

INFLUENCE OF COIRPITH BASED CYANOBACTERIAL BASAL AND FOLIAR BIOFERTILIZER ON HIBISCUS ESCULENTUS

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ABSTRACT

Growth promoting ability of coirpith based cyanobacterial (CB + CP) basal and foliar biofertilizer application on *Hibiscus esculentus* was evaluated. Scrutiny of varying concentration of foliar spray revealed that 30% of foliar along with basal induced maximum growth and yield. The present investigation results were well supported by comparison of morphological and biochemical parameters in all the plants. The results indicated the presence of plant growth promoting substances in coir pith basal and foliar biofertilizer.

KEYWORDS: *Oscillatoria annae*; Coirpith; biofertilizer; foliar spray and *Hibiscus esculentus*.

I. INTRODUCTION

Biofertilizers are ecofriendly and are also called as microbial inoculants. The name implies biological origin and serves the function of supplying the nutrients for effective plant growth. The bioorganic fertilizer can increase the output; improve the quality of the crops responsible for agricultural environment.

Cyanobacteria are oxygenic photosynthetic free living and nitrogen fixing microorganisms in marine, freshwater and soil. The blue green color of cells is due to the combination of green chlorophyll pigment and a unique blue pigment (Phycocyanin). It is being used as a biofertilizer for plants food for cattles and man and medicinal products such as vitamins and drug compounds for human [1].

Coconut (*Cocos nucifera* L.) is cultivated in tropical countries. The fibrous mesocarp of coir is used to make ropes. The waste of coir yarn industry gets accumulated in large quantities and making their disposal difficult, though it is used as soil conditioner. Foliar spray could be used in many different growing medium for excellent production in organic farming, industries and home application such as gardening.

H. esculentus common name of lady's finger, okra. It is an annual herbaceous shrub. It has showy hibiscus flower. The edible part is the seed pod; it is actually a capsule. Okra is grown as a perennial and is a fast growing plant. The mucilage binds cholesterol and bile acid carrying toxins dumped into it by the liver. It helps to lubricate the large intestine due to its laxative qualities. The fiber in okra helps to stabilize blood sugar (It helps the rate at which sugar is absorbed from the intestinal tract).

II. MATERIALS AND METHODS

A. Organism and culture conditions

Pure culture of fresh water cyanobacteria, *Oscillatoria annae* was obtained from the germplasm of National Facility for Marine Cyanobacteria, Bharathidasan University, Tiruchirappalli, Tamil Nadu, India. The culture was maintained in BG11 medium [2] at 1500 lux at 25 ± 2 C in 14/10 light and dark cycle.

B. Lignocellulosic material

Coir pith was collected from coir pith industry, Tiruchirappalli, Tamilnadu, India.

C. Experimental condition

Log phase culture of cyanobacteria was taken and mixed with (1:10 ratio) coir waste and incubated for degradation process. The coirpith based cyanobacterial biofertilizer was filtered and dried for storage this coirpith used as basal biofertilizer and filtered supernatant was applied as foliar spray. Basal and foliar spray in various concentrations (10%, 20%, 30%, 40% & 50%) applied on plants which were treated as test and without any treatment plant acted as control. Finally, the morphological parameters like length of the root, shoot, and number of leaves, flowers, fruits and dry weight of *Hibiscus esculentus* were analyzed. Biochemical parameters were also analyzed such as chlorophyll [3] carotenoid [4] protein [5] total phenolics (6) and free amino acids [7].

III. RESULTS AND DISCUSSION

The increase in morphological, biochemical and yield of *H. esculentus* were observed with consecutive application of coirpith based cyanobacterial basal and foliar application.

Only in 30% foliar spray observations showed marked increased in shoot length, leaves and number of flowers, fruits, dry weight of the root, shoot and leaves when compared to control and other treatments (Table - 1).

Table 1. Effect of coirpith based cyanobacterial biofertilizer on biochemical parameters and yield of Hibiscus esculentus

Root length (cm)	Shoot length (cm)	Number of leaves/plant	Dry weight of root (gm)	Dry weight of shoot (gm)	Dry weight of leaves (gm)	Number of flowers/plant	Number of fruits/plant
9.0±0.12	14.0±0.026	3±0.024	0.12±0.036	0.26±0.043	0.04±0.006	1	1
15.0±0.013	18.5±0.003	12±0.001	0.37±0.027	0.74±0.018	0.86±0.01	3	3
24.0±0.033	26.0±0.031	13±0.021	0.52±0.016	1.06±0.026	1.09±0.022	4	4
28.0±0.042	33.5±0.041	15±0.031	1.74±0.011	3.72±0.015	3.01±0.01	7	7
16.0±0.036	32.0±0.007	14±0.040	0.68±0.04	2.26±0.028	1.85±0.006	5	5
13.0±0.041	20.0±0.023	14±0.071	0.38±0.018	1.13±0.007	1.40±0.012	4	4

Values are the mean of three replicates ± SD.

