

## **Studies on the Use of Cyanobacteria As Biofertilizer For Vegetable Cultivation in Hydroponic System, in Schirmacher Oasis Region, East Antarctica**

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### **Abstract**

**During the eleventh Indian expedition to Antarctica an attempt was made to grow vegetables, using blue green algae (Cyanobacteria) as fertilizer. The result obtained is discussed in this report.**

### **Introduction**

**Algae form a conspicuous part of the Antarctic vegetation and occupy bare patches of low lying rocks where melt water is plentiful (Komarek and Ruzicka,1966). The blue green algae (cyanobacteria) are capable of fixing the atmospheric nitrogen and convert it into an available form of ammonium required for plant growth. Attempt towards the cultivation of vegetables viz., radish, spinach, methi, tomato and cucumber has been made in the soil media in Antarctica (Joshi and Banerjee, 1988). Later on the cultivation of vegetables was undertaken through hydroponic system using the micronutrients in water (Hoaglands solution) during the tenth Indian expedition to Antarctica. Literature reveals that blue green algae (cyanobacteria) already available in Antarctic soil have not yet been used as biofertilizer for vegetable cultivation in ice covered continent. The present study deals with the isolation and mass culture of cyanobacteria and to study their effect as biofertilizer on the performance of vegetables.**

### Materials and Methods

Soil samples were collected from different sites of lake Priyadarshini close to Indian Antarctic station Maitri (70°45'52"S: 11 °44'03"E) in sterilized tubes and were studied under the microscope. Diazotrophic Cyanobacterium (*Nostoc*) was isolated and the organism was inoculated on agar in petri dishes. After the growth the algae were inoculated in BG 11 medium (nitrogen free) in 20 litre glass jar for mass culture at 20 to 25<sup>0</sup>C temperature. Average humidity was maintained at 42.5% with a variation of 12 to 88% in variable glass house conditions. The sample was harvested on the 14th day and 200 ml cyanobacterial culture (600 fg protein/ml) was applied on the transplanting day in one group-of vegetables (two varieties of bean, cucumber and bottlegourd and one variety of muskmelon) grown in hydroponic system with usual Hoagland solution (without nitrogen variables). The second group of the vegetables was kept controlled. The solution was stirred in trays manually, thrice a day. Different parameters (leaf area, plant height and general performance) were recorded at weekly interval. The experiment was conducted in a glass house at Maitri station in Antarctica.

### Results and Discussion

The data are presented in Table I. Under controlled conditions, except bean, all vegetables died in the third week. The symptom of the nitrogen deficiency was noted after fifth day of transplanting these plants. However, the leaf area was found to be increasing in each variety. In treated vegetables also, symptom of nitrogen deficiency was noted between 5th and 7th day of transplantation, which recoverd after 8th day. The cyanobacteria spreaded inside the tray on 8th day, its bluish green colour being visible en masse. Average area per leaf and per plant was-recorded higher in Pusa Parvati variety than VL- Bauni variety of bean in both conditions. However, this increase was noted upto second week in other varieties of vegetables in both conditions. The average leaf area of Pusa Parvati, PSPL and Pusa Navin varieties decreased in the third week of transplantation in treated plants whereas an increase in the total leaf area per plant was recorded. In both varieties of cucumber average area per leaf and total leaf area per plant were recorded increasing till the fourth week in treated condition. Increased plant height was recorded in all varieties of vegetables under both conditions, though the rate of increase was lower in untreated plants.

In the fourth week the increase in area per leaf of two varieties of bean was recorded. The increase was five times in both varieties under controlled conditions whereas, under treated conditions, it was 13.40 times in Pusa Parvati

**Table I: Average Leaf Area (cm<sup>2</sup>) and Plant Height (cm). [Figures in Parentheses Denote the Data Recorded in untreated vegetables and Figures Out of Parentheses are those for vegetables]**

Vegetables	Variety	20 Jan. 1992		27 Jan. 1992			4 Feb. 1992			11 Feb. 1992		
		Area per leaf	Area per plant	Area per leaf	Area per plant	Height per plant	Area per leaf	Area per plant	Height per plant	Area per leaf	Area per plant	Height per plant
Bean	Pusa Parvati	10.6 (10.8)	21.2 (21.6)	17.6 (13.52)	88.0 (67.6)	3.5 (3.5)	16.6 (15.85)	132.8 (89.25)	8.0 (6.0)	29.5 (18.75)	236.0 (112.50)	10.5 (7.50)
	VL-Bauni	11.5 (10.5)	23.0 (21.0)	13.6 (11.2)	68.0 (56.0)	3.0 (2.5)	15.6 (13.03)	93.6 (65.15)	6.0 (5.0)	26.5 (17.50)	212.0 (105.00)	8.75 (6.25)
Bottlegourd	PSPL	3.8 (4.2)	7.6 (8.4)	18.5 (18.5)	37.0 (37.0)	2.5 (2.0)	All plants died			27.0	13.50	6.0
	Pusa Navin	4.0 (3.6)	8.0 (7.2)	21.2 (19.0)	42.4 (38.0)	2.0 (2.0)	All plants died			19.5	58.5	3.0
Cucumber	Japanese Long Green	8.6 (8.0)	17.2 (16.0)	27.5 (19.8)	82.5 (59.4)	2.5 (2.25)	All plants died			39.63	118.89	3.0
	Pusa Sangog <sup>9.2</sup>	9.2 (10.2)	18.4 (20.4)	39.85 (22.10)	119.55 (66.3)	3.0 (2.25)	All plants died			43.65	174.5	4.0
Muskmelon	Pusa Madhuras	2.8 (3.0)	5.6 (6.0)	5.9 (3.9)	11.8 (7.8)	2.5 (2.2)	All plants died			3.3	13.2	5.5
								All plants died			15.50	139.50

and 9.21 times in VL-Bauni. Similarly, increase in plant height recorded was 3.0 times in treated compared to 2.0 times in Pusa Parvati and 2.5 times in VL-Bauni varieties of bean under controlled conditions. This increase was recorded 17.16 times in PSPL and 20.37 times in Pusa Navin variety of bottlegourd, 24.11 times in Japanese Long Green and 25.33 times in Pusa Sanyog variety of cucumber and 24.9 times in muskmelon. A- decrease in average area per leaf was observed in Pusa Parvati variety of bean, PSPL and Pusa Navin variety of bottegourd and muskmelon in the third week as compared to second week. In other plants, average area per leaf was found to be increasing upto fourth week. The increased leaf area and plant height in treated condition arc supposed to be the effect of application of cyanobacteria culture.

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