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Effect of Algae as Liquid Fertilizer on Growth and Biochemical Constituents of Groundnut

R. B. Borse

Dept. of Botany, Nagnath Arts, Commerce and Science College Aundha (Nag.) Dist. Hingoli (M.S.), India
rajeshborse25 [at]gmail.com

Abstract: ***In the present study, the effect of fresh water algae, asalgal liquid fertilizer (ALF) of Nostoc linkia and Anabaena circinalis on seed germination of growth, pigments and biochemical parameters of Groundnut (Arachis hypogaea)and the future perspective of its usage as ALF are discussed. The algal liquid fertilizer (ALF) was prepared from two different algae like Nostoc linkia and Anabaena circinalis. Seeds of Arachis hypogaea were soaked with aqueous extract of Nostoc and Anabaena in different concentration to find out their efficiency on germination of seeds, plant growth and biochemical parameters. The seeds treated with different concentration of ALF extract were monitored for various physical parameters such as root length, shoot length and dry weight of root and shoot. The results showed increased or decrease germination with response to different concentration. ALF of Nostoc and Anabaena extract showed better rate of germination.***

Keywords: ALF, Algal Liquid Fertilizer, *Nostoc*, *Anabaena*, germination of groundnut

1.Introduction

Fertilizer is one of the most important inputs in agricultural production. Chemical fertilizers are used commonly, shows hazardous effect on nitrogen, environment and human health directly or indirectly [8].Consequently farmers are changing methods of agriculture and replacing conventional chemical fertilizers by organic fertilizer, alternatively or low input sustainable agriculture. With increased demand, available of organic fertilizers from one or two sources was not adequate, to meet increasing demand many viable options have to be explored and one of the options is algal liquid fertilizer. Famers using seaweed liquid fertilizer. Extract of seaweed have recently gained importance as foliar spray for several crops because extract containing growth promoting harmony (IAA, IBA), Cytokinins, trace elements, (Fe, Cu, Zn, Co, Mo, Mn, Ni) vitamins and amino acids [25]. Algal Liquid fertilizer stimulate the growth and yield of crops [2]. Develop the activity of environmental tress, increase the nutrients uptake from soil and enhance the antioxidant properties [9]. Thus these extract when applied to seeds or added to the soil, stimulate growth of plants and increase the yield [3]. Earlier study have shown that application of ALF enhance seed germination of tomato [6]. Aqueous extract of *Sargassum wightii* when applied as a foliar spray on *Ziziphus mauritiana* showed an increased yield and quality of fruit [20]. [26], observed that the seeds of five treated plants with 1.0% SLF of *Ulva lactuca* and *Sargassum wightii* have an increased on germination and protein profile. Earlier study reveals that SLF of *Ulva reticulata* could be used as foliar spray at low concentration 2% to maximize the growth and yield of Vigna mungo and also increase the number of stomata in the leaf [11]. The use of algae as manure in farming practice is very common practices among the Britain, France, Spain, Japan and China. The use of fresh micro algae as fertilizer in crop production has a long tradition in all over the world [10]. Algae continued to be so valuable to farmers, even in the early 1900s [16]. Algal extract is a new generation of natural organic fertilizers highly nutritious and promotes faster germination of seeds and increase yield and resistant ability of many crops [7]. Seaweeds are rich in micro and macro nutrients [5].

2.Material and Methods

2.1 Collection of Algae

The Algae used in the present study were *Nostoc linkia* and *Anabaena circinalis* belonging to the classes Cyanophyceae. They were collected from the Aundha region of Dist. Hingoli. The algae were collected from lake, river and cultured in laboratory.

2.2 Preparation of Algal liquid fertilizer (ALF)

Freshly collected Algae were shade dried for ten days. Dried material was finely powdered. 50 gm. of finely powdered material was extracted with 500 mL boiling water for 60 min and then filtered. The resulting extract was cooled and taken as 100% concentration of the ALF [21]. As the algal liquid fertilizers contained organic matter, the algal liquid fertilizers were refrigerated between 0 and 4 °C.

2.3 Physico-chemical analyses of ALF

The color, pH, nitrate, phosphorus, potassium, iron, zinc, copper and manganese content were analyzed and are described in Table 1.

2.4 Experimental design and treatments

The seeds of groundnut were collected from Agriculture University Parbhani. They were surface sterilized with 5% sodium hypochlorite. The seeds with uniform size, color and weight were chosen for the experimental purpose. Fifty seeds were soaked in the 5 petri-plates for each treatment. The treatments were 10%, 20%, 30%, 40% and 50% aqueous extracts of *N. linkia*. One petriplate of seeds were considered as the control of distilled water and the remaining of them were treated with 10 ml of 10%, 20%, 30%, 40% and 50% of aqueous algal extract of *A. circinalis* at the first and three days later. All petriplates were taken on 7thday after sowing.