Table 2. Comparison of biochemical parameters of coirpith based cyanobacterial biofertilizer treated and untreated Hibiscus esculentus

S. No	Sample	Total chlorophyll (mg/g)	Chlorophyll (mg/g)	Chlorophyll (mg/g)	Phenol (µg/g)	Protein (mg/g)	Carotenoid (mg/g)	Amino acid (mg/g)
1.	Control	0.23±0.017	0.13±0.034	0.02±0.001	75.0±0.008	160.0±0.01	75.1±0.14	18.0±0.132
2.	10% basal + Foliar spray	0.28±0.13	0.17±0.02	0.07±0.015	115.0±0.08	180.0±0.047	128.8±0.016	29.0±0.002
3.	20% basal + foliar spray	0.29±0.002	0.18±0.011	0.10±0.033	150.0±0.01	360.0±0.06	156.4±0.012	38.0±0.002
4.	30% basal + foliar spray	0.49±0.017	0.34±0.003	1.15±0.009	347.5±0.015	560.0±0.014	203.4±0.015	79.0±0.016
5.	40% basal + foliar spray	0.47±0.001	0.29±0.013	0.18±0.004	77.5±0.007	540.0±0.001	149.1±0.005	22.0±0.004
6.	50% basal + foliar spray	0.22±0.01	0.13±0.023	0.10±0.024	65.0±0.004	520.0±0.021	145.0±0.023	22.0±0.032

Values are the mean of three replicates ± SD.

Biochemical estimations also indicated higher amount of total chlorophyll, carotenoid, protein, phenol and amino acid. In contrast, the higher concentration (40% and 50%) treatments showed decreased amount than the above biochemical tests analysed in the 30% basal spray. Fay [8] have reported that *Anabena azolla* as a biofertilizer exhibited lignolysis and released phenolic compounds which induced profuse sporulation of the organism.

Nishida and Murata [9] reported the positive effect of nutrient content and soil structure on the addition of cyanobacteria. Ravishankar and Malliga [10] reported that *Phormidium valderianum* BDU 20041 showed a remarkable increase in percentage of germination. In addition they also proved that the *Plectonema terebrans* BDU 92192 has a significant effect on the growth of

seedlings. The survival strategies of cyanobacteria occurring as crust in the rice fields under drought conditions were investigated by [11].

They observed fenugreek plant height, number of branches per plant; dry matter production and chlorophyll content were significantly high.

Immobilized as well as free living cyanobacterial applications were found to be distinctly advantageous over control as it enhanced significantly the various parameters of growth of rice plants such as shoot length and root length, fresh and dry weight of the plants chlorophyll and protein content over a period of 30 days [11]. [12] examined that seaweed liquid fertilizer increased the number of flowers in black gram. [13] explained cyanobacteria as a source of biofertilizer was

the only sustainable and alternative source for the rice production.

Growth promoting substance from cyanobacteria influenced the amino acid and sugars in paddy field [14]. Many biologically active compounds are produced by microalgae [15]. Application of heterocystous and non-heterocystous cyanobacterial biofertilizers to the rice field clearly increased the number and weight of the grains and also enhanced the NPK content of the soil [16]. There is a report on increase in germination percentage, shoot, root length and biochemical contents like proteins, carbohydrate, amino acids in the seedlings *Hibiscus annus* L. grown in effluent amended with cyanobacteria than in the effluent without cyanobacteria [17].

The cyanobacterial biomass when incorporated in the soil conserved organic matter, phosphorus, moisture and improves the chemical and physical structure of the soil [18, 19, 22]. Amther [20] has calculated that only 61%-77% of carbon available from photosynthesis can be retained during lignin utilization. Zeenat and Sharma [21] observed the effect of application cyanobacteria in combination with the chemical fertilizer diammonium phosphate on the growth on yield of tomatoes. From this, it is concluded that 30% of basal and foliar spray shows better enhanced biochemical and morphological rate. It also gives maximum fruit yield when compared to other treatments (control, 10%, 20%, 40% and 50%). This can be recommended for the better result of *Hibiscus esculentus*

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