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EFFECT OF COMBINED USE OF UREA SUPERGRANULES, PHOSPHORUS AND AZOLLA ON GROWTH AND YIELD OF RICE

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ABSTRACT

An experiment involving three levels of N as USG (0,30 and 60 kg.ha^{-1}) two levels P (50 and 75 kg.ha^{-1} P_2O_5) and two levels of Azolla (o and 10 t.ha^{-1}) was conducted to study their effects on growth and yield of rice. Application of 60 kg ha^{-1} N recorded significantly higher grain and straw yield over 30 kg.ha^{-1}. The grain yield of rice was not influenced by P while straw yields showed significant variation due to levels ofP. The grain yield of rice was significantly increased with 10 t.ha^{-1} of Azolla (3560 kg.ha^{-1}) over no azolla (2954 kg.ha^{-1}). The grain yield obtained with 30 kg.ha^{-1} + 10 t.ha^{-1} of Azolla (3705 kg.ha^{-1}) was equal to yield obtained with 60 kg.ha^{-1} N (3709 kg.ha^{-1}).

KEY WORDS : Urea super granules, phosphorus, Azolla.

The recovery of applied N in transplanted rice is low and varied from 25 to 34 per cent (Prasad *et al.* 1982). Use of modified source and improved methods of urea application offer the possibility of increasing the N use efficiency. Use of urea supergranules (USG) is considered one of the ways of increasing the efficiency of fertilizer N. Recent international network on soil fertility and fertilizer evaluation for rice studies proved that placement of USG gave significantly higher yield increase than those derived from split application of urea (Craswell and Vlek 1982). The N fixing ability of the *Azolla anabaena* complex offers potential for increasing rice yield at comparatively low cost. Phosphorus is reported to be the most limiting nutrient for *Azolla* growth (Watanabe, *et al.* 1980; Subudhi and Watanabe, 1981). This study aims to know whether the combined use of *Azolla* with P and USG will result in better response in rice crop.

MATERIAL AND METHODS

A field experiment was conducted during the kharif-1986 to elucidate the information on combined use of USG, P and *Azolla*. Soil of the experimental site was sandy loam with pH of 6.8, organic carbon 0.61 per cent and available N 282 kg.ha^{-1}. The experimentwas laid out in a completely randomised block design with four replications.

Treatments consisted of the combinations of three levels of N as USG (0, 30 and 60 kg.ha^{-1} N), two levels of P (50 and 75 kg.ha^{-1} P_2O_5), and two levels of *Azolla* (0 and 10 t.ha^{-1}). *Azolla* was inoculated at the rate of 250 gm^{-2}, 20 days before trarsplanting, (DAT) and allowed to grow to form a complete mat and was incorporated into the soil just before transplanting. The P and K were applied at the rate of 50 kg.ha^{-1} each, to all the plots just before transplanting as basal dose. Additional P (25 kg.ha^{-1} P_2O_5) was applied to the plots that received 75 kg.ha^{-1} treatment at the time of *Azolla* inoculation to help better multiplication of *Azolla*. The USG were placed at about 8 to10 cm depth after 8 days of transplanting. The rice variety 'Rasi' (IET 1444) with a duration of 135 days was used in the experiment.

RESULTS AND DISCUSSION

The periodical dry matter accumulation (DMA) in rice varied significantly due to N application (Table 1). At 30 DAT, the DMA hill^{-1} was 2.60, 3.63 and 4.61 g at 0, 30 and 60 kg.ha^{-1}, respectively. At 60 DAT, the DMA was 8.42 g with no N compared to 11.06 g with 30 kg.ha^{-1} N and 14.46 g with 60 kg.ha^{-1} N. Instance of increased DMA due to deep placement of USG was also reported by Rambabu (1980).

Application of N as USG significantly influenced the number of panicles m^{-2} (Table 1). Higher number of panicles were with 60 kg.ha^{-1} N (385.8.m^{-2}) followed by 30 kg.ha^{-1} N (361.4.m^{-2}) and no nitrogen (284.3.m^{-2}). The increased number of panicles m^{-2} was mainly due to increased number of tillers hill^{-1}. The number of spikelets panicle^{-1} and filled grains panicle^{-1} were also influenced significantly by the application of N. Prased *et al.* (1982) reported significant increase in panicles metre^{-2} and grain number panicle^{-1} with deep placement of USG. Maximum number of spikelets (83.26) and filled grains (67.31) panicle^{-1} were with 30 kg.ha^{-1} N and they were on a par with those of 60 kg.ha^{-1} N. A slight but not significant reduction in spikelets and filled grains panicle^{-1} with 60 kg.ha^{-1} N might have been due to increased number of tillers. Application of 60 kg.ha^{-1} N recorded maximum grain weight per panicle (1.51 g) followed by 30 kg.ha^{-1} N (1.45 g) which were on a par with each other but significantly superior over no N (1.19 g).

The variations in grain and straw yields of rice were significant (Table 1) due to application of N. Maximum grain and straw yields were with 60 kg.ha^{-1} N (3337 and 3083 kg.ha^{-1}, respectively) and no N (2529 and 1982 kg.ha^{-1}, respectively). The increased yields of rice was mainly due to increased growth and yield components. The instanrces of yield increase due to deep placement of USG were also reported by Sen *et al.* (1985) and Singh *et al.* (1985). The harvest index values were significantly reduced by the application of N as a result of increased straw yields.

