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# STUDIES ON THE EFFECT OF VARIOUS LEVELS OF NITROGENOUS FERTILIZER ALONG WITH BLUE GREEN ALGAE ON BIOCHEMICAL COMPOSITION OF RICE VARIETY PUSA 1509 AND PUSA SHARBATI

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**ABSTRACT**

Nitrogen occupies a prime place in growth promotion of rice crop. Urea is most commonly used nitrogenous fertilizer which supplement rice crop with nitrogen. To study the effect of nitrogenous fertilizer along with bio-fertilizer (blue green algae) on biochemical composition of rice varieties Pusa 1509 and Pusa sharbati field experiments were performed during the period of 2018 and 2019. Nitrogenous fertilizer combined with blue green algae was applied in the experimental field and comparative observations were made on both the varieties. The interaction between nitrogenous fertilizer and bio-fertilizer treatments had a significant effect on biochemical composition of both rice varieties. Eventually, it may be concluded that the use of bio-fertilizer (BGA) in paddy plantation can save at least 40kg/ha/yr apart from the increase crop production.
***Keywords*** : Nitrogenous fertilizer, Blue green algae, Rice.

## Introduction

Rice is the staple food and play vital role related with diet and human health for majority of world's population including Asian countries (FAO, 2008). Nearly one fourth of the Asian population is still poor and has considerable unmet demand for rice. India is one leading producer of rice in Asia (Tony Cisse, 2005) and contribute to the economic growth of the country. About 114 million hectares are under cultivation out of 329 million hectares (Raghuwanshi, 2012). Crop yield are increased by adopting new farming method, improvements in varieties used and improving soil conditions. Soil conditions can be improved through the use of fertilizers. Fertilizers can be of two types either chemical fertilizers or bio- fertilizers. During the last 70 years high input of chemical fertilizer caused soil degradation, pollution and turns the soil less productive that also posed severe health issues and environmental hazards. Organic farming in which we use bio-fertilizers would over come from all these health issues and environmental health hazards (Kamal, 2002). In addition, bio-fertilizer comprises beneficial microbes which increased crop production (Panhwar, 2014).

Most of the Indian soil are deficient in nitrogen for obtaining higher yield of modern varieties of Rice. Bio-fertilizers play a very significant role in improving soil fertility by fixing atmospheric nitrogen, both in association with plant roots and without it. By application of bio-fertilizer the population of microorganisms increases that can transform plant nutrient to the available form in soil (Vessey, 2003) Nitrogen is most predominant element and essential compound of protein, nucleic acids, vitamins, porphyrins etc. Bio-fertilizers promoted biological system of nutrient formation and mobilization. Bio-fertilizer enhances growth and yield of crop and reduces the use of chemical fertilizer (Ngoc, 2001).

Bio-fertilizers differ from the chemical fertilizers in nitrogen availability i.e. they do not direct supply any nutrients to crops. Bio -fertilizer have simple production technology and installation cost is very low compared to the chemical fertilizer plants. Bio-fertilizer improves the beneficial microbial activity particularly biological nitrogen fixing bacteria that fixes atmospheric nitrogen and reduces the use of N fertilizer and phosphate solubilizing bacteria solubilize insoluble phosphate and make available for the crop (Marschner, 2011).

The innovative agriculture practices is best option for the use of bio-fertilizer along with chemical fertilizer to increase crop yield. Hence, this study conducted to improve the rice crop yield using the combination of bio-fertilizer and chemical fertilizer.

## Material and Methods

Comparative study of different levels of Nitrogen fertilizer along with BGA (Blue green algae) on biochemical composition of two popular hybrid varieties of *Oryza sativa*

*Linn.* (Rice) viz, Pusa 1509 and Pusa sharbati. A block of land was divided in 30 plots of size 5x3 sq. M. treat them with different levels of N fertilizer along with BGA in basal form concurrently. The different levels of treatments of Nitrogenous fertilizers and BGA are summarized as under :

| **Nitrogen level** | **+** | **BGA** |
|---|---|---|
| I. 0 kg/ha | + | 0 kg |
| II. 0 kg/ha | + | 12.5 kg |
| III. 40 kg/ ha | + | 12.5 kg |
| IV. 80 kg/ ha | + | 12.5 kg |
| V. 120 kg/ha | + | 12.5 kg |
| VI. 160 kg/ha | + | 12.5 kg |

**Date schedule**

| | | |
|---|---|---|
| Date of sowing | - | 26-07-2019 |
| Date of transplanting | - | 15-08-2019 |
| Date of harvesting | - | 08-11-2019 |
| Date of thrashing | - | 15-11-2019 |

**Soil characteristics :** The soil of the experimental field was sandy. Since the field crop are greatly influenced by the physical and chemical properties of soil, the composite soil samples from the 0-15 cm and 15-30 cm depths were collected, air dried processed and used for chemical analysis. Before sowing soil has low to medium fertility status with low organic content, available N, available P and S were in low range, available K was medium in range and neutral to slightly alkaline in nature.

