IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Efficacy of fresh water weed liquid fertilizer on seed germination and plant growth of *Vigna radiata* (L.) R. Wilczek (Green gram)

[1]Arunima. K, [2] Dr. Sr.M. Arul Sheeba Rani, [3]Ashika Jith. J.S, [4] Theertha. M and [5]Sreethu. R. K

M.Sc. Botany [1,3,4 &5], Assistant Professor[2]

Department of Botany

Nirmala College for Women, Coimbatore, India.

Abstract: Aquatic weeds cause serious problems to water flow in the big irrigation canals and drainage channels. They interfere with fishing and boating activities in ponds, lakes and water reservoirs. For the development of aquatic flora, solar energy is converted into chemical energy and for continuous releasing of oxygen during photosynthesis. The rate of germination was also higher in liquid fertilizer when comparing with the control. The efficient concentration of liquid fertilizer for the healthiest plant growth is 20%, which shows highest length of plantlets, highest growth rate and root and shoot development occurring in the equal ratio. The present study is an attempt to investigate the efficacy of fresh water weed liquid fertilizer prepared from *Hydrilla verticellata* and *Salvinia natans* on seed germination, plant growth rate and leaf expansion of *Vigna radiata*. Fresh water weed liquid fertilizer is prepared from *Salvinia natans* (L.) and *Hydrilla verticillata* (L.f.) Royle., determined the seed germination percentage within 3 days and plant growth rate of *Vigna radiata* in various concentration of liquid fertilizer to find out the efficient concentration of liquid fertilizer for the best growth of *Vigna radiata* (L.) R. Wilczek (Green gram) which can be followed for modern agricultural activities and by farmers.

Index Terms - Hydrilla verticillata, Salvinia natans, Weed liquid fertilizer, Seed germination, Plant growth rate, *Vigna radiata.*

I. INTRODUCTION

Aquatic macrophytes are macroscopic plants growing in the water, which exhibit rapid growth in water bodies. Aquatic weeds refer to plants living in water that photosynthesize and complete their life cycle in or near the water. Aquatic weeds cause serious problems to water flow in the big irrigation canals and drainage channels. They interfere with fishing and boating activities in ponds, lakes and water reservoirs. For the development of aquatic flora, solar energy is converted into chemical energy and for continuous releasing of oxygen during photosynthesis. However, some aquatic plants become a problem which hamper aquatic ecosystem, these undesirable plants are called aquatic weeds. Salisbury, (1961) defined "weeds as a class have much in common with criminals. Weeds do not only possess the harmful aspect but they have beneficial aspects towards utilization in a number of ways for humans. Small and marginal farmers and landless labours may use weeds as a fertilizer for their own living.

Use of synthetic fertilizers in agriculture for increase productivity is a global trend today. But their excessive use led to the pollution of soil as well as negatively influence various organisms which depends on the plant, totally it makes imbalance in the natural environment. The application of fresh water weed liquid fertilizer can be used to seed treatment and to increase the growth rate. Unlike chemical fertilizers, freshwater weed fertilizers are biodegradable, eco-friendly, non-toxic, non-pollutants and non-hazardous to organisms.

The preparation of the fertilizers from fresh water aquatic weed may leads to the remedy for their extensive growth in the fresh water ecosystem there by to maintain the natural environment for the water organisms. It can be used in various concentrations in different stages of development of plant growth and so that it can be used for laboratory techniques. As these are liquid in nature it has many benefits to use in modern technologies of plant growth such as drip irrigation and hydroponics. Green gram (*Vigna radiata (*L.) R. Wilczek) is one of the most important grain legumes cultivated in Asia. It is one of the main crops used by the common man in their daily diet.

