



Efficiency of Farm Pond Algae as a Liquid Bio-Fertilizer on the Growth of Spinach (*Spinacia oleracea* L.)

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ABSTRACT

Efficiency of farm pond algal extracts as a liquid bio-fertilizer on the growth of spinach was studied by considering seed germination, seedling growth and seedling vigour index (SVI). The experimental analysis was carried out by soaking the seed overnight in various concentrations of algal extracts. viz., 1%, 5%, 10%, 15%, 20%, 25% and control. Results revealed that algal extracts at 20% concentration showed maximum activity in terms of increase in seed germination, root length, shoot length and seedling vigour index as compared to other concentrations and control.

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

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INTRODUCTION

Spinach (*Spinacia oleracea* L.) is an edible flowering plant and a nutritious leafy vegetable also known as Palak, belonging to the family Amaranthaceae. It is an important source of vitamin-A, vitamin-B (Folate), vitamin-B1 (Thiamine), vitamin-C, vitamin-K, magnesium, potassium, phosphorus, dietary fibers, calcium, carbohydrates and proteins. The plant is cultivated within the country as a leafy vegetable. Various inorganic fertilizers are used for growing the crop, but continuous use of such fertilizers has started showing their adverse effects on the soil as a result the soil is losing its fertility and responsible for increasing salinity [3, 15].

Time has arisen to move towards organic farming to avoid the harmful effects of inorganic fertilizers. Use of algal biofertilisers is one of the important approaches of organic farming. Certain blue green algal members are rich in minerals and have the ability to fix the atmospheric nitrogen that can be used for the growth of the crop. These algae are easily available and some of them are known to improve seed germination [4, 5, 10, 14].

Hence in present investigation an attempt was made to study the Efficiency 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 vigor index.

MATERIAL AND METHODS

Algae collected from the farm pond of Wakadi village were identified with the help of monographs viz. [7, 11, 12, 8, 6, 13].

Healthy seeds with uniform size, colour and weight of Indian summer variety were obtained from agricultural centre Loni. A mixture of fresh water 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 grinded 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°C 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.*, [5].

To analyze the effect of fresh water algal extract on Spinach as test plant, paper towel method [2] was used. Identical size fifteen healthy seeds were presoaked in different concentrations of algal extracts for 24 hours. The experiment was carried in triplicates. 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 lower and right side of the paper towel. The paper towel was rolled from the right end with plastic paper and the ends were tightened with rubber bands. Paper towel was placed vertically in beaker containing little water.

First count for germination percentage was recorded after 7 days 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 seedling
- Seedling vigour index (SVI)

Above mentioned parameters were calculated by using the following formulae

$$\text{Germination percentage} = \frac{\text{No. of Seed Germinated} \times 100}{\text{Total No. of Seeds placed}}$$

$$\text{Total height of seedling} = \text{Shoot length} + \text{Root length.}$$

$$\text{SVI} = (\text{Mean root length} + \text{Mean shoot length}) \times \% \text{ of seed germination [1]}$$

RESULTS AND DISCUSSION

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

Results revealed that all the parameters under study were generally influenced by the application of algal extract as compare to the control. Seeds treated with 20% concentration of algal extract showed maximum shoot length, root length, total height of seedling, maximum seed germination and seedling vigour index as compared to control (Table-1). However, total height of plant and percent seed germination was also significant at 1% algal extract treatment. The increase trend has been reported in the outcome of all parameters starting from 1%, 5%, 10%, 15% and 20% algal concentrations. However all parameters have shown significant decrease in the outcome at concentrations higher than 20%. It was reported that, algal concentration of 20% was more effective in the seed germination (Fig-1), seedling vigour index and seedling growth as compared to control.

