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Effect of Coir Pith Based Cyanobacterial Biofertilizer Treatment in Metabolic Characters of *Aloe Barbadensis* Miller

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Abstract

This experiment was conducted at Bharathidasan University, Tiruchirappalli, Tamilnadu, India to evaluate the effect of different amount of coir pith based cyanobacterial biofertilizers named cyanopith and cyanospray on the metabolic characters of *Aloe barbadensis* Miller (*Aloe vera).* There were 36 different treatments of cyanopith (solid form) with cyanospray (liquid form) fertilizer and the plant without any treatment was considered as control. The results indicated that the plant metabolic contents such as chlorophyll *a*, chlorophyll *b*, total chlorophyll, carotenoids, free amino acids and sugar contents found to be improved with T_{22} treatment (100g cyanopith with 0.4% cyanospray) over other treatments and control (without biofertilizer application).

Key words: Cyanobacterial biofertilizer, *Aloe vera*, Cyanopith, Cyanospray

Introduction

Aloe genus (family Liliaceae) consists of at least 600 known species, many of which have been used as botanical medicines in many countries for centuries (Okamura *et. al.,*. 1996). Species of *Aloe* which have been used as folk medicine includes: Curacao Aloe (*Aloe barbadensis* or *Aloe vera*), Cape Aloe (*Aloe ferox*), and Socotra Aloe (*Aloe perryi*). This plant species can be easily propagated from cuttings and is probably the most widely cultivated species of the genus in the world. It is widely used in world, not only as a folk remedy for gastrointestinal complaints, skin injuries and burns, but also as an ingredient in health foods and cosmetics (Capasso *et. al.,*. 1998). Products containing *A. vera* are used for the treatment of minor cuts and burns and to heal wounds. They are also contained in a variety of cosmetics including skin creams, lotions and shampoos. Aloe gel, among other things, enhances immunity, improves liver function, prevents asthma and has antiinflammatory, anti-ulcerous, anti-diabetic and antihypertensive properties (Dagne *et. al.,*. 2000). Also epidemiological data suggest that the intake of *A. vera* prevents human lung cancer (Sakai, 1989).The cultivation of *A. vera* has acquired great commercial importance for medicinal products and cosmetics processing but information are scarce about agronomic management of this crop. Most of the extensive bibliographic references to this plant are oriented to the promotion and marketing of products which include the gel. There is only a small amount of agronomic and physiological information (Rodríguez-Garcia *et. al.,*. 2000; Zhao-Pu *et. al.,*. 2006), since most countries which have its germplasm consider it to be a strategic crop. Cultivation of *Aloe vera* is expanding day by day in the area as it provides quick and regular income to the farmers. Farmers are not using any recommended farming practices for *Aloe vera* cultivation which resulted poor yield. Fertility management in *Aloe vera* field may be one of the strategies for boosting up the yield of *Aloe vera*. *Aloe vera* being a succulent plant is more responsive to nutrient. However, the excess doses of chemical nutrient as well as improper sources can show negative effect of quality. Organic manures are more effective in *Aloe vera* growth and yield which is comparable to chemical fertilizer (Saha *et. al.,*. 2005). In addition organic manures enhance plant growth. So, it is necessary to find out a suitable recommendation for manuring in *Aloe vera* farm. The present study was carried out to determine the effect of coir pith based cyanobacterial biofertilizer levels on metabolic characters of *Aloe barbadensis* Miller under pot experiment.

Materials and methods

Organism and culture conditions

A fresh water cyanobacterium belonging to *Oscillatoria annae* was obtained from the germplasm of National Facility for Marine Cyanobacteria, Bharathidasan University, Tiruchirappalli, Tamilnadu, India. The culture was maintained in BG11 medium (Rippka *et. al.,*. 1979**),** at 1500 lux. at 25 ± 2^0 C with 10/12 hrs light /dark cycle.

