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SHORT COMMUNICATION

Effect of nitrogenous fertilizer and blue green algae on grain yield, chlorophyll and protein content on two rice (*Oryza sativa*) varieties Jaya and Sarju-52

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ABSTRACT

In Agronomic studies on individual and integrated application of Blue Green Algae (BGA) biofertilizer with graded levels inorganic nitrogen under field conditions and possible utilization of these organisms to meet at least a part of the nitrogen requirement of rice were carried out during Kharif season at agriculture research station of Nawabganj, Bareilly, India. Application of BGA @ 12.5 Kg/ha in combination with 80 Kg/ha as urea recorded favourable results in the two rice varieties (Jaya & Sarju-52) and it is comparable with grain yield, chlorophyll and protein content at recommended doses of 160Kg/ha. Thus, it may be concluded that the use of biofertilizer (blue green algae) in rice crop can save at least 40 Kg/ha/year with increased yield.

***Key words*:** Nitrogen; Blue green algae; Grain yield; Chlorophyll content; protein content; *Oryza sativa*

1) INTRODUCTION

Rice is the basic food of nearly half of the human population most of which is concentrated in Asia. The most effective and expensive input for increased rice production is fertilizer nitrogen. All nitrogen present in the living or the dead has its origin i.e. the atmosphere which contains this element in abundance, 78% by volume. In the elemental form, in which it exists, it cannot be utilized by the plant. Its conservation to ammonia or nitrate- a form acceptable to the plant by synthetic means requires considerable energy- nearly five tons of coal to convert one ton of elemental nitrogen to ammonia. To produce ammonia by way of reduction of nitrogen with hydrogen under high temperature (500-600 °C) and pressure (of 1000 atmosphere) is the essential principal of production of synthetic nitrogenous fertilizers. Obviously, this needs considerable capital investment, foreign exchange commitment and technical know- how.

Fortunately, a replica of the synthetic process described above exists in nature perhaps working with greater efficiency and at no cost. This is the biological nitrogen fixation of the soil in which a variety of micro-organisms plays an admirable role. Certain types of blue green algae display marked nitrogen fixing capacity under waterlogged conditions in rice fields.

The blue green algae or cyanobacteria are primitive plants, having certain resemblance to bacteria but better evolved virtue of their ability to synthesize their organization they are simple unit or multi-cellular with chlorophyll and other pigments, giving characteristic brown, red and blue green colors. They are distributed in nature and exist practically in all situations where moisture is available.

The occurrence of cyanobacteria in rice growing soil is of great significance due to their ability to fix atmospheric nitrogen which becomes available for utilization by the growing rice plant. In addition to nitrogen fixation, the algae utilize the carbon dioxide released in root respiration for its photosynthesis, and release oxygen which aerates the root zone of the rice. This is a unique feature for partially meeting the oxygen requirement of the roots of the rice plant in an aerobic environment of the waterlogged soil.

In addition to N fixation, BGA also synthesize and liberate growth promoting substances such as auxin and amino compounds which stimulate the growth of rice.

The utilization of blue green algae as a biofertilizer for rice is very promising. A judicious use of these algae could provide, to the country's entire rice hectarage, as much nitrogen as obtained from 15-17 lakh tones of urea.

Therefore, an attempt has been made through present trials to study the effect of different levels of N-fertilizer along with Blue green algae (BGA) over grain yield, chlorophyll and protein content in rice variety Jaya and Sarju-52 grown in Tarai region of Bareilly district.

2) MATERIALS AND METHODS

Field experiments were conducted at Nawabganj, Agriculture Research station at Bareilly. The experiment was performed in replicates, hence a block of land was

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divided in 30 plots of size 5x3 sq. m. along with inoculum comprising N fertilizer and a soil based BGA inoculum comprising species of *Aulosira, Anabaena, Nostoc, Tolypothrix, Calothrix and Westiellopsis* was inoculated @12.5Kg/ha over standing water in the field in basal form concurrently.

Nitrogen level		+	BGA
C.	0 Kg/ha	+	0Kg/ha
T_1.	0 Kg/ha	+	12.5 Kg/ha
T_2.	40 Kg/ha	+	12.5 Kg/ha
T_3.	80 Kg/ha	+	12.5 Kg/ha
T_4.	120 Kg/ha	+	12.5 Kg/ha
T_5.	160 Kg/ha	+	12.5 Kg/ha

Grains at the time of maturity were collected plot wise and the samples of both the varieties were analysed for grain yield, chlorophyll content according to method Brougham [1] and protein content according to method Lowry et. al. [2].

3) RESULTS AND DISCUSSION

Different levels of N fertilizer along with EGA had significant bearing on grain yield of rice in both the varieties. Present observation clearly indicates a positive effect of N fertilizer along with BGA upto 80 KgN/ha on grain yield in both the varieties of rice. However, the value of all the treatments are significant.

Application of BGA inoculants in soil has been of much significance as they not only fix atmospheric nitrogen but also produce growth promotory and antifungal substances and ultimately increase the total yield per unit area.

The increase in growth and yield of rice has been reported earlier by many workers due application of blue green algae or nitrogen individually or in combination. Similar findings were also reported by several authors [3, 4, 5, 6].

