Effect of fertilization by Cladophora algae on morphological characteristics of Vigna radiate & Sesamum indicum plants

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Abstract: An experiment was done in pots at the garden of biology department, College of Science, University of Thi-Qar during September until November 2018. The experiment aimed to Know the chemical content of Cladophora sp. and it use in soil amendment as organic fertilizer, as well as its effect on some morphological characteristics (shoot and root length, shoot and root dry weight and leaf area). The experiment contained the following treatments: control (c) no adding algae, (1%), (2%), (3%) with adding Cladophora sp. as (300, 600, and 900) gm/30 kg soil respectively. All Cladophora sp. treatments showed significant increase in all morphological characters compared with the control. (3%) treatment gave significant increase as compared to other treatments in (shoot and root length, shoot and root dry weight, leaf area and grains number) in both plant. Vigna radiate showed increasing in total length, total dry weight and leaf area (34.6 cm, 35.5 gm and 79.1 cm²) respectively in T3(3%). As for Sesamum indicum, it also showed significant differences in morphological characteristics in all the treatments and the highest values in (shoot and root length, shoot and root dry weight, leaf area and grains number) was (129.9 cm, 28.8 gm and 67.2 cm²) respectively in T3(3%).

Keywords: Cladophora sp., Vigna radiata L., Sesamum indicum.

1. Introduction

The bio-fertilizer, organic manure, and bio-control factors have seem to be as a favorable component of integrating nutrient supply system in agricultural soil. Biological fertilizers are significant to access of eco-friendly agricultural practices (Bloemberg et al., 2000). Bio-fertilizers contain principally the nitrogen fixing, phosphate solubilizing and plant growth promoting microorganisms (Goel et al., 1999). The main biofertilizers are Azotobacter, Azospirillium, blue green algae, Azolla, P-solubilizing microorganisms, mycorrhizae, and Sinorhizobium (Hegde et al., 1999). Green manures were also observed to induce root growth and make good yields (Boussiba, 1987; Mandimba et al., 1998). Algal biomass contains high percentage of macronutrients, elegant amount of micronutrients and amino acids (El Fouly et al., 1992; Mahmoud, 2001). Algal biomass as a new bio-fertilizer contain macronutrients as well as micronutrients, some growth regulators, polyamines, natural enzymes carbohydrates, proteins and vitamins carry out for improving vegetative growth and yield (Shaaban, 2001 and Abd El-moniem and Abd-allah, 2008). Aside from, algae biomass to the soil improve soil characteristics that have suitable effect on nutritional status of plants (Al-Gosaibi, 1994).
*Cladophora glomerata* is a genus of filamentous branched green algae which forms free-floating mats in shallow waters or attached to the base of shallow pools for example, lakes and canals, in shaded littoral zones of lakes, and in slow streams stay connected to the substratum by abasal cell.

The objective of this study is to determine the effect of powder macroalgae *Cladophora glomerata* on morphological characteristics of *Vigna radiate & Sesamum indicum* plants in the pots.

## 2. Materials and Methods

### 2.1. Algal culture

Macroalgae (*Cladophora sp.*) isolated from Euphrates River in Nassireya city in April 2018 Algal specimen were pressed and stored in 5% formalin for identification according to (prescot,1962). Biomasses of macroalgae were rinsed with fresh water to eliminate other materials such as sand, shells, etc. The macroalgae were stored in the laboratories to identified and dried at 50°C under ventilation in an oven and then grounded to powder form by the blender.

### 2.2. Chemical and physical analysis of soil and algae

Soil and algae were collected from all the treatments and placed in Nylon bags, the samples were dehydrated and tested and passed from a 2 mm diameter sieve and packaged in plastic containers. The chemical and physical properties of soil and algae were determined by using pH and electrical conductivity (E.C.) meter(Jackson, 1958). Soil and algae organic matter (O.M.) was determined using the Smith-Weldon method as described in (Rhoades,1996) as shown in table (1).

| pH | E.C. (ds/m) | O.M. (gm/g) | N (mg/g) | P (mg/g) | K (mg/g) |
|----|-------------|-------------|----------|----------|----------|
| 7.8 | 4.8         | 14.4        | 17.5     | 2.4      | 1.2      |

### 2.3. Plant materials

The experimental plants used in this study were *Vigna radiate & Sesamum indicum* plants for planting in a pots, capacity is 30 kg soil per one pot. The experiment include the following treatments: control (C) 0 gm algae/30 kg soil, (T1) 300 gm algae/ 30 kg soil,(T2)600 gm algae/30 kg soil and (T3) 900 gm algae / 30 kg soil.

### 2.4. Growth measurements of plant

At the end of the experiment; plant height, leaf area, and total dry weight for shoots and roots were recorded.

Measurement of plant height and leaf area:

The height of the plant (cm) and the leaf area of the plant leaf (cm²) were measured by using the following equation Calculation of Space and Science leaf Method(Nelson and sommer1982):

Leaf area = leaf length * Maximum paper width *0.905

The plants were harvested and weighed, plants were dehydrated and then placed in the oven at a temperature of 68 c until proven weight and dry weight record for each treatment.
3. Results & Discussion

The addition of *Cladophora sp.* has led to changes in soil properties (chemical and physical) tab.(2). The (PH) value decrease in all alga treatment in the soil this may be due to the degradation of organic substance by microorganisms and the production of acids and thus reduce the degree of soil PH. On the contrary (E.C.) electrical conductivity increase in the values at the high level of addition alga and may be due to the containment of these algae on salt compare with control treatment (C).