2.5 Growth and biochemical analysis

The biochemical parameters of seeds as well as growth parameters including germination percentage, fresh and dry weight, shoot length and root length were calculated. The biochemical constituents such as chlorophyll a, b, and carotenoid and carbohydrates content were estimated in Arachis hypogaea.

3.Result and Discussion

The Physico-chemical properties of ALF of *Nostoc linkia* and *Anabaena circinalis* were studied and are presented in Table 1. The colour of the ALF of *N. linkia* was dark green and *A. circinalis* was light green. The pH of ALF of *N. linkia* 6.5 and ALF of *A. circinalis* was 6.2. Among the two algal liquid fertilizers, the ALF of*N. linkia* contained higher levels of potassium, phosphorus, iron, Magnesium, copper and nitrate than the ALF of *A. circinalis.*

The effect of ALF of *N. linkia* and *A. circinalis* on germination percentage, shoot length, root length, fresh and dry weight of shoot and fresh and dry weight of root of groundnut is presented in Table2 and 3. The greatest seed germination was found at 30% and 40% concentration of *N. linkia*, and 20% concentration of*A. circinalis*, result confirmed with previous report by [23]. The 100% seed germination was observed in all the concentration of *Nostoc linkia* and *Anabaena circinalis*. In the *N. linkia* highest shoot length, dry weight of root at 40% concentration, dry weight of shoot at 30% concentration, largest root length, fresh weight of shoot and dry weight of root were observed at 50% concentration. In *A. circinalis* longest shoot length at 50% concentration and highest value of root length, fresh weight of shoot, dry weight of shoot, fresh weight of root and dry weight of root at 40% concentration.

Table 1: Physico-Chemical Properties of *N. linkia* and *A. circinalis*

Sr. No.	Physico-chemical Parameters	Nostoc linkia	Anabaena circinalis
1	Colour	Dark green	Light green
2	pH	6.5 mg/l	6.2 mg/l
3	Nitrate	123.3 mg/l	120.5 mg/l
4	Iron	0.23 mg/l	0.32 mg/l
5	Zinc	1.3 mg/l	1.4 mg/l
6	Copper	0.72 mg/l	0.77 mg/l
7	Potassium	87 mg/l	85 mg/l
8	Magnesium	78 mg/l	87 mg/l

In the *N. linkia* the lowest root length, fresh weight of shoot, fresh weight of root, dry weight of root at 10% concentration and dry weight of shoot at 20% concentration. In the *A. circinalis* shoot of length, root of length, fresh weight of shoot, fresh weight of root, dry weight of root at 10% concentration and dry weight of shoot at 20% concentration, result confirm those previous reported by [17]. Values of distil water was lowest in both ALF of *N. linkia* and *A. circinalis.*

Table 2: Effect of *Nostoc linkia* on Germination and Growth of *Arachis hypogaea*

Conc. of ALF	Germination Percent	Shoot length (cm)	Root length (cm)	Fresh weight of shoot (g)	Dry weight of shoot(g)	Fresh weight of root (g)	Dry weight of root (g)
DW	100%	3.9	2.2	0.301	0.171	0.127	0.022
10%	80%	4.8	3	0.403	0.281	0.260	0.023
20%	100%	8.2	4.5	0.723	0.222	0.312	0.035
30%	100%	8.3	4.2	0.820	0.252	0.315	0.035
40%	100%	9.9	4.5	0.830	0.251	0.345	0.036
50%	100%	9.4	4.6	0.780	0.231	0.435	0.043

Table 3: Effect of *Anabaena circinalis* on Germination and Growth of *Arachis hypogaea*

Conc. of ALF	Germination Percent	Shoot length (cm)	Root length (cm)	Fresh weight of shoot (g)	Dry weight of shoot(g)	Fresh weight of root (g)	Dry weight of root (g)
DW	100%	3.5	3.2	0.231	0.172	0.128	0.015
10%	100%	4.9	3.3	0.410	0.271	0.230	0.020
20%	100%	8.9	4.6	0.823	0.210	0.313	0.037
30%	100%	8.7	4.8	0.890	0.251	0.310	0.038
40%	100%	10.1	4.9	0.930	0.257	0.535	0.039
50%	100%	10.3	5	0.880	0.247	0.525	0.048

