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The Effect of Amendment of Fish Waste Fertilizer to Soil and its Impact on the Growth and Nutritional Status of *Trigonella foenum-graecum*

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Abstract:- The current study has been aimed to utilise the fish waste collected from the market as an organic fertilizer to study its effect on the growth and nutritive potential of Trigonella foenum-graecum (fenugreek). The experiment on fenugreek was conducted with and without the application of fish waste fertilizer to the soil. Fish waste fertilizer was prepared by mixing jaggery, water and banana together and fermented up to 15 days and used as an organic fertilizer which offer nutrients to the soil that helps for the plant growth. Fish waste fertilizer sprayed on the experimental plant for upto 10 days. This was maintained for both experimental plants (Test) and normal plant without fertilizer (Control). The germination of the plant, shoot length, root length, leaf length and the time taken for growth were noted. After the growth of the plant, the macro and micronutrients were determined in both test and control plant. This study showed a significant role of fish waste fertilizer in enhancing the growth and nutritional quality when compare to the normally grown plant without the fish waste fertilizer. The number of seeds germinated, height of the plant, and level of the minerals increased in the test plant. This study showed that the fish waste acts as an excellent organic fertilizer which continuously provide nutrient to the soil and it results in better growth and nutritional quality of the fenugreek and also creates way of converting waste to wealth which is eco-friendly and cost= effective.

Keywords:- *Fish Waste Fertilizer, Trigonella Foenum-Graecum, Macro and Micronutrients, Nutritional Quality and Growth.*

I. INTRODUCTION

Plant growth and its development depends on nutrients derived from the soil or air, or supplemented through fertilizer. There are various essential elements required for plant growth, each play their unique functions in the development of the plant. Nutrient requirements generally increase with the growth of plants, and deficiencies or too much of nutrients can damage plants by decreasing or inhibiting growth and reducing yield. Elements required in large quantities by the plant for its development are termed macronutrients, which can be further defined as primary or secondary. The primary nutrients include nitrogen (N), phosphorus (P), and potassium (K). These elements contribute to plant nutrient content, function of plant enzymes and biochemical processes, and integrity of plant cells. Deficiency of these nutrients contributes to reduced plant growth, health, and yield; thus they are the three most important nutrients supplied by fertilizers. The secondary nutrients generally minerals include calcium (Ca), magnesium (Mg), and sulfur (S).

The various major sources of plant nutrients are derived from the soil, mineral fertilizers, organic matter and atmospheric nitrogen fixed by microorganism or carried down in precipitation.

- *Fish Waste As Organic Fertilizer*

Fish contains many nutrients which is good for plant growth. In recent days many farmers use organic fertilizer as an alternative to chemical fertilizers. Skin, intestine, head, gills and guts of the fish are usually thrown as waste. Hence the goal of this study was to prepare an organic fertilizer from fish waste and to investigate its impact on fenugreek growth and nutritional status.

Fig 1 & 2 Fish Waste

II. MATERIALS AND METHODS

- *Collection of Fish Waste*

Well blended mixture consisting of the head portion, gut, intestine, skin and gills of the fish was collected from the local fish market in Chennai. Raw materials needed for the preparation of fish waste fertilizer such as jaggery (2 kilograms), bananas were collected from the local shops.

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➢ *Preparation of Fish Waste Fertilizer*

A clean clay pot of 10 litres capacity was taken and filled with 5 litre of water. 2 kg of powdered native jaggery was added and stir well to dissolve. Then 2 Kg of fish waste including skin, intestine, head, gills and gut was added and mixed thoroughly. Two well blended bananas were added in to the mixture and mixed thoroughly. The mouth of the pot was covered with a cotton cloth to prevent the entry of flies. The content of the pot was mixed every day. After 15 days, the contents were filtered and the filtrate was used as organic liquid fertilizer. Filtrate was diluted in 1:10 ratio with water for 5litres.

Fig 2 & 3 Preparation of Control and Test Soil Mixture of Fish Waste Fertilizer

Fig 4 Prepared Fish Waste Fertilizer After Fermentation

➢ *Soil Collection*

The soil was collected from nearby nursery. The soil was weighed approximately and filled in two wide and length pots. Each pot was filled with 10kg of soil.(Figure 5).