II. MATERIALS AND METHODS

2.1. Study Area

Plate- 1: Location map

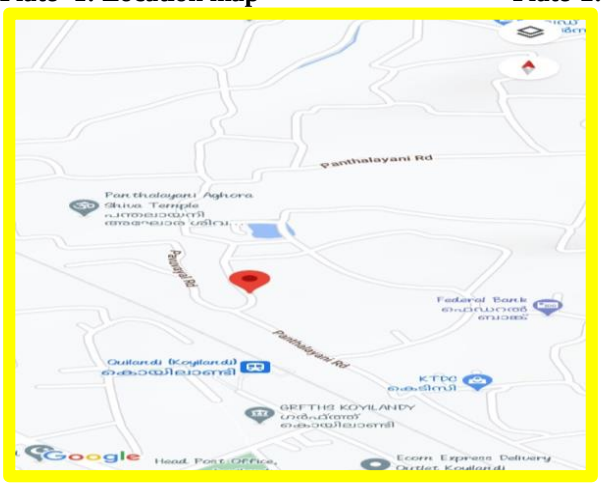


Plate-2: Study Area

Kerala is located in southern most part of India. Kozhikode *district*, in the central part of the former Malabar district, is a district of Kerala state, on the southwest coast of India. The district of Kozhikode is 38.25% urban and is bordered by Malappuram to the South, Wayanad to the East, and Kannur district to the North. To the West, lies the mighty Arabian Sea. The district is situated between latitudes 11° 08'N and 11° 50'N and longitudes 75°30'E and 76°8'E. The Koyilandy town is located between Kozhikode and Vadakara on National Highway 66. The average annual temperature in Koyilandy is 26.2 °C, precipitation here is about 2864 mm and humidity of 63%.

2.2. Collection of selected samples

For the present study the fresh water weeds *Salvinia natans* (L.) and *Hydrilla verticillata* (L.f.) Royle are collected from local water body, pond of Koyilandy municipality, Kozhikode district, Kerala State for the preparation of fresh water weed liquid fertilizer. The fresh water weeds are collected by hand in shallow water and by snorkelling in deeper water. Although, some materials such as glass bottomed box, three-prondeg gravel or dredge can be used and put in bucket of 5L volume. After collection the sample should be squeezed in order to remove the water before storage (Dhargalkar *et al*., 2004). The weeds were collected and washed thoroughly with the pond water followed by fresh water to remove the impurities, dirt, epiphytes and adhering soil particles. Algae are repeatedly washed immediately after collection in order to remove sand particles and other impurities (Thirumaran *et al*., 2009).

Sample-1: *Salvina natans* (L.)

Systematic Position

Division : Polipodiophyta
Class : Polypodiopsida
Order : Salviniales
Family : Saliviniaceae
Genus : *Salvinia*
Species : ***S. natans,* (L.)**

Plate-3: *Salvina natans* (L.)

Salvinia natans (L.) is free floating two nickel-sized leaves lying flat against the surface of the water, and a third submerged leaf which functions as a root. Flotation is made possible by pouches of air within the leaves. It is coming under the family Salviniaceae widely distributed, being native to several continents. Heterosporous, producing spores of differing sizes. However, leaf development in Salvinia is unique. The upper side of the floating leaf, which appears to face the stem axis, is morphologically abaxial.

Sample-2: *Hydrilla verticillata* (L.f.) Royle.

Systematic Position

Division : Angiosperms
Class : Monocotyledonae
Order : Hydrocharitales
Family : Hydrocharitaceae
Genus : Hydrilla
Species : ***H. verticillata* (L.f.) Royle.**

Plate-4: *Hydrilla verticillata* (L.f.) Royle.

It is native to Asia or Africa, although it is widely spread across the globe and an extensively grown fresh or Frog's-bit family. It is a submersed, rooted aquatic plant that can grow in water up to depths of 20 ft. (6.1 m). Leaves are whorled in bunches of 3-8, but most often with whorls of 5. It forms dense mats at the surface of the water. The dense mats can restrict native vegetation,

irrigation practices, recreation, hydroelectric production, and water flow. It was first introduced into North America as an aquarium plant in the 1950s (Kenneth, *et al*., 1996).

