Advances in Bioresearch
Adv. Biores., Vol 16 (2) March 2025: 412-417

Print ISSN 0976-4585; Online ISSN 2277-1573
Journal's URL: http://www.soeagra.com/abr.html
CODEN: ABRDC3
DOI: 10.15515/abr.0976-4585.16.2.412417

Advances in Bioresearch

SHORT COMMUNICATION

Liquid Biofertilizer from Fresh Water Algae: A Novel Approach for Enhancing Safflower (*Carthamus tinctorium* L.) Growth and Yield

D. N. Gholap and A. S. Wabale*
Arts, Commerce and Science College, Satral, Tal. Rahuri, Dist. Ahmednagar (M.S.)
*Padmashri Vikhe Patil College of Arts, Science and Commerce, Pravaranagar- 413 713
deepakgholap1972@gmail.com/ anil.wable@pravara.in

ABSTRACT
The use of bio-fertilizers has emerged as a viable solution to counteract the detrimental effects of chemical fertilizers on soil fertility. Freshwater algae, in particular, have exhibited remarkable potential as liquid bio-fertilizers, augmenting crop productivity and soil fertility. A study was conducted to investigate the efficacy of algal extract mixed with cattle urine as a bio-fertilizer on Carthamus tinctorium L. seeds. The seeds were treated with varying concentrations of the algal extract mixture, ranging from 1% to 25%, and a control group was treated with distilled water. The seeds were then germinated on paper towels, and the following parameters were assessed: Percent seed germination, Shoot length, Root length and Total seedling height. The results demonstrated that the optimal concentration of algal extract mixed with cattle urine was 20%, yielding the most favorable outcomes. This innovative approach to agriculture offers a sustainable and environmentally friendly alternative to conventional fertilizers, enhancing soil health while promoting eco-friendly practices.
Key words: Algae, Bio-fertilizer, Carthamus tinctorium L., Ecofriendly

Received 14.11.2024 Revised 19.12.2024 Accepted 23.03.2025

How to cite this article:
D. N. Gholap and A. S. Wabale. Liquid Biofertilizer from Fresh Water Algae: A Novel Approach for Enhancing Safflower (*Carthamus tinctorium* L.) Growth and Yield. Adv. Biores., Vol 16 (2) March 2025: 412-417.

INTRODUCTION

The Green Revolution, which transformed modern agriculture, has led to an over-reliance on chemical fertilizers. While these synthetic chemicals have increased crop yields, their excessive and uneven use has resulted in severe environmental and health consequences. To mitigate these adverse effects and maintain agricultural efficiency, biofertilizers have emerged as a sustainable and eco-friendly alternative.

Biofertilizers are biological supplements that are rich in growth hormones, which stimulate plant growth and development. These microorganisms, when applied to seeds, roots, or soil, enhance nutrient availability, promote beneficial microbial activity, and improve soil health. The use of biofertilizers offers several advantages over synthetic fertilizers, including cost-effectiveness, environmental sustainability, and the ability to clean up residual chemical fertilizers [5-9].

Biofertilizers are available in two forms: granular (powder) and liquid. Liquid biofertilizers, in particular, have gained popularity due to their ease of application and rapid effects on plant growth. Algae, a diverse group of microorganisms, are a key ingredient in the formulation of liquid biofertilizers. Algal biofertilizers have been shown to promote plant growth, increase crop yields, and enhance soil fertility.

The benefits of biofertilizers can be attributed to their unique characteristics, which include: Growth promotion, Nutrient mobilization, Soil health improvement, Environmental sustainability and Cost-effectiveness. In conclusion, biofertilizers, particularly those formulated with algae, offer a sustainable and eco-friendly solution for modern agriculture. By reducing the reliance on chemical fertilizers, biofertilizers can help mitigate environmental degradation, promote soil health, and ensure long-term agricultural sustainability [5].

The present investigation aimed to explore the potential of freshwater algae as a liquid biofertilizers for promoting the growth and development of *Carthamus tinctorium* L., a leafy vegetable. Freshwater algae were collected from Rahata tehsil of Ahmednagar district and used to prepare a liquid biofertilizers. The efficacy of this biofertilizers was evaluated on seed germination, shoot length, and root length of *Carthamus tinctorium* L. The study aimed to provide insights into the use of freshwater algae as a sustainable and eco-friendly alternative to synthetic fertilizers.

MATERIAL AND METHODS

Collection of Fresh Water Algae

Freshwater algae were carefully collected from the canals and rivers of Rahata tahsil, Ahmednagar district, using a standardized sampling protocol. The sampling locations were selected based on their accessibility, water quality, and algal abundance. The algae were handpicked from the surface waters, ensuring that only healthy and vibrant specimens were collected.