**Cropping history of experimental field :** The experimental field had only one crop of rice annually during proceeding years. During the years under experimentation, the land was fallow during Rabi season and the experimental crop of *Oryza sativa* Linn. was sown in Kharif season.

**Experimental Details**

**Design and Layout :** Field experimental was conducted during kharif season of 2019-2020 in randomized block with three replications. Other details are as under-

Variety - *Oryza sativa* Linn.

Plot size - 5.0 m. into 3.0 m.

Row to row spacing - 40 cm.

Plant to plant spacing - 15 cm.

Number of rows per plot - 14

Number of rows harvested per plot - 10

The samples collected and were tested to determine biochemical composition.

## Results

**Nitrate reductase activity in the leaves of *Oryza sativa* Linn. (Pusa 1509 and Pusa sharbati) as affected by different levels of N fertilizer along with Blue green algae.**

The data presented in Table-1.1. have shown that there is an increase in NRA of *Oryzasativa Linn.* Leaves. The value of NRA in treatments T1 and T2 is 6.60 and 6.99 respectively in variety Pusa 1509, in var. Pusa sharbati the value of T1 and T2 is 6.44 and 6.73 respectively. The value of NRA in T3 is further increase to 7.53 in var Pusa 1509and 7.40 in var. Pusa sharbati when the quality of N fertilizer is just doubled than T2. Further addition of N fertlizer in T4 which was just triple of T2 and in T5 which was just doubled of T3 but both (T4 and T5) had BGA in same quantity but the mean value (7.45 and 7.08) are decreased marginally in both the varieties, it indicates that the increase dose of N fertilizer is not beneficial to enhancement of NRA value. The optimum dose of 80 kg N/ha along with BGA which has the highest value of NRA content.

**Protein content of *Oryza sativa* Linn. (Pusa 1509 and Pusa sharbati) as affected by different levels of Nitrogenous fertilizer along with Blue green algae.**

From the Table-1.2 it is revealed that the mean value of protein content of both the varieties (Pusa 1509 and Pusa sharbati) are in the order of 10.36 for Pusa 1509 and 10.04 Pusa sharbati. Different levels of N fertilizer along with BGA was supplemented to the soil and the response was noted in both the varieties. The best result were obtained at the level of 80 kgN/ha along with BGA. It may be noted that the table shown that the quantity of protein increases at T1, T2 and T3 level but decreased at the T4 and T5 (120 and 160 kg N/ha along with same quantity of BGA). It can be concluded from the result of this experiment that best application of 80kg/ha N fertilizer along with 12.5kg of bio-fertilizer at T3 and further addition of 40 kg N/ha along with BGA over the above T3 is not appreciable.

**Total free amino acid of *Oryza sativa* Linn. (Pusa 1509 and Pusa sharbati) as affected by different levels of N fertilizer along with BGA.**

From Table 1.3 we find that there is a continuous decrease in the quantity of total free Amino acid in all the levels of N fertilizer along with Blue green algae during the experiment. It is clear that the requirement of amino acid for different varieties, is different irrespective of the dose of N fertilization. Pusa sharbati contained the least amount of total free amino acid (0.93%) compared to Pusa 1509 (0.95%). It is not necessary that plant utilize all the quantities of different amino acids formed inside the plant body by enzymatic action. Naturally different species of the plant will leave different amounts of amino acid unused. The results obtained clearly indicate that treatment T5 (160 kg N/ha +12.5kg BGA) give the highest values of total free amino acid I.e. 1.19% in var. Pusa 1509 and 1.18% in var. Pusa sharbati.