2.3. Preparation of liquid fertilizer (G.Thirumaran *et al*.,2009)

The weeds were collected and washed thoroughly with the pond water followed by fresh water to remove the impurities, dirt, epiphytes and adhering soil particles. Then it is spread on blotting paper to remove excess water. One kg of fresh water weeds each of 500 grams was cut into small pieces. It is then autoclaved for 1 hour and the hot extracts were filtered through a double layered cheese cloth and allowed to cool at room temperature. The filtrate was then centrifuged at 10,000rpm for 30 minutes at 4 degree Celsius and the resulting supernatant was taken as 100% seaweed extract. It is stored in refrigerator for further studies. Take seven Petri-plates each with filter paper. The aquatic weed liquid fertilizer was prepared with different concentrations viz., 10%, 20%, 30%, 40%, 50%, 100% from the stock of 100% seaweed extract. A Petri-plate added only with water taken as control and each petri-plate is added with different concentrations of fresh water weed liquid fertilizer. Healthy10 seeds of *Vigna radiata* is put in each Petri plates and covered with other petri-plates to prevent contamination during seed germination. After proper germination of seeds, it is transferred to the disposable glasses with glass with cotton plug and respective concentrations of fertilizer is added.

2.3.1. Seed germination percentage:

Germination percentage of each concentration is calculated by formula (Yang, *et al*., 2008).

$$\frac{\text{Total number of germinated seeds}}{\text{Total number of seeds}} \times 100$$

2.3.2. Plant Growth:

Liquid fertilizer of corresponding concentrations is added regularly to each petriplates. And it is maintained in proper uniform environment. Growth rate of plant can be calculated by counting length in c.m of root and shoot plant in definite interval of 3 days. Separate table is formed for root growth and shoot growth. graph can be constructed for each concentration of liquid fertilizer for each day. The leaf peculiarities are also observed.

III. RESULTS AND DISCUSSION

Table 3. 1: Day 1 Observation

Percentage of liquid fertilizer	Observations
0%	No seeds are germinated
10%	6 seeds germinated. Among the germinated seeds 2 are very healthy 1 c.m length and shows an average length of 0.2 c.m length.
20%	7 seeds are germinated. Among the germinated seeds 4 are healthy with length of 1.1 c.m long and having average length of 0.4 c.m
30%	4 seeds are germinated with an average length of 0.5c.m long
40%	8 seeds are germinated with an average length of 0.2 c.m.
50%	4 seeds are germinated with an average length of 0.1c.m
100%	5 seeds are germinated with an average length of 0.1 c.m

After one day, maximum seed germination shows in the petri-plate with 40% concentration of fresh water weed fertilizer. In that 8 seeds are germinated out of 10 seeds. But in 0% fertilizer no seeds are germinated in the first day it is the minimum germination value.

Table3. 2: Day 2 Observation

Percentage of liquid fertilizer	Changes observed
0%	6 seeds are germinated having an average radicle length of 0.3 c.m
10%	2 more seeds are germinated having an average length of 0.5 c.m long
20%	1 more seed germinated having an average length of 1.2 c.m long
30%	2 more seeds germinated having an average length of 1.9 c.m long
40%	1 more seed germinated having an average length of 1.8 c.m
50%	1 more seed germinated having an average length of 0.9 c.m
100%	1 more seed germinated having an average length of 0.6 c.m.

In Day 2 observation also seed germination is higher in petri-plate with 40%, total 9 seeds are germinated in the petri-plate.

Table 3. 3: Day 3 Observation

Percentage of liquid fertilizer	Changes observed
0%	Total germinated seeds are 6 having an average length of 1.3 c.m
10%	Total germinated seeds are 8 having an average length of 1.8 c.m
20%	Total germinated seeds are 7 having an average length of 2.8 c.m.
30%	Total germinated seeds are 7 having an average length of 2.5 c.m
40%	Total germinated seeds are 9 having an average length of 2.1 c.m
50%	Total germinated seeds are 6 having an average length of 1.9 c.m
100%	Total germinated seeds are 6 having an average length of 1.7 c.m

After 3 days maximum seed germination is showing in all petri-plates. Among various concentrations of fertilizers 40% fertilizer is most effective in which 9 seeds are germinated out of 10 seeds.

