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The effects of using farm-pond algae as a liquid bio-fertilizer on spinach (Spinacia oleracea L.) growth

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ABSTRACT:

By taking into consideration seed germination, seedling growth, and seedling vigour index, the effectiveness of farm pond algal extracts as a liquid bio-fertilizer on the growth of spinach was investigated (SVI). The experiment involved soaking the seed overnight in a variety of algal extract concentrations, including 1 per cent, 5 per cent, 10 per cent, 15 per cent, 20 per cent, 25 per cent, and control. The results showed that, when compared to other concentrations and the control, algal extracts at a 20 per cent concentration displayed the greatest activity in terms of increasing seed germination, root length, shoot length, and seedling vigour index.

Keywords: Algal, Bio-fertilizer, seed germination, seedling growth, seedling vigour index, spinach

INTRODUCTION:

Spinach, also known as Palak, is a leafy vegetable that is both an edible flowering plant and a member of the Amaranthaceae family. It is a good source of calcium, dietary fibre, vitamin A, vitamin B (folate), vitamin B1 (thiamine), vitamin C, vitamin K, magnesium, potassium, and phosphorus. The plant is grown domestically as a leafy vegetable. Different inorganic fertilisers are employed to grow the crop, but regular use of these fertilisers has begun to have a negative impact on the soil, causing it to lose its fertility and contributing to an increase in salinity.

To avoid the negative consequences of inorganic fertilisers, it is now necessary to switch to organic farming. One of the key methods of organic farming is the use of algae biofertilizers. A few species of blue-green algae are mineral-rich and have the capacity to fix atmospheric

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nitrogen for use in crop growth. These algae may be found easily, and some of them have been shown to increase seed germination (Bhosle et. al., 1975; Rathore, 2009; Pise and Sabale, 2010; Aher and Wabale, 2016 and 2017).

Determining the effectiveness of farm pond algae as a liquid bio-fertilizer on the growth of spinach (Spinacia oleracea L.) with reference to seed germination, root length, shoot length, and seed vigour index was thus the goal of the current study.

MATERIALS AND METHODS:

Algae collected from the farm pond of Wakadi village were identified with the help of monographs viz. Philipose M.T. 1967, Prasad and Srivatava 1992, Prescott, 1951, Randhava M.S., 1959, Dishikachary T.V., 1959 and Gonzalves E.S. 1981.

Healthy seeds with uniform size, colour and weight of Indian summer variety were obtained from agricultural centre Loni. A mixture of freshwater alga used in the experiments was collected from the agricultural pond of a farmer from Wakadi village. Fresh material was handpicked and brought to the laboratory, washed thoroughly under running tap water and epiphytes found were removed. The material was shade dried for 4 to 6 days and ground to get the powder, which was stored in airtight plastic bottles.

10 gm fine powder of algae was mixed separately in 100ml of sterile distilled water and boil at 100^0C to reduce the volume up to 10ml. This extract was filtered through a muslin cloth and cooled. The extract was used as stock solution (100%). The extract was diluted with sterile distilled water for preparing 1%, 5%, 10%, 15%, 20% and 25% concentrations respectively and stored in airtight bottles for further study. Algal extracts were prepared by using the method of Bhosle *et. al.*, 1975.

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To analyze the effect of the freshwater algal extract on Spinach as a test plant, the paper towel method (Agarwal, 1999) was used. Identical size fifteen healthy seeds were presoaked in different concentrations of algal extracts for 24 hours. The experiment was carried out in triplicates. The moist and disinfected paper towel was stretched on a clean polythene paper and fifteen seeds were arranged on its half portion containing three rows each of five seeds. About 3-inch space was left on the lower and right sides of the paper towel. The paper towel was rolled from the right end with plastic paper and the ends were tightened with rubber bands. A Paper towel was placed vertically in a beaker containing little water.The first count for germination percentage was recorded after 7 days the and final count after 21 days for total seedling growth. Different parameters were used in the present investigation as follows.

