYS	Trigonella frenum- graecum (fenugreek)	Brassica (mustard)	Sesamum indicum (sesame)	Capsicum frutescens (chilli)	Vigna radiata (green gram)
DAY 5	Shoot- 1.9cm Root- 2cm	Shoot- 0 Root-0 No growth	Shoot-1.5cm Root- 1cm	Shoot-0.5cm Root-0.1cm	Shoot-2.3cm Root-1cm
DAY 10	Shoot- 6cm Root- 1.7cm	Shoot- 0 Root- 0 Fungi formed	Shoot-1.5cm Root- 1cm Fungi formed	Shoot-1.2cm Root- 1cm	Shoot-5.5cm Root-2cm
DAY 15	Shoot- 9cm Root-5cm	Shoot- 0 Root- 0	Shoot- 0 Root- 0	Shoot-1.7cm Root- 1.3cm	Shoot-7cm Root-3.5cm
DAY 20	Shoot- 9.5cm Root- 6.1cm	Shoot- 0 Root- 0	Shoot- 0 Root- 0	Shoot- 2cm Root- 1.4cm	Shoot-8cm Root-4cm
DAY 25	Shoot-10.5cm Root- 7.2cm	Shoot- 0 Root- 0	Shoot- 0 Root- 0	Shoot-2.4cm Root- 1.6cm	Shoot-8.4cm Root-4.3cm

DAY 30	Shoot- 11cm Root- 9cm	Shoot- 0 Root- 0	Shoot- 0 Root- 0	Shoot- 2.5cm Root- 1.6cm	Shoot- 8.9cm Root-5cm

TABLE 5.2.3 READING OF PLANT GROWN IN AZOLLA BIOFERTILIZER

DAYS	Trigonella frenum- graecum (fenugreek)	Brassica (mustard)	Sesamum indicum (sesame)	Capsicum frutescens (chilli)	Vigna radiata (green gram)
DAY 5	Shoot- 1.3 cm Root- 0.9 cm	Shoot- 1.0cm Root- 1.1cm	Shoot- 1cm Root- 1.9cm	Shoot- 0 Root- 0	Shoot- 5.5cm Root- 4.5cm
DAY10	Shoot- 4 cm Root- 4 cm	Shoot- 1.9cm Root- 4.5cm	Shoot- 1.9cm Root- 4.5cm	Shoot- 2.0 cm Root- 1.9cm	Shoot- 6.3cm Root- 4.9cm
DAY 15	Shoot- 4.3 cm Root- 4.5 cm	Shoot-4cm Root- 4.7cm	Shoot- 4cm Root- 4.7cm	Shoot- 2.4cm Root- 2.4cm	Shoot- 7.1cm Root- 5.5cm
DAY 20	Shoot- 5.3 cm Root- 4.9 cm	Shoot- 4.1cm Root- 4.9cm	Shoot- 4.1cm Root- 4.9 cm	Shoot- 2.7cm Root- 2.6cm	Shoot-8cm Root- 5.9cm
DAY 25	Shoot- 5.7 cm Root- 5.3 cm	Shoot- 4.3cm Root-	Shoot- 4.3cm	Shoot- 3.1cm	Shoot- 8.5cm Root-

		5.1cm	Root- 5cm	Root- 2.9cm	6.2cm
DAY 30	Shoot- 5.9 cm Root- 5.4 cm	Shoot- 4.7cm Root- 5.2cm	Shoot- 4.7cm Root- 5.3cm	Shoot- 3.5cm Root- 3.1cm	Shoot- 8.9cm Root- 6.3cm