Table 3. 4: Day 4 Observation

Percentage of liquid fertilizer	Changes observed
0%	The germinated radicle is thin and leaf is arising in one of the seed.
10%	The germinating radicle is healthy comparing with the Petri plate without liquid fertilizer. Leaf is arising among one of the seed.
20%	Healthy germination of seeds among these leaves are arising in 6 seeds out of 7 germinated seeds.
30%	Showing healthy germination with leaves are arising on two seeds.
40%	Among the 9germinated seeds leaves are arising only in 2 seeds
50%	Healthy germination leaves are arising only in 1seed. Shoot length is lesser comparing to low concentrations of fertilizers. Root is developing with branches
100%	Shoot length is very much decreased but root is very much branched and developed. Radicle is relatively thin.

After 3 days of observation leaves are arising in the germinated seeds.

Table 3. 5: Day 5 Observation

Percentage of liquid fertilizer	Changes observed
0%	Elongated roots. Root branches are developing in 3 plants. leaves are arising in 2 plantlets.
10%	Leaves are arising in two plantlets. Root is not much branched.
20%	Leaves are well developed at all the germinated seeds. Healthy plantlet with long shoot and roots well branched with 4-5 branches on each plantlet.
30%	Leaf is developed at one of the seed. Root hairs are numerous.
40%	Plantlets are not much healthy; leaves arise on 4 plantlets. Root hairs are much developed.
50%	Root hairs are developed but plantlets are not much healthy. Leaves arising on 2 plantlets only.
100%	Profusely branched roots but leaf developed only on 1 plantlet.

Maximum leaf development is seen in 20% fertilizer when comparing to other concentrations of fertilizers.

Table 3. 6: Day 6 Observation

Percentage of liquid fertilizer	Changes observed
0%	The well aroused leaves on 4 plantlets and leaves are just arising on 2 plantlets.
10%	Leaves are developed on 2 plantlets; leaves are arising on 2 plantlets. Plantlets are healthy.
20%	Most healthy plantlets. 2 leaves are well expanded for 5 plantlets and leaves are arising for 2 plants.
30%	Leaves are aroused in 2 plants and for 4 plantlets leaves are arising.
40%	In 6 plantlets leaves are fully developed. Rooting is also developed.
50%	For 5 plantlets leaves are arising. Plantlet growth rate is lesser when comparing to other.
100%	Leaves are just arising for 2 plantlets. Shoot length is less and root is well developed.

In 6^{th} day most healthy plantlets are formed at 20% concentration of liquid fertilizers.plant shows high growth rate.

Table 3. 7: Day 7 Observation

Percentage of liquid fertilizer	Changes observed
0%	Light green coloured leaves, small leaf comparing to other. leaf having an average size of 1.1 c.m
10%	Root growth is lesser when comparing with shoot growth. Leaves are light green in colour with an average size of 2 c.m length.
20%	Well expanded, mature, dark green leaves are formed in 5 plantlets leaves are arising in 3 plantlets. Leaves having an average size of 2.5 c.m. Roots are good and developed.
30%	Leaves are well expanded with average size of 2.1 c.m. root is profusely branched.
40%	Root growth and shoot growth is in equal ratio. Leaf is not much expanded with an average leaf size of 1.5 c.m.
50%	Leaf size is less of an average size of 1.5 c.m. leaf is developed on 5 plantlets. Root is well branched.
100%	Leaf is less developed and leaf is developed only in plantlet, leaves are arising on 2 plantlets with an average leaf size of 1.2 cm root is well developed, well branched and elongated

Optimum concentration for the maximum growth of plantlet is 20% fertilizer. Leaf size is highest for 20% fertilizer.

Table3. 8: Day 8 Observation

the concentration can be changed according to the plants and their growth stage.

Percentage of liquid fertilizer	Changes observed
0%	Plant is not much healthy. Leaves are developed on 4 plantlets with an average leaf size of 1.5 c.m length.
10%	Plantlets are healthy. Leaves are healthy and mature with an average size of 2.1 c.m
20%	Healthiest plant among all other plantlets. Leaf is well expanded in all plantlets with an average leaf size of 3 c.m. Root is also well developed.
30%	Plantlets are not much healthy but leaves are well expanded with an average leaf size of 3.5 c.m length.
40%	Plantlets are not much healthy. Growth rate is retarded for many plantlets. Average leaf size is 2.5 c.m.
50%	Leaves are not much expanded and plant growth s also retarded.
100%	There is not much growth for plantlets and leaves are also not much expanded. Plant is going to dry.

