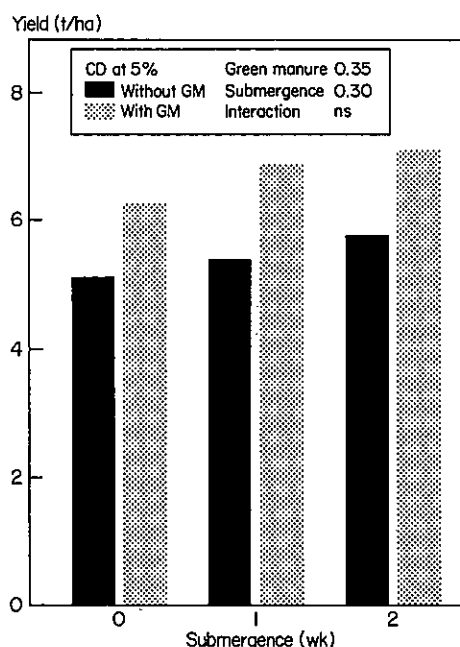


Soil and Crop Management

Effect of pretransplanting submergence and green manure on yield and sodic soil improvement

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A field experiment in split-plot design evaluated the effect of 0, 1, and 2 wk field submergence before transplanting with and without green manure on yield and sodic soil improvement. The experiment was replicated three times.



Response of rice to pretransplanting submergence with and without *Sesbania* green manure. CSSRI, Karnal, India.

The highly sodic soil of the test plots had pH 10.25, exchangeable sodium percentage (ESP) of 86, 0.48 meq of exchangeable Ca + Mg/100 g soil, 0.21% organic C, 2.85% CaCO₃, 10.8 meq CEC/100 g soil, and 20 t gypsum requirement/ha.

Gypsum was applied at 10 t/ha in all 40-m² plots and water was ponded for 1 wk before sowing *Sesbania aculeata* (10 May 1985). The green manure crop was irrigated as required. Plots without a green manure crop were irrigated at the same time.

Sesbania was incorporated at 50 d and plots were submerged 0, 1, and 2 wk before transplanting Jaya rice in standing water (12 Jul). Plots were kept submerged throughout rice crop growth. Urea at 150 kg N/ha and

ZnSO₄ at 40 kg/ha were applied to all treatments. Half the N and all the Zn were applied at transplanting. The remaining N was topdressed in 2 equal splits at 3 and 6 wk. The crop was harvested 30 Oct.

Green manuring significantly enhanced yield (see figure), contributing 111.6 kg N/ha. One week of submergence with incorporated green manure significantly improved yield over no flooding and equaled 2 wk submergence. Yield with pretransplanting submergence without green manure was significant only with 2 wk submergence. Continuous submergence improved the sodic soil and green manuring further decreased pH and exchangeable sodium (see table). *J*

Effect of presubmergence and green manure on N contribution to rice crop, soil pH, and ESP at 0-15 cm soil depth.^a CSSRI, Karnal, India.

Treatment		Biomass (t/ha)	N turned in (kg/ha)	At transplanting		After harvest	
N source	Presubmergence (wk)			Soil pH	ESP	Soil pH	ESP
No green manure, 150 kg N/ha	0	—	—	9.6	45	9.4	36
	1	—	—	9.6	42	9.3	34
	2	—	—	9.5	42	9.3	34
Green manure, 150 kg N/ha	0	3.8	111.5	9.3	35	9.0	30
	1	3.8	110.8	9.2	32	8.9	28
	2	3.9	112.6	9.1	32	8.8	25
LSD (0.05)	Biomass and N	NS	NS	—	—	—	—
	Green manure	—	—	0.22	3.2	0.20	2.4
	Submergence	—	—	0.12	1.5	0.11	1.2

^aInitial soil pH 10.25, ESP 86. Gypsum was applied at 10 t/ha before sowing *S. aculeata*.

Response of rice to different N fertilizers

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The relative efficiency of slow-release N fertilizers was studied in 1984 rabi (Oct-Feb) and 1985 kharif (Jun-Sep). Test varieties were IR20 (135 d) in rabi and TKM9 (110 d) in kharif.

The experimental field was sandy loam, with pH 4.9 and 288 kg N, 33 kg P, and 112 kg K/ha available nutrients. In the split-plot design, replicated three times, four N sources were applied at two levels in the main plot and two application methods were compared in subplots. P and K were applied to all plots at transplanting. Urea supergranule (USG) was placed in alternate rows as basal and topdressed; prilled urea (PU), neem cake-blended

urea, and coal tar-coated urea were incorporated just before transplanting (basal) and broadcast at the time of topdressing.

Application methods were 100% N applied as basal and incorporated just before transplanting and 50% N applied as basal and 50% N as topdressing in 2 equal splits at active tillering and panicle initiation.