- *The fish waste fertilizer was taken and diluted with normal water in the ratio 1:90 (fish waste fertilizer: normal water) and mixed in one pot which is labeled as **"TEST".***
- *The soil sample without fish waste fertilizer was labeled as **"CONTROL".***

Fig 5 Soil Collection

➢ *Seed Processing*

Fenugreek seeds were purchased from local super market. 25 seeds of Fenugreek were taken and soaked in water overnight. Drain the water the next morning before planting and sow the seeds in Control and Test pot. The seeds (25 seeds) were sown in two different pots in which one with fish waste fertilizer and other without fish waste fertilizer. The plants were allowed to grow up to 10 days.

Fig 6 Fenugreek Seeds

- *Physical Examination*

✓ *Number of Seeds Germinated*

The germination rate of the Trigonella foenum-graecum seeds in test and control were observed. Two to Three days after sowing, the number of seeds germinated was determined.

✓ *Height of the Plant*

Plant height was taken from the ground level to the last full opened leaf in control and test plant at regular intervals of 3rd day, 7th day , 10th day from the time of seed sown and root length and shoot length of the fenugreek was noted at the time of harvest.

✓ *Time Taken for the Leaf Formation*

Number of leaves formed and growth of plant in test and control were noted.

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✓ *Preparation of Leaf Extract*

The leaves were cut and crushed in mortar and pestle and diluted with distilled water. Then filtered with filter paper. This Extract is used for mineral analysis such as Potassium, Calcium. Carbohydrate, Iron, Essential Dietary Fibre, Protein Fat.

Fig 7 & 8 Prepared Aqueous Fenugreek Leaves Extract

III. DETERMINATION OF MACRO AND MICRONUTRIENTS

➢ *Determination of Total Carbohydrate:*

Total carbohydrate was estimated by Dubois method (Dubois M, et al, 1956).

➢ *Estimation of Total Protein:*

The Protein was estimated by Bradford's method. (Bradford, M.M. (1976)).

➢ *Dtermination of Total Lipid:*

The total lipid content was estimated by Folch method (Bloor WR, 1928).

➢ *Detemation of Iron:*

Determination of iron by atomic absorption spectrophotometer [AOAC 21st EDITION 2019].

➢ *Determination of Dietary Fibre:*

The dietary fibre in test and control plant was estimated by AOAC method (Kanaya K, Tada S,et al , 2007).

➢ *Detemation of Vitamin C:*

Vitamin C was estimated by Spectrophotometric method (Hamad, Q. Y. M. M. 2009).

➢ *Determination of Calcium:*

Determination of soluble calcium was determined by EDTA method. [Food and agricultural organization, 2007. EDTA- Titrimetric method].

➢ *Determination of Total Nitrogen:*

The total nitrogen was determined by the method of Vijayarengan P et al, 2017.

➢ *Determination of Phosphorus*:

The Phosphorus content was determined by the method of Vijayarengan P et al, 2017.

➢ *Determination of Potassium:*

Determination of potassium was determined by the method of Vijayarengan P et al, 2017.

IV. RESULTS

➢ *The Results of the Present Study is given below.*

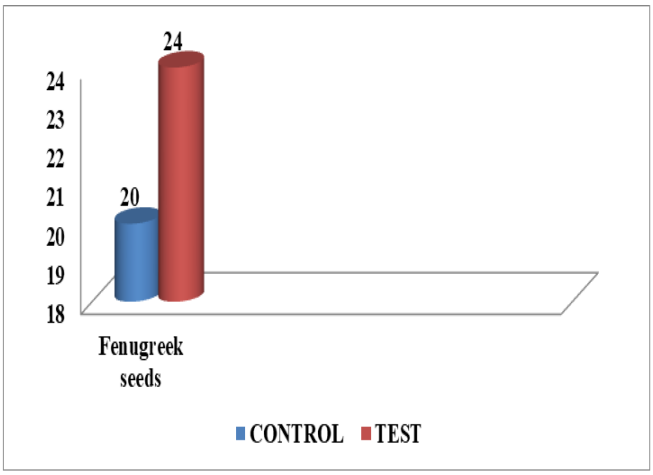
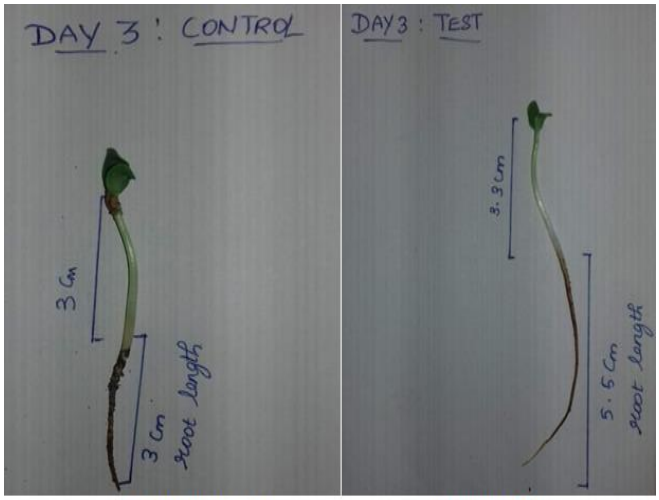


