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Role of Blue Green Algae in Paddy Crop

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ABSTRACT

Cyanobacteria (BGA) are one of the major components of the nitrogen fixing biomass in paddy fields. Due to the important characteristic of nitrogen fixation, cyanobacteria have a unique potential to contribute to enhance productivity in a variety of paddy. The best known effect of blue-green algal growth on rice increased nitrogen availability resulting from nitrogen fixation but other effects have been reported. In this research BGA used as inoculum in rice experimental plot. The BGA+FYM inoculum plot effective treatment compared to the control. The 50% NPK+BGA most effective treatment compared to the recurred of rice NPK (100%). Applications of NPK, BGA with FYM produce most significantly plant height, Weight of 1000 grain, Total grain yield percentage, extra increase yield percentage, compared to the control. The 50% NPK+BGA+FYM inoculums found to be most effective treatment for the rice production.50% NPK,FYM with BGA in inocolation in rice Plot No. 5 in this plot height of rice plant 149.9 cm, weight of 1000 grain 23.833 gm and extra increase percentage yield 20.06%.

Key Words: Rice production, Blue Green Algae, Nitrogen Fixation, Rice Field

INTRODUCTION

Cyanobacteria (Blue-Green Algae) are one of the major components of the nitrogen fixing biomass in paddy fields. The agricultural importance of cyanobacteria in rice cultivation is directly related with their ability to fix nitrogen and other positive effects for plants and soil. After water, nitrogen is the second limiting factor for plant growth in many fields and efficiency of this element is met by fertilizer [14].

Cyanobacteria play an important role in maintenance and build up of soil fertility, consequently increasing rice growth and yield as a natural biofertilizer [19]. Blue green algae (BGA) are photosynthetic nitrogen fixers and are free living. Cyanobacteria are capable of abating various kinds of pollutants and have advantages as potential biodegrading organisms [21]. Excretion of growth-promoting substances such as hormones (Auxin, Gibberellins), vitamins, amino acids [18], [17]. Increase in water- holding capacity through their jelly structure [18]. Increase in soil biomass after their death and decomposition [20]. Preventing weeds growth. Increase in soil phosphate by excretion of organic acids [23].

Nitrogen fixation is one of the most important biological processes and, though, the atmosphere contains about 79% nitrogen, most of the plants cannot e utilize it. They can utilize combined nitrogen, like ammonium, nitrate, nitrite; etc. This process is called biological nitrogen fixation. The most common nutrient limiting the production of agricultural crops is nitrogen.

Blue Green Algae (BGA) are alternative source of nitrogen to the chemical fertilizers. The choice of biological fertilizer is due to eco-friendly, fuel independent, cost effective and easily availability. BGA fix nitrogen under anaerobic conditions in specialized cells called heterocyst which comprises 5 to 10% of cells in a filament [7].

Blue-green algae (cyanobacteria) are distributed world-wide and contribute to the fertility, either as free-living organisms or in symbiotic association with the water-fern *Azolla* [8]. The nitrogen-fixing ability of many species is the principal. But by no means the only, reason for this increased fertility. The abundance of blue-green algae in rice fields has been reported in numerous papers since Fritsch's accounts [9a], [10b]. Culture studies were introduced by [4] and the importance of blue-green algal nitrogen fixation in helping to maintain fertility of the rice fields was first recognized by [6]. Many rice fields show visually obvious growths of blue-green algae, although eukaryotic green algae may be more abundant where high quantities of nitrogenous fertilizer have been added. Reports from many countries indicate that the blue-green algal flora is often rich in species [11], [3], [22], [2].

MATERIALS AND METHODS

The experiment was conducted in the rice field of Village - Mahewa Khurd, Manda, and Allahabad District of Uttar Pradesh in the year 2013. Each experimental plot measured 5m×5m in size. The field was designed as a Randomized Block Design (RBD). The trials were carried out in a Five (Randomized Block Design) Plot.

I have selected local regional variety "Pant-4" Since 2 June of prepared nursery, 22 days old rice seedling were transplanted in experimental 8 plot of 5×5 meter at the rate of 4 seedling/hill and the hill to hill distance 5 inch. The treatment used plot No. 1 (P1) no inoculums, Plot No. 2 in used 100% NPK, Plot No. 3 in BGA+FYM used only, Plot No. 4 in used 50% NPK with BGA, Plot No. 5 in used 50% NPK+ BGA with FYM. The fertilizers were applied after transplantation of rice plant. BGA and FYM were applied Inoculation during transplantation. After the rice harvest, rice yield, extra increase yield and plant height parameters were recorded.