5.3 GRAPHICAL REPRESENTATION:

Graphical representation of plant growth rate in normal soil

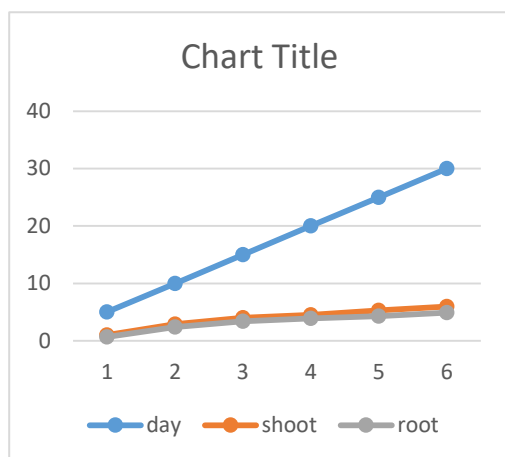


Fig 5.3.1Graph of plant growth of *Trigonella foenum-graecum* in normal soil

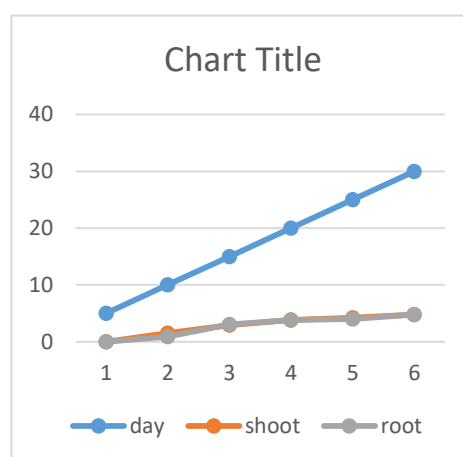


Fig 5.3.2 Graph of plant growth of *Brassia* in normal soil

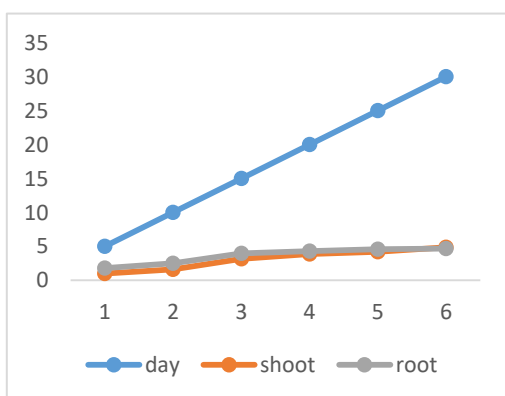


Fig 5.3.3Graph of plant growth of *Trigonella foenum-graecum* in normal soil

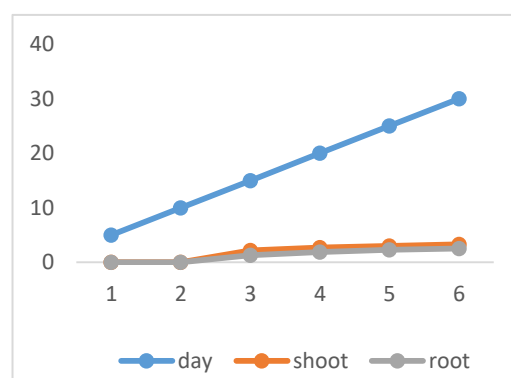
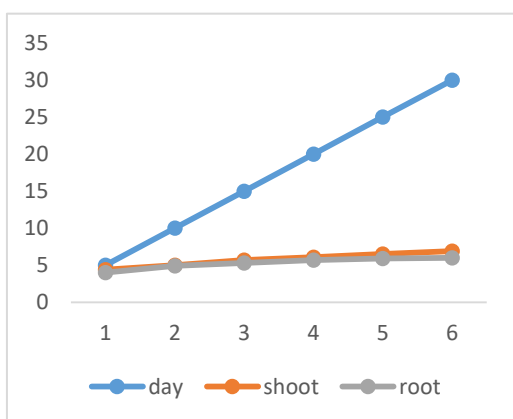


Fig 5.3.4Graph of plant growth of *Brassia* in normal soil

Sesamum indicum in normalsoil



Capsicum frutescens in normal soil

Fig 5.3.5Graph of plant growth of vigna radiata in normal soil

Graphical representation of plant growth in Spirulina biofertilizer

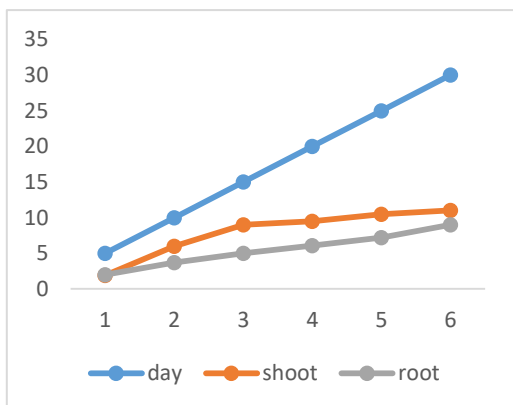


Fig 5.3.6 Graph of plant growth of
**Trigonella foenum-graecum in
Spirulina biofertilizer**

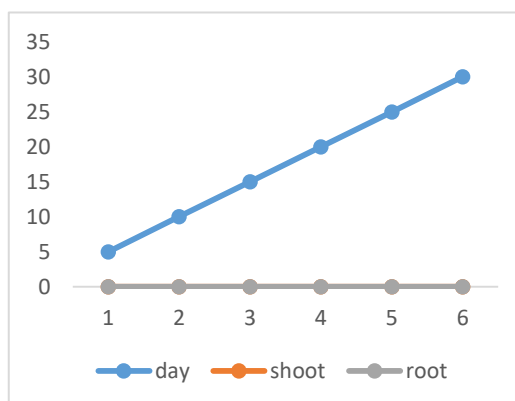


Fig 5.3.7Graph of plant growth of
Brassia in spirulina biofertilizer

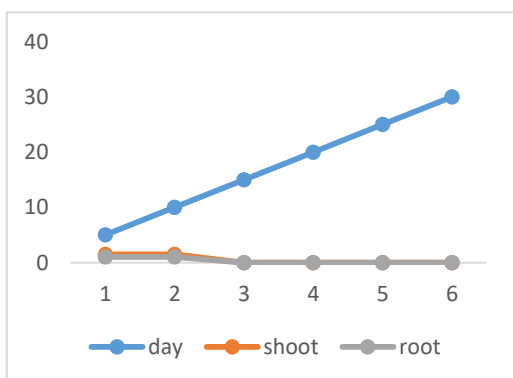


Fig 5.3.8 Graph of plant growth of
Sesamum indicum in spirulina

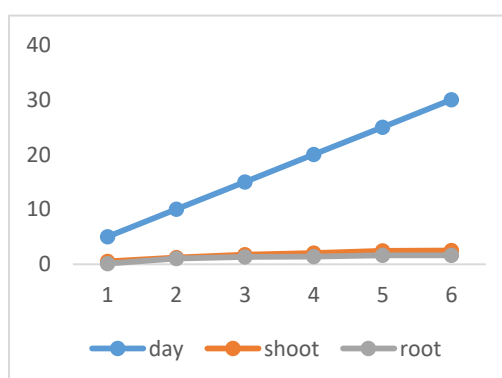
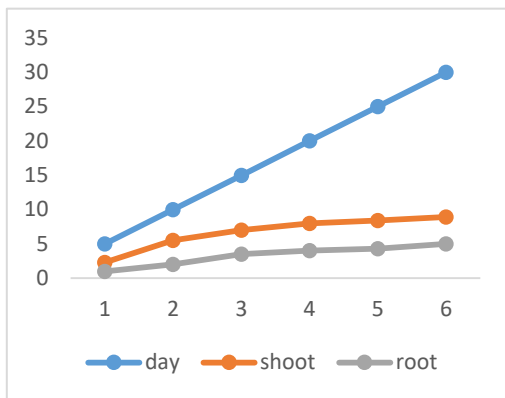


Fig 5.3.9 graph of plant growth of
Capsicum frutescens in spirulina

Biofertilizer



biofertilizer

Fig 5.3.10Graph of plant growth of vigna radiata

In spirulina biofertilizer

Graphical representation of plant growth in azolla biofertilizer

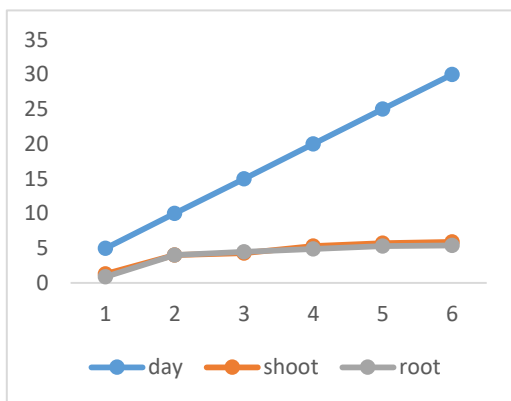


Fig 5.3.1 Graph of plant growth of
Trigonella foenum-graecum in
Azolla biofertilizer

