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BLUE GREEN ALGAE – AN ENZYME ACTIVITY BOOSTER IN PADDY PLANTS

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ABSTRACT

The use of organic manure as compared to nitrogen fertilizer is very less expensive, besides being quite safer as compared to the chemicalfertilizers. Blue green algae as bio-fertilizers may prove efficient tool for boosting green revolution and to overcome food shortage all over the world.

The Paddy (Oryza sativa, L.var. SAKET) plants were taken in experiment. These plants were raised in soil-pot culture conditions. The different Supply levels of blue green algae, nil (control), 50, 100, 150, 200 and 250g bga/kg soil were applied to plants.

The increase in catalase activity was observed with the increase in bga supply level upto 150 g bga/kg soil level. Beyond 150 g bga/kg soil level, the decrease in catalase activity was observed with the increase in bga supply level.

The increase in catalase activity was found to be highly significant (P = 0.01) at each level of bgasupply, upto 150g bga/kg soil supply level over control, in both tops of 30 and 90 days old plants.

Key Words – Paddy, bga, BNF, controlled condition, DM

INTRODUCTION

With the aim of the utilization of organic amendments or biofertilizersdue to very high cost of chemical nutrients, the various attempts have been made with the hydrophytes or with the algae as biofertilizers. Among the ecosystems in which blue green algae can be found, wet soils provide an ideal environment for blue green algae to grow.

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Blue green algae represent a small taxonomic group of photosynthetic prokaryotes. Some of them posses ability of nitrogen fixation and also possess a tremendous potential for producing a wide range of secondary metabolities.

The biofertilizers contains beneficial microorganisms which improve plant growth and protect plants from pests and diseases (El-yazeid et al, 2007). The role of soilmicroorganisms in sustainable development of agriculture has been reviewed (Lee and Pankhurst,1992). Biofertilizers are important components ofintegrated nutrients management. These potential biological fertilizers would play key role in productivity and sustainability of soil and also protect the environment as eco-friendly and cost effective inputs for the farmers. They are cost effective, eco-friendly and renewable source of plant nutrients to supplement chemical fertilizers in sustainable agricultural system.

Blue green algae have drawn much attention as prospective and rich sources of biologically active constituents and have been identified as one of the most promising groups of organisms capable of producing bioactive compounds (fish & codd 1994, schlegel et al…1999). De (1939) attributed the natural fertility of flooded rice field soil and its maintenance to the process of biological nitrogen fixation by blue green algae.

In developing countries like India where there is immediate need to rely increasingly organic fertilization of soil. These bio-fertilizer play a role in minimising dependence on inorganic nitrogenous fertilizers. The bio-fertilizers, otherwise called microbial inoculants are preparations containing live or latent cells of efficient strains of nitrogen fixing micro- organisms used for seed or soil application. The main objective of applying inoculants is to increase the number of such microorganisms in soils or rhizosphere and consequently improve the extent of micro-biologically fixed nitrogen to plant growth. Application of bio-fertilizers in combination with organic nitrogenous fertilizers has a key role to play in the economic management of nitrogen needs of crops.In India, considerable progress has been made in the development of blue green algae based bio-fertilizer technology. It has also been demonstrated that this technology can be a powerful means of enriching the soil fertility and improving rice crop yields.

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MATERIAL AND METHOD

Normal water was used during culture work. After the seeds emergence, plants were thinned to a uniform number in each pot. Subsequent thinning was done whenever needed.For the experiment, there were six pots. The pots were arranged in 3 blocks A, B andC. In each block there were two pots, one pot was meant for control treatment and other one with BGA treatment. In each block the treatments were completely randomized.

For studies, the Paddy (Oryza sativa, L.var. SAKET) plants were raised in soil pot culture. Soil samples were collected in clean polythene bags after surface scrapping and brought to the laboratory. Calculated amounts of normal water were applied daily to pots to provide as for as possible uniform soil moisture conditions.All samples were drawn at the same time and placed in the shade. The 3 blocks a, b and c were sampled at the same time.

Soil was separately mixed with required amount of blue green algae. There after it was air dried thoroughly grounded and mixed. For through mixing required amount of BGA were mixed with small amounts of soil, divided and mixed again and again. Then these amended soils were mixed with bigger amounts of soil similarly, and finally these soils were mixed with bigger lots of calculated soils required for experiments. Soil mixing was done on separate clean chart to avoid any contaminations. Mixed soils were filled inpots.