The proportion of organic matter in the soil after the harvest increased with the level of addition of algae and reached this increase to 12.33gm/kg in T3. These results are consistent with what was found by (PiJuamet, al. 2010) and (Hussein, 2016).

**Table (2)** Some chemical and physical properties of soil

| Treatments | pH   | E.C. (ds/m) | Organic matter (gm/kgm) | Soil texture |
|------------|------|------------|--------------------------|--------------|
| C          | 7.7  | 4.38       | 7.15                     | Sand% 42 Clay% 39 Silt% 19 |
| T1         | 7.5  | 4.42       | 9.56                     | Sand% 42 Clay% 39 Silt% 19 |
| T2         | 7.4  | 4.61       | 10.20                    | Sand% 43 Clay% 38 Silt% 19 |
| T3         | 7.1  | 4.89       | 12.33                    | Sand% 44 Clay% 38 Silt% 18 |

Table (3,4) show the increase of length by increasing added of algae *Cladophora glomerata* in both study plant (*Vigna radiate* and *Sesamum indicum*).

The increase in plant length when using algae may be due to the positive effects through the effect of cytokinein and oxyin that present in algae, which play a large role in the division of apical meristem (O’Dell, 2003). As well as to increase the size of cells due to the impact of hormones (Nelson and Van Staden, 1984).

**Table (3 ) Effect of Cladophora glomerata on length of Vigna radiate**

| Fertilizer | Treatment | Shoot length (cm) | Root length (cm) | Total length (cm) | Increasing (%) |
|------------|-----------|-------------------|------------------|-------------------|----------------|
| Control    | 0         | 20.4a             | 9.1ab            | 29.5c             | 0%             |
| Chladophora| T1        | 20.9a             | 9.3ac            | 30.2d             | 2%             |
|            | T2        | 22.3b             | 9.9ad            | 32.2d             | 8%             |
|            | T3        | 24.8c             | 9.8ad            | 34.6f             | 14%            |

Similar letters in the same column mean that there are no significant differences at the probability level 0.05

**Table (4 ) Effect of Cladophora glomerata on length of Sesamum indicum**

| Fertilizer | Treatment | Shoot length (cm) | Root length (cm) | Total length (cm) | Increasing (%) |
|------------|-----------|-------------------|------------------|-------------------|----------------|
| Control    | 0         | 80.2a             | 22.5c            | 102.7b            | 0%             |
| Chladophora| T1        | 88.4b             | 24.7a            | 113.1d            | 9%             |
|            | T2        | 93.7c             | 28.5d            | 122.2a            | 15%            |
|            | T3        | 99.8d             | 30.1b            | 129.9c            | 20%            |

Similar letters in the same column mean that there are no significant differences at the probability level 0.05
The dry weight in the both plants were also increased when treated with alga T3 as shown in (table 5,6). The increase in dry weight resulting in an increase in nutrient readiness and thus increase absorption and growth. Algae mineralization produces a lot of Nutrients essential for plant growth. bio fertilization has also played a significant role in increasing production and supply Plant with the elements necessary for its growth of nitrogen, phosphorus and potassium.

This is consistent with many studies that confirm the use of algae increases the production of crops, especially in drought conditions where water and soil lack organic matter(He et,ai.2006;Eid et,ai.2000).

| Fertilizer | Treatment | Shoot dry weight (gm) | Root dry weight (gm) | Total dry weight (gm) | Increasing (%) |
|------------|-----------|-----------------------|----------------------|-----------------------|----------------|
| Control    | 0         | 9.9a                  | 2.5c                 | 12.4b                 | 0%             |
| Cladophora | T1        | 18.4b                 | 2.9d                 | 21.3a                 | 41%            |
|            | T2        | 30.6c                 | 3.2a                 | 33.8d                 | 63%            |
|            | T3        | 32.4d                 | 3.1a                 | 35.5c                 | 65%            |

Similar letters in the same column mean that there are no significant differences at the probability level 0.05

| Fertilizer | Treatment | Shoot dry weight (gm) | Root dry weight (gm) | Total dry weight (gm) | Increasing (%) |
|------------|-----------|-----------------------|----------------------|-----------------------|----------------|
| Control    | 0         | 11.8d                 | 2.9c                 | 14.7a                 | 0%             |
| Cladophora | T1        | 12.3c                 | 3.1a                 | 15.4b                 | 4%             |
|            | T2        | 18.6b                 | 3.9a                 | 22.5c                 | 34%            |
|            | T3        | 24.6a                 | 4.2b                 | 28.8d                 | 48%            |

Similar letters in the same column mean that there are no significant differences at the probability level 0.05

4. Conclusion

1- Organic matter (algae) can be converted to organic fertilizer that’s due to Minimize the use of chemical fertilizers
2- Improve the qualities of soil chemical and physical
3- The best productivity in both plants (Vigna radiate & Sesamum indicum) was in the T3 (900g clad./30kg soil).

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