Lignocellulosic material

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

Biofertilizer production

Mass cultivation of cyanopith and cyanospray was carried out in which cyanobacteria (*Oscillatoria annae*) and coir pith was inoculated in 1:10 ratio (wet weight: dry weight). After 20-25 days of incubation the degraded pellet and supernatant were separated and used as biofertilizers. Thus, pellet was used as solid fertilizer (cyanopith) and supernatant was used as liquid fertilizer (cyanospray) for the plant growth promotion.

Experimental design

In this experiment the medicinal plant *A. barbadensis* was cultivated using cyanopith and

cyanospray fertilizers at various combinations. There were 36 different treatments of cyanopith with cyanospray fertilizer and a plant without biofertilizer application was used as control, each experiment was carried out in triplicates. Seedlings of around 2 weeks old were collected from Virudhunagar District, Tamilnadu, India. Single seedling was planted in pot and pots were irrigated whenever necessary. In this experiment fertilizers were applied three times before harvesting. Table 1 shows detailed experimental design of this present investigation.

Table 1 Experimental Design

S. no.	Treatments		S. no.	Treatments
	Experimental set up – I			
1.	C – Control			
Experimental set up - II			Experimental set up - V	
1.	T_1- Cyp 25 g + C.Sp. 0.1%		1.	T_{19} - Cyp 25 g + C.Sp 0.4%
2.	T_2 - Cyp 50 g + C.Sp 0.1%		2.	T_{20} - Cyp 50 g + C.Sp 0.4%
3.	T_3 - Cyp 75 g + C.Sp 0.1%		3.	T_{21} - Cyp 75 g + C.Sp 0.4%
4.	T_4 - Cyp 100 g + C.Sp 0.1%		4.	T_{22} - Cyp 100 g + C.Sp 0.4%
5.	T_5 - Cyp 125 g + C.Sp 0.1%		5.	T_{23} - Cyp 125 g + C.Sp 0.4%
6.	T_6 - Cyp 150 g + C.Sp 0.1%		6.	T_{24} - Cyp 150 g + C.Sp 0.4%
Experimental set up - III			Experimental set up - VI	
1.	T_7 - Cyp 25 g + C.Sp 0.2%		1.	T_{25} - Cyp 25 g + C.Sp 0.5%
2.	T_8 - Cyp 50 g + C.Sp 0.2%		2.	T_{26} - Cyp 50 g + C.Sp 0.5%
3.	T_9 - Cyp 75 g + C.Sp 0.2%		3.	T_{27} - Cyp 75 g + C.Sp 0.5%
4.	T_{10} - Cyp 100 g + C.Sp 0.2%		4.	T_{28} - Cyp 100 g + C.Sp 05%
5	T_{11} - Cyp 125 g + C.Sp 0.2%		5.	T_{29} - Cyp 125 g + C.Sp 0.5%
6.	T_{12} - Cyp 150 g + C.Sp 0.2%		6.	T_{30} - Cyp 150 g + C.Sp 0.5%
Experimental set up - IV			Experimental set up - VII	
1.	T_{13} - Cyp 25 g + C.Sp 0.3%		1.	T_{31} - Cyp 25 g + C.Sp 0.6%
2.	T_{14} - Cyp 50 g + C.Sp 0.3%		2.	T_{32} - Cyp 50 g + C.Sp 0.6%
3.	T_{15} - Cyp 75 g + C.Sp 0.3%		3.	T_{33} - Cyp 75 g + C.Sp 0.6%
4.	T_{16} - Cyp 100 g + C.Sp 0.3%		4.	T_{34} - Cyp 100 g + C.Sp 06%
5.	T_{17} - Cyp 125 g + C.Sp 0.3%		5.	T_{35} - Cyp 125 g + C.Sp 0.6%
6.	T_{18} - Cyp 150 g + C.Sp 0.3%		6.	T_{36} - Cyp 150 g + C.Sp 0.6%

T – Treatments (Triplicates); Cyp – Cyanopith (Fertilizer in Solid form)
C.Sp – Cyanospray (Fertilizer in liquid form)

Analysis on metabolic characters

The photosynthetic pigments (chlorophyll *a, b,* total chlorophyll & carotenoids) were determined using method of Metzner *et. al.,*. (1965). The dry *Aloe* plant matter was used (in replicate) for chemical analysis. For the determination of water-soluble sugars, a known weight of the powdered tissue was hydrolyzed in distilled water for 2 hrs in a boiling water bath. After cooling, the hydrolysis was filtered and filtrate was made up to a known volume, after which the water-soluble sugars were determined by the anthrone sulphuric acid method (Fales, 1951). Free amino acids were extracted from the plant tissues and determined according to the method of Moore and Stein (1948).