Catalase was assayed in crude tissue extracts. The fresh plant material was used for the assay of catalase. The material was finally chopped, chilled and grounded with a little acid washed white silica sand in a chilled pestle and mortar in 0.005 m phosphate buffer pH 7, in the proportion of 1 g plant Catalase material to 10 ml of the buffer. Grinding was carried out in an ice-bath. The crude extract was filtered through two fold muslin. Catalase was assayed in the crude tissue extracts within 3 hours of the preparation of the extracts. During this period the extracts were stored in a refrigerator where they were not found to undergo appreciable loss in activity of the enzyme assayed. Catalase was assayed by the permanganate titration method of the Euler and Josephson (1927). 25 ml of 0.01 N hydrogen peroxide was taken in a flask and stabilized at 25 ^{0}C in a water bath. To this was added I ml of properly diluted enzyme extract. The contents were thoroughly mixed and 0.5 ml aliquot was immediately drawn in a test tube

containing 5 ml of 2 N-Sulphuric acid. Further aliquots from the reaction mixture were drawn at 3, 6, 9 and 12 minutes. The aliquots were titrated against 0.05 N $KMn0_4$ to determine the hydrogen peroxide decomposed. Monomolecular reaction constant was calculated as:

$$K = 1/t \log_{10} A/A\text{-}X$$

where 't' is time in minutes. 'A' is ml $KMn0_4$ used at 0 minutes and 'A-X' is ml KMn04 used at 3,6,9 and 12 minutes. 'K' value for zero time was obtained by extrapolating the 3,6,9 and 12 minutes readings. The results have been expressed as units catalase/g FM. The amount of crude tissue extract, taken for enzyme assay was such that by extrapolation of readings of 3,6,9 and 12 minutes, the reading obtained for zero time was higher than that at 3 minutes. Care was taken to ensure that the activity of the enzyme in the crude extract was in the range in which the activity was found to be proportional to the enzyme concentration in the extract.

RESULT

The increase in catalase activity of tops of both 30 and 90 days old plants at 150 g bga/kg soil over 100 g bga/kg soil and at 100 g bga/kg soil over 50 g bga/kg soil level, was found to be highly significant (P = 0.01). 250 g bga/kg soil over 200 g bga/kg soil showed significant (P=0.05) decrease in catalase activity of tops of 90 days old plants, and 250 g bga/kg soil over 200 g bga/kg soil in tops of 30 days old plants and 200 g bga/kg soil over 150 g bgo/kg soil in tops of 30 and 90 days old plants showed highly significant (P= 0.01) decrease in catalase activity of paddy plants.

Maximum value for catalase activity in tops of both 30 and 90 daysold plants was found at 150 g bga/kg soil level.

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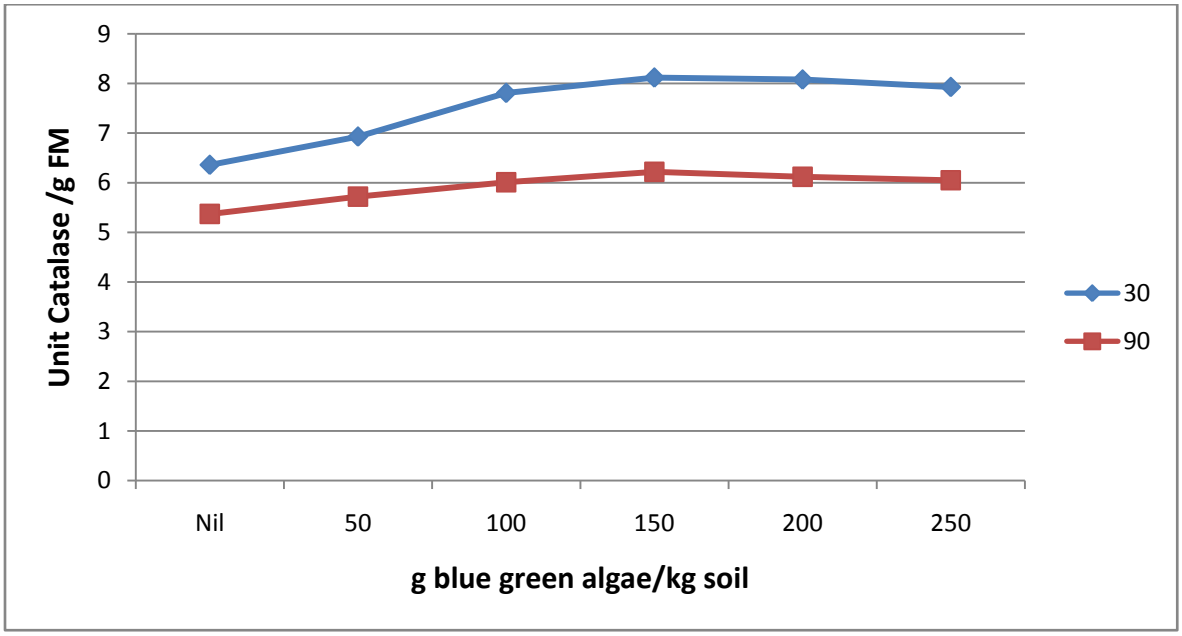
Effect of the blue green algae as biofertilizers on catalase activity of Paddy (Oryza sativa, L.var. SAKET) plants

