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EFFECTIVE MANAGEMENT OF NITROGEN FOR INCREASED PRODUCTIVITY IN RICE

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ABSTRACT

Effect of split application of N at different physiological stages was studied. Total dose of 100 Kg. of N was supplied to the rice crop IR60 adopting four treatments bnesides the normal treatment i.e., 50:25:25. Sufficient N supplied from the panicle initiation onwards favoured for better source activity and sink capacity. Improvement in panicle Number, spikelet Number, filled spikelet due to the appropriate treatment favoured for the concomitent increase in the grain yield and harvest index.

Rice is very responsive to nitrogen fertilization and the high yield potential of modern varieties cannot be realised without adequate N supply to the plant during the entire growing season. Among the fertilizer nutrients essential to plants, nitrogen levels are the most important limitations in rice soils. Nitrogen fertilizers, therefore, are widely applied to increase yield markedly. Improper application of N fertilizer in wetland rice soils can lead to considerable losses of N. The recovery of fertilizer nitrogen is thus generally low, usually 30 - 40 per cent of the amount applied as basal dressing and 50 - 60 percent when top dressed near pinicle initiation (Mamaril and Villapando, 1984).

Rice plant requires nitrogen at early and mid-tillering to maximise panicle number. Plants also need N at reproductrive and ripening stage to produce optimum spikelets per panicle and percentage of filled spikelets (De Datta, 1986). The timing of fertilizer application varies substantially. Many rice farmers apply N in three split doses - the first dose just before transplanting, the second dose at maximum tillering and the final dose at or just before panicle initiation. Split application seeks to maintain a pool of labile N which liminising the risks or massive losses through ammonia volatalisation, denitrification and leaching.

MATERIALS AND METHODS :

In order to study the time of application and the efficient utilization of nitrogen by the rice crop, field experiment was conducted at Paddy Breeding Station, TNAU, Coimbatore during summer 1987. Variety IR 60 with a duration of 105 days was selected for this study.

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Recommended dose of N,P and K at 100:50:50 Kg ha -1 was adopted wherein 100 Kg of N was supplied in the form of Urea with split doses through out the growth stages. Accordingly the treatments were fixed as detailed below :

T_0 = 50:25:25

T_1 = 25:25:25:25

T_2 = 25:20:20:20:15

T_3 = 25:15:15:15:15:15

T_4 = 25:7:3:7:12:23:23

Stage, age and the dose of N applied are presented in table 1. Experiment was carried out in rendomised block design, replicated four times. Normal cultural practices were adopted and the observations on yield and yield components were made at the time of harvest.

RESULTS AND DISCUSSIONS:

To get a higher yield, it is essential to understand the use of nitrogen the most important of the major elements. For soils with low nitrogen holding capacity, split application of fertilizer should result in a higher niotrogen recovery and hence, a higher yield than a basal application (Yoshida,1981).

The present study was also aimed at to investigate the effect of different levels of split doses of nitrogen on yield and yield components.

A close observation on yield and yield components clearly exhibits the advantage of split application of Nitrogen over the normal practice (50:25:25). Pinicle number was higher (660) both in the cas4e of T_1 (25:25:25:25) and T_4 (25:7:3:7:12:23:23). Whereas the T0 (50:25:25) recorded the minimum value. A similar trend was observed with reference to spikelet number also. Yoshida et.al. (1972) concluded that the grain yield in IR 8 was increased linearly with increase in spikelet number. Application of Nitrogen at about 20 days before heading had a high productive efficienty when the level is moderate or low. This period coincides with the active growth of young panicles before heading. Yoshida (1981) attributed, the absorbed nitrogen at this time is efficiently used to increase spikelet number. Singh and Takahashi (1962) opined top dressing at 20 days before heading not only gives the maximum panicle weight but also increases lodging resistance by affecting the length and diameter of internode, dry matter accumulation in basal portions and the breaking strength of the shoot.

There were two peaks in the rate of N uptake one at the maximum tillering stage and another at panicle development. This was investigated at cuttack and they concluded that the N requiements of the rice plant are high at maximum tillering stage and again at the ear development stage. This fact is very well in accordance with the treatment T_1 wherein it has received the equal dose of 25 Kg/ha during maximum tillering, pod initiation and pod development stages.