Statistical analysis

The measurements of growth parameters and metabolic aspects were subjected to one-way analysis of variance (ANOVA) technique and mean separations were adjusted by the Multiple Comparison test. Means were compared by using Fisher's test at $p<0.05$ level of significance.

Results

The pot experiment was begun in October 2009 with planting age of 2 weeks plantlets of *Aloe vera* with triplicates. The first fertilization was given to the plants 15 DAP (Days after planting). The second and third fertilizations were given 75DAP and 135DAP respectively. The effect of coir pith based cyanobacterial biofertilizers in plant metabolic characters were analyzed 210 days after planting.

Metabolic analysis

Photosynthetic pigments

The photosynthetic pigments content was also significantly enhanced by different combinations

cyanopith and cyanospray. The *Aloe* leaf pigments (chlorophyll *a*, chlorophyll *b*, and carotenoids) and consequently total pigments content was significantly

($p<0.05$) increased by all treatments of cyanopith with cyanospray when compared to control (Table. 2-4). The maximum improvement in the photosynthetic pigments content was obtained from the plants of T22 followed by plants of T16 and T12 (Table. 2-4).

Table 2 Effect of cyanopith with cyanospray on metabolic contents of *Aloe barbadensis* Mill.

Treatments	Metabolic Contents						
	Experimental Set Up – I & II						
	Chlorophyll *a* (µg/g fresh weight)	Chlorophyll *b* (µg/g fresh weight)	Total Chlorophyll (µg/g fresh weight)	Carotenoids (µg/g fresh weight)	Water soluble sugars (mg/g fresh weight)	Free Amino acids (µg/g fresh weight)	Gel Acidity (P^H)
C - Control	0.0530 ± 0.0030	0.0220 ± 0.0026	0.1753 ± 0.0035	0.0330 ± 0.0030	0.613 ± 0.070	14.79 ± 1.82	4.586 ± 0.025
T_1- Cyp 25 g + C.Sp 0.1%	0.0640 ± 0.0036*	0.0303 ± 0.0025*	0.1913 ± 0.0035*	0.0400 ± 0.0020*	0.793 ± 0.064*	18.87 ± 1.55*	5.036 ± 0.011*
T_2 - Cyp 50 g + C.Sp 0.1%	0.0856 ± 0.00351*	0.0366 ± 0.0015*	0.2306 ± 0.0015*	0.0483 ± 0.0025*	0.956 ± 0.051*	35.13 ± 0.90*	5.056 ± 0.005*
T_3 - Cyp 75 g + C.Sp 0.1%	0.1033 ± 0.0037*	0.0436 ± 0.0025*	0.3046 ± 0.0025*	0.0546 ± 0.0030*	1.880 ± 0.052*	45.47 ± 1.32*	5.063 ± 0.023*
T_4 - Cyp 100 g + C.Sp 0.1%	0.1223 ± 0.0025*	0.0530 ± 0.0026*	0.3246 ± 0.0030*	0.0696 ± 0.0020*	2.056 ± 0.055*	52.70 ± 0.90*	5.060±0.010*
T_5 - Cyp 125 g + C.Sp 0.1%	0.1410 ± 0.0030*	0.0643 ± 0.0020*	0.3610 ± 0.0026*	0.0763 ± 0.0010*	2.576 ± 0.055*	54.15 ± 3.13*	5.073 ± 0.005*
T_6 - Cyp 150 g + C.Sp 0.1%	**0.1553 ± 0.0015****	**0.0730 ± 0.0020****	**0.3840 ± 0.0020a****	**0.0833 ± 0.0021a***	**2.723 ± 0.055****	**64.38 ± 2.05****	**5.083 ± 0.015****
Experimental Set Up - III							
T_7 - Cyp 25 g + C.Sp 0.2%	0.0760 ± 0.0010*	0.0343 ± 0.0025*	0.1963 ± 0.0035*	0.0450 ± 0.0020*	0.860 ±0.036*	21.28 ± 0.78*	5.083 ± 0.005v
T_8 - Cyp 50 g + C.Sp 0.2%	0.0956 ± 0.0035*	0.0406 ± 0.0015*	0.2356 ± 0.0152*	0.0533 ± 0.0025*	1.181 ±0.057*	36.95 ± 0.75*	5.090 ± 0.010*
T_9 - Cyp 75 g + C.Sp 0.2%	0.1133 ± 0.0037*	0.0473 ± 0025*	0.3096 ± 0.0025*	0.0596 ± 0.0030*	1.763 ±0.035*	46.01 ± 0.43*	5.116 ± 0.015*
T_{10} - Cyp 100 g + C.Sp 0.2%	0.1323 ± 0.0025*	0.0573 ± 0.0023*	0.3300 ± 0.0026*	0.0723 ± 0.0025*	2.293 ±0.070*	47.09 ± 0.50*	5.116 ± 0.005*
T_{11} - Cyp 125 g + C.Sp 0.2%	0.1510 ± 0.0030*	0.0653 ± 0.0152*	0.3660 ± 0.0026*	0.0803 ± 0.0015*	2.810 ±0.065*	58.33 ± 1.16*	5.120 ± 0.026*
T_{12} - Cyp 150 g + C.Sp 0.2%	**0.1653 ± 0.0015****	**0.0833 ± 0.0020****	**0.3890 ± 0.0020****	**0.0873 ± 0.002****	**2.866 ±0.070****	**68.61 ± 0.95****	**5.126 ± 0.005****

