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EFFECT OF SEEDLING ROOT DIPPING OF AZOSPIRILLUM IN RICE

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Studies on the effect of root dipping of seedling with *Azospirillum* along with sub-optimal levels of N indicated that application of 75 kg N/ha along with root dipping of *Azospirillum* @ 1 kg of inoculant/ha recorded significantly higher grain yield and application of 50 kg N plus *Azospirillum* produced comparable grain yield in rice as compared to application of recommended level of 100 kg N/ha.

Azospirillum is a free living aerophilic microbacterium having greater ability to fix atmospheric N in submerged soils as compared to free living aerobic bacterial genera viz., Azotobacter. Under submergence, the rhizosphere of rice remains aerobic to micro aerophilic owing mainly to the downward transport of air through the rice plants (Yoshida and Broadbent, 1975). Recent studies clearly indicated that the *Azospirillum* spp. are closely associated with rice roots (Nayak and Rao, 1977 and Nayak *et al*, 1981). This relationship between Azospirillum and rice roots offers consistent increase in dry matter and grain yield of rice. The seedling root dipping has enriched the *Azospirillum* population in the rhizosphere of rice which in turn could have augmented the production of plant growth substance in addition to the nitrogen fixing activity. Moreover, the field experiments conducted at different locations of India have also indicated the positive response of rice to *Azospirillum* inoculation (Subba Rao *et al*., 1979 and Rajarammohan Rao *et al*., 1983).

MATERIALS AND METHODS

With the objective of studying the yield reponse of rice to *Azospirillum* inoculation along with sub-optimal dose of N, the field experiments were conducted during *Kharif* and *Rabi* seasons of 1985-86 in the soils of Agricultural College and Research Institute farm, Madurai. The soil is sandy loam in texture with low N, medium P_2O_5 and high K_2O. The *Azospirillum* inoculant with the bacterial load of 10^6 cells per g of inoculant (*Azospirillum lipoferum*) was obtained from the Department of Microbiology, Agricultural College and Research Institute, Madurai.

The ruling rice varieties viz., Co.37 and IR.20 were used as test varieties for *Kharif* and *Rabi* respectively. The treatments were replicated thrice in a randomised block design in plots of 27m² size. The following are the treatments.

T_1 — 100 kg N/ha alone
T_2 — 75 kg N/ha alone
T_3 — 50 kg N/ha alone

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T_4 — 76 kg N/ha + *Azospirillum*
T_5 — 50 kg N/ha + *Azospirillum*
T_6 — *Azospirillum* alone
T_7 — Control

Fifty kg each of P_2O_5 and K_2O/ha and half of N as per treatments were applied basally at the time of planting and the rest half was top dressed in two equal splits at 30th and 45th day after planting. No organic manure (FYM) was applied in the field. Dipping the root portion of 25 days old seedlings sufficient for one ha land was done in a water-slurry perparad with one kg of *Azospirillum* inoculant for 20 minutes just before transplanting.

At harvest, the biometric observations such as plant height, total number of tillers/hill, number of productive tillers/hill, number of filled grains/panicle, length of panicle, 1000 grain weight and yield of grain and straw were recorded.

RESULTS AND DISCUSSION

1. Growth characters

From the experimental results of both *Kharif* and *Rabi* seasons (Table.1) it was observed that the growth characters such as plant height and total number of tillers/hill were found maximum in the treatment which received 75 kg/N ha plus *Azospirillum* (T_4) and it was statistically on par with the treatment of N alone 100 kg/ha (T_1). There was no significant different in plant height and total tillers between the treatment with 50 kg N/ha plus *Azospirillum* (T_5) and the treatment of application of 75 kg N/ha alone (T_3). Root dipping of *Azospirillum* alone (T_6) had a significant influence in plant height and total number of tillers as compared to absolute control (T_7). This increase in plant height and total number of tillers might be due to synthesis and excretion of growth substances such as IAA and other auxins, vitamin B-12 etc., by *Azospirillum* (Tien *et al.*, 1979) and which in turn promoted lush vegetation of rice crop.