Plant		g blue green algae/kg soil					
Age (days)	Part	Nil	50	100	150	200	250
Unit catalase/g FM							
30	Tops	6.36	6.93	7.81	8.12	8.08	7.93
90	Tops	5.37	5.72	6.01	6.22	6.12	6.05



DISCUSSION

The modern day intensive crop cultivation requires the use of chemical fertilizers, but fertilizers are not only in short supply but also expensive in developing countries. Therefore, the current trend is to explore the possibility of supplementing chemical fertilizers with organic ones, more particularly biofertilizers of microbial origin.

Rice is an exclusive crop plant of aquatic habitat, largely raised in anaerobic or partially anaerobic submerged environment. The most important characteristic of a submerged soil is the existence of a layer of standing water, which exercises a profound influence on the physio-chemical and biological conditions of the soil below. The important physical changes brought about by inundation are gaseous exchange, reaction, specific conductance and redox potential. The chemical properties which undergo changes on submergence are essentially the complex transformations of various elements. These depend on factors like the redox potential, pH, nature and quantity of organic matter, base status of the soil and microbiological activity..

The blue green algae have inhabited much of the surface of the earth for billions of years and today they are responsible for a significant amount of biological nitrogen fixation (BNF). The tropic independence of blue green algae made them suitable for use as biofertilizers. Blue green algae are widely distributed organisms all over the world and can be found in extreme habitats, from hot springs to arctic regions.

Blue green algae dominate a wide range of diverse environments characterized by extremes of temperature, desiccation, pH,salinity, light intensity and nutrients (Whitton, 2000). Many blue algae tolerate high levels of ultraviolet irradiation (Sinha et al, 1999) permitting them to survive at the soilsurface.

In conformity with the results of the present study, Rai et. al., 2000 reported that blue green algae are good colonizers of the nitrogen poor soils, and that through their nitrogen input into the environment they may help to create habitats suitable for other species. Many blue green algae have the capacity to manufacture nitrogenase. Because the enzyme complex is anaerobic, significant fixation by unicellular, colonial and some filamentous species occurs only in the absence of air. Therefore, only heterocystous species are valuable as biofertilizers. Blue green algae i.e. biofertilizers have several advantages over chemical fertilizers. They are non-polluting, inexpensive, utilize renewable resources.In addition to their ability of using free available solar energy, atmospheric nitrogen and water. Besides supplying N_2 to crops, they also supply other nutrients such as vitamins and growth substances (Wagner,1997). Anabaena and Nostoc have been recorded among the common nitrogen fixing blue green algae in ricefields.The use of blue

green algae as nitrogen based biofertilizers is reported in many rice growing countries of the world. This was because of the increased cost of chemical fertilizers, that cause soil and water pollution, changes soil structure and produce microflora. In comparison, blue green algae is a cheap source of N, which does not cause pollution. It improves the organic matter status and water holding capacity. Venkataraman (1981) reported that open air soil culture is simple, less expensive and easily adaptable by farmers. As mentioned earlier, blue green algae has minimum growth requirements of sunlight, simple inorganic nutrients and moisture.

The modern day intensive crop cultivation requires the use of chemical fertilizers, but fertilizers are not only in short supply but also expensive in developing countries. Therefore, the current trend is to explore the possibility of supplementing chemical fertilizers with organic ones, more particularly biofertilizers of microbial origin.

So in the end we can say that use of blue green algae as biofertilizers is important to overcome the adverse effect of chemical fertilizers.

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