

## Yield maximization of hybrid rice (*Oryza sativa*. L.) through integrated nutrient management

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**ABSTRACT :** The experiment was laid out in Complete Randomized Block Design (RCBD) with ten treatments replicated thrice. The treatments consisted of 100 per cent, 75 per cent and 50 per cent recommended doses of nutrients (RDN) through chemical fertilizers and 25 per cent and 50 per cent RDN through organic sources like farm yard manure and blue green algae (BGA). Application of 75 per cent of recommended NPK through inorganic + FYM @ 10 t ha<sup>-1</sup> + BGA @ 15 kg ha<sup>-1</sup> recorded significantly higher plant height, more No. of tillers/ hill and yield.

**Key Words :** Organic, Inorganic, INM, Hybrid rice, BGA

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Rice is one of the most important cereal crops in India. The country has to produce about 130 mt of rice by 2025 to feed the ever growing population. Meeting the targeted demands of rice is a challenging task. Decreasing in the soil fertility and increasing in water scarcity is becoming threat for rice cultivation. Hence, the technology which maintains the soil health and water scarcity and as well as economically beneficial needs to be developed. The role of organic fertilizer in plant nutrition is now attracting the attention of agriculturists and soil scientists throughout the world. Chemical fertilizers, no doubt have the positive impact on crop growth and yield, but had negative impact on soil organic matter, soil structure, and microbial population. Application of organic materials along with inorganic fertilizers into soil results an increase in productivity of the system and also sustain the soil health for longer period. Rice being a crop having water requirement, there is a need to search for alternative method to reduce water requirement of rice without reduction in yield. In low land rice cultivation, biological nitrogen fixation (BNF) has been the most effective system in sustaining production which is being considered not only as a strategic necessity but also an economic advantage. The main agents of BNF in a paddy field are blue green algae (BGA) and the water fern *Azolla*. The surface of rice field water provides a suitable environment for their growth and multiplication. *Azolla*, a water fern that assimilates atmospheric nitrogen in association with N fixing blue green algae, *Anabaena azollae*. This *Azolla*-*Anabaena*

complex is considered to be the potential biological system for increasing rice yield. BGA not only fix atmospheric nitrogen but also ameliorate the soil water. The growth of BGA in soil seems to influence the physical and chemical properties of soil. Keeping above factors in mind, present investigation was conducted to study the effect of integrated nutrient management on growth and yield of hybrid rice.

### RESEARCH PROCEDURE

Field experiment was conducted during *Kharif* season of 2010 at central research farm, Sam Higginbottom Institute of Agriculture, Technology and Sciences, Allahabad. The soil of the experimental site was sandy loam with pH (7.7) and medium in organic carbon (0.4%). The initial status of available N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O of the experimental site was 220.0, 18.8 and 250.0 kg ha<sup>-1</sup>, respectively. The experiment was laid out in a Randomized Complete Block Design with ten treatments replicated thrice. The treatments were control (T<sub>1</sub>), BGA @ 15 kg ha<sup>-1</sup> (T<sub>2</sub>), FYM @ 10 t ha<sup>-1</sup> + BGA @ 15 kg ha<sup>-1</sup> (T<sub>3</sub>), 50% of recommended NPK through inorganic (T<sub>4</sub>), 50% of recommended NPK through inorganic + BGA @ 15 kg ha<sup>-1</sup> (T<sub>5</sub>), 50% of recommended NPK through inorganic + FYM @ 10 t ha<sup>-1</sup> + BGA @ 15 kg ha<sup>-1</sup> (T<sub>6</sub>), 75% of recommended NPK through inorganic (T<sub>7</sub>), 75% of recommended NPK through inorganic + BGA @ 15 kg ha<sup>-1</sup> (T<sub>8</sub>), 75% of recommended NPK through inorganic + FYM @ 10 t ha<sup>-1</sup> + BGA @ 15 kg ha<sup>-1</sup> (T<sub>9</sub>), 100% of recommended NPK

through inorganic ( $T_{10}$ ). Observations were recorded for various growth and yield attributes.

