recommended for cold temperate region. Khumal 2 and Khumal 4 were selected for warm temperate regions under irrigation. Chaite 2 and Chaite 4 are recommended for early season (Feb to Jun) and Barkhe 2 and Khajura 2 for normal season (Jun to Oct) cultivation under irrigation in tropical or subtropical regions. Makwanpur 1 is released for rainfed lowland and Ghaiya 2 for rainfed lowland for the hot region. □

Evaluation of African Upland Rice Advanced Trial (AURAT) at Ibadan, Nigeria

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Nurseries of 17 entries in 1985 and 15 each in 1986 and 1987 were laid out during the wet season at Ibadan in a randomized complete block design with 4 rep1ications. Plot size was 12 m^2. Four to six dry seeds were dibbled at 25- × 25-cm spacing.

Eleven entries were tested over 3 yr. In 1985, moisture stress reduced plant height and grain yield. IRAT104, which possessed clean grains, significantly outyielded the check FARO 11. Yields in 1986 were variable but not significantly different. In 1987, plant height, tillering, and grain yields generally increased because of steady rainfall throughout the growing season. ITA305, ITA3 15, IRAT170, and UPLRi-5 yielded significantly higher than FARO 11.

Four entries—ITA305, IRAT161, IRAT 104, and ITA3 15—that outyielded FARO 11 by 25% were selected for national multilocation trials.□

Data management and computer modeling

Models for panicle growth simulation

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Panicle growth simulation helps determine rate and duration of grain filling. Using data from 1987 wet season experiments at IRRI, we tested six growth models to find the best one for simulating panicle growth.

Richard's function performed best, with the largest regression coefficient between simulated and actual growth. Logistic function ranked second, followed by cubic polynomial, quadratic polynomial, negative exponential, and Gompertz function. Results indicate Gompertz function is not suitable for panicle growth simulation. □

CROP AND RESOURCE MANAGEMENT

Soils and soil characterization

Effect of soil type on draft force needed to plow soils of South Sulawesi, Indonesia

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We measured the draft required to pull special-purpose plows on different soils in South Sulawesi. Draft was measured with a drawbar dynamometer, three times for each soil. Carabao, cow, or human power was used, depending on site condition. Cuts were 15 cm wide

Draft of soil types in South Sulawesi, Indonesia.

Soil	Soil draft (kN)			
	Wetland		Dryland	
	Grassy	Nongrassy	Grassy	Nongrassy
Grey alluvial	0.53	0.45	0.58	0.50
Old grey alluvial	0.66	0.51	0.63	0.57
Grey brownish alluvial	0.54	0.47	0.60	0.49
Yellowish grey alluvial	0.43	0.39	0.49	0.42
Hydromorphic alluvial	0.65	0.93	0.63	0.64
Brownish grey alluvial	0.54	0.46	0.65	0.59
Brownish alluvial	0.60	0.46	0.63	0.54
Complex brown Regosol, Mediterranean, and Latosol	0.44	0.40	0.48	0.37
Latosol	0.47	0.44	0.60	0.47
Reddish brown Mediterranean	0.52	0.47	0.57	0.51
Complex reddish brown Mediterranean and Latosol	0.56	0.50	0.57	0.51

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and 12 cm deep at 2.0 km/h or 0.56 m/s.

Of the soils tested, grey Grumusol required the highest draft, yellowish red lateritic soil the lowest (see table). Grassy soil needed higher draft than nongrassy soil. Soil with scattered stones needed a high draft.

Wetland (previously puddled) needed a slightly lower soil draft than dryland (nonpuddled): 0.64 kN on grassy wetland, 0.57 kN on nongrassy wetland, 0.63 kN on grassy dryland, and 0.58 kN on nongrassy dryland.

The following formula calculates power required for land preparation on different soil types:

Power (kW) = draft (kN) × speed (m/s)

For example, on vegetative grey Grumusol with a soil draft of 1.26 kN and on yellowish red lateritic with a soil draft of 0.38 kN, the required power for land preparation is 0.71 and 0.21 kW, or 0.95 and 0.28 hp, respectively. □

Table continued

Soil	Soil draft (kN)			
	Wetland		Dryland	
	Grassy	Nongrassy	Grassy	Nongrassy
Complex reddish brown Latosol and Latosol	0.58	0.49	0.50	0.49
Grey Grumusol	1.26	1.08	1.18	0.88
Old grey Grumusol	1.12	1.09	0.99	0.88
Black Grumusol	1.16	1.14	1.16	1.07
Yellowish red lateritic	0.38	0.33	0.40	0.36
Yellowish grey Regosol	0.73	0.65	0.79	0.70
Yellowish red podzolic	0.48	0.42	0.40	0.36
Yellowish brown podzolic	0.49	0.41	0.57	0.44
Brown podzolic	0.69	0.63	0.78	0.68
Violet podzolic	0.63	0.58	0.67	0.51
Brown Mediterranean	0.79	0.72	0.82	0.74
Grey Mediterranean	0.43	0.41	0.54	0.44
Complex grey brown podzolic	0.57	0.51	0.67	0.52
Complex yellowish brown Mediterranean and Latosol	0.72	0.67	0.78	0.12
Complex red Mediterranean and Latosol	0.62	0.55	0.76	0.61
Yellowish red Latosol	0.73	0.60	0.79	0.62
Reddish brown Latosol	0.60	0.50	0.64	0.60
Brown Latosol	0.88	0.77	1.02	0.79
Grey brown Regosol	0.77	0.66	0.86	0.69
Brownish yellow Latosol	0.70	0.62	0.72	0.69

Soil microbiology and biological N fertilizer

Growth and K uptake of *Azolla pinnata* under different salt levels

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We studied salt tolerance, growth, N content, acetylene reduction, and K accumulation of *Azolla pinnