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Effect of integrated management of *Azotobacter*, *Azolla* and urea on growth and yield of rice

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ABSTRACT : Field experiment was conducted to investigate the influence of integrated use of urea and bio-fertilisers on soil properties, crop growth and yield of rice. The observation were made on T_1 (control), T_2 (50% N through urea), T_3 (100% N through urea), T_4 (*Azotobacter* + *Azolla*) and T_5 (50% N through urea + *Azotobacter* + *Azolla*). The experiments on rice were carried in Randomized Block Design with three replications. Characterization of soil physio-chemical properties in terms of pH, EC, organic carbon, available nitrogen, available phosphorus and available potassium were made at different time interval (30, 60 days after plantation (DAP) and at harvest).The important plant parameter such as plant height, number of tiller, grain and straw yield etc. were also obtained in plots recived 50 per cent urea N and bio-fertilizers (*Azotobacter and Azolla*).

Key Words : Integrated management, Nitrogen, *Azotobacter* and *Azolla*

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Rice (*oryza sativa* L.) is the most important cereal crop. It is the staple food of more than 60 per cent of the world population. About 90 per cent of all rice grown in the world is produced and consumed in the Asian region where, it contributes to 50 per cent of dietary energy. Rice is primarily a high energy of high calorie food. Its importance will continue to increase in the future because population grown in rice consuming areas is far more rapid than in non rice area (Da. Mota *et al.*,1976).

In recent years the research work on bio-fertilizer carried out in different parts of the country indicated the effectiveness of bio-fertilizer in boosting the production and maintaining the soil fertility (Gaur and Sunita, 1992). Microbial inoculants are generally used as bio-fertilizers. They can be products of active strain of specific bacteria, fungi, algae, alone or in combination. In view of their facts, the present experiment is the effects integrated management of *Azotobacter*, *Azolla* and Urea on growth and yield of rice has been designed. This may help in increasing crop productivity by way of helping in biological nitrogen fixation, solubilization of insoluble fertilizer stimulating plant growth or by decomposition of plant residues.

The experiment consisted of 5 treatments T_1 = control, T_2 = 50% nitrogen through urea, T_3 = 100% nitrogen through urea, T_4 = *Azotobacter* + *Azolla*, T_5 = 50% N through urea + *Azotobacter* + *Azolla*. The experiment was laid out in Randomized Block Design in three replications. In paddy crop recommended doses 120kg N_2, 60kg P_2O_5 and 40kg K_2O ha^{-1} were applied through urea, single super phosphate (SSP) and muriate of potash (MOP), respectively. Full dosed of phosphorus and potassium were applied at the time of transplanting. Nitrogen was applied as per treatment, half dose of nitrogen applied at time of transplanting and rest 50 per cent of N was applied in two equal splits, one at tillering and second at milking stage. *Azotobacter* was applied as seedling treatment at time of transplanting. *Azolla* inoculation was done at 7 days after transplanting @ 500 kg ha^{-1} (fresh weight). The fresh *Azolla* was contained 3 per cent on dry weight basis.

Plant height:

The data related to the plant height at different stages of crop growth under various treatments consisted of urea and bio-fertilizer has been presented in Table 1. The plant height of rice crop increased continuously with advancement in growth stages up to the harvest under all treatments and was found in

Table 1: Effect of integrated use of nitrogen and biofertilizer on plant height, no. of tiller, grain yield and straw yield

Treatments	Plant height (cm)			No. of tiller (M^2)			Grain yield	Straw yield
	30	60	Harvesting	30	60	Harvesting	Qha^{-1}	Qha^{-1}
T_1	69.20	87.20	89.13	280	342	313	26.6	60.00
T_2	73.60	89.0	90.60	291	370	341	31.7	71.44
T_3	77.20	92.06	94.26	310	390	368	39.0	78.14
T_4	71.26	89.74	91.20	395	377	350	34.5	74.16
T_5	79.73	99.80	1010.33	330	415	390	43.58	83.21
S.E.±	1.408	2.290	0.846	6.159	11.898	8.961	1.674	30.074
C.D. (0.005%)	3.248	5.282	1.951	14.203	27.437	20.664	3.860	7.089

the order $T_5>T_3>T_4>T_2>T_1$. The mean plant height of the plots applied with 50% urea N + bio-fertilizers was significantly higher as compared to other combinations. The average plant height under T_1,T_2,T_3,T_4 and T_5 treatments at 30 DAP were 69.20, 73.60, 71.26, 74.26 and 79.73cm and at 60 DAP 87.20, 89.0, 92.06, 89.74 and 99.80cm and at harvesting 89.13, 90.60, 94.26, 91.20 and 101.33cm, respectively. This beneficial effect of *Azotobacter* and *Azolla* on plant height was also observed by other workers (Singh *et al.*, 2005).

Number of tillers:

It is evident from the results, application of nitrogen through bio-fertilizer and urea significantly increased the number of tillers as compared to control at all growth stages. The number of tillers/m^2 of rice under different treatments increased with time and reached maximum at 60 DAP (Table 1). The number of tillers were, however, significantly higher in T_5 treatment ($390m^{-2}$) and lower in T_1 treatment ($313m^{-2}$) at 60 DAT. The no. of tillers obtained under T_1,T_2, T_3,T_4 and T_5 treatment at harvesting were 313, 341, 368, 350 and 390 per square meter area, respectively. Similar findings were reported by Ram *et al.* (1985).

Grain yield:

The results obtained in respect of the effect of integrated nitrogen supply to rice crop on grain yield are shown in Table 1. As evident from results the grain yield of rice under 50% urea N + bio-fertilizer treatment plots (T_5) was significantly higher (43.58 qha^{-1}) as compared to control (T_1) (26.6 qha^{-1}), 50% N through urea treated plots (T_2) (31.7 qha^{-1}), 100% N through urea traded plot (T_3) (39.0 qha^{-1}) and *Azotobacter* + *azolla* treated plots (T_4) (34.5 qha^{-1}). Similar observations were also made by Mohammad Idris (2000).

Straw yield:

Data presented in Table 1 revealed that effect of different treatments of urea and bio-fertilizer on straw yield of rice were found in the order $T_5>T_3>T_4>T_2>T_1>$ and the value of straw yield were 83.21, 78.14, 74.16, 71.44 and 60.00 qha^{-1} under respective treatments. T_5 treatment recorded significantly higher yield over control. Similar observations were also made by Ponnamperuma (1984).

It is evident from the results obtained that the plant height, number of tillers, grain yield, and straw yield were maximum in plots received 50 per cent urea N and biofertilizers (*Azotobacter* and *Azolla*).

Conclusion:

Considering the economics of different nutrient management (NM) treatments, maximum growth was recorded in treatment T_5 (50% N through urea+ *Azotobacter*+ *Azolla*). This may be attributed to better manifestation of yield and yield attributes on account of application of organic and bio-fertilizer combination of biofertilizers and fertilizers resulting in better growth indices due to efficient utilization of nutrients by the test crop of paddy.

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