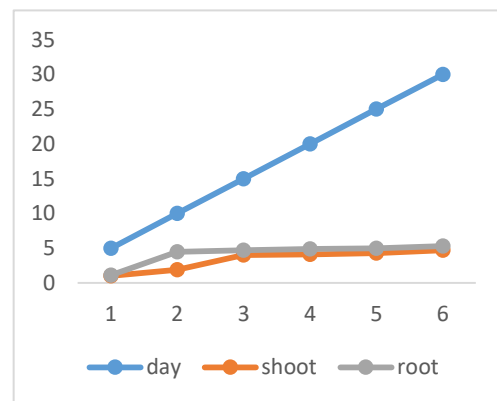


Fig 5.3.2Graph of plant growth of
brassica in **azolla** biofertilizer

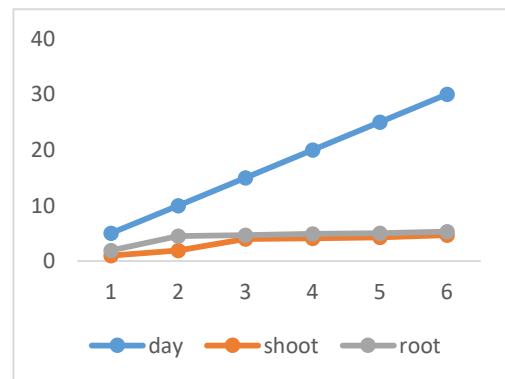


Fig 5.3.13Graph of plant growth of
Sesamum indicum in **azolla** biofertilizer

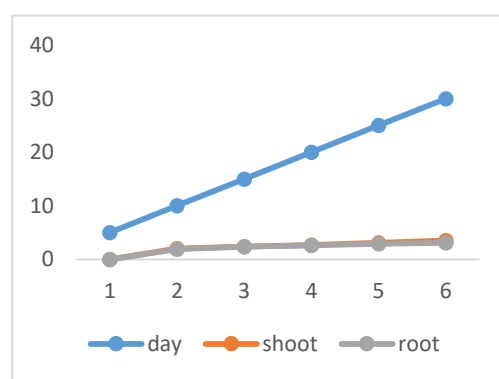


Fig 5.3.14Graph of plant growth of
Capsicum frutescens in **azolla** biofertilizer

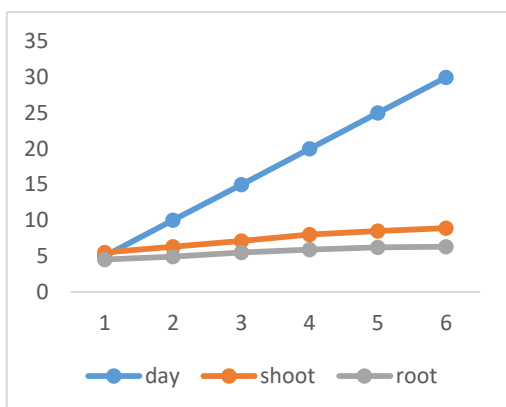


Fig 5.3.15Graph of plant growth of vigna radiata in azolla biofertilili

5.4 RESULT OF NPK TEST

For NPK test two normal soil were used one was used for spirulina biofertilizer and second one used for azolla and geitlerinema biofertilizer. The amount of soil sample were 80g for each sample.

TABLE 5.4.1 NPK TEST VALUE OF NORMAL SOIL

PARAMETER	UNIT	RESULT
Nitrate Nitrogen	mg/kg	31.4
Available Phosphorous	mg/kg	26.29
Potassium exchangeable K	mg/kg	155

TABLE 5.4.2 NPK TEST VALUE OF SPIRULINA USED ON FEW DAYS

PARAMETER	UNIT	RESULT
Nitrate Nitrogen	mg/kg	5.8
Available Phosphorous	mg/kg	90.03
Potassium exchangeable K	mg/kg	259

TABLE 5.4.3 NPK TEST VALUE OF SPIRULINA USED ON MORE DAY

PARAMETER	UNIT	RESULT
Nitrate Nitrogen	mg/kg	35.4

Available Phosphorous	mg/kg	14.89
Potassium exchangeable K	mg/kg	99

Compared with normal soil , spirulina get lower nitrogen in few days of biofertilizer application almost 25.4mg/kg because it may be seed observed nitrogen to grow. And then 4mg/kg nitrogen level increased in more days of biofertilizer application.