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% |

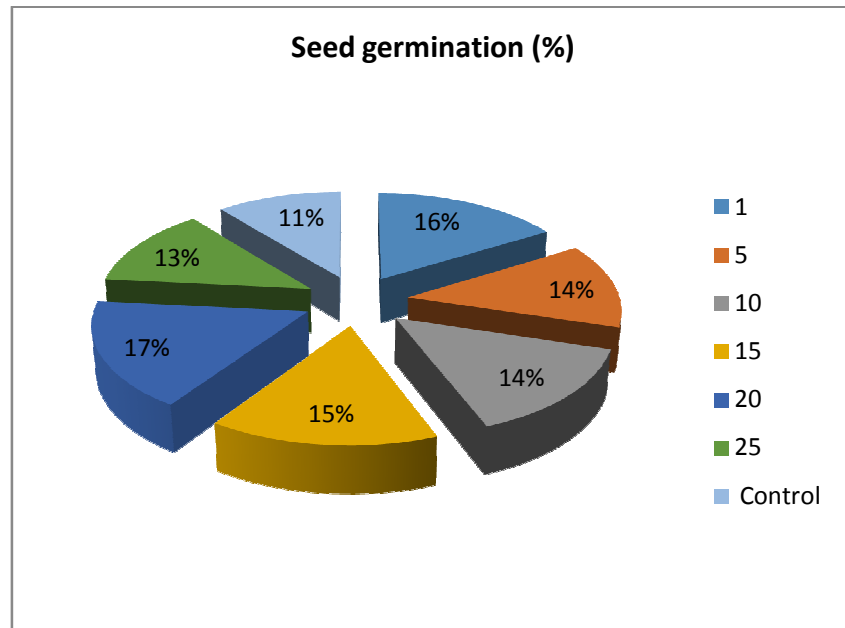


Fig 1: Effect of Fresh Water Algal Extracts on the Seed Germination in Spinach

Results have shown that, 20% concentrations of algal extract have stimulated the germination, SVI and the growth of the spinach seeds and seedling respectively. Other concentrations have also proved to be effective in stimulating at least one or more parameters of spinach under study. The total height of seedling at algal concentrations of 1%, 5%, 10%, and 15% was 12.95cm, 12.28cm, 8.65cm and 9.98cm respectively. Only the concentration of 20% had shown more seedling height (Fig.1) and seedling vigour index than control. 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, [10] also reported significant shoot growth in fenugreek seeds treated with sea weed extracts. Extract of *Ulva* was found slightly more effective than that of *Sargassum* and *Gracilaria*. They have further concluded from their study that, liquid sea weed extracts are more effective in stimulating the growth of fenugreek seedlings.

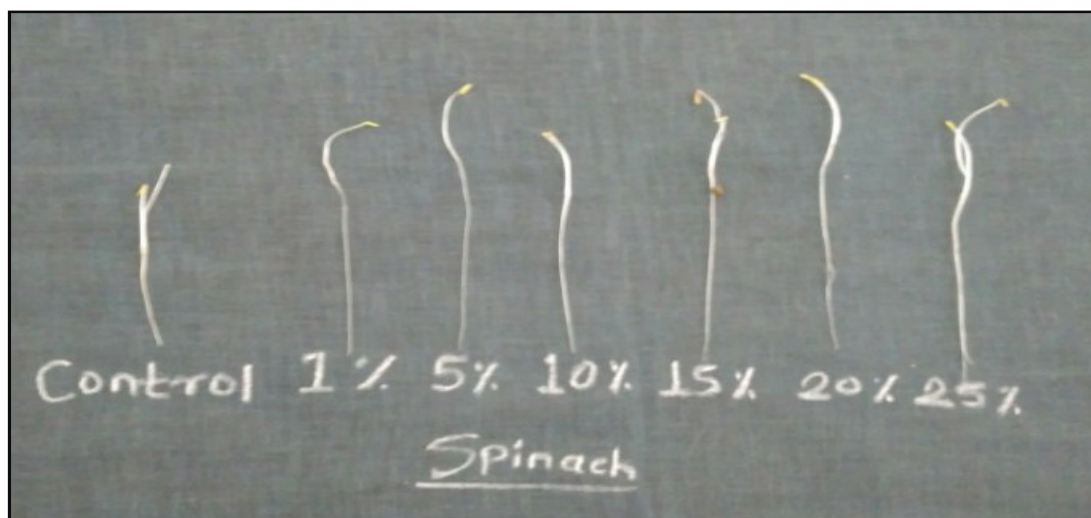


Fig.2. Seedling Growth at different concentrations

CONCLUSIONS

Above experimental results clearly indicates that the seed germination percentage, seedling vigour index (SVI) and total height of seedling in spinach has increased due to the application of algal extract as compare to control. The percentage findings will be useful to the marginal farmers for utilizing fresh water algal extract as liquid fertilizers. Utilization of algal extracts in fertilizers will produced low cost eco-friendly, commercial products which will help in reducing environmental pollution and pesticide

tolerance. Moreover, the algal material will be available to the farmers in their own agricultural ponds and these biofertilisers are easy for farmers to handle. Further study will be carried out to screen out the algal mixture and find out exactly which of the algal species is more effective in enhancing the growth.

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