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Effect of Management of Nitrogen Fertilisation on Rice Under Moderate Levels

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Two years data on grain yield revealed non-significant differences in the first year due to slow-release sources of N at a moderate dose of 50 kg N/ha for rice IR 20. In the second year however, IBDU was able to record the highest grain yield of 5040 kg/ha. The split application of N at 25 kg/ha at tillering and another 25 kg/ha at panicle initiation stage and pre-plant application of SCU at 50 kg N/ha gave similar grain yield during second year.

No significant difference in the panicle number per unit area, numberof filled spikelets, panicle weight and 1000 grain weight due to sources and time of application of N during first year.

Nitrogen management occupies a dominant place in the case of high yielding dwarf rice varieties. In order to increase the efficiency of applied nitrogen, the proper time of its application synchronising with the physiological growth stages of rice has been the subject of study in recent years. According to ten Have (1971) early nitrogen application promotes tillering, while late application does not increase tillering. The increase in grain yield is mainly by producing heavier panicles The heading time, plant height at harvest, 1000 grain weight and spikelet sterility mainly depend on the level of nitrogen and are not much affected by the time of application, unless high doses of nitrogen given at a late stage of growth. The late and high nitrogen application at panicle initiation, but especially at the booting stage, increase the protein content of the grain.

Adequate nitrogen during vegetative phase of growth encourage tillering, number of panicle / plant, increased filled grains and finally the yield (Thenababu, 1972; Verma, 1973; Anon., 1973; Modgal, 1974).

More recent nitrogen management practice is the use of slow release fertilisers, the solubility of which are by the use of coating material. The method increases the efficiency of nitrogen reducing the losses to a very great extent. The studies so far made although are meagre indicate the superiority of the same. However, their efficiency, with reference to the moderate levels of N as well as the application of N at different times, needs to be investigated in detail.

MATERIALS AND METHODS

With the object of finding out the

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efficiency of slow-release nitrogen fertilisers, as compared to straight fertilisers applied in splits trials were conducted during 1973 and 1974 *kharif* season at Tamil Nadu Agricultural University, Coimbatore. The trail was laid out with variety IR. 20, in randomised replicated block design. There were 15 treatments in the first year as per Table and one more treatment viz. 50 kg of Isobutylene diurea was added in 1974 season. The details of treatments are furnished in Table I.

RESULTS AND DISCUSSION

The data on the influence of treatments on yield components and yield are presented in Table II.

Yield components

Number of panicle : Regarding the time of application the same was found to affect significantly the productive panicle number. In the Ist year the highest number of panicle/m^2 was observed in T14 i.e. 50 kg/N/ha applied in three splits. This treatment was on par with T. 9, T. 8, T. 6, T. 4 and T. 13 In the IInd year the highest panicle number of 353 was found in T 10 i. e. nitrogen applied 1/2 N at tillering and 1/2 N at panicle initiation. It was

TABLE I. The details of the treatment

Treatment	Total N kg/ha	At planting	At tillering	At 7 days before panicle initiation	At panicle initiation
1	0	0	—	—	—
2	50	50	—	—	—
3	50	50*	—	—	—
4	50	50+	—	—	—
5	50	50@	—	—	—
6	50	25*	—	25	—
7	50	—	50	—	—
8	50	—	—	50	—
9	50	—	25	25	—
10	50	—	25	—	25
11	50	25	25	—	—
12	50	25	—	25	—
13	50	25	—	12.5	12.5
14	50	12.5	25	—	12.5
15	100	100	—	—	—
16	50	50o	—	—	—

* Sulphur coated urea (SCU)

+ Shellac coated urea (LCU)

@ Neem oil cake + urea

o Iso butylene diurea (IBDU)

TABLE II. Effect of Treatments on Yield Components and Yield

Treatment	No. of Matured panicles/sq. met. 1973	1974	Total No. of filled spikelets/panicle 1973	1974	Panicle weight in gm 1973	1974	1000 grain weight in gm 1973	1974	Grain kg/ha 1973	1974	Straw kg/ha 1973	1974
1	198	258	97.8	136.0	1.32	2.42	17.75	18.33	2302	3444	1712	1754
2	204	284	96.8	137.8	1.54	2.50	17.75	18.45	3254	4212	2698	2962
3	198	304	102.3	153.8	1.41	2.77	18.00	17.64	3277	4568	2426	3288
4	245	283	105.8	139.3	1.42	2.63	17.75	18.59	2762	4222	2585	2862
5	216	283	105.5	152.3	1.39	2.81	18.00	18.92	3197	4244	2710	2832
6	247	328	107.0	153.0	1.31	2.75	17.25	18.73	3141	4310	2732	3020
7	232	326	99.3	144.8	1.37	2.60	18.00	19.16	3141	4212	2880	3202
8	239	305	106.5	138.0	1.41	2.54	17.75	18.66	3016	4274	2143	2492
9	248	292	111.5	130.5	1.60	2.38	18.00	18.35	3197	4334	2834	2550
10	217	353	112.0	136.8	1.44	2.61	17.75	18.80	3481	4520	3141	2980
11	199	244	94.8	131.0	1.55	2.46	17.75	19.21	2971	4364	2415	2446
12	170	315	108.0	132.3	1.43	2.54	18.00	19.41	2982	4050	2891	2546
13	229	279	103.8	138.5	1.45	2.72	18.00	19.20	3220	4098	2540	2402
14	278	293	105.3	148.3	1.35	2.74	17.25	19.23	3073	4214	2528	2608
15	220	327	108.5	149.5	1.65	2.58	17.75	19.13	3447	4956	3425	3784
16	—	282	—	149.5	—	2.79	—	18.68	—	5040	—	2754
S.E.	18	17	5.8	7.7	0.08	0.11	0.43	0.49	167	164	361	334
C.D.	51	47	16.6	21.9	0.22	0.31	N.S.	N.S.	475	466	1020	950

