wide and furrows 30 cm wide were prepared. The field was irrigated to capacity. Thirty-day-old seedlings of 8 rice cultivars (see table) were transplanted on the sides of the ridges at 30- × 10-cm spacing with 2-3 seedlings/hill, in a randomized block design with 6 replications.

A basal application of 50 kg N/ha, 13 kg P/ha, and 30 kg K/ha was broadcast before ridges and furrows were prepared. Nitrogen at 25 kg/ha was applied in a band 5 cm away from planted rows at 20 and 45 days after transplanting. The crop was hand-weeded twice during the early stages of crop growth. A fair distribution of rains during the season made protective irrigation unnecessary.

Performance of rice cultivars transplanted under nonpuddled conditions. Mandya, India, 1980 kharif (wet season).

Cultivar	Duration (days)	Grain yield (t/ha)
Rasi	125	4.4
IR20	150	3.7
Mangala	110	3.6
IRAT 2	150	3.5
Jaya	160	3.2
IRAT 10	144	3.2
Lagore	144	2.8
IRAT 13	116	2.0
CD (0.05)		0.11
CV (%)		29

Results indicated that, of the eight rices tested, Rasi recorded the significantly highest yield, followed by IR20 and Mangala (see table). These rices had early and good stand establishment, satisfactory canopy cover with high panicle number, and low spikelet sterility. The rice yields obtained were very competitive with those of ragi grown under similar conditions. □

Foliar spraying *Eichhornia* inoculum and incorporation of *Eichhornia* and *Ipomoea* green leaves as supplemental nitrogen sources

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The aquatic weeds *Eichhornia crassipes* and *Ipomoea carnea,* unlike conventional green leaf manures, are abundant. An experiment was conducted in a randomized block design, replicated four times, on the College Farm, Rajendranagar, in the 1977 wet season to determine the effect of *Eichhornia* inoculum spraying and *Eichhornia* and *Ipomoea* green leaf incorporation in the nitrogen economy of rice. One hundred milliliters of *Eichhornia* spray solution with a count of 23.1 × 10^9/ml was diluted 10 times and sprayed in each 13.5-m^2 plot. In treatments with 2% urea spray, 1,000 ml of 2% urea solution was sprayed in each plot.

Grain yield was highest (4.1 t/ha) in the treatment with 100 kg N/ha (see table). It was on par with the yields in treatments that received 60 kg N/ha + *Eichhornia* leaves; 60 kg N/ha +*Ipomoea* leaves, and with 60 kg N/ha + 2% urea spray. Yield differences between the treatment with 60 kg N/ha + 2% urea solution spray and that with 60 kg N/ha + *Eichhornia* inoculum spray were insignificant. That indicates a spraying of *Eichhornia* inoculum is as effective as 3 sprayings of 2% urea. *E. crassipes* and *I. carnea* weeds, when used as green manure at 10 t/ha, provide supplementary 40 kg N/ha and increase rice grain yield. They do not proliferate in the field during succeeding seasons, however, if the leaves are properly incorporated before rice is planted. □

Effect of *Eichhornia* inoculum spray and leaf incorporation of *Eichhornia* and *Ipomoea* with nitrogen application on rice yields. Rajendranagar, Hyderabad, India.

Treatment	Grain		Straw	
	Yield (t/ha)	Increase (%) over yield with 60 kg N/ha	Yield (t/ha)	Increase (%) over yield with 60 kg N/ha
100 kg N/ha	4.1	24	4.7	30
60 kg N/ha + Ipomoea leaf incorporation at 10 t/ha	3.9	18	4.2	17
60 kg N/ha + Eichhornia leaf incorporation at 10 t/ha	3.8	15	4.2	17
60 kg N/ha + 2% urea solution spray	3.8	15	3.8	6
60 kg N/ha + Eichhornia inoculum spray	3.7	12	3.5	97
60 kg N/ha + 2% urea spray + Eichhornia inoculum spray	3.5	6	3.9	8
60 kg N/ha	3.3	–	3.6	–
C.D. at 5%	0.4	–	0.4	–

Fertilizer usage and productivity of aus, aman, and boro rice

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A study of 225 randomly selected farmers was conducted in Haringhata block, West Bengal, India. to determine the relationship between levels of fertilizer usage and rice yields during different seasons. Data for the preceding year were collected from January to March 1981.

Multiple regression analysis revealed that NPK levels used explained 73% of the variation in boro (dry season-winter rice) yields, 40% variation in aus (September, pre wet-season) yields, and 7% variation in aman (wet season) yields.

Computed F-ratios were significant at 1% in each case. N, K, and P levels used contributed positively and significantly to boro rice yield and were ranked first, second, and third, respectively, in importance.