To remove any unwanted impurities, soil particles, and debris, the collected algae were thoroughly washed with running tap water. This washing process helped to eliminate any contaminants that might have been present on the surface of the algae or in the surrounding water.

Following the washing process, the algae samples from different locations were carefully placed in separate plastic bags of suitable sizes to prevent any cross-contamination or mixing of samples. The plastic bags were sealed and labeled with relevant information, including the location, date, and time of collection.

The algae samples were then transported to the laboratory in a cool, dry place to prevent any degradation or spoilage. Upon arrival at the laboratory, the samples were stored in a refrigerated environment at a consistent temperature to maintain their viability and freshness. The samples were then processed for further analysis and experimentation Abhang [1].

Preparation of Algal Powder

The washed algal samples were carefully transferred to a shaded area in the laboratory, where they were allowed to air dry slowly. This shade drying process helped to preserve the delicate cellular structure of the algae and prevent any degradation of their nutritional content.

The algal samples were dried to a state of complete desiccation, ensuring that all moisture was removed. This step was crucial in preventing any microbial growth or spoilage during the storage and handling of the algal material.

Once the algal samples were completely dry, they were ground into a fine powder using a mechanical grinder. This process helped to break down the algal cells and release their intracellular contents, making it easier to extract their bioactive compounds.

The resulting algal powder was stored in airtight plastic containers to maintain its freshness and prevent any contamination. These containers were sealed tightly and labeled with relevant information, including the date of preparation and the contents of the container.

The algal powder was stored in a cool, dry place, away from direct sunlight and moisture, to preserve its nutritional content and bioactive compounds. This powder was intended for further use in the preparation of an algal extract, which would be used to study its potential as a liquid biofertilizers. [3].

Preparation of Algal extracts

To investigate the impact of algae on seed germination, shoot length, and root length of saffolkwer (*Carthamus tinctorium* L.), a series of algal extracts were prepared using Indian breed Khillar cattle urine as a solvent. This unconventional approach aimed to harness the potential of algae as a biofertilizers while leveraging the nutritional properties of cattle urine.

The extraction process involved dissolving 10 grams of algal powder in 100 milliliters of cattle urine. The mixture was then boiled down to a final volume of 10 milliliters, resulting in a concentrated algal extract. This stock solution served as the basis for preparing various concentrations of the algal extract.

To assess the effects of different algal extract concentrations on safflower growth, a range of dilutions were prepared from the stock solution. Specifically, the following concentrations were tested:

- 1% (1 milliliter of algal extract per 99 milliliters of water)
- 5% (5 milliliters of algal extract per 95 milliliters of water)
- 10% (10 milliliters of algal extract per 90 milliliters of water)
- 20% (20 milliliters of algal extract per 80 milliliters of water)
- 25% (25 milliliters of algal extract per 75 milliliters of water)

These dilutions were carefully prepared to ensure accuracy and consistency in the experimental treatments. The resulting algal extracts were then used to investigate their effects on seed germination, shoot length, and root length of safflower [3].

Testing the effect of liquid biofertilizer on seed germination, shoot and root length

Following the preparation of the algal extracts, safflower seeds were subjected to a soaking treatment to assess the effects of the extracts on seed germination and seedling growth. The seeds were soaked in the various concentrations of the algal extract (1%, 5%, 10%, 20%, and 25%) for a period of 12 hours. This soaking treatment allowed the seeds to absorb the nutrients and bioactive compounds present in the algal extract.

After soaking, the seeds were placed on previously sterilized paper towels, following the protocol outlined by Agrawal [2]. The paper towels provided a sterile and moist environment for the seeds to germinate and grow. To maintain humidity and prevent dehydration, the paper towels were rolled and placed in large beakers containing a small amount of water.

The experiment was conducted in triplicate for each concentration, ensuring that the results were reliable and reproducible. The seeds were allowed to germinate and grow for a period of 14 days. The first count for percent seed germination was taken on the 4th day, providing an initial assessment of the effects of the algal extract on seed germination. A second count was taken on the 14th day, allowing for a more comprehensive evaluation of the extract's effects on seed germination and seedling growth.

In addition to seed germination, the shoot and root length of the seedlings were also recorded on the 14th day. This provided a quantitative assessment of the effects of the algal extract on seedling growth and development.

RESULT AND DISCUSSION

Fig.1: Effect of algal liquid biofertilizer on the shoot and root length of Safflower seedlings

The algal extract, which was evaluated for its potential as a liquid biofertilizer on safflower seeds, yielded significant and promising results. The data revealed a positive correlation between the concentration of the algal extract and seed germination, with higher concentrations generally resulting in increased germination rates.

