SLW were significant independent variables ($P<0.03$) for predicting leaf N concentration in both greenhouse and field studies. With three SPAD readings per leaf blade in each case, the proportion of variability in leaf N concentration that the independent variable accounted for increased from 81 to 86% in the greenhouse study and from 74 to 78% in the field study when based on SPAD values alone vs the combination of SPAD values and SLW as independent variables (see table).

Using a chlorophyll meter to monitor the N status of the rice plant may provide a useful tool for managing research experiments and varietal trials where adequate N supply must be maintained in diverse environments and on different soils. Data, however, should be interpreted with caution because the SLW can influence the SPAD reading. If leaf N estimates need to be more accurate than SPAD readings, then the SLW should also be determined. This process is much simpler and faster than using the kjeldahl method to determine N. □

Fertilizer management—inorganic sources

Nutrient management for cotton - rice cropping system

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Cotton *Gossypium hirsutum* L. is grown in Srivilliputtur during Feb-Mar under summer irrigated conditions following wet-season rice. A short-duration pulse is generally grown during Aug-Sep between the cotton and rice crops in this system.

We studied nutrient management for cotton - green gram - rice during 1991-92. The experiment was laid out in a randomized block design with four replications. The soil at the site represents the tract and is a sandy clay loam with low available N, medium P, and high K. Short-duration cotton variety SVPR 1 was sown during Apr 1991, and the second crop, green gram KM2, was grown during Sep 1991. This was followed by IR20, which was transplanted in Nov 1991 with different fertilizer levels.

There was a clear response when NPK was applied to cotton and green gram under rice - fallow conditions. Cotton yields with 60-30-30 kg NPK/ha and 60 kg N/ha alone were similar. In the succeeding green gram, the yield was higher when 25 kg N and 22 kg P/ha were applied, which was on par with 22 kg P/ha alone. In this sequence, the rice crop had a uniform application of the recommended dose of NPK fertilizers. Rice yield was not affected by fertilizer treatments in the preceding crops.

These results indicate the significance of the recommended 60 kg N/ha for summer cotton, 22 kg P/ha for a pulse crop, and NPK for a wet-season rice crop in the cropping system studied (see table). □

Crop yields in a cotton-rice system in Srivilliputtur, Tamil Nadu, India, 1991-92. [a]

Treatment			Yield (t/ha)		
Cotton 60-30-30 kg NPK/ha	Pulse 25-50-0 kg NPK/ha	Rice 100-50-50 kg NPK/ha	Cotton	Green gram	Rice
Full NPK	Full NP	Full NPK	0.78	0.33	4.1
N	Full NP	Full NPK	0.74	0.33	4.0
N	P	Full NPK	0.74	0.32	4.0
N	No fertilizer	Full NPK	0.75	0.24	3.8
No fertilizer	No fertilizer	Full NPK	0.49	0.23	3.8
Full NPK	No fertilizer	Full NPK	0.77	0.26	3.9
No fertilizer	No fertilizer	Full NPK plus preen gram stubble	0.50	0.23	4.2
LSD (0.05)			0.06	0.03	ns

[a] ns = not significant.

Fertilizer management—organic sources

Breaking seed dormancy in *Sesbania rostrata*

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Sesbania rostrata has potential as a leguminous green manure for lowland fields in many countries. But its thick, hard seed covering can cause problems for growers.

We tested several methods to break seed dormancy using hot water, sulfuric acid, scrubbing with sand, and scrubbing and soaking in hot water.

Scrubbing seeds with sand for 5 min and/or soaking in hot water (about 60 °C) for 15 min were not very effective. Treating seeds with concentrated H_2SO_4

Germination of *S. rostrata* seed under different treatments.

Treatment	Observation (no.)	Germination rate (%)[a]
Control	4	12.00 ± 3.61
Hot water for 15 min	4	17.25 ± 2.77
Scrubbing with sand for 5 min	3	12.33 ± 1.70
Scrubbing + hot water	3	20.00 ± 2.94
H_2SO_4, concentrated		
Fast washing	7	94.39 ± 4.06
Slow washing	3	6.13 ± 0.72
H_2SO_4 diluted	3	15.67 ± 1.88

[a] Mean ± standard error.

(commercial grade, 96%) for 30 min increased germination to more than 90%. Seeds must be washed very quickly after treatment so as not to subject them to temperatures of more than 45 °C. Slow washing resulted in temperatures of about 110 °C that damaged seeds and resulted in very poor germination. Diluting commercial grade H_2SO_4 tenfold was not effective. □

Flowering, seed production, and germination of *Sesbania speciosa* used as green manure for lowland rice in Sri Lanka

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We evaluated the flowering, seed production, and germination of *S. speciosa* for use in a green manuring system for lowland rice in Sri Lanka.

The study was conducted in the ARS lowland experimental site at Maha Illuppallama, in the dry zone, Sri Lanka. Soil is Tropaqualf with pH of about 7.3, 4.4% organic matter, 0.095% total N, and 94 µg available P/g soil. We conducted a year-round *S. speciosa* planting trial from Nov 1990 to Oct 1991.