**Table 1.1:** Nitrogen reductase activity (M mol $NO_2$ $g^{-1}$ f.w.t. $ha^{-1}$) in the leaves of *Oryza sativa* as affected by different level of nitrogen fertilizer + BGA

| | Nitrogen Level + BGA | Varieties | | Total | Mean |
|---|---|---|---|---|---|
| | | Pusa 1509 | Pusa sharbati | | |
| C. | 0 kg $ha^{-1}$ | 6.42 | 6.30 | 12.72 | 6.36 |
| T1. | 0 kg $ha^{-1}$+12.5 kg | 6.60 | 6.44 | 13.04 | 6. 52 |
| T2. | 40 kg $ha^{-1}$+12.5 kg | 6.99 | 6.73 | 13.72 | 6.86 |
| T3 | 80 kg $ha^{-1}$+12.5 kg | 7.53 | 7. 40 | 14.93 | 7.47 |
| T4. | 150 kg $ha^{-1}$+12.5 kg | 7.52 | 7.37 | 14.89 | 7.45 |
| T5. | 150 kg $ha^{-1}$+12.5 kg | 7.15 | 7.01 | 14.16 | 7.08 |
| | **Total** | 42.21 | 41. 25 | | |
| | **Mean** | 7.04 | 6. 88 | | |

**Analysis of variance**

| Source of Variation | Degree of Freedom | Sum of Squares | Mean Squares | Variance ratio 'F' |
|---|---|---|---|---|
| Levels | 5 | 6.409342 | 1.281868 | 3.845989** |
| Varieties | 1 | 0.231391 | 0.231391 | .6942425** |
| Error | 22 | 7.332601 | 0.333300 | |
| Total | 35 | 94.65942 | | |

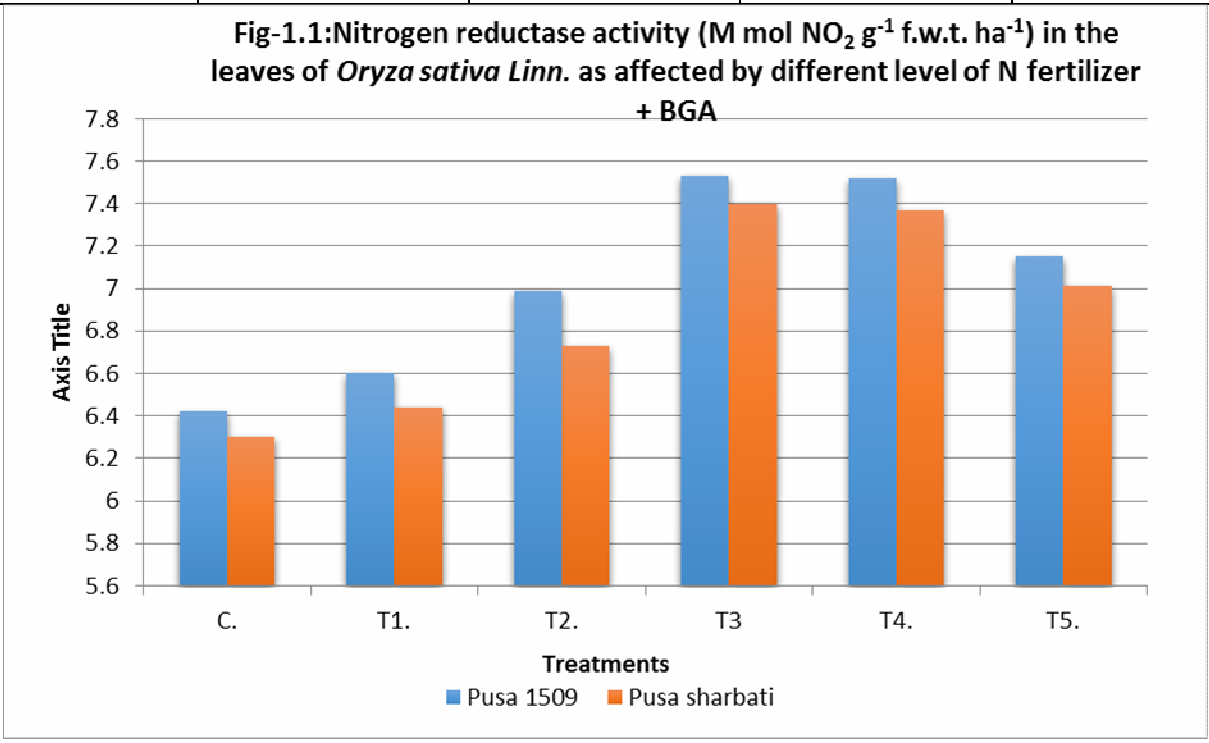



**Table 1.2 :** Protein content (%) in the grains of *Oryza sativa* Linn. as affected by different level of Nitrogen fertilizer + BGA

| | Nitrogen Level + BGA | Varieties | | Total | Mean |
|---|---|---|---|---|---|
| | | Pusa 1509 | Pusa sharbati | | |
| 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 |
| | **Total** | 62. 17 | 60. 26 | | |
| | **Mean** | 10.36 | 10.04 | | |

