cropping because of reduced panicle weight and grain weight/panicle, caused by poor grain filling. This may have been due to overcrowding and mutual shading of plants during the 40 d from transplanting to panicle initiation.

Grain yield was highest (5.8 t/ha) in dual azolla cropping without fertilizer N, followed by that with 50 kg N/ha (Table 2). Results indicated that only a small amount of added N is needed to obtain higher grain yield, and a poorly timed excessive N supply may adversely affect the grain yield where soils have good N and P status. Applying P did not significantly affect grain yield.☐

Table 2. Effect of N and azolla interaction on rice grain yield, Bangalore, India.

N level (kg/ha)	Rice grain yield (t/ha)		
	No azolla	Intercropping	Dual cropping
0	4.9	5.8	5.1
50	5.5	5.0	4.7
100	5.0	4.8	4.2
CD P: 0.05	0.6[a]	0.7[b]	

[a]Between 2 azolla means at the same level of N. [b]Between 2 N means at the same or different levels of azolla.

Effect of N sources and levels on deep water rice

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We studied the effect of N source and level on deep water rice yield at Thot Not in 1983 wet season. Soil was a Sulfaquept with pH 4.5,0.178% N, 0.067% P_2O_5, 0.067% SO_4^{--}, 2.88 meq Al^{3+}/100 g, and 0.56 meq H^+/l00 g. Water depth reached 120 cm in mid-Oct.

The experiment was in a split-plot design with 18-m^2 subplots and 3 replications. Thirty-five-day-old Nang Tay Dum (local floating variety) and RD19 (modern variety) were transplanted at 25- × 30-cm spacing in the main plots. Prilled urea (PU), sulfur-coated urea (SCU), or urea supergranules (USG) were applied at 14.5, 29, or 43.5 kg N/ha and compared to a no-N control. Basal P at 18 kg/ha was applied to all plots.

PU and SCU were broadcast and incorporated 10 d after transplanting (DT) and USG was placed 10 cm deep between 4 hills at 7 DT.

Yield increased with increased N application (see table). At 43.5 kg N/ha, USG performed better than SCU or PU. At 14.5 kg N/ha, yields were similar for all N sources. SCU generally performed poorly because of the acid sulfate soil.

Varietal performance and interaction between varieties and N management did not significantly differ. Although RD19 has improved plant type, a high percentage of unfilled grains, few grains/panicle, and gall midge damage caused it to yield the same as Nang Tay Dum. Drought at early growth reduced yield of both varieties. ☐

Yield of Nang Tay Dum and RD19 at different N sources[a] and levels, Hau Giang, Vietnam, 1983.

Variety	Yield (t/ha)										
	0 N	14.5 kg N/ha			29 kg N/ha			43.5 kg N/ha			Mean
		PU	SCU	USG	PU	SCU	USG	PU	SCU	USG	
RD19	1.2	1.2	1.1	1.3	1.4	1.3	1.7	1.5	1.6	1.9	1.4
Nang Tay Dum	1.0	1.1	1.2	1.3	1.3	1.4	1.7	1.7	1.6	2.1	1.4

Varieties : ns — CV (%) 21.96
Nitrogen : LSD 5%: 0.23 — CV (%) 13.88
Variety × nitrogen : ns — CV (%) 13.88

[a]PU = prilled urea, SCU = sulfur-coated urea, USG = urea supergranules.

N release from sesbania green manure and effect of time of application of N fertilizer on lowland rice

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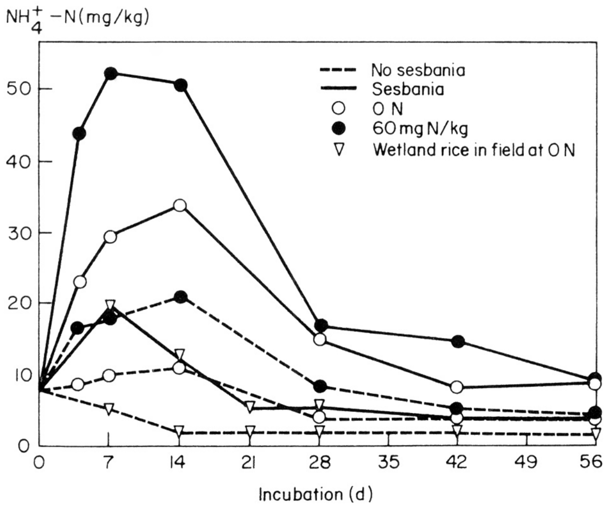
Interest is increasing in the use of organic and green manures for rice culture. At the PAU farm, we showed that N release from sesbania (*Sesbania aculeata*) incorporated in irrigated rice depended on the number of days it was buried before transplanting. Incorporation 1 d before transplanting released 60-120 kg N/ha,



1. Effect of sesbania on KCl-extractable NH_4^+ –N in a flooded soil under laboratory and field conditions, Ludhiana, India.