Even though healthiest plantlets are seen at 20% fertilizer, the maximum leaf expansion is seen in 30% fertilizer with an average leaf size of 3.5 cm.

Table 3.9: Day 9 Observation

Percentage of liquid fertilizer	Changes observed
0%	There are 4 healthy plants with an average leaf size of 2.4 c.m.
10%	There are 5 healthy plants with expanded leaves with an average leaf size of 3 c.m.
20%	All the plants are healthy and having expanded large sized leaf with an average size of 3.3 c.m.
30%	Only 3 plants are healthy with expanded leaves with an average leaf size of 3.6 c.m.
40%	The plants are not much healthy. Their growth rate is decreasing.
50%	Growth rate is decreased leaf size is also lesser with an average size of 2.5 c.m
100%	Growth is very low and the leaves are wrinkled and not expanding in the highest concentration.

Plantlets in higher concentration of liquid fertilizer is not healthy and having a trend to dry. Shows very low growth rate.

Table- 3.10: Day 10 Observation

Percentage of liquid fertilizer	Changes observed
0%	Only 3 healthy plants and there are some spots on the leaf. Average leaf size of 2.2 c.m.
10%	Healthy plants with expanded leaves. Leaves having an average size of 2.8 c.m.
20%	These are the healthiest plants with expanded leaves. Leaf size is about 3.8 c.m
30%	Only 4 healthy plants with expanded leaves about 4 c.m size.
40%	Plants are going to be die. Leaf is not much expanded with an average size of 2.4 c.m
50%	Plant's health condition is decreasing leaf size is not increasing.
100%	Plantlets are going to be die. Leaves are wrinkled and not expanding

Plantlets at 20% concentration of liquid fertilizer is the healthy plantlets, but leaves are much developed and expanded in 30% liquid fertilizer. In 100 % fertilizer the plantlets are going to die.

Table -3.11: Seed Germination

S. No	Concentration of fertilizer in %	Number of germinated seeds in Day 1	Number of germinated seeds in Day 2	Number of germinated seeds in Day 3
1	0%	0	6	6
2	10%	6	8	8
3	20%	7	8	8
4	30%	4	6	7
5	40%	8	9	9
6	50%	4	5	6
7	100%	5	6	6

Maximum number of seed germinated is in 40% concentration of fresh water weed liquid fertilizer. In that 9 seeds are germinated within 2 days. In 0% fertilizer only 6 seeds are germinated within 3 days.