The variation in DMA hill^{-1} of rice due to levels of P were significant at all the stages except at harvest (Table 1). Application of 75 kg.ha^{-1} P_2O_5 produced significantly higher DMA (3.88 and 12.27 g at 30 and 60 DAT, respectively) over 50 kg.ha^{-1} P_2O_5 (3.35 and 10.36 at 30 and 60 DAT, respectively). The P application did not cause significant variation in the yield parameters of rice and as a result, grain yields (3149 and 3365 kg.ha^{-1} at 50 and 75 kg.ha^{-1}, P_2O_5 respectively) did not differ significantly due to P application. Studies conducted in the laterite sandy loam soils of Rice Research Station, Pattambi, over a period of 35 years also revealed no appreciable response to applied P (Nair and Pishrody, 1970). The low response to applied P may be due to increased availability of P under submerged conditions. Straw yields (2721 and 3131 kg.ha^{-1} at 50 and 75 kg.ha^{-1}, P_2O_5 respectively) showed significant variation due to levels of P (Table 1).

Application of *Azolla* (10 t.ha^{-1}) recorded significantly higher DMA hill^{-1} (12.6 g) as compared to no *Azolla* (10.03 g) only at 60 DAT (Table 1). The variations in yield parameter of rice due to application of Azolla were not significant except in grain weight panicle^{-1}. The grain yield of rice 2954 kg.ha^{-1} with no *Azolla* and 3560 kg.ha^{-1} with 10 t.ha^{-1} of *Azolla* were significantly different from each other. The straw yields of rice, (2606 kg.ha^{-1}) with no *Azolla* and (3246 kg.ha^{-1}) with 10 t.ha^{-1} of *Azolla* also differed significantly. Kannaiyan *et al.* (1983), Joy and Havanagi (1985) have reported instances of yield increase in rice due to *Azolla* appplication.

Apart from the main effects of N, P and *Azolla*, the combined effects were also found to influence yield of rice. The grain and straw yields obtained with 30 kg.ha^{-1} N + 10 t of *Azolla*.ha^{-1} (3705 and 3545 kg.ha^{-1}, respectively) were equal to yield obtained with 60 kg.ha^{-1} N alone (3709 and 3499 kg.ha^{-1}, respectively). Yields obtained with 10 t of *Azolla*.ha^{-1} (2876

and 2264 kg.ha^{-1}, respectively) were comparable to yields with 30 kg.ha^{-1} N alone (2870 and 2721 kg.ha^{-1} respectively). This indicates that application of *Azolla* at 10 t.ha^{-1} can supplement nearly 30 kg.ha^{-1} N or the yield with 10 t of *Azolla*. ha^{-1} was equivalent to yield with 30 kg.ha^{-1} N. Eventhough, P alone had no much beneficial effect on yield of rice, the beneficial effect was more pronounced when combined with Azolla. The grain yield obtained with 75 kg.ha^{-1} P_2O_5. ha^{-1} + 10 t of *Azolla*.ha^{-1} (3711 kg.ha^{-1}) was more by 8.8 per cent when compared to yield with 50 kg.ha^{-1} P_2O_5 + 10 t of *Azolla*.ha^{-1} (3410 kg.ha^{-1}), whereas yield obtained with 75 kg.ha^{-1} P_2O_5 + no *Azolla* (3019 kg.ha^{-1}) was more by only 4.49 per cent when compared to 50kg.ha^{-1} P_2O_5 + no Azolla (2889 kg.ha-1).

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Table 1. Effect of Nitrogen (As USG), Phosphorus and *Azolla* on yield parameters and yield of rice.

Treatment	Dry matter accumulation (g hill^{-1}) at			Number of panicles m^{-2}	Spikelets panicle^{-1}	Number of filled grains panicle^{-1}	Grain weight panicle^{-1} (g)	Grain yield (kg ha^{-1})	Straw yield (kg.ha^{-1})	Harvest index
	30 DAT	60 DAT	Harvest							
N0	2.60	8.42	13.56	284.3	72.16	57.15	1.19	2529	1982	56.06
N30	3.63	11.06	21.32	361.4	83.26	67.31	1.45	3337	3083	52.30
N60	4.61	14.46	20.79	385.5	80.70	65.08	1.51	3905	3714	51.36
CD (5%)	0.637	1.445	3.135	44.343	8.142	6.755	0.118	338.0	327	1.484
P50	3.35	10.36	18.24	341.6	79.59	64.49	1.35	3149	2721	54.20
P75	3.88	12.27	18.88	345.9	77.80	61.84	1.41	3365	3131	52.29
CD (5%)	0.520	1.180	NS	NS	NS	NS	NS	NS	267	1.212
A0	3.61	10.03	17.45	332.5	77.41	62.95	1.33	2954	2606	53.70
A1	3.62	12.60	19.69	335.0	80.02	63.41	1.43	3560	3246	52.78
CD (5%)	NS	1.180	NS	NS	NS	NS	0.096	276	267	-

A1 = 10t Azolla NS = Not Significant