| Table -1 Mode of | Treatments NPK, | BGA and FYM: |
|------------------|-----------------|---------------------|
|------------------|-----------------|---------------------|

| Treatment | N (kg/ha) | P (kg/ha) | K (kg/ha) | BGA (10kg/ha) | FYM (2-3t/ha |
|-----------|-----------|-----------|-----------|---------------|--------------|
| Plot No. | | | | | |
| P1 | 0 | 0 | 0 | - | - |
| P2 | 90 | 50 | 40 | - | - |
| P3 | 0 | 0 | 0 | + | + |
| P4 | 45 | 25 | 20 | + | - |
| P5 | 45 | 25 | 20 | + | + |

Note -: N Application in three split and BGA, FYM Inoculation during transplantation.

RESULTS

One of the objectives of the present study was to increase the yield of Rice production. The Rice yield of the plot No. 5 used 50% NPK+BGA+FYM are shown in table - 2. In this plot, the total rice grain yield Wt of 1000 grain 23.833 gm when the plant height was recorded 149.9 cm and extra increase yield percentage 20.06% over the control. I have obtained to respectively effective of 50% NPK+BGA+FYM in significant yield, plant height and extra yield percentage over the other treatment plots.

| Treatment Plot No | Plant height (cm) | wt. of 1000 grains (gm) | Yield (%) | Increase Yield |
|----------------------|----------------------|----------------------------|--------------|-------------------|
| | | | | (%) |
| P1 | 130 | 19.850 | 100 | 00.00 |
| P2 | 143 | 21.950 | 110.57 | 10.57 |
| P3 | 136.3 | 20.850 | 105.03 | 5.03 |
| P4 | 145 | 22.935 | 115.54 | 15.54 |
| P5 | 149.9 | 23,833 | 120.06 | 20.06 |

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Fig 1: Plant Height of Rice Plant (cm)



Fig. 2: Weight of 1000 Grain of Rice



Fig. 3: Increase Extra Yield % over the Control

DISCUSSION

The quantity of N fixed by BGA to support the growth and development of the rice plant. BGA increase in grain production was due to the nitrogen fixation of the algae which cause the increment in the plant height and grain quality of rice plant. The application nitrogen fertilizer could increase the yield of rice, chemical fertilizer resulted the poor performance than combined with BGA. The rice yield was found more in P_1 plot no treated sets than the controlled sets. The maximum amount of grain, plant height and extra increase yield percentage in the treatment containing reduced dose of 50% NPK, FYM with BGA was obviously due to the additional supply of N contributed by combined effect of chemical N and BGA (Table 2). The bulk of nitrogen fixed by BGA is probably released only in death and decay of BGA. The grain yield increased by 50% NPK, FYM with BGA in this research work ranged from 5.03% to 20.06% whereas increase in plant height ranged from 130 cm to 137.2 cm and wt. of 1000 grain ranged from 19.850 gm to 23.833 gm. Plot No. 1 in plant height 130 cm, wt of 1000 grain 19.850 gm was recorded in no treatment condition (control). In NPK treatment condition (Plot No. 2) plant height was found 143 cm, wt of 1000 grain 21.950 gm and increase yield percentage 10.57%. Plant height 136.3 cm, wt of 1000 grain 20.850 gm and increase yield 5.03% was found in BGA+FYM treated plant (Plot No. 3). Plot No. 4 plant height 145 cm, wt of 1000 grain 22.935 gm and increase yield 15.54 % was recorded in 50 % NPK+BGA treatment condition. Plot No. 5 plant height 149.9 cm, wt of 1000 grain 23.833 gm and increase yield 20.06 % was found in 50 %NPK+BGA+FYM very most effective treatment compare to other treatment Plot.

Blue green algae are reported to contribute to the higher nitrogen fertility of rice fields. They grow on the surface of paddy soil and water enriching with good source of nitrogen [1], [5], [16]. Reported yield increased by 5 to 24.1% in rice field by BGA inoculation [12] reported 5.26% increase in soil N due to BGA inoculation in rice field of Kathmandu which ultimately increased the yield of rice.[15] also found the yield increased by 12.3 to 19.5% on BGA inoculation in rice field. I was found BGA inoculation in rice field increase yield percentage ranged from 5.03% to20.06%.

The results suggest that application of cyanobacteria with lower level of applied urea-N was effective in enhancing the growth attributes of rice plant. This indicates the better efficiency of cyanobacteria in promoting the growth of rice plants in soil low in nitrogen fertility. Reports are also available that effective cyanobacterialization could increase the yield of rice grain significantly. Similarly [13] also reported the positive effect of cynobacterilization on reduction of sterility of rice grain.

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