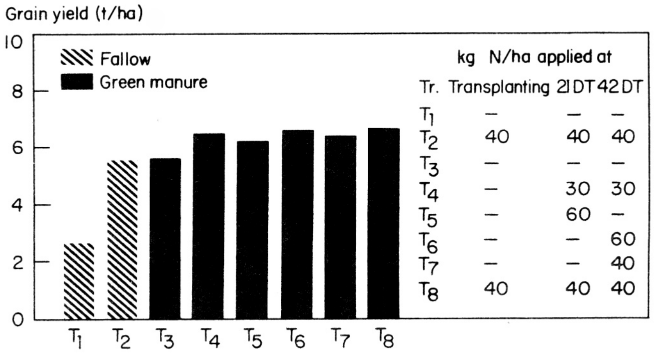
depending upon the amount incorporated in the soil. We studied N release from sesbania green manure and its effect on timing fertilizer N application.

Soil of the experiment was loamy sand (Typic Ustochrept) with 5 mm percolation/h. It had pH 8.4, EC 0.15 mmho/cm, 0.34% organic carbon, 0.06% N, and 8 μg/g KCl-extractable NH_4^+-N. Finely chopped 2-mo-old fresh sesbania was mixed 20% by volume with soil with and without fertilizer N. The soil samples were submerged and incubated at 30 ± 1°C. Three samples from each treatment were taken at 4, 7, 14, 28, 42, and 56 d of incubation and extracted with 2 N KCl to determine NH_4^+-N content (Fig. 1).

In a field experiment, 2-mo-old sesbania, equivalent to 22 t green matter/ha and 120 kg N/ha, was incorporated 1 d before transplanting rice on 10 Jul 1984. All but the no-green-manure plots received the same amount of sesbania. At last puddling, 26-30 kg PK/ha was applied to all plots. Urea N at 40-120 kg/ha was applied in different combinations at transplanting or 21 or 42 d after transplanting (DT). The crop was harvested at maturity and grain yield was determined at 14% moisture content.

The kinetics of KCl-extractable NH_4^+-N indicated that sesbania began releasing N soon after incorporation. At 4 d of incubation, 44 and 23 mg NH_4^+-N/kg was received in soil with sesbania, with and without applied N. Peak NH_4^+-N was within 7 to 14 d of sesbania incorporation and release remained steady through 56 d.

Data indicated that incorporating sesbania alone gave yield as high as applying 120 kg N/ha as urea (Fig. 2). Furthermore, with sesbania, applying 40-60 kg fertilizer N/ha at 42 DT gave yields at par with treatments where N was applied at transplanting or 21 DT. Sesbania-N was sufficient for rice at early growth stages. Topdressing 40 kg N/ha at 42 DT was necessary in lowland rice with incorporated sesbania. □



2. Effect of sesbania green manure on time of N application in rice, Ludhiana, India.

Effect of seeding rate and N levels on yield of direct-seeded rice

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We evaluated IR21717-42-1 performance at different seeding rates and N levels on a Ustifluvent soil with pH 5.7 at Chau Thanh District, An Giang Province. N was applied at 40, 70, 100, or 130 kg/ha in main plots and seeding rates were 200, 250, 300, 350, or 400 kg seed/ha in subplots. The experiment was in three replications. After land preparation, excess water was drained away and 13 kg P/ha as superphosphate was broadcast. Pregerminated seed was broadcast on uniformly puddled soil on 15 May 1983. N was applied, one-half at 20 d after sowing (DS) and in equal splits at 30 and 45 DS. Rice was harvested 18 Aug and yield was estimated from an 18-m^2 area.

Interaction between seeding rate and N level was significant. It was not possible to increase yield by increasing seeding rate beyond 200 kg/ha (see table). Data indicate that seeding rate might be reduced below 200 kg/ha without affecting yield. □

Grain yield as influenced by seed rate and N level, An Giang Province, Vietnam.

Seeding rate (kg/ha)	Grain yield (t/ha) 40 kg N/ha	70 kg N/ha	100 kg N/ha	130 kg N/ha	Mean
200	3.9	4.7	4.8	5.0	4.6
250	3.9	4.7	4.7	5.0	4.6
300	4.0	4.4	4.8	4.7	4.5
350	4.0	4.3	4.5	4.2	4.4
400	3.8	4.3	4.3	4.1	4.1
Mean	3.9	4.5	4.6	4.6	

	CD at 5%	CV (%)
Main effects		
Seed rate (S)	0.2	6.7
N level (N)	0.4	10.0
Interaction effects		
Seed rate at a constant N level	0.3	
N at a constant S level	0.5	

Comparison of chemical indices for available K for rice in alluvial soils of Punjab

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We compared different soil tests for available K in 20 soils and their relationship to rice yield and K uptake in the greenhouse. Soils had pH 8.7 ± 0.4, electrical conductivity 0.52 ± 0.26 mmho/cm, 0.44 ± 0.18% organic C, 57.4 ± 17.6 ppm $KMnO_4$-N, and 2.2 ± 1.1 ppm Olsen-P. Five 20-d-old PR106 seedlings grown in a K deficient solution were transplanted into pots each with 4.5 kg soil.

Treatments were 0 and 21 ppm K as KCl. A basal dose of 50 ppm N and 11 ppm P was applied to all pots and 50 ppm