During the first week of each month, we seeded a 5- × 4-m plot with *S. speciosa* at 0.05- × 0.5-m row spacing. Plots were irrigated once every 3 d and kept weed-free. We recorded dates of 50% flowering in the plots (a visual observation), podding, and seed setting.

Because seed germination can be as low as 30%, we applied two promising seed treatments—concentrated sulfuric acid for 40 min and 80°C water for 45 s—to improve germination in wet-sand cultures.

Monthly seeding of *S. speciosa* resulted in irregular flowering (see figure) and seed production. Seeding between Jan and Mar produced 5.6 - 8.5 g seed/plant; Apr-Aug, 12.1-15.5 g seed/plant; and Sep to Dec, 4.7, 4.4, 2.0, and 0.9 g seed/plant, respectively.

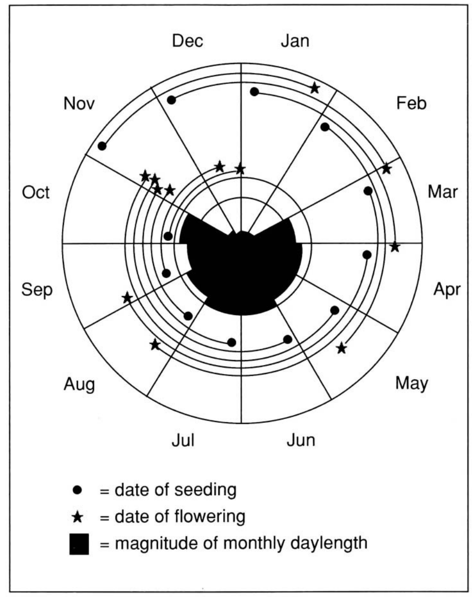
Seeding S. *speciosa* between May and Oct causes it to flower during Nov-Dec (see figure) and to pod and set seed in Jan-Feb. This schedule is the most efficient for seed production because it concentrates seed setting into a period as short as 2 mo. Because *S. speciosa* is photoperiod sensitive, this seed production program is useful for tropical countries with similar monthly daylengths.

The acid treatment enhanced germination of *S. speciosa* significantly compared with the hot water treatment, which was significantly better than the control (see table). □

The effect of seed treatment on germination of *S. speciosa*.

Seed treatment	Germination[a] (%)
Acid	61 ± 5a
Hot water	35 ± 5 b
Control	20 ± 4 c

[a] Germination (%) ± SE. Values followed by different letters are significantly different at 5% level according to x^2-tect.



Effect of monthly daylength on flowering of *S. speciosa.* Circle that crosses the shaded sectors indicates 12 h photoperiod.

Ammonia excretion by *Anabaena azollae* immobilized in alginate and its effect on the growth of rice seedlings

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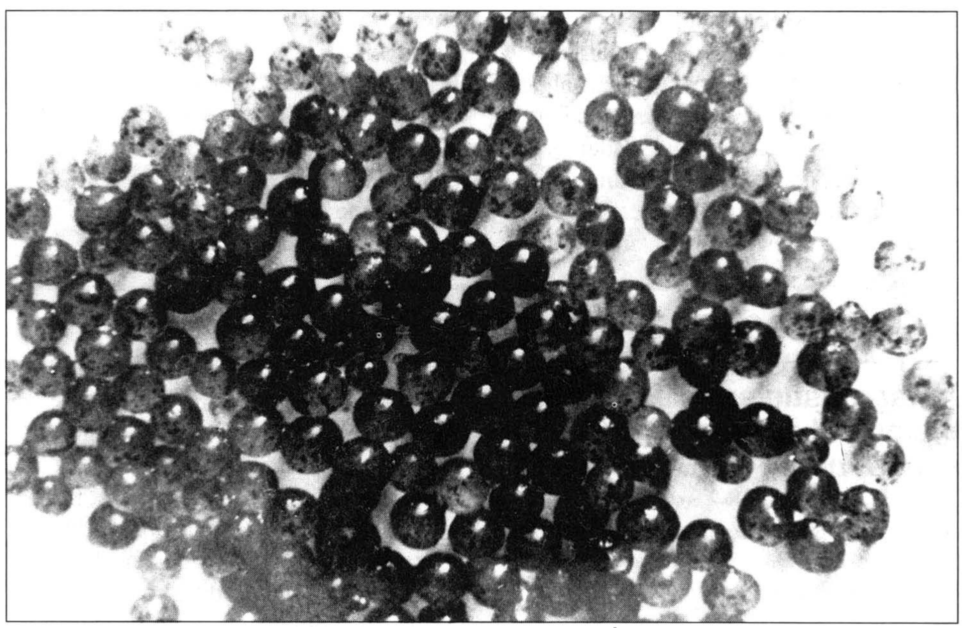
Azolla is a water fern that fixes atmospheric N in association with an algal symbiont. *A. azollae* can contribute 40-60 kg N/ha of a rice crop under low-cost rice production management.

We investigated the effect of immobilizing two strains of algal



1. Algal symbiont AS-K_4 immobilized in calcium alginate.