2. Yield components

From the results (Table 2) it was observed that among treatments the treatment with 75 kg N/ha along with *Azospirillum* (T_4) has shown more number of productive tillers more filled grains, higher panicle length and 1000 grain weight. The increase in yield components were statistically on par with treatment of application of N alone 100 kg N/ha (T_1) It was also noticed that the application of 50 kg N/ha plus *Azospirillum* (T_5) was par with the treatment T_4 in the production of yield components. The increase in yield components might have been influenced by atmospheric nitrogen fixed by *Azospirillum* (Subba Rao *et al.* 1979) was which made avilable to the crop throughout the crop period.

3. Grain and straw yield.

The two seasons grain and starw yield are griven in Table. 2. The treatment of 75 kg N/ha along with root dipping of *Azospirillum* (T_4) had significantly influenced the grain yield over the treatment of application of 100 kg N/ha alone (T_1). The grain yield obtained from the treatment of application of 50 kg N plus *Azospirillum* (T_5) was comparable and also statistically on par

Table 1. Effect of *Azospirillum* on Growth characters and yield components of rice

Treatments	Growth characters: Plant height (cm)		Growth characters: Total tillers/ hill		Yield components: Number of productive tillers/ panicle		Yield components: Length of panicle (cm)		Yield components: Filled grains/ panicle		Yield components: 1000 grain weight (g)	
	Kharif Co.37	Rabi IR.20	Kharif Co.37	Rabi IR.20	Kharif Co.37	Rabi IR.20	Kharif Co.37	Rabi IR.20	Kharif Co.37	Rabi IR.20	Kharif Co.37	Rabi IR.20
T_1—100 kg N/ha alone	89.7	94.7	12.27	10.13	9.40	8 00	20.83	22.13	102.87	100.53	20.60	19.40
T_2—75 kg N/ha	85.0	87.5	10.47	8.67	8.93	6.47	20.07	21.07	98.07	94.80	20.03	18.93
T_3 50 kg N/ha	79.3	82.9	9.47	6.67	8.07	5.33	19.40	20.07	89.33	19.93	19.93	18.40
T_4 75 kg N /ha + *Azospirillum*	87.2	94.4	13.20	10.87	11.47	8.07	21.20	22.33	108.60	101.33	20 95	19.47
T_5 50 kg N/ha + *Azospirillum*	82.5	86.2	10.60	7.73	8.60	6.80	20.67	21.33	101.53	96.80	20.37	18.73
T_6—*Azospirillum* alone	76.1	76.1	7.73	6.20	6.80	5.00	18.86	19.13	84.13	84.00	19.42	17.93
T_7—Control	69.1	68.1	6.53	5.40	5.73	4.20	18.07	18.40	73.80	76 93	19 06	16.73
SEO ±	2.55	2.73	0.59	0.42	0.52	0.62	0.78	0.77	3.73	2.00	0.31	0.41
CD (0.05)	5 56	5.95	1.30	0.91	1.13	1.36	1.70	1.67	8.13	4.38	0.68	0.89

Table. 2. Effect of *Azospirillum* on Grain and Straw yield

Treatments	Grain yield (kg/ha)			Straw yield (kg/ha)		
	Kharif Co.37	Rabi IR.20	Mean over two seasons	Kharif Co.37	Rabi IR.20	Mean over two seasons
T_1 — 100 kg N/ha alone	5926	4253	5090	8962	5538	7250
T_2 — 75 kg N/ha ,,	5979	393	4836	8567	5191	6879
T_3 — 50 kg N/ha ,,	5000	3802	4401	8246	4948	6597
T_4 — 75 kg N/ha + *Azospirillum*	6419	4531	5475	9112	5885	7499
T_5 — 50 kg N/ha + *Azospirillum*	5926	4064	4995	8642	5277	6960
T_6 — *Azospirillum* alone	4876	3281	4079	7259	4271	5765
T_7 — Control	4136	2999	3468	6270	3541	4906
$SE_D \pm$	139	107		210	179	
CD (0 05)	302	234		457	398	

with the application of recommended level of 100 kg N/ha (T_1). This is in confirmity with the results observed by Kumar and Balasubramanian (1986).

Regarding straw yield, treatment T_4 recorded maximum straw yield which was statistically on par with treatment T_1 (100 kg N/ha alone). This higher starw yield was only due to the increase in plant height and total number of tillers/hill by *Azospirillum.*

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