Of the plant nutrients, N and P levels used contributed positively and significantly to aman yield. □

Azolla — a supplemental nitrogen source for flooded rice culture

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In an experiment to evaluate the relative advantage of using *Azolla pinnata* as a supplemental source of nitrogen in combination with fertilizer urea, azolla was added at 5, 10, and 15 t/ha to plots fertilized with urea (see table). The experiment was conducted in a randomized block design with four replications at Rajendranagar during 1979-80 kharif. A uniform basal dose of 26 kg P/ha and 30 kg K/ha was applied to all plots. The variety used was Tellahamsa. The nitrogen content of azolla on wet weight basis was 0.25%.

Differences in grain and straw yields were significant among treatments. The highest grain yield — 3.7 t/ha — was obtained with 100 kg N/ha supplied through urea. It was significantly higher than that of the other treatments but on par with those obtained with 87.5 kg N + 15 t azolla/ha and 62.5 kg N/ha + 15 t azolla/ha. Similarly the grain yield with 37.5 kg N + 15 t azolla/ha was equal to that with 75 kg N/ha applied through urea. Differences among the other treatments were nonsignificant. In general the grain and straw yields were low because of late planting. □

Yield of rice as influenced by azolla and inorganic nitrogen fertilization. Rajendranagar, Hyderabad, India.

Treatment	Grain		Straw	
	Yield (t/ha)	Increase (%) over yield in control	Yield (t/ha)	Increase (%) over yield in control
100 kg N/ha	3.7	185	4.3	139
87.5 kg N + 5 t azolla/ha	3.6	177	4.1	128
62.5 kg N + 15 t azolla/ha	3.4	162	3.9	117
75 kg N/ha	3.0	131	3.4	89
37.5 kg N + 15 t azolla/ha	3.0	131	3.4	89
50 kg N/ha	2.8	115	3.2	78
25.0 kg N + 10 t azolla/ha	2.7	108	3.1	72
12.5 kg N + 5 t azolla/ha	2.2	69	2.9	61
25 kg N/ha	2.0	54	2.8	56
Control	1.3	–	1.8	–
C.D. at 5%	0.6	–	0.4	–

Azolla as a substitute for nitrogen fertilizer in rice

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A study to assess the potential value of azolla as a substitute for nitrogen fertilizer in rice in sandy soils was made during 1981 kharif in Kerala.

Fourteen treatment groups in a randomized block design with 3 replications included azolla incorporation at 10 t/ha, azolla inoculation at 1 t/ha, a combination of incorporation and inoculation, and a combination of azolla inoculation and nitrogen fertilizer at 30 kg/ha, applied at basal, active tillering, and panicle initiation stages.

Grain yield (2.9 t/ha) and straw yield (3.0 t/ha) were greatest with basal incorporation of azolla combined with dual culturing and in situ incorporation at active tillering stage and 30 kg N/ha applied at panicle initiation. Several other treatments, including a treatment that received no N fertilizer, had similar yields. The treatment that received 90 kg N/ha in 3 equal splits recorded the lowest grain yield (2.2 t/ha) (see table).

Grain and straw yield with azolla incorporation, Kerala, India, 1981.

Treatment[a]			Yield (t/ha)	
Basal	Active tillering	Panicle initiation	Grain	Straw
FN	FN	FN	2.2	2.6
AI	FN	FN	2.6	2.9
FN	AI	FN	2.8	2.9
FN	FN	AI	2.4	2.8
FN+DC	Aii	FN	2.7	2.8
FN+DC	FN	Aii	2.4	2.8
FN+DC	–	FN	2.5	3.0
FN+DC	FN	–	2.3	3.0
FN+DC	–	–	2.4	3.0
AI+DC	FN	–	2.7	3.1
AI+DC	–	FN	2.6	2.9
AI+DC	–	–	2.6	2.8
AI+DC	Aii	FN	2.9	3.0
AI+DC	FN	Aii	2.7	3.1
CD (0.05)			0.38	N.S.

[a]FN = 30 kg N/ha, AI = azolla incorporation (10 t/ha), Aii = azolla in situ incorporation (dual culture), DC = dual culture (inoculation @1 t/ha).

Treatment results indicate azolla is an efficient substitute for N fertilizer in sandy soil where there is likely to be vertical and lateral leaching. This may be because azolla releases N slowly and steadily, thereby limiting N losses. □

Effect of phosphorus fertilizer placement on root and shoot growth of wetland rice

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A pot experiment was conducted to determine the effect of phosphorus (P) placement on root and shoot growth of wetland rice. P was applied to varieties IR42 and MR7 at 0 (surface application), 5, 10, and 15 cm soil depth in 6 replications. Pots were 35 cm in diameter and 45 cm deep. Ten kilograms of clay loam (pH 5.8, organic carbon 1.05%, 0.15% total N, 4 ppm available P, 0.26 meq exchangeable K/100 g, and 17.4 meq CEC/100 g) were added to each pot. Soil was puddled