Weed index (WI)

The WI indicates the level of competition between crop and uncontrolled weed for inputs. The lowest WI of 2.9, 1.8 and 2.2 per cent was recorded in PI of metolachlor in Co 4, NARP 1 and Co GG 89047 respectively followed by HW which recorded 3.9, 3.9 and -1.1 per cent in the above cultivars. The highest WI of 44.1, 45.3 and 43.1 per cent was recorded in C in the above cultivars (Table 3). Among the cultivars, Co GG 89047 was superior than NARP 1 and Co 4.

Grain yield (GY)

Herbicide application significantly increased the GY over the unweeded control and the metolachlor followed by fluchloralin could considerably reduce the weed population, dry weight, and thereby increased the WCE and resulted in higher grain yield (Table 3) as reported by Singh *et al.*, (1988) in green gram. Hence to maintain the yield potentiality of crop, either PI of PE application of herbicide followed by one hand weeding at flowering stage will be more economical.

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EFFECT OF TIME OF NITROGEN APPLICATION ON GROWTH, YIELD AND ECONOMICS OF IRRIGATED RICE

K. RAMAMOORTHY, V.V. KRISHNAMURTHI and A. BALASUBRAMANIAN

Agricultural Research Station
Tamil Nadu Agricultural University
Bhavanisagar 638 451.

ABSTRACT

Field experiments were conducted at the Agricultural Research Station, Bhavanisagar during *kharif* seasons of 1994 and 1995 on transplanted rice to study the effect of doses and timing of N application. Increasing rate of N application upto 200 kg N/ha significantly increased the grain yield mainly dur to improvement in yield attributes like productive tillers and filled grains per panicle. N applied in 5 splits at 7 DAT, active tillering, panicle initiation heading and floweing stages along with *Sesbania rostrata* incorporation produced maximum grain yield and economics.

KEY WORDS : Transplanted rice, N fertilizer, split application, *Sesbania rostrata*, grain yield.

There are two reasons for not getting expected yield levels after application of fertilizer N to rice. Either, the recovery of fertilizer N is poor or the efficiency at which N once taken up, is used for grain production is low (Dash *et al.*, 1993) Nitrogen is an important growth limiting factor for rice. De Datta and Patrick (1986) reported that recovery of fertilizer N applied at different growth stages may vary widely. It is, therefore, important to develop a good understanding of the processes of N transformations in soil and plant. The cost of N during the past decades in India has increased four fold. Rice farmers with small land holdings are, therefore, more and more burdened with the high cost of chemical fertilizer. Hence, locally available alternative N sources need to be explored for use in lowland rice. In this context, green manure may offer a good and cheap alternative to inorganic fertilizer. Field experiments were undertaken to study the use of *Sesbania rostrata* as a N source for growth and yield of irrigated lowland rice.

MATERIALS AND METHODS

The experiments were conducted at the Agricultural Research Station, Bhavanisagar during *kharif* seasons of 1994 and 1995 in an alfisol soil with pH 7.2, organic carbon 0.33% and 218, 9.3 and 259 kg/ha of available N, P_2O_5 and K_2O respectively, to study the efficiency of split application of different doses of N with and without green manure substitution at various growth stages and control in a randomised block design with four replications (Table 1). The inorganic source of N in the form of urea was broadcast asper the treatment schedule. A uniform dose of 60 kg each of P_2O_5 and K_2O was applied as basal at the time of transplanting to all the plots. The organic source of N in the form of *Sesbania rostrata* incorporation @ 6.25 t/ha was done 7 days before transplanting (equivalent to 50 kg N/ha). Young plants of *S. rostrata* were cut and sun dried for 54 per cent moisture level, spread over the soil surface 15 days before transplanting and then incorporated. Rice variety IR.64 was planted with a spacing of 15 x 10 cm. The data on growth and yield parameters showing similar trends during both the seasons were pooled. Economics was also worked out for different treatments.

RESULTS AND DISCUSSION

Growth and yield components

The plant height was not significantly influenced by timing of N application. More pronounced tillering was noticed under T_7 and it might be dueto incorporation of *S. rostrata* which helps the crop the putforth profused tillering. Similar results were obtained by Rao *et al.*, (1993).

Yield atrributes studied except panicle length were significantly altered by timing of N application. More number of productive tillers and filled grains recorded under T_7 treatment (Table 1) might be due to timely application of N at heading stage which is the ultimate reason for increased

Table 1. Growth and yield components of rice var. IR 64 as affected by timing of nitrogen application (Mean of 2 years)

Treatment	Growth characters		Yield components			
	Plant height (cm)	Total tillers/hill	Productive tillers/hill	Filled grains/panicle	Panicle length (cm)	Test weight (g)
T_1 Control (without N)	80.7	10.6	8.5	52.6	18.8	22.37
T_2 200 kg N/ha (as inorganic) applied 50 kg N/ha each at basal, AT, PI and FL	79.0	15.4	12.8	73.9	19.2	23.27
T_3 150 kg N/ha applied 50 kg N/ha each at AT, PI and FL	82.7	13.9	12.1	64.9	19.0	22.83
T_4 150 kg N/ha applied 50 kg N/ha each at Basal, PI and FL	82.1	12.6	10.6	64.2	19.2	22.98
T_5 150 kg N/ha applied 50 kg N/ha each at Basal, AT and FL	81.2	14.2	12.1	63.6	18.2	22.71
T_6 150 kg N/ha applied 50 kg N/ha each at Basal, AT and PI	78.1	12.3	10.2	56.3	18.8	22.46
T_8 200 kg N/ha (organic - inorganic) applied (50 kg N/ha as *S. rostrata* incorporation @6.25 t/ha + 150 kg N/ha applied in 5 splits (25, 50, 25, 25 and 25 kg N/ha at 7 DAT, AT, PI, H and FL)	82.8	16.5	14.8	79.4	20.9	23.67
CD (P=0.05)	NS	2.1	1.9	6.2	NS	0.47

AT : Active tillering : PI : Panicle initiation : H : Heading ; FL : Flowering DAT : Days after transplanting

Table 2. Yield and economics of rice as affected by timing of 'N' application (Mean of 2 Years)

Treatments	Grain yield (kg/ha)			Straw yield (kg/ha)			Mean economics	
	1994	1995	Mean	1994	1995	Mean	Net return Rs./ha.	B/C ratio
T_1	5320	5947	5634	9257	9787	9522	16,856	2.66
T_2	7847	8914	8381	10135	11436	10786	26,568	3.46
T_3	7714	8229	7972	10695	10053	10374	25,138	3.38
T_4	7305	6367	6836	8938	8245	8592	19,681	2.85
T_5	7581	8558	8070	8618	9733	9176	24,440	3.29
T_6	5983	7739	6861	10694	9894	10294	21,176	3.00
T_7	7980	9457	8719	11651	12287	11969	28,777	3.69
CD (P=0.05)	1276	1266	-	NS	1059	-	-	-

growth and yield components, besides *S. rostrata* incorporation helped to release N slowly for better growth of rice plants. This was in confirmity with the earlier findings of Dascalsota *et al.*, (1986). In all the parameters, the control treatment (without 'N' application) registered the lowest values.

Yield and economics

Highest yields (Table 2) were obtained when N was applied in 5 splits along with *S. rostrata* incorporation @ 6.25 t/ha. Higher yield under 5 splits is due to increased number of productive tillers and number of grain per panicle and testweight as the result of increased availability of N in all the growth stages as a result of reduced leaching loss in the alfisol. Besides, mineralisation of green manure ensures a continuous supply of NH_4+_N which is preferred and readilyabsorbed by rice plants resulting in better growth and improved the yield attributes and yields. Skipping a basal application or an application of N at 25 kg/ha in between panicle initiation and flowering (heading) resulted in higher yield of grain (8719 kg/ha) and straw (11,969 kg/ha). Increased yield under application of N at heading and flowering is mainly due to increased number of grains per panicle and test weight as the result of increased availability of nutrients at spikelet development stage. Delay in nitrogen application at the time of active tillering (T_4) resulted in reduced grain and straw yield by reducing yield attributes. This was in line with the results of Yoshida (1981). Higher net return and return per rupee invested were obtained under T^7 treatment. This was followed by T_2. The lowest economic values were recorded under control (without N application).

In conclusion, application of 200 kg N/ha both in the form of organic (*Sesbania rostrata*) incorporation as 50 kg N/ha) and inorganic (150 kg N/ha in 5 splits at 7 DAT, active tillering, panicle initiation, heading and flowering stages) registered higher grain and straw yields with increased net return in lowland transplanted rice.

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