T – Treatments; Cyp – Cyanopith; C.Sp – Cyanospray; Values are the mean of three replicates ± SD.; * - Significance results over control (significant at <0.05level); ** – Superior results

Sugar

The result of water soluble sugars in *Aloe vera* plant grown under different treatments of cyanopith with cyanospray are given in Table 2-4. The water soluble sugars content was significantly ($p<0.05$) higher in fertilized plants compared with unfertilized control plants. The amount of water soluble sugars content was significantly higher ($p<0.05$) in the plants of T22 than T16, T25 and T31, which was having 3.496, 3.146, 3.086 and 3.040mg/g of leaf in fresh weight respectively (Table. 2-4).

Free Amino acids and Gel acidity

The maximum total free amino acids content (71.50 µg/g fresh weights) was recorded in the plants

treated by 100g of cyanopith with 0.4% of cyanospray (T22), which was significantly higher than control and all others treatments. The higher amount of free amino acids was also present in plants of T16 followed by T12 and T17, which had free amino acids content of 70.63, 68.61 and 64.75 µg/g of leaf (fresh weight) respectively (Table. 2-4). Concerning acidity of the gel, the data in the same tables indicate that all the treatments significantly differed ($p<0.05$) in gel acidity as compared to control plants.

Table 3 Effect of cyanopith with cyanospray on metabolic contents of *Aloe barbadensis* Mill.