During kharif, the interaction of N level and sources significantly

influenced yield. USG at 75 kg N/ha gave the maximum yield (6.15 t/ha) (see table). During rabi, application method and the interaction of N level and source were significant. At 100 kg N/ha, USG gave the maximum yield (4.05 t/ha), equal to yields with coal tar- and neem cake-coated urea and with USG applied at 75 kg N/ha. Split application of N was best.

In kharif, USG, urea coated with neem cake (20%), and coal tar (1%) at higher N levels produced significantly higher yields than PU. In rabi, USG placement at lower N levels produced yields equal to those with neem cake, coal tar, and USG applied at higher N levels, resulting in 25% N savings. \mathcal{J}

Influence of different N sources and levels on rice grain yield, Tamil Nadu, India.

N level (kg/ha) and sources	Yield (t/ha)		
	100% basal	50% basal + 50% split	Mean
<i>TKM9 in kharif</i>			
50 kg N/ha			
PU	5.4	5.5	4.50
Neem cake-blended (20%)	5.5	5.5	5.50
Coal tar-coated (1%)	5.4	5.5	5.45
USG	5.7	5.8	5.75
75 kg N/ha			
PU	5.6	5.8	5.70
Neem cake-blended (20%)	6.0	6.2	6.10
Coal tar-coated (1%)	5.9	6.2	6.05
USG	6.2	6.1	6.15
Mean	5.7	5.8	
<i>IR20 in rabi</i>			
75 kg N/ha			
PU	3.5	3.6	3.55
Neem cake-blended (20%)	3.7	3.7	3.70
Coal tar-coated (1%)	3.5	3.7	3.60
USG	4.0	3.9	3.95
100 kg N/ha			
PU	3.6	4.0	3.80
Neem cake-blended (20%)	3.8	4.0	3.90
Coal tar-coated (1%)	4.0	4.1	4.05
USG	4.0	4.1	4.05
Mean	3.76	3.88	

CD at 5%

N X source
Application method
N X sources X application
method

1984 rabi

0.22
0.09
ns

1985 kharif

0.29
ns
ns

Integrated organic and inorganic nitrogen fertilizer in lowland rice

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The effectiveness of urea or urea supergranules (USG) applied alone or in combination with azolla or rice straw was evaluated during 1984 kharif. The experiment was laid out in a randomized block design with four replications. Soil was clay loam with a pH of 8.2, 1.10% organic matter, 201 kg available N/ha, 5 kg available P/ha, and 427 kg available K/ha.

Urea and USG were compared at 58 and 87 kg N/ha. Azolla and straw were used to substitute for 29 kg N/ha. P and K were applied basally at 22 kg P/ha and 42 kg K/ha.

Fresh azolla was incorporated 1 d before transplanting. To ensure proper decomposition, straw was chopped and incorporated 15 d before transplanting. Urea was applied 1/3 basal, 1/3 at tillering, and 1/3 at flowering. USG was deep placed 1 wk after transplanting.

N level significantly influenced yield (see table). Deep placement of USG was significantly superior to urea at all N levels. Yield was highest with deep placement of USG at 87 kg N/ha.

The relatively lower yield with broadcast application of urea was presumably due to losses of N through ammonia volatilization and denitrification. Incorporating azolla with USG was as good as USG alone. Incorporating straw with USG was as

Effect of source and level of N on yield and return on investment. Coimbatore, India.

Source	N (kg/ha)	Yield (t/ha)	Return on investment (%)
Control	0	2.8	51
PU	58	3.5	80
USG	58	4.2	106
PU + azolla	29	3.3	66
PU + straw	29	3.3	46
USG + azolla	29	3.5	72
USG + straw	29	3.4	50
PU	87	4.3	113
USG	87	5.2	147
PU + azolla	58	4.2	104
PU + straw	29	4.1	76
USG + azolla	58	5.0	138
USG + straw	29	4.9	108
SED.		155.8	
CD (P = 0.05)		315.9	

effective as USG alone. The N and P fertilizers might have enhanced response to straw incorporation.

Azolla or straw combined with urea did not increase yield.

The net income and return on investment were highest with deep placement of USG at 87 kg N/ha. Deep placed USG was more profitable than split applied urea at all levels of N. Incorporation of azolla or straw with either urea or USG resulted in lower net income and return on investment than complete application of urea or USG. Azolla and straw involved high cultivation costs. \mathcal{J}

Evaluating rate, timing, and method of N application using tracer technique

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To study rate, timing, and method of N application, ammonium sulfate enriched

at 5% atom excess level with N-15 was used as a tracer. The field trial was conducted on clay alluvial soil with pH 8.4, 1.77% organic matter, 1,940 ppm total N, 37.2 ppm inorganic N, 16.8 ppm Olsen's P, 580 ppm ammonium acetate extracted K, EC 1.21 dS/m, and 53% CaCO₃. The experiment was a complete randomized design with four replications. All plots received a blanket application of P and K.