**Analysis of variance:**

| Source of Variation | Degree of Freedom | Sum of Squares | Mean Squares | Variance ratio 'F' |
|---|---|---|---|---|
| Levels | 5 | 47.31177 | 9.462354 | 57.63636** |
| Varieties | 1 | 0.910834 | 0.910834 | 5.548004** |
| Error | 22 | 3.611814 | 0.164173 | |
| Total | 35 | 136.3535 | | |

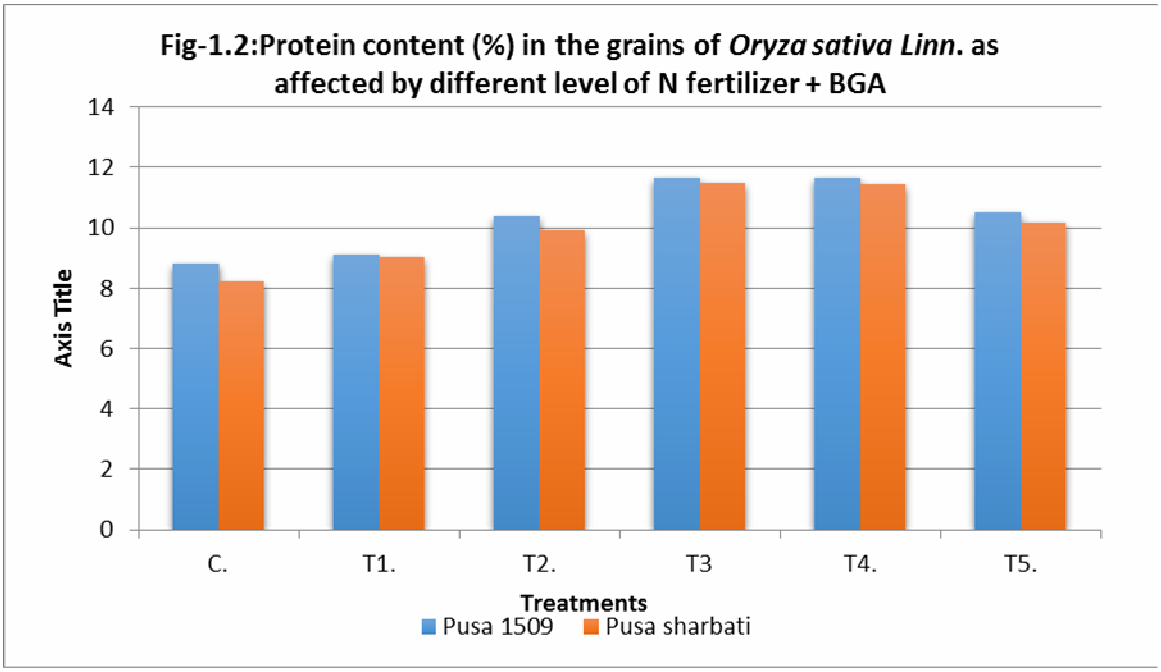
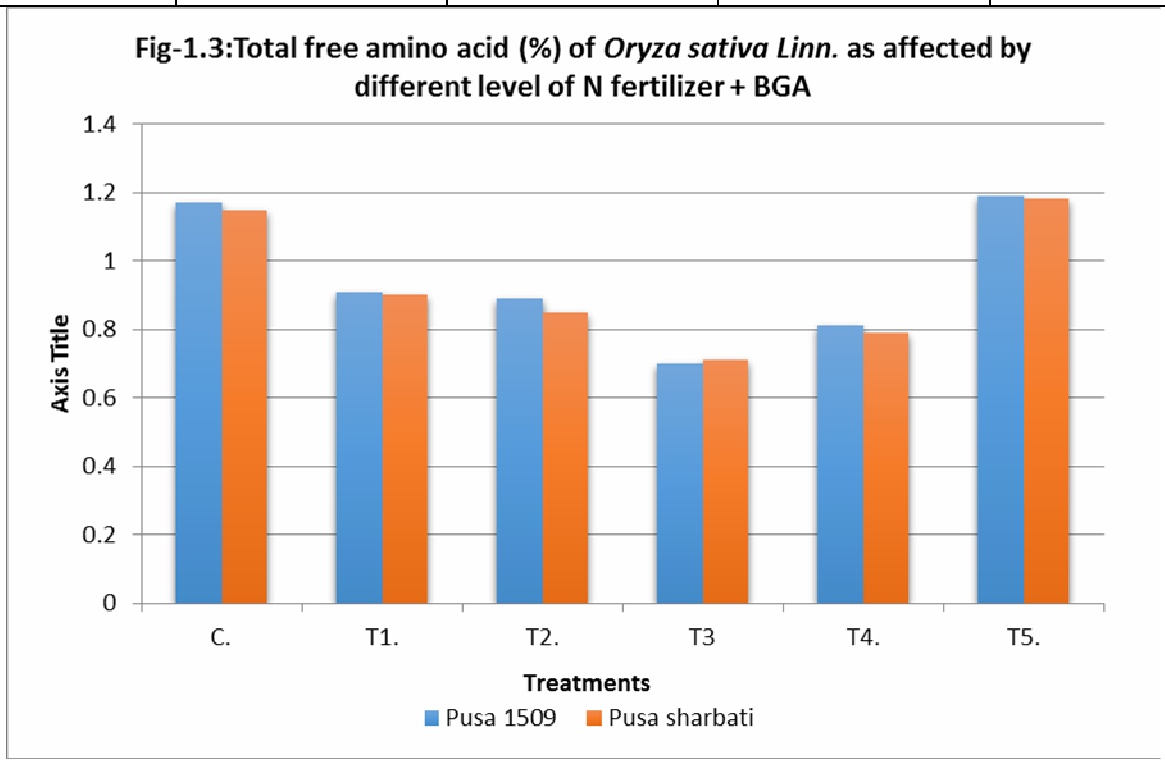