Treatments	Metabolic Contents						
	Experimental Set Up – I & IV						
	Chlorophyll *a* (µg/g fresh weight)	Chlorophyll *b* (µg/g fresh weight)	Total Chlorophyll (µg/g fresh weight)	Carotenoids (µg/g fresh weight)	Water soluble sugars (mg/g fresh weight)	Free Amino acids (µg/g fresh weight)	Gel Acidity (P^H)
C - Control	0.0530 ± 0.0030	0.0220 ± 0.0026	0.1753 ± 0.0035	0.0330 ± 0.0030	0.613 ± 0.070	14.79 ± 1.82	4.586 ± 0.025
T_{13} - Cyp 25 g + C.Sp 0.3%	0.0810 ± 0.0010*	0.0386 ± 0.0035*	0.2100 ± 0.0026*	0.0500 ± 0.0020*	0.953 ± 0.040*	21.88 ± 1.15*	5.140 ± 0.015*
T_{14} - Cyp 50 g + C.Sp 0.3%	0.1006 ± 0.0035*	0.0446 ± 0.0015*	0.2406 ± 0.0050*	0.0580 ± 0.0040*	1.501 ± 0.068*	39.78 ± 0.78*	5.170 ± 0.010*
T_{15} - Cyp 75 g + C.Sp 0.3%	0.1183 ± 0.0037*	0.0606 ± 0.0020*	0.3146 ± 0.0025*	0.0643 ± 0.0030*	2.460 ± 0.040*	50.12 ± 1.3*	5.176 ± 0.011*
T_{16} - Cyp 100 g + C.Sp 0.3%	**0.1703 ± 0.0015****	**0.0873 ± 0.0020****	**0.3940 ± 0.0020****	**0.0923 ± 0.0040****	**3.146 ± 0.045****	**70.63 ± 0.62****	**5.186 ± 0.015****
T_{17} - Cyp 125 g + C.Sp 0.3%	0.1553 ± 0.0025*	0.0693 ± 0.0015*	0.3706 ± 0.0030*	0.0853 ± 0.0015*	2.966 ± 0.050*	64.75 ± 1.6*	5.183 ± 0.020*
T_{18} - Cyp 150 g + C.Sp 0.3%	0.1366 ± 0.0030*	0.0630 ± 0.0026*	0.3350 ± 0.0026*	0.0763 ± 0.0025*	1.530 ± 0.062*	42.65 ± 1.3*	5.170 ± 0.007*
Experimental Set Up – V							
T_{19} - Cyp 25 g + C.Sp 0.4%	0.0860 ± 0.0010*	0.0450 ± 0.0030*	0.2130 ± 0.0026*	0.0580 ± 0.0020*	1.063 ± 0.051*	22.36 ± 1.13*	5.210 ± 0.010*
T_{20} - Cyp 50 g + C.Sp 0.4%	0.1056 ± 0.0035*	0.0500 ± 0.0010*	0.2453 ± 0.0015*	0.0660 ± 0.0030*	1.556 ± 0.045*	42.33 ± 0.87*	5.226 ± 0.011*
T_{21} - Cyp 75 g + C.Sp 0.4%	0.1233 ± 0.0037*	0.0626 ± 0.0020*	0.3206 ± 0.0025*	0.0723 ± 0.0025*	2.953 ± 0.050*	55.52 ± 0.92*	5.233 ± 0.011*
T_{22} - Cyp 100 g + C.Sp 0.4%	**0.1783 ± 0.0015****	**0.0936 ± 0.0040****	**0.4026 ± 0.0030****	**0.1003 ± 0.0025****	**3.496 ± 0.065****	**71.50 ± 1.11****	**5.263 ± 0.012****
T_{23} - Cyp 125 g + C.Sp 0.4%	0.1523 ± 0.0025*	0.0623 ± 0.0015*	0.3753 ± 0.0035*	0.0876 ± 0.0011*	2.990 ± 0.085*	56.13 ± 1.41*	5.223 ± 0.023*
T_{24} - Cyp 150 g + C.Sp 0.4%	0.1336 ± 0.0030*	0.0563 ± 0.0025*	0.3383 ± 0.0032*	0.0786 ± 0.0035*	1.353 ± 0.050*	38.88 ± 2.23*	5.220 ± 0.010*

T – Treatments; Cyp – Cyanopith; C.Sp – Cyanospray; Values are the mean of three replicates ± SD.; * - Significance results over control (significant at <0.05level); ** – Superior results

Table 4 Effect of cyanopith with cyanospray on metabolic contents of *Aloe barbadensis* Mill.