Specifically, the lowest concentration of 1% algal extract exhibited a respectable 88% seed germination rate. As the concentration of the algal extract increased, so did the seed germination rate, with a gradual and consistent improvement observed across the various concentrations.

The maximum seed germination rate of 95% was achieved at a concentration of 20% algal extract, which was significantly higher than the germination rates observed at lower concentrations of 5%, 10%, and 15%. This suggests that the optimal concentration of the algal extract for maximizing seed germination in safflower lies between 15% and 20%. (Fig.1)

However, it is worth noting that the seed germination rate decreased slightly at the highest concentration of 25% algal extract. This decrease may be attributed to an overabundance of nutrients or bioactive compounds in the algal extract, which can potentially inhibit seed germination at high concentrations.

The results of this study are presented in Table 1, which provides a comprehensive summary of the effects of different concentrations of the algal extract on seed germination in safflower. Overall, these findings suggest that the algal extract has significant potential as a liquid biofertilizer for promoting seed germination and improving crop yields in safflower.

The data revealed that the maximum shoot length, root length, and total height of the seedling were achieved at a concentration of 20% algal extract. This treatment outperformed not only the control but also all other concentrations tested, demonstrating a significant positive impact on seedling growth and development.

Specifically, the 20% concentration treatment exhibited the longest shoot length, root length, and total seedling height, indicating optimal growth and development. This suggests that the algal extract contains bioactive compounds that stimulate seedling growth, and that the 20% concentration is the optimal level for maximizing seedling growth.

However, it was observed that increasing the concentration of the algal extract above 20% resulted in a reduction in seedling height. This decrease in seedling growth may be attributed to an overabundance of nutrients or bioactive compounds in the algal extract, which can potentially inhibit seedling growth at high concentrations.

The results of this study provide a comprehensive summary of the effects of different concentrations of the algal extract on seedling growth and development. Overall, these findings suggest that the algal extract has significant potential as a liquid biofertilizer for promoting seedling growth and improving crop yields, and that the optimal concentration for achieving maximum growth is 20%.

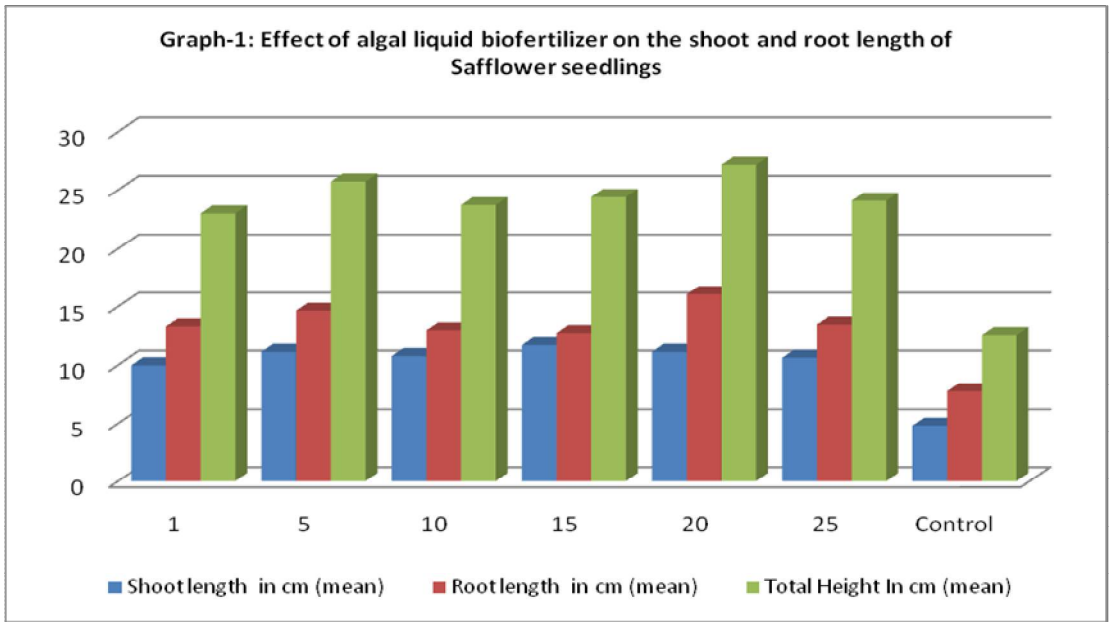
A similar study conducted by Aher and Wabale [3] on Okra *(Abelmoschus esculentus)* seeds also reported comparable results. In their investigation, the researchers evaluated the effects of farm pond algae on Okra seed germination and seedling growth. Notably, they observed that a 15% concentration of farm pond algae extract yielded optimal results, with significant enhancements in seed germination and seedling growth.