Table 4: Effect of ALF of N. linkia, Biochemical Constituents of *Arachis hypogaea*

Concentration of ALF	Chlorophyll a (mgg^{-1} fresh wt.)	Chlorophyll b (mgg^{-1} fresh wt.)	Carotenoid (mgg^{-1} fresh wt.)	Carbohydrate (mgg-1 dray wt.)
0	0.155±0.002bc	0.022±0.001ab	0.078±0.001efg	19.40±0.624ef
10	0.188±0.001g	0.034±0.001ef	0.186±0.000de	20.27±0.260a
20	0.198±0.001hi	0.036±0.001h	0.188±0.001efg	22.24±0.233bc
30	0.198±0.001i	0.050±0.001i	0.190±0.001fg	26.13±0.425cd
40	0.210±0.001k	0.069±0.001k	0.194±0.001hi	21.60±0.433hi
50	0.220±0.001j	0.039±0.001i	0.191±0.001gh	28.50±0.737ef

Table 5: Effect of ALF of A. circinalis, Biochemical Constituents of *Arachis hypogaea*

Concentration of ALF	Chlorophyll a (mgg^{-1} fresh wt.)	Chlorophyll b (mgg^{-1} fresh wt.)	Carotenoid (mgg^{-1} fresh wt.)	Carbohydrate (mgg-1 dray wt.)
0	0.156±0.002bc	0.022±0.001ab	0.070±0.001efg	16.40±0.624ef
10	0.187±0.001g	0.036±0.001ef	0.187±0.000de	23.27±0.260a
20	0.199±0.001hi	0.037±0.001h	0.190±0.001efg	24.24±0.233bc
30	0.198±0.001i	0.056±0.001i	0.199±0.001fg	27.13±0.425cd
40	0.216±0.001k	0.070±0.001k	0.200±0.001hi	26.60±0.433hi
50	0.226±0.001j	0.040±0.001i	0.201±0.001gh	29.50±0.737ef

The data of various biochemical studies are presented in Table 4 and 5. There were significant differences in biochemical status of different concentration, in the *N. linkia* the highest value of chlorophyll a, carbohydrates were observed at 50%concentration and chlorophyll b and carotenoid were observed at 40% concentration, result confirmed with those previously reported by [18]. In the result of *A. circinalis* shows some changes highest value of chlorophyll a, carotenoid and carbohydrates were observed at 50% concentration and highest value of chlorophyll b was observed at 40% concentration.

There were highest value of chlorophyll a in the leaves under different treatment was recorded, in *N. linkia* chlorophyll a was observed height at 50% concentration and chlorophyll b was highest at 40% concentration. Likewise result also found in *A. circinalis*. These results were confirmed with [27], who noted increased content of total chlorophyll in Cyamopsis tetragonoloba (L) with algal concentration application.

The present study shows that the percentage of seed germination with *N. linkia* and *A. circinalis* was increased. Similar results were also observed in *Cajanus cajan* [14] and *Lycopersicon spp.* [1]. This is due to the presence of growth-promoting substances such as IAA and IBA, Gibberellins (A&B), cytokinins, in ALF [13]. There was an increase in root, shoot growth by the application of algal extract. This is coincided with those of earlier studies made in *Phaseolus vulgaris* [15]. The increased seedling growth may be due to the presence of phenyl acetic acid and other closely related compounds. It was reported that the presence of plant growth regulators, trace elements, vitamins, micronutrients and amino acids in the low concentration of ALF enhance the growth of root and shoot [6]. Auxins play a key role in growth of plants. Auxin also by increasing production of some soluble materials inside the cell, decrease the water potential and finally let water enter to the cells. These procedures lead to growth of cell and finally growth of plant [8].

There was significant increase in chlorophyll content in leaves under different treatments and maximum (40% and 50% concentration of *N. linkia* and *A. circinalis* respectively) was recorded.

Our results confirm those previously reported by [27], who noted increased content of total chlorophylls in Cyamopsis tetragonoloba (L) with algal concentrate application. The higher chlorophyll concentrations in the leaves resulting from application of the algal extract [25]. These data strongly indicate that the effects on leaf chlorophyll contents produced by the use of algal extracts are due to the betaines contained in them [24].

4.Conclusion

Clear evidence and scientific consensus indicate that, two different ALF, extract prepared from *N. linkia* and *A, circinalis*, were found to be promising in possessing fertilizer activity. Hence, this simple practice of application of eco-friendly algal liquid fertilizers to *Arachis hypogaea* is recommended to the farmer community for attaining better germination, growth and yield.

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