TABLE 5.4.4 NPK TEST VALUE OF NORMAL SOIL

PARAMETER	UNIT	RESULT
Nitrate Nitrogen	mg/kg	66.3
Available Phosphorous	mg/kg	71.73
Potassium exchangeable K	mg/kg	227

TABLE 5.4.5 NPK TEST VALUE OF AZOLLA USED ON FEW DAY

PARAMETER	UNIT	RESULT
Nitrate Nitrogen	mg/kg	26.8
Available Phosphorous	mg/kg	61.63
Potassium exchangeable K	mg/kg	296

TABLE 5.4.6 NPK TEST VALUE OF AZOLLA USED ON MORE DAYS

PARAMETER	UNIT	RESULT
Nitrate Nitrogen	mg/kg	40.5
Available Phosphorous	mg/kg	83.43
Potassium exchangeable K	mg/kg	312

Compared with normal soil , azolla get lower nitrogen in few days of biofertilizer application almost 39.5mg/kg because the same like spirulina it may be seed observed nitrogen to grow. And then 13.7mg/kg nitrogen level increased than the few days of application. More azolla application Nitrogen level 40.5mg/kg which is lower than normal soil nitrogen level almost 25.8mg/kg. Most of the theory explained azolla have high nitrogen level but this studied got low nitrogen then normal . This may be use of dried azolla this may could happened.

TABLE 5.4.7 NPK TEST VALUE OF GEITLERINEMA USED ON FEW DAYS

PARAMETER	UNIT	RESULT
Nitrate Nitrogen	mg/kg	96.7
Available Phosphorous	mg/kg	51.25
Potassium exchangeable K	mg/kg	361

TABLE 5.4.8 NPK TEST VALUE OF GEITLERINEMA USED ON MORE DAYS

PARAMETER	UNIT	RESULT
Nitrate Nitrogen	mg/kg	25.0
Available Phosphorous	mg/kg	72.19
Potassium exchangeable K	mg/kg	354

Compared with normal soil , geitlerinema get high nitrogen in initial stage of biofertilizer application almost 30.4mg/kg . And then nitrogen level decreased. In more days of biofertilizer application almost 41.3mg/kg were reduced and resulted no growth.

5.5 EFFECT OF ALGAE ON EARTHWORM:

Four earthworm were taken one in normal soil , second in spirulina ,third in azolla and fourth in geitlerinema. This algae were kept for one week to eat the algae. Earthworm measured before allow to eat the algae and after one week took and measured again , the length of the earthworm were given table 5.5.1.

TABLE 5.5.1 LENGTH OF THE EARTHWORM

EARTHWORM	BEFORE EATEN THE ALGAE	AFTER EATEN THE ALGAE
NORMAL	12	12.5
SPIRULINA	4	5
AZOLLA	13	13
GEITLERINEMA	13	8

Normal and spirulina showed earthworm length got increased 0.5cm and azolla have be in same length and finally earthworm in geitlerinema was shrinkled and 5cm length reduced

CHAPTER 6 : SUMMARY AND CONCLUSION

The Azolla,spirulina,and spirulina,and geitlerinema of algae are belongs to the genus of cynobacterium were used as sample.These samples are collected from online and from the department of biotechnology,sathyabama.These samples are used in three ways Azolla as dried at 21^o C and used as biofertilizer,spirulina was directly collected as extracted powder and geitlerinema as liquid.These biofertilizer were used to grow 5 different plants (Trigonella Foenum-graecum, Brassica, Sesamum indicum,capsicum frutscens,vigna radiata) for 30days and measured the length of shoot and root of plant every 5 days. Also grown all this 5 plants in normal soil and measured its too. Compared to normal plants Azolla resulted more growth,spirulina resulted moderate growth and from this Brassica and Sesamum indicum were affected by fungi and geitlerinema resulted no growth.NPK test were taken for normal and sample used soil. Soil Sample has been collected few days of application and more days of application. The result of NPK shown Azolla and spirulina nitrogen level was lower than the normal in few days of application and get higher in more days of application.In geitlerinema in nitrogen level higher than the normal in few days of application and get lower in more days of application. The toxicity of algae on earthworm were observed by allowing the earthworm to eat the algae for one week. The observation shown in normal and spirulina the earthworm grown 0.5 cm, In azolla earthworm was in same length and geitlerinema the earthworm shrinkled and length reduced.

The conclusion of the study is azolla have more capacity to grown the plant,spirulina have moderate capacity and geitlerinema have no capacity to grown the plant. Azolla and spirulina have more nitrogen fixation than geitlerinema .

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