The findings of Aher and Wabale [4] align with the results of the present study, where a 20% concentration of algal extract was found to promote maximum seed germination and seedling growth in safflower. Although the optimal concentration of algal extract varied slightly between the two studies (15% for Okra vs. 20% for safflower), both investigations demonstrate the potential of algal extracts as a biofertilizer for enhancing crop growth and productivity.

The consistency of these findings across different plant species (Okra and safflower) and experimental conditions highlights the broad applicability of algal extracts as a sustainable and eco-friendly alternative to synthetic fertilizers.

Table-1: Effect of algal liquid biofertilizer on seed germination, shoot and root length of Safflower seedlings

Sr. No.	Concentration %	Germination %	Shoot length in cm (mean)	Root length in cm (mean)	Total Height In cm (mean)
1.	1	88 .00	9.96	13.3	22.99
2.	5	88.33	11.10	14.63	25.73
3.	10	90.00	10.74	12.96	23.70
4.	15	91.66	11.66	12.73	24.39
5.	20	95 .00	11.10	16.06	27.16
6.	25	86.66	10.60	13.46	24.06
	Control	25 .00	4.80	7.76	12.56



CONCLUSION

The present study demonstrated a profound impact of a 20% freshwater algal extract, prepared in Indian breed Khillar cattle urine, on the germination and growth of Safflower (*Carthamus tinctorium L.*) seedlings. The results showed a significant enhancement in percent seed germination, root length, and shoot length, indicating the potential of this liquid biofertilizers as a sustainable and eco-friendly alternative to synthetic fertilizers.

Notably, the study revealed that higher concentrations of the algal extract, beyond 20%, did not yield significant improvements in seedling growth. This suggests that the optimal concentration of the algal extract for promoting Safflower seedling growth is 20%, and that excessive concentrations may not provide additional benefits [6].

The preparation of this liquid biofertilizers is a simple and cost-effective process that can be easily adopted by farmers. By utilizing freshwater algae and cattle urine, which are readily available and inexpensive resources, farmers can reduce their reliance on chemical fertilizers and promote organic farming practices [7].

The widespread adoption of this approach could have significant environmental and economic benefits, including reduced soil pollution, improved soil fertility, and increased crop yields. Furthermore, the use of liquid biofertilizers can help to promote sustainable agriculture and reduce the environmental footprint of farming practices.

Overall, the present study highlights the potential of freshwater algal extract as a liquid biofertilizers for promoting Safflower seedling growth and development. The simplicity and cost-effectiveness of this approach make it an attractive option for farmers seeking to adopt sustainable and eco-friendly farming practices.

ACKNOWLEDGEMENT

The authors would like to express their sincere gratitude to the Research Centre of Padmashri Vikhe Patil College of Arts, Science and Commerce, Pravaranagar, for providing the necessary facilities and support to conduct this research study. The availability of state-of-the-art infrastructure and resources at the research centre enabled the authors to carry out the experimental work efficiently and effectively. The authors appreciate the college administration's commitment to promoting research and academic excellence, which has created a conducive environment for scholarly pursuits.

REFERENCES

1. Abhang A.R. (2009), Screening of Blue Green Algae for their potential as biofertilizer using leafy (Trigonella and Spinach) and fruit (*Capsicum* and Tomato) vegetables as a test plants*. Ph.D. Thesis, University of Pune, Pune*
2. Agrawal R. L. (1999), Seed Technology (Second Edition), Oxford and IBH Publishing Co.Pvt.Ltd.
3. Aher A. A., and A. S. Wabale (2016), Effect of liquid algal extract on seed germination and seedling growth in Okra (*Abelmoschus esculentus* L.), *Inter. Jour. of Recent Trends in Sci. and Tech.,* Spl. Issue: 01-03

4. Aher A. A., and A. S. Wabale (2019), Algal diversity of fresh water farm pond, Inter. Interdisciplinary Res. Jour.,**09** Spl. Issue: 06-12
5. Bentley, J.A (1958). Role of plant hormones in algal metabolism and ecology., *Nature*, **181**:1499-1501.
6. Burrows, E.M.(1956). Growth control in Fucaceae. Abstract Int. SYMP., Seaweed Symposium.
7. Knight, M (1947). Biological activity of *Fucus vesiculosus* and *Fucus cerratus*. *Proc.Linn.Soc.* London.**159**:87-90.
8. Thimann, K.V.,Skoog,F and Byer,A.C.(1942). The extraction of auxin from plant tissues II.*Amer.J.Bot.***27**: 598-660.
9. Williams, L.G.(1949). Growth regulating substances in *Laminaria aghardhi* Science, **110:** 169-170.