Besides other environmental factors, the level of fertilizer application especially the N affects filled spikelet or the

TABLE 1. Details of N application at different growth stages and age of the rice crop (IR 60). Duration - 105 days

Treatment (N levels)	Days after sowing							
	21	35	50	55	60	65	75	80
T_0	50	25	25	—	—	—	—	—
T_1	25	25	25	—	—	25	—	—
T_2	25	20	20	—	—	20	15	—
T_3	25	15	15	—	—	15	15	15
T_4	25	7	3	7	12	23	—	23

35th day : Tillering 50th day : Panicle Initation
65th day : Panicle development 75-80 day : Heading

sterility percentage. Since all the treatments have received a moderate splitted dose of N at growth stages they have registered the appreciable values of filled grain percentage ranging from 70.90 to 75.03. Here again the treatments T1 and T4 favoured for a slight improvement in filled grain percentage. He also attributed that lodging reduces the cross sectional areas of vascular bundle and disturbs the movement of assimilates the absorped nutrients via the roots which also disturbs the leaf display and increases shading. There were no variations with reference to 1000 grain weight due to the treatmental differences.

Maximum grain yield was recorded for the treatment T_1 (529 g/m2) which showed 16.8 per cent increase over the normal practice (50:25:25). Next to this the treatment T_4 recorded the value of 497 g/m2. The treatments T_2 and T_3 registered very close values of T_0. This may be attributable that the improvement made in yield components viz., panicle number spikelet number and filled grain percentage might have contributed for the better grain yield.

Izhizuka (1973) observed heavy application of N at later stage produce a decrease in the amount of budding of spores on the stigma. It was found that under similar condition the amount of germinated pollen on the stigma was reduced, this being attributed to the increased occurence of incomplete dehishing of the anther and the abnormal behaviour of filaments at the time of flowering.

Matsushima (1969) suggested, the lower dose of N application at panicle development stage will minimize the lodging and decrease culm weight, the length of three upper leaves will also be reduced and the leaf blades will be erect and thick. He also opined that the application of N during the period after heading by top dressing with N just after the stage of reduction division of meiosis will increase the percentage of ripened grains. The present investigation clearly endors the above view wherein

TABLE 2. Effect of split application of 'N' fertilizer during different growth stages on yield omponents

Treatment	Panile No./m^2	SpikeletNo./m^2	Filled grain percentage	1000 grain weight (g)	Grain yield/m^2(g)	TDMA/m^2 (g)	HI %
T_0	528	33,168	70.90	1.784	453.0	1344.5	34
T_1	660	33,990	75.03	1.860	529.0	1465.0	36
T_2	594	33,336	71.49	1.811	475.0	1202.8	39
T_3	554	33,462	71.36	1.811	458.0	1220.8	37
T_4	660	33,696	72.42	1.816	497.0	1436.8	35
CD at 5%	38.0	105.5	1.3	0.033	21.0	98.8	0.96

the treatment T_4 the crop has received 7 Kg. at 55th Day, 12 Kg on 60th day and 2 doses of 23 Kgs. each on 65th and 80th day. Total drymatter accumulation due to different treatments also established a similar trend. Maximum value of 1465 g/m2 was registered for the treatment T_0 was the maximum (1:2.97) which has received the basic dose of 50 Kg of N/ha. This implies luxury consumption of N at early growth stages was used to produce more straw than grain and N absorbed at later growth stage was effectively utilized for the better grain production (Yoshida, 1981). Moreover the N absorbed during the after heading enhances the leaf area duration and the concomitent increase in photosynthetic efficiency.

Relevent concluion can be drawn from this study that split application of N fertilizer especially from panicle initiation stage onwards favours for better source activity and sink capacity. Even within different treatments, the statge and dose indicated for T_1 and T_4 established its supremacy for yield improvement.

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RESEARCH NOTES

A SIMPLE METHOD FOR ESTIMATING LEAF AREA IN TOMATO

The measurement of leaf area is one of the important method of assessing the crop growth and productivity. Several methods for the estimation of leaf area have been described (Marshall, 1968; Wiersma and Bailey, 1975). Among these methods, non-destructive method is simple, inexpensive and accurate (Yeboah et.at., 1983). However such method of measuring leaf area in tomato is lacking. So the primary objective of this study is to find out the leaf area in tomato by non-destructive method.

Hundred leaves from the bottom to the tip of the plants were removed at flowering stage in tomato CV. PKM-1. The maximum length (L) and breadth (B) of the individual leaf was measured. While measuring the leaf breadth, the breadth of two sides of the leaves (both left and right) were taken into consideration and the total was taken as leaf breadth. Their corresponding leaf area was accurately measured in L1-COR 3100 comrade belt leaf area meter. The area was predicted by using the formula $A = K (L \times B)$, where A = Leaf area per leaf K = Leaf area constant. L and B are the maximum length and width respectively (Balakrishnan et.at., 1987). The data were subjected to correlation coefficient (Snedecor and Cochran, 1967).

Data on mean performances of linear measurements were presented (Table 1). A highly positive and significant correlation (r - 0.9547**) between actual and predicted leaf area. The overall mean leaf area constant (K) was found to be 0.294. This constant was used for