Chart-3.1: Seed Germination

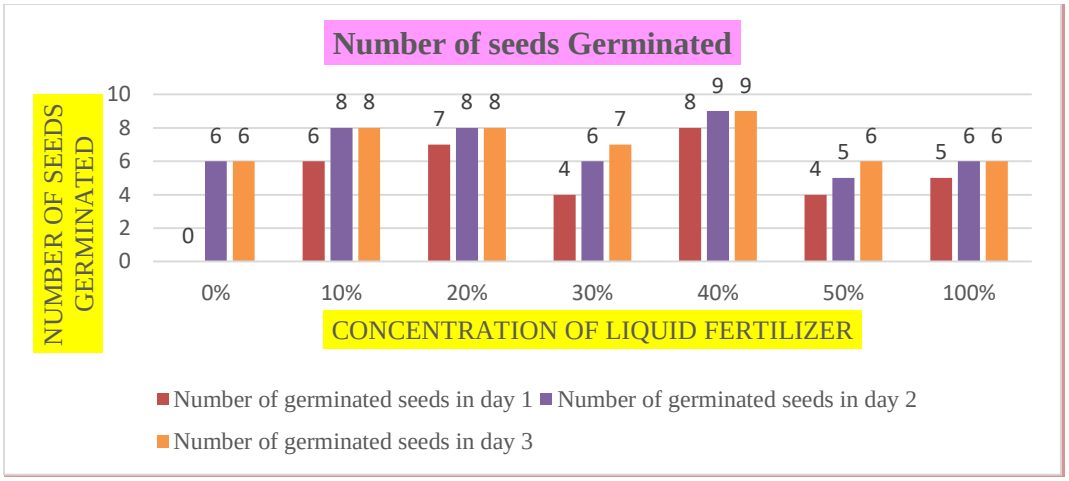


Table -3.12: Seed Germination Percentage

Sl No.	Concentration of fertilizer in %	Seed germination percentage
1	0%	60%
2	10%	80%
3	20%	80%
4	30%	70%
5	40%	90%
6	50%	60%
7	100%	60%

The maximum seed germination percentage among the various concentration of freshwater weed liquid fertilizer is 90% and it is seen in 40% liquid fertilizer. 80% seed germination percentage is seen in 10% and 20% concentration of fertilizers. 70% seed germination percentage is seen in 30% liquid fertilizers. The lowest seed germination percentage is seen in lowest and highest concentrations of liquid fertilizers i.e., in 0%, 50% and 100% concentrations of fertilizers the seed germination percentage is 60%.