Fig 9 Number of Seeds Germinated in Control and Test Pot



CONTROL PLANT TEST PLANT

Fig 10 &11 Height of the Plant (Day 3)

CONTROL SINGLE PLANT TEST SINGLE PLANT

Fig 12 & 13 Height of the Plant (Day 10)

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Fig 14 Growth of Fenugreek


Fig 15 Test – Growth of Fenugreek

Table 1 Height of the Plant (Cm)

NO. OF .DAYS	HEIGHT OF CONTROL PLANT (cm)	HEIGHT OF TEST PLANT (cm)
DAY 3	6cm	9cm
DAY 5	8cm	10cm
DAY 7	11cm	12cm
DAY 10	14cm	16cm

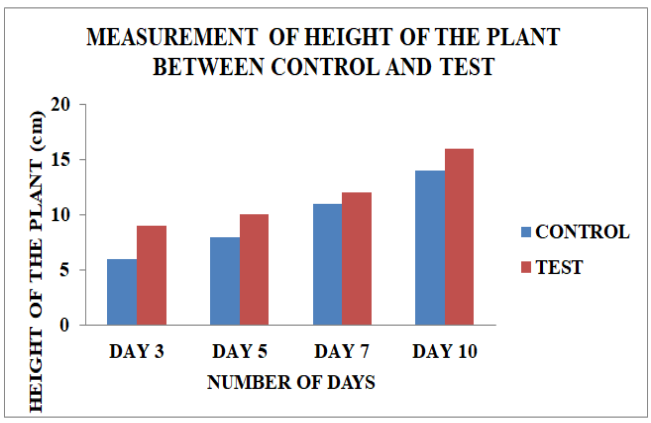

Fig 16 Measurement of Height of the Plant between Control and Test

Table 2 Npk in Fish Fertilizer and Normal Soil

PARAMETERS	TEST(%)	CONTROL(%)
NITROGEN(N)	3.12	2.05
PHOSPHORUS(P)	1.24	0.86
POTASSIUM(K)	1.02	0.65

Table 3 Represents the Macro and Micronutrients Level in Control and Test Plant

PARAMETERS	CONTROLmg/g	TESTmg/g
CARBOHYDRATE	5.3	23.4
PROTEIN	3.025	4.295
LIPID	0.3	0.4
DIETARY FIBRE	0.2	0.3
VITAMIN C	22.14	24.28
CALCIUM	169	182
POTASSIUM	681	801
IRON	28.00	38.05

V. DISCUSSION

Organic farming is one such technique that promotes food safety while also increasing soil biodiversity. Chemical fertilizers, on the other hand, pollute water bodies and groundwater, and excessive synthetic inputs in soils have rendered them biologically dead. The results of the present study shows a better way to remediate the fish waste and use it as fertilizer for the plant growth and development. The present result was also supported by Bhaskoro et al., 2020. The author reported that the addition of fish bone meal on the production of Gracilaria sp. liquid organic fertilizer increases nitrogen, phosphorus and potassium concentration. Hence, the present study evaluates the effect of fish waste fertilizer on the growth and nutritional potential of Trigonella foenum-graecum showing increased growth and enhanced the nutritional quality when compared to the Control plant. Fish waste fertilizer in soil visibly increased the height and germinatirate on of the fenugreek plant when compared to the normal plant without the fish waste fertilizer (Control) which was shown in the results. This study shows that fish waste fertilizer can continuously supply nutrient to the soil and it can maintain the better growth of the plants and increase their nutritive value.

VI. CONCLUSION

- *Organic fertilizer is one of the good fertilizers, than chemical fertilizer as they cause no pollution of water bodies as well as ground water.*
- *This study shows that fish waste fertilizer acts as an excellent organic fertilizer which increases the growth and nutritional quality of plant.*
- *Hence, fish waste can be recycled and used as a fertilizer and may be used effectively in agricultural practices to improve plant growth and nutritive value.*

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