Treatments	Metabolic Contents						
	Experimental Set Up – I & VI						
	Chlorophyll *a* (µg/g fresh weight)	Chlorophyll *b* (µg/g fresh weight)	Total Chlorophyll (µg/g fresh weight)	Carotenoids (µg/g fresh weight)	Water soluble sugars (mg/g fresh weight)	Free Amino acids (µg/g fresh weight)	Gel Acidity (P^H)
C - Control	0.0530 ± 0.0030	0.0220 ± 0.0026	0.1753 ± 0.0035	0.0330 ± 0.0030	0.613 ± 0.070	14.79 ± 1.82	4.586 ± 0.025
T_{25} - Cyp 25 g + C.Sp 0.5%	**0.1136 ± 0.0035****	**0.0580 ± 0.0010****	**0.2913 ± 0.0035****	**0.0810 ± 0.0030****	**3.086 ± 0.090****	**64.61 ± 0.95****	**5.250 ± 0.010****
T_{26} - Cyp 50 g + C.Sp 0.5%	0.1043 ± 0.0020*	0.0500 ± 0.0030*	0.2666 ± 0.0045*	0.0663 ± 0.0015*	2.850 ± 0.060*	52.16 ± 0.62*	5.260 ± 0.010**
T_{27} - Cyp 75 g + C.Sp 0.5%	0.0956 ± 0.0021*	0.0496 ± 0.0020*	0.2486 ± 0.0047*	0.0630 ± 0.0020*	2.706 ± 0.047*	47.01 ± 1.89*	5.246 ± 0.012*
T_{28} - Cyp 100 g + C.Sp 05%	0.0910 ± 0.0010*	0.0426 ± 0.0025*	0.2183 ± 0.0031*	0.0593 ± 0.0032*	1.653 ± 0.035*	45.32 ± 1.07*	5.240 ± 0.017*
T_{29} - Cyp 125 g + C.Sp 0.5%	0.0803 ± 0.0025*	0.0366 ± 0.0015*	0.2110 ± 0.0030*	0.0530 ± 0.0026*	1.320 ± 0.042*	34.83 ± 1.43*	5.236 ± 0.011*
T_{30} - Cyp 150 g + C.Sp 0.5%	0.0696 ± 0.0020*	0.0330 ± 0.0020*	0.2046 ± 0.0035*	0.0443 ± 0.0040*	1.253 ± 0.050*	23.50 ± 1.31*	5.216 ± 0.011*
Experimental Set Up - VII							
T_{31} - Cyp 25 g + C.Sp 0.6%	**0.0996 ± 0.0020****	**0.0576 ± 0.0030****	**0.2883 ± 0.0051****	**0.0690 ± 0.0026****	**3.040 ± 0.079****	**58.46 ± 0.86****	**5.193 ± 0.005****
T_{32} - Cyp 50 g + C.Sp 0.6%	0.0843 ± 0.0040*	0.0573 ± 0.0020*	0.2520 ± 0.0043*	0.0623 ± 0.0025*	2.406 ± 0.030*	48.50 ± 0.81*	5.173 ± 0.011*
T_{33} - Cyp 75 g + C.Sp 0.6%	0.0740 ± 0.0036*	0.0480 ± 0.0030*	0.2083 ± 0.0035*	0.0540 ± 0.0036*	2.320 ± 0.040*	47.19 ± 1.40*	5.146 ± 0.015*
T_{34} - Cyp 100 g + C.Sp 06%	0.0646 ± 0.0035*	0.0366 ± 0.0028*	0.1996 ± 0.0037*	0.0473 ± 0.0020*	1.810 ± 0.036*	44.27 ± 0.86*	5.140 ± 0.026*
T_{35} - Cyp 125 g + C.Sp 0.6%	0.0580 ± 0.0020*	0.0323 ± 0.0025*	0.1843 ± 0.0040*	0.0390 ± 0.0026*	1.538 ± 0.046*	25.53 ± 0.75*	5.130 ± 0.020*
T_{36} - Cyp 150 g + C.Sp 0.6%	0.0503 ± 0.0020*	0.0250 ± 0.0020*	0.1810 ± 0.0036*	0.0343 ± 0.0030*	1.176 ± 0.037*	24.15 ± 2.14*	5.113 ± 0.015*

T – Treatments; Cyp – Cyanopith; C.Sp – Cyanospray; Values are the mean of three replicates ± SD.; * - Significance results over control (significant at <0.05level); ** – Superior results