Chart-3. 2: Seed Germination Percentage

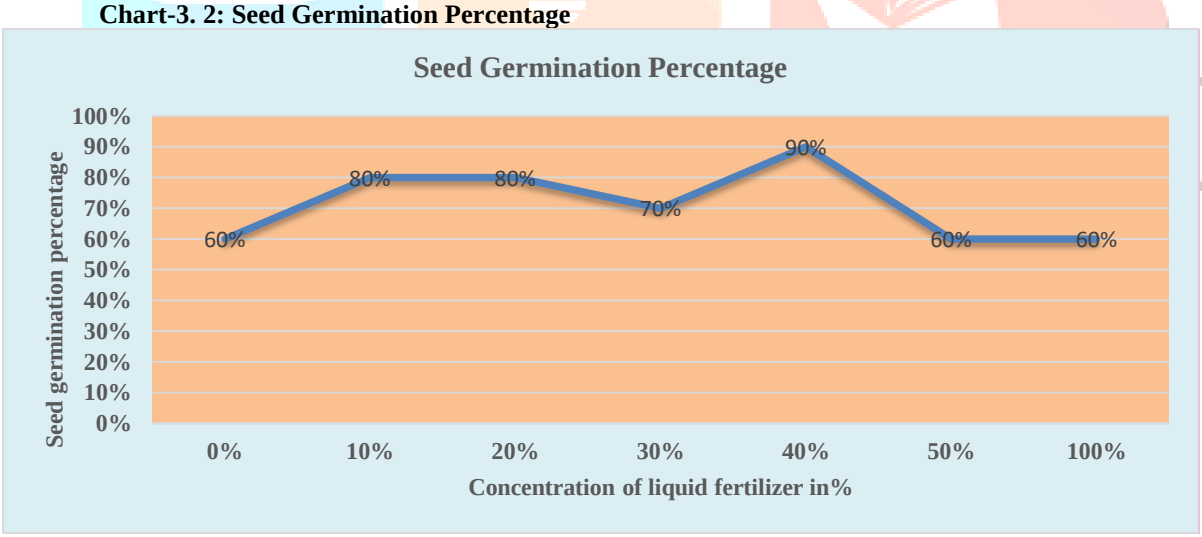


Table 3.13: Plant Growth

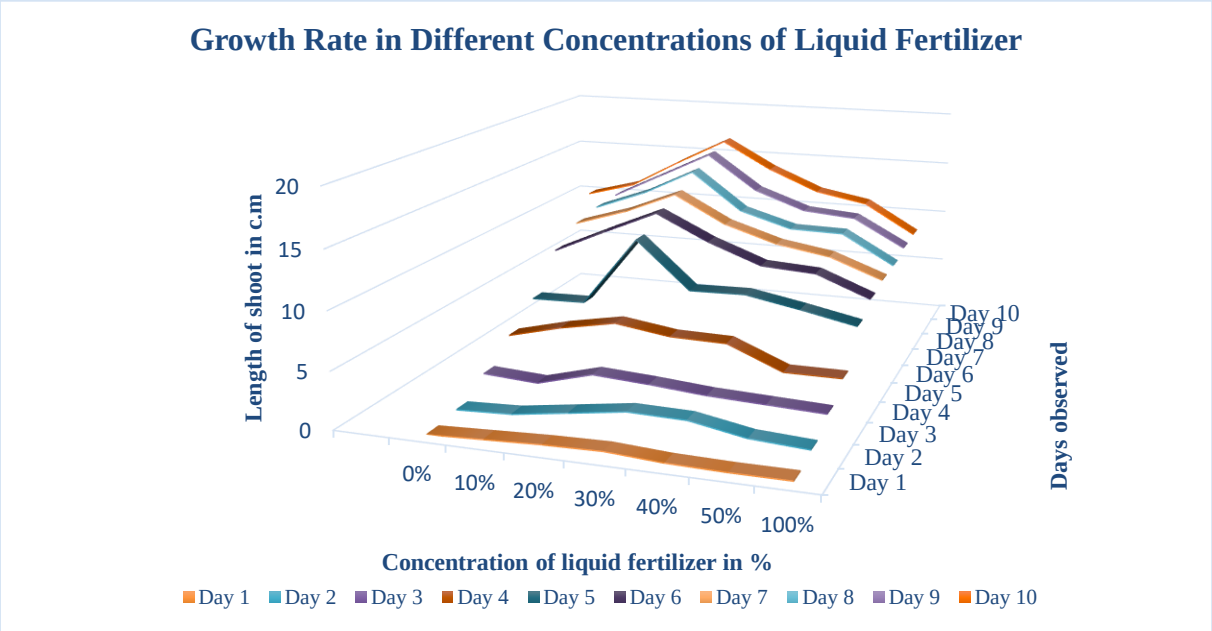
Percentage of liquid fertilizer	Seed growth in cm									
	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10
0%	0	0.3	1.3	3.7	5.7	9	10.5	11	11.2	11.3
10%	0.2	0.5	1.5	4.9	5.8	11.2	12	12.8	13.6	14
20%	0.4	1.2	**2.8**	**5.8**	**12**	**13.3**	**14**	**15.2**	**16**	**16.5**
30%	**0.5**	**1.9**	2.5	5.1	7.8	11	11.5	11.7	12.7	13.9
40%	0.2	1.8	2.1	5.0	7.9	9.2	10	10.3	11	11.9
50%	0.1	0.9	1.9	3	7	8.9	9.2	10.2	10.6	11
100%	0.1	0.6	1.7	3	6	7	7.4	7.5	8	8.2

The healthiest plants are seen in 20% of liquid fertilizers. They show highest growth rate. Highest germination size of plantlets is seen in 20% fertilizer. It shows an average length of 16.5 c.m with 10 days. The root develop was higher in high concentration of liquid fertilizer (100%) in early days of development. Equal ratio of shoot and root development is seen in 30% fertilizers. Leaf expansion, development and maturation is very high in 30% fertilizers. It is then decreased to the both sides of concentration. After the 6^{th} day the higher concentration of liquid fertilizer will negatively affect the growth of plantlets and growth rate is decreased as well as the leaf shows wrinkling appearance and the plantlets may die after 10 days which is grown in 100% concentration of liquid fertilizer. Plants grown in fertilizer shows a resistance against some insect because the leaf of plantlet in 0%

fertilizer alone is attacked by an insect and spot is seen on leaves. And also, the leaf colour is a pale green comparing to other plantlets.

Among the various concentrations of liquid fertilizer made from *Hydrilla verticillata* and *Salvinia natans*, 40% concentration is the efficient concentration for seed germination of *Vigna radiata*. High growth rate is promoted by 20% fertilizer.

Chart-3.3: Growth Rate



IV. CONCLUSION

4.1 Efficacy of Fresh Water Weed Fertilizer

Developing countries are facing the important problem of food crisis with the population explosion. Decrease in the quality of soil and water due to the contaminations by various metals and usage of chemical fertilizers is negatively affected for farmers. Fresh water weeds are luxuriantly growing in the rural waterbodies which is easily available and nutrient rich. Nutrient studies with submerged and floating plants were conducted on invasive species in the 1970s and 1980s. The nutrient content of soils varies widely throughout the different regions of the world, the requirement of various nutrients for plants also varies.