## RESEARCH ANALYSIS AND REASONING

The results of the present study as well as relevant discussions have been presented under following sub heads:

### Growth attributes :

The different growth indices like plant height and number of tillers of hybrid rice significantly influenced by various treatments (Table 1). Significantly higher plant height (128.80) was recorded with application of 75% of recommended NPK through inorganic + FYM @ 10 t ha<sup>-1</sup> + BGA @ 15 kg ha<sup>-1</sup>. However, it was at par with 100% of recommended NPK through inorganic (128.08). The lower plant height (78.33) was observed with the control treatment. Significantly increase in plant height with these treatments might be due to greater availability and steady release of nutrients from organic sources (FYM, poultry manure), which perhaps increased the plant height. Devaraju *et al.* (1998) opined that adequate supply

of plant nutrients influenced the plant height. Nitrogen increases the chlorophyll content at later stages of crop growth as it is a constituent and might have increased the photosynthesis and resulted in increased plant height (Gill and Singh, 1985). Significantly more number of tillers per hill (15.47) was recorded with application of 75 per cent of recommended NPK through inorganic + FYM @ 10 t ha<sup>-1</sup> + BGA @ 15 kg ha<sup>-1</sup> recorded significantly more number of tillers. However, it was at par with 100 per cent of recommended NPK through inorganic (15.43). The minimum Number of tillers (7.20) was observed with the control treatment. The development of leaf area is an important factor that could affect crop response to added nitrogen. Larger leaf area development aided in more interception of light leading to higher dry matter production (Vijayalakshmi and Nagarajan, 1994).

### Yield attributes :

The yield attributes like panicle length (cm), grains panicle<sup>-1</sup> (No.) and thousand grain weight (g) differed significantly due INM in Hybrid rice (Table 2). Significantly highest length of panicle was recorded with the treatment 75%

**Table 1: Influence of integrated nutrient management on plant height and number of tillers hill<sup>-1</sup> of hybrid rice**

Treatments	Plant height (cm)	Number of tillers hill <sup>-1</sup>
T <sub>1</sub> -Control	78.33	7.20
T <sub>2</sub> -BGA @ 15 kg ha <sup>-1</sup>	86.00	8.27
T <sub>3</sub> -FYM @ 10 t ha <sup>-1</sup> + BGA @ 15 kg ha <sup>-1</sup>	93.60	8.70
T <sub>4</sub> -50% of recommended NPK through inorganic	106.27	10.07
T <sub>5</sub> -50% of recommended NPK through inorganic + BGA @ 15 kg ha <sup>-1</sup>	114.47	10.67
T <sub>6</sub> -50% of recommended NPK through inorganic + FYM @ 10 t ha <sup>-1</sup> + BGA @ 15 kg ha <sup>-1</sup>	120.43	11.57
T <sub>7</sub> -75% of recommended NPK through inorganic	117.90	10.77
T <sub>8</sub> -75% of recommended NPK through inorganic + BGA @ 15 kg ha <sup>-1</sup>	123.63	13.73
T <sub>9</sub> -75% of recommended NPK through inorganic + FYM @ 10 t ha <sup>-1</sup> + BGA @ 15 kg ha <sup>-1</sup>	128.80	15.47
T <sub>10</sub> -100% of recommended NPK through inorganic	128.08	15.43
S.E. ±	0.99	0.20
C.D. (P=0.05)	2.08	0.43

**Table 2: Influence of integrated nutrient management on panicle length, grains panicle<sup>-1</sup>, thousand grain weight and grain yield of hybrid rice**

Treatments	Panicle length (cm)	Grains panicle <sup>-1</sup> (No.)	Test weight (g)	Grain yield (q ha <sup>-1</sup> )
T <sub>1</sub> -Control	23.60	92.10	21.50	17.20
T <sub>2</sub> -BGA @ 15 kg ha <sup>-1</sup>	24.30	97.50	22.20	19.10
T <sub>3</sub> -FYM @ 10 t ha <sup>-1</sup> + BGA @ 15 kg ha <sup>-1</sup>	25.30	98.40	22.20	22.50
T <sub>4</sub> -50% of recommended NPK through inorganic	26.00	120.20	22.30	48.20
T <sub>5</sub> -50% of recommended NPK through inorganic + BGA @ 15 kg ha <sup>-1</sup>	26.40	122.40	22.30	48.90
T <sub>6</sub> -50% of recommended NPK through inorganic + FYM @ 10 t ha <sup>-1</sup> + BGA @ 15 kg ha <sup>-1</sup>	27.00	130.00	22.80	54.30
T <sub>7</sub> -75% of recommended NPK through inorganic	26.70	123.10	22.50	50.20
T <sub>8</sub> -75% of recommended NPK through inorganic + BGA @ 15 kg ha <sup>-1</sup>	29.00	140.80	22.90	55.40
T <sub>9</sub> -75% of recommended NPK through inorganic + FYM @ 10 t ha <sup>-1</sup> + BGA @ 15 kg ha <sup>-1</sup>	29.67	155.80	23.40	57.20
T <sub>10</sub> -100% of recommended NPK through inorganic	29.30	145.10	23.20	55.80
S.E. ±	0.14	0.43	0.08	0.19
C.D. (P=0.05)	0.29	0.89	0.16	0.39