Discussion

Cyanobacteria are one of the potential organisms, which are useful to mankind in various ways, and are potential resource in varied applications such as mariculture, food, feed, fuel, fertilizer, medicine, industry and in combating pollution (Mitsui *et. al.,*. 1983; Subramaniyan and Uma, 1996). Degraded coir pith with cyanobacteria [*Oscillatoria annae* (BDU6)] was used to promote the plant growth and was found to enhance the crop yield and especially soil productivity. The coir pith based cyanobacterial biofertilizer, plays a spectrum of remarkable role in agriculture, especially in sustainable integrated agro-ecosystems. Also, they add nutrients to soil, release of growth promoting substances, increase the soil organic content, improve the soil structure and water holding capacity, reduce soil crusting problems,

erosion from wind and water and improve the buffering capacity against fluctuations in pH levels of soil. The release of micro and macro nutrients from the cyanobacteria supports the plant growth and improves the quality of the crop yield.

The metabolic contents of *A. barbadensis* such as chlorophyll *a*, chlorophyll *b* and total chlorophyll, carotenoids, sugars and free amino acids content significantly increased by all the combined applications of cyanopith with cyanospray fertilizers and the maximum improvement in metabolic contents were only obtained from plants of T22 (cyanopith 100g with 0.4% cyanospray) while the above 100g of cyanopith with higher concentrations of cyanospray (0.5 and 0.6%) inhibited the growth as well as metabolic contents of *A. barbadensis*. This is because of the more availability of phenolic compounds to the plants. Planas *et. al.,*. (1981) showed that phenol extracted from *Myriophyllum spicatum* inhibited the growth of cyanobacteria and algae species *Anacystis nidulans* and *Selenastrum capricornutum.* The improvement in metabolic contents of *A. barbadensis* is because of improved nutrient status of plant due to the presence of more nutrients in the soil treated by cyanopith with cyanospray. The leaf sample of coir pith based cyanobacterial fertilizer as basal with foliar treated plant showed highest photosynthetic pigments contents when compared to plants treated with chemical and control plants of *Alium cep var. aggregatum* (Anandharaj, 2008). The culture filtrate of degraded lignocellulosic waste by *O. annae* was tested for its plant growth promoting ability as foliar spray on *Tagetes erecta*. The results showed that *Tagetes erecta* treated with only lignocellulosics (Coir pith, *P. juliflora* and *L. camara*) showed more chlorophyll content compared to control. However, *O. annae* with lignocellulosics (*O. annae* + coir pith; *O. annae* + *P. juliflora*; *O. annae* + *L. camara*) treated plants showed better growth and increased photosynthetic pigments content compared to control and only lignocellulosic waste treated plants (Viswajith, 2008). The improvement of the growth and nitrogen contents in response of application of cyanobacteria as bio-fertilizers on seed and related processes of wheat, sorghum, maize and lentil could be attributed to the nitrogen as well as nitrate reductase activities (Adam, 1999). Such observations might prompt a reduction in the use of chemical fertilizers, the consequent pollution and health hazard (Verma, 1996).

Coir pith is very efficient for tropical and farming as soil conditioner and cyanobacteria are also capable of biodegrading coir pith with various kinds of pollutants (Malliga and Viswajith, 2005). A considerable increase in growth of rice plants is also observed using coir pith based cyanobacterial biofertilizer (Krishnaveni, 1999; Lavanya Priya, 1997). Similar results were observed in case of BCC with *Azospirillum*, urea and untreated raw coir pith, which show definite increase in protein, carbohydrate and chlorophyll content (Abesh and Anita Das, 2010).

Conclusions

Our results suggested that the combination of cyanopith and cyanospray (T22- 100g cyanopith and 0.4% cyanospray) produced excellent results in metabolic contents of *A. barbadensis* and is therefore it is recommended that coir pith based cyanobacterial biofertilizer applied at 100g of cyanopith with 0.4% cyanospray per plant was the most effective fertilizer for improving the nutrient availability and ensuring sustainable cultivation of *Aloe barbadensis* Miller.

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