4.1.1 Seed Germination Percentage

Fresh water weed liquid fertilizer prepared from *Hydrilla verticillata* (L.f.) Royle. and *Salvinia natans* (L.) are highly efficient as a biofertilizer. It shows 90% seed germination percentage at the 40% concentration of fresh water weed liquid fertilizer. So, the aquatic weed liquid fertilizer with 40% concentration can be used in the early stages for the seed germination which shows maximum seed germination percentage.

4.1.2 Plant Growth

The rate of germination was also higher in liquid fertilizer when comparing with the control. At the early developmental stages of plantlets plants showed maximum root growth at 100% of liquid fertilizer, but later prolonged application of 100% fertilizer caused to the wilting of plant and also the growth rate was decreased. The efficient concentration of liquid fertilizer for the healthiest plant growth is 20%, which shows highest length of plantlets, highest growth rate and root and shoot development occurring in the equal ratio. For the leaf expansion and their maturation, 30% liquid fertilizer is the optimum concentration. So that from the study we can conclude that liquid fertilizer prepared from *Hydrilla verticillata* (L.f.) Royle. and *Salvinia natans* (L.) is highly efficient as an eco-friendly fertilizer with low coast and high result. After the proper seed germination, the plant should be applied with 20% concentration of liquid fertilizer which enhances further growth and development. For high leaf expansion 30% liquid fertilizer is the proper concentration.

As it is a liquid fertilizer it can be used in varying concentrations in various stages of plant growth which is optimum. And also, it has a higher application in modern types of agriculture i.e., aquaponics and along with drip irrigation. These liquid fertilizers show resistance against some pest, which is an application for pest management also. The usage of weeds as liquid fertilizer is a best remedy for the extensive growth of weed in the aquatic system and to maintain the favourable environment for all the aquatic organisms.

Weeds do not only possess the harmful aspect but they have beneficial aspects towards utilization in a number of ways for humans. Small and marginal farmers and landless labours may use weeds as a fertilizer for their own living. Aquatic weed is extremely difficult to eradicate once established. The goal of most management efforts is to minimize economic costs and ecological change. Efforts have been made by various countries to control or manage the weeds. So fresh water weeds can be used as liquid fertilizers for crops for farmers with low cost.

REFERENCES

[1] Amir Zaman, Haji Muhammad, Shad Khan Khalil and Zahir Sharh, 2014., Effect of Beneficial Microbes on the Efficiency of Organic N Fertilizer on Wheat Crop., *Sharhad J Agric*, 30: 7-8.

[2] Kevin Tindo Koffi, Dr. Sumit Kumar, Prof. Dhamesh H. Sur, Extraction of Plant Nutrients from Freshwater Algae and their Role in Sustainable Agriculture, 2018., *International Journal of Current Biotechnology*, 6(4):1-8.

[3] Mohammad Javad Shakouri, Akram Feiz Abadi, Tohid Nooralvadndi Mohammad, Hosein Bijesh Keshavarzi., 2014, Study the Effect of Biological and Chemical Fertilizers on *Artemisia annual L.* Root Characteristics., *International Journal of Bioscience*, 4 (12): 295-300.

[4] Q.H. Yang and X. L. Zeng, 2008., Seed biology and germination ecophysiology of *Camellia nitidissima*, *Forest ecology and management*,255(1): 113-118.

[5] Thirumaran G, Arumugan M, Rajashekharan Arumugan, Anantharaman P, 2009., Effect of Seaweed Liquid Fertilizer on Growth and Pigment Concentration of *Cyamopsis tetrogonolaba L.*, *American- Eurasian Journal of Agronomy*, 2(2): 50-56.

[6] Tiwari P. K, Misra A. K, Ezio Venturino, 2017., The Role of Algae in Agriculture: Mathematical Study., *Journal of Biological Physics*, 43(2): 297-314.