Patel [7] also observed that grain yield of rice was increased when rice was soil inoculated with blue green algae along with 0-75 KgN/ha as compared to no inoculation. Similarly, Sinha et. al. (2002) found that application of 12.5 KgN/ha BGA with 90 KgN/ha gave favourable result with respect to grain and straw yield, at recommended dose of 120 KgN/ha. (Table 1).

Table 1: Grain yield (q/ha) of *Oyza sativa* as affected by different levels of nitrogen fertilizer + BGA

	Nitrogen level+ BGA	Varieties		Total	Mean
		Jaya	Sarju-52		
C.	0 kg ha^{-1}	42.83	41.28	84.11	42.06
T1.	0 kg ha^{-1} + 12.5 kg	49.16	48.39	97.55	48.78
T2.	40 kg ha^{-1} + 12.5 kg	53.33	52.86	106.19	53.10
T3.	80 kg ha^{-1} + 12.5 kg	61.67	59.35	121.02	60.51
T4.	120 kg ha^{-1} + 12.5 kg	60.04	58.98	119.02	59.51
T5.	160 kg ha^{-1} + 12.5 kg	59.34	56.83	116.17	58.09
CD at 5% level		0.20			

Value of total chlorophyll recorded, reveal that there is a significant increase in total chl. of rice in all the treatments but the amount of total chl. is significantly higher in treatment T3 (80 KgN/ha + BGA) as compared to control. Further increase in the dose was not found beneficial. Between the two varieties total chl. was higher in variety Sarju -52.

The main symptoms of nitrogen deficiency in crops are a yellowish (or pale) green color, a distinctly slow and stunted growth. Nitrogen increase the chlorophyll of the leaves by imparting deep green color which ensure production of more carbohydrate and accelerate growth, (Table 2).

Table 2: Total chlorophyll (mg/gm f.wt.) of *Oryza sativa* leaves as affected by different levels of nitrogen fertilizer + BGA

	Nitrogen level+ BGA	Varieties		Total	Mean
		Jaya	Sarju-52		
C.	0 kg ha^{-1}	0.635	0.583	1.218	0.609
T1.	0 kg ha^{-1} + 12.5 kg	0.655	0.658	1.313	0.657
T2.	40 kg ha^{-1} + 12.5 kg	0.666	0.669	1.335	0.668
T3.	80 kg ha^{-1} + 12.5 kg	0.757	0.774	1.531	0.766
T4.	120 kg ha^{-1} + 12.5 kg	0.728	0.747	1.475	0.738
T5.	160 kg ha^{-1} + 12.5 kg	0.705	0.694	1.399	0.700
CD at 5% level		0.0009			

From the table it is evident that the maximum value of protein content of both the varieties (Jaya and Sarju-52) are in the order of 11.68 for Jaya & 11.47 for Sarju-52 at a level of 80 KgN/ha along with BGA. Further increase in N level showed decrease in protein content.

The results obtained above were found to be significant when analysed and subjected to statistical analysis. It may be inferred from the above results that under similar agroclimatic conditions, varieties do differ in requirements of nitrogen dose which will be ultimately reflected in their protein content.

Out of three major elements NPK, nitrogen is the most important factor which is responsible for the synthesis of protein, amino acid, nucleic acid, alkaloids and coenzymes etc. Nitrogen is mostly taken up from the soil in the form of nitrate NO_3 and to some extent as NH_4^+. Maximum uptake of nitrogen take place at pH-7 and gose on decreasing with increasing acidity accompanied by low pH [Bhatia and Sharma [8], Balyan and Singh [9]. After entering the plant, it is utilized in protein synthesis through a series of reaction catalysed by a chain of enzymes. Therefore, nitrogen may be called as a precursor of amino acid and proteins [10].

The percentage protein content in rice grain was reported to be increased by algal inoculation [11, 12, 13]. Amarit et. al. [14] observed an increase in protein content due to inoculation of blue green algae. Phongthep Anantarikanon et. al. [15] investigated significant increase in the protein content of rice in algalized plots.

Antarik et. al. [16] reported significant increase in protein content of algalized plots. (Table 3).

Table 3: Protein content (%) in the grains of *Oryza sativa* as affected by different levels of nitrogen fertilizer + BGA

	Nitrogen level+BGA	Varieties		Total	Mean
		Jaya	Sarju-52		
C.	0 kg ha^{-1}	8.80	8.22	17.02	8.51
T1.	0 kg ha^{-1} + 12.5 kg	9.12	9.03	18.15	9.08
T2.	40 kg ha^{-1} + 12.5 kg	10.37	9.93	20.30	10.15
T3.	80 kg ha^{-1} + 12.5 kg	11.68	11.47	23.15	11.58
T4.	120 kg ha^{-1} + 12.5 kg	11.67	11.45	23.12	11.56
T5.	160 kg ha^{-1} + 12.5 kg	10.53	10.16	20.69	10.35
CD at 5% level		0.48			

4) CONCLUSION

This study shows that the best results are obtained when 80 Kg nitrogenous fertilizer combined with 12.5 Kg blue green algae/ha is used. Hence a net saving of 40 Kg nitrogenous fertilizer/ha can be achieved. It may be mentioned that EGA is not only cheap it is also beneficial for the soil.

BGA biofertilizer should be used in every rice crop as a kind of insurance to the crop yield as well as to give a stop to the deterioration of soil physicochemical properties.

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