- Germination percentage
- Shoot length
- Root length
- Total height of the seedling
- Seedling vigour index (SVI)

Above mentioned parameters were calculated by using the following formulae

- Germination percentage = $\frac{\text{No. of Seed Germinated} \times 100}{\text{Total No. of Seeds placed}}$
- Total height of seedling = Shoot length + Root length.
- SVI = (Mean root length + Mean shoot length) × % of seed germination (Abdul-Baki and Anderson, 1973)

RESULTS AND DISCUSSION:

Algal members like Hydrodictyon, Coelastrum, Mougetia, Ulotrix, Cladophora, Pithophora, Rhizoclonium, Ocillatoria, Lyngbya, Scytonema, Microcoleus, Navicula, Pinnularia, Melosira, Fragilaria and Nitzschia were recorded in the agricultural pond fresh water.

The administration of algal extract had a more broad impact on all of the study's parameters than on the control, according to the findings. When compared to control seeds, those exposed to a 20 percent concentration of algal extract exhibited the greatest shoot length, root length, the total

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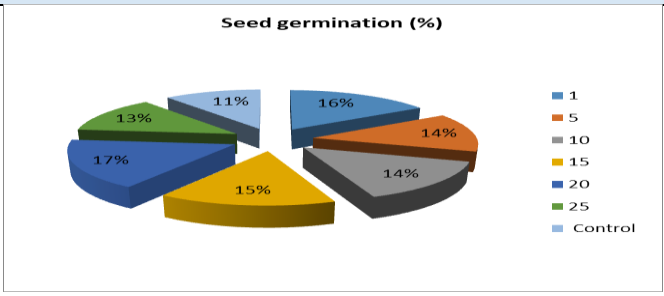
height of seedlings, greatest seed germination, and greatest seedling vigour index (Table-1). At a 1 percent algal extract treatment, however, the overall height of the plant and the percentage of seed germination were also substantial. All measures, including those with algal concentrations of 1 percent, 5 percent, 10 percent, 15 percent, and 20 percent, showed an increasing trend. However, at concentrations greater than 20%, the results for all parameters showed a considerable drop. According to reports, a 20 percent algal concentration improved seed germination and seedling vigour index (Graph 1).

Table -1: Effect of Fresh Water Algal Extracts on the Seedling Growth of Spinach.

Boiled water algal extract (%)	Shoot length(cm)	Root length(cm)	Total height of seedling (cm)	Seedling vigour index (SVI)	Seed germination (%)
1	5	7.11	12.95	1089.9	90%
5	4.92	7.36	12.28	921	75%
10	3.26	5.38	8.65	691.2	80%
15	3.92	6.06	9.98	848.3	85%
20	**5.47**	**8.48**	**13.96**	**1325.25**	**95%**
25	4.98	7.16	12.15	849.8	70%
Control	6.32	7.38	12.65	822	60%



Graph 1: Effect of Fresh Water Algal Extracts on the Seed Germination in Spinach

The germination, SVI, and growth of spinach seeds and seedlings were each enhanced by 20% concentrations of algal extract, according to the results. Other concentrations have also shown promise in enhancing at least one or more of the studied spinach parameters. At algal concentrations of 1 percent, 5 percent, 10 percent, and 15 percent, the total height of the seedling was 12.95 cm, 12.28 cm, 8.65 cm, and 9.98 cm, respectively. Only the concentration of 20 percent demonstrated greater seedling height and vigour index compared to control (Fig. 1).

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Percent seed germination at 1%, 5%, 10%, 15%, and 20% was 90%, 75%, 80%, 85%, 95% which was more than the control (60%).Pise and Sabale, 2010 also reported significant shoot growth in fenugreek seeds treated with seaweed extracts. Extract of Ulva was found slightly more effective than that of Sargassum and Gracilaria. They have further concluded from their study that, liquid seaweed extracts are more effective in stimulating the growth of fenugreek seedlings.

Fig.1. Seedling Growth at different concentrations

CONCLUSIONS:

The aforementioned experimental results unmistakably show that applying algal extract boosted the spinach seedlings' overall height, seedling vigour index (SVI), and seed germination % as compared to the control. For using fresh water algal extract as liquid fertilizers, marginal farmers will find the percentage findings valuable. The use of algal extracts in fertilizers will result in low-cost, environmentally friendly, commercial goods that will aid in lowering environmental pollution and pesticide tolerance. Farmers will also have access to the algal material in their own agricultural ponds, and these biofertilizers are simple for farmers to use. Additional research will be done to separate the combination of algae and determine precisely which algal species are more efficient in enhancing growth.

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