**Table 1.3 :** Total free amino acid (%) of *Oryza sativa* Linn. as affected by different level of Nitrogen fertilizer + BGA

| | Nitrogen Level + BGA | Varieties | | Total | Mean |
|---|---|---|---|---|---|
| | | Pusa 1509 | Pusa sharbati | | |
| C. | 0 kg $ha^{-1}$ | 1.17 | 1.15 | 2.32 | 1.16 |
| T1. | 0 kg $ha^{-1}$+12.5 kg | 0.91 | 0.90 | 1.81 | 0.91 |
| T2. | 40 kg $ha^{-1}$+12.5 kg | 0.89 | 0.85 | 1.74 | 0.87 |
| T3 | 80 kg $ha^{-1}$+12.5 kg | 0.70 | 0.71 | 1.41 | 0.71 |
| T4. | 120 kg $ha^{-1}$+12.5 kg | 0.81 | 0.79 | 1.60 | 0.80 |
| T5. | 160 kg $ha^{-1}$+12.5 kg | 1.19 | 1.18 | 2.37 | 1.19 |
| | **Total** | 5.67 | 5.58 | | |
| | **Mean** | 0.95 | 0.93 | | |

**Analysis of variance:**

| Source of Variation | Degree of Freedom | Sum of Squares | Mean Squares | Variance ratio 'F' |
|---|---|---|---|---|
| Levels | 5 | 1.1360174 | 0.227203 | |
| Varieties | 1 | 0.002020 | 0.002020 | 26382.18** |
| Error | 22 | 0.000189 | 0.00009 | 234.568 |
| Total | 35 | 1.1449067 | | |



## Discussion

From the data it can be conclude that blue green algae is more beneficial to enhance nitrate reductase activity. It observed that blue green algae influence the enzyme activity of rice seed and show an increase in catalase activity and peroxidase activity (Mehta *et al*., 1999). The treatment that is 80 kg N/ha along with blue green algae gives best results and higher doses than 80 kgN/ha along with blue green algae will go waste in regard to the concentration of crude protein concentration two varieties of rice. Phongthep Anantari-Kanon *et al*. (1990) reported significant increase in the protein content of rice in algalized plots. We examine significant decrease in total free amino acid content with a dose of 120 kgN/ha along with blue green algae and significant increase with next higher dose of 160 khN/ha along with blue green algae. The treatment with blue green algae increased amino acid contents in grain of rice have been reported (Nguyen *et al*., 1978).

## Conclusion

From the above result we observed that Nitrogenous fertilizer applied to the rice field along with blue green algae show significant increase in biochemical composition of the crop, it reduces the use of N fertilizer up to 40%. it also mentioned that BGA supplemented the N fertilizer and can be good, cheap and beneficial option for the farmers.

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