on par with single application at tillering (T7), and two split applications at planting seven days before panicle initiation. These results indicate that the panicles can be increased by proper fertiliser management especially under moderate levels. This could be achieved to a certain extent by late application of fertilisers at tillering or at panicle initiation stage. The amount of N absorbed by plant at different stages also plays an important role. Wada (1968) found that the number of panicles and primary rachis branches per unit area was mainly affected by the amount of N absorbed at the neck-node differentiation stage.

Regarding the differences between straight and slow fertilisers, the same was not found to be significant. The purpose of split application is to make the nutrient available at the proper time in sufficient quantity. The same principle is achieved by the slow release fertilisers which makes the nutrients available slowly and the nutrient is available at important stages. This may be the reason for the non significant difference between these two in the present study. Among the slow release fertilisers also, there was very little difference as far as panicle production was concerned.

Total number of filled spikelets per panicle : In the I year in T10 recorded the highest number of spikelets of 112 which was better than single application.

In the II year although the slow release fertiliser viz. T3,T4,T5,T6, and T16 recorded higher spikelets/panicle it was on par with the other split application. This indicated that both split application of nitrogen as well as the use of slow release fertilisers are equally effective.

The general non significant results between slow and straight fertilisers indicated that both are equally effective in increasing the number of spikelets/panicle. Regarding the split application, although the results were not significant, the results are in favour of split application existing upto seven days before panicle initiation and at panicle initiation.

Panicle weight : In the Ist year the highest panicle weight was seen in T15 i. e. 100 kg N/ha. However, it was on par with 50 kg N applied in 2 splits i. e. at T9, T11 and T13.

In the IInd year T_5 i. e. Neem cake coated urea recorded maximum panicle weight of 2 81 gms. However there was no difference within the various slow release fertilizer. Further the panicle weight recorded in T_{10} viz. 2.61gms was also on par with that of slow release fertiliser. Earlier results by several authors (Place *et al.*, 1970; Pillai *et al.*, 1972) had indicated the beneficial effect of split application of N especially at panicle initiation stage in increasing the panicle weight. The results of the present study also confirm the same.

1000 grain weight : None of the treatments had any significant influence on the weight of thousand grains.

Grain yield : In the first year, the highest yield of 3481 kg/ha of grain

was obtained in T10. (Nitrogen applied in two splits at tillering and panicle initiation). It was on par with single application of N either at planting or at tillering.

This indicated that medium dose of nitrogen as basal can be used efficiently by the crop. If the basal N exceeds 50 kg N/ha, the extra N applied may not be useful for crop growth and yield. The extra nitrogen applied would have been leached out and incorporated in the deeper layers which may not be utilised by the standing rice crop

Slow-release fertilisers in clayey soil has no advantage over ordinary urea.

The economics of 50 kg N/ha a medium level is also seen in comparison with 100kg N/ha as basal.

During the second year : Among the treatments the time of application with ordinary urea, it was seen that T_{10} was ranking first and it was on par with all the treatments applied either single or split application. This evidently supports the superiority of T10 as in case of first season.

Among the slow-release Nitrogen fertilisers, the additional treatment IBDU 50 kg N/ha ranked first, and it was also superior to ordinary urea and other slow release fertiliser with equal dose of N.

Urea at 100 kg N/ha was on par with IBDU (50 kg N/ha) and was on par with T10 and T2. This clearly indicates that in the second season, unlike in the first season has fared well probably due to the favourable climatic condition the added fertiliser nitrogen was well utilised by the crop during the crop growth.

In comparing the I and II years it is seen that among the ordinary urea a total 50 kg N/ha the treatment 10 (50 kg N/ha applied in equal two splits at tillering and panicle initiation) has favoured the crop with higher grain yield and ranked first. This was also on par with 50kg N/ha as basal. This is in agreement with findings of IRRI Philippines (Anon., 1973). With regard to slow-release nitrogen fertilisers SCU, shellac coated urea, neem cake plus ordinary urea are similar in efficacy as ordinary urea. This is in confirmity with the findirgs of Subbiah and Morachan (1974). In case of IBDU the efficacy of fertiliser is well seen in the clayey soil. It is also stated that IBDU is more suited to clayey soil whereas SCU, shellac coated urea and neem cake plus ordinary urea are not comparable to it. The findings of Japanese worker support this view (Hamamota, 1966).

Under medium fertility of soil a moderate level of 50 kg N/ha when applied in two splits viz., at tillering and panicle initiation stage will be able to record economic yield.

Straw yield

In both the seasons, the yield was significantly increased by the nitrogen fertilisation. There was linear response for N application in respect of straw yield. As the N generally promotes the

vegetative growth, there is increased straw yield with increased N dose. Many investigators showed positive influence of N on straw yield (Krishnamaraju and Rao, 1969; and Sadayappan 1972). The results of the present study is also in agreement with their findings.

Within the N management practices it could be seen that the T10 recorded the maximum straw yield of 3141 kg/ha in the Ist year. While in the IInd year T3 recorded 3288 kg/ha. However, there was not much of difference between the various split applications as well as the forms of nitrogen.

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