of recommended NPK through inorganic + FYM @ 10 t ha<sup>-1</sup> + BGA @ 15 kg ha<sup>-1</sup> (29.67). It was closely followed by the treatments 100% of recommended NPK through inorganic (29.30). Minimum panicle length (23.60) was recorded with the control treatment. It was found to be statistically significant. Singh *et al.* (2001) also reported similar results. Use of higher dose of nitrogen, phosphorus and potassium through organic sources might have helped in inducing good vegetative growth (Dhurandher and Tripathi, 1999). which in turn produced higher number of panicles leading to higher yield. This increased panicle length may be attributed to steady supply of nutrients which enhanced the dry matter production due to more availability of photosynthates. Significantly more number of grains per panicle was recorded with the treatment 75% of recommended NPK through inorganic + FYM @ 10 t ha<sup>-1</sup> + BGA @ 15 kg ha<sup>-1</sup> (155.80). It was closely followed by the treatments 100% of recommended NPK through inorganic (145.10). Minimum number of grain (92.10) per panicle was recorded with the control treatment. It was found to be statistically significant. Singh *et al.* (2001) also reported similar results. Organic manure contains growth promoting hormones and produce better root growth than fertilizer (Garg *et al.*, 1971). Poultry manure contains most of the nutrients which might have helped to produce better growth parameters *viz.*, number of tillers per hill, dry matter per hill, leaf area and yield parameters such as total number of grains, number of filled grains, decreased unfilled grains and least chaffiness per cent. Significantly highest test weight was recorded with the treatment 75 per cent of recommended NPK through inorganic + FYM @ 10 t ha<sup>-1</sup> + BGA @ 15 kg ha<sup>-1</sup> (23.40). It was closely followed by the treatments 100 per cent of recommended NPK through inorganic (23.20). Minimum test weight (21.50) was recorded with the control treatment. It was found to be statistically significant. Singh *et al.* (2001) also reported similar results. As a result of application of higher dose of nitrogen, phosphorus and potassium through

organic sources more bold seeds were formed which in turn increased the test weight of aerobic rice. This result is in accordance with earlier findings of Singh *et al.* (2001).

#### Grain yield :

The grain yield differed significantly due INM in hybrid rice (Table 2). Significantly higher grain yield was recorded with the treatment 75% of recommended NPK through inorganic + FYM @ 10 t ha<sup>-1</sup> + BGA @ 15 kg ha<sup>-1</sup> (57.20 q/ha). It was closely followed by the treatments 100% of recommended NPK through inorganic (55.80 q/ha). The minimum test weight (17.20 q/ha) was recorded with the control treatment. It was found to be statistically significant. Singh *et al.* (2001) also reported similar results. There will be increase in growth and yield components and both grain and straw yield, higher leaf area and leaf area duration which are responsible for higher photosynthetic activity promoted dry matter production resulting in higher grain and straw yield (Dhyani and Mishra, 1994; Dhurandher and Tripathi, 1999). Because of more leaf area and more light interception, dry matter production was increased significantly resulting into significant increase in straw yield. These results confirm the findings of Sharu and Meerabai (2001) who reported that application of equal ratio of chemical fertilizer and organic manure increased the nutrient levels. As the nitrogen supply increased, the extra protein content might have induced the plant leaves to grow larger and made more surface area for photosynthesis.

#### Conclusion :

On the basis of above findings, it may be concluded that application of 75 per cent of recommended NPK through inorganic + FYM @ 10 t ha<sup>-1</sup> + BGA @ 15 kg ha<sup>-1</sup> recorded maximum plant height, more number of tillers hill<sup>-1</sup>, panicle length, grains panicle<sup>-1</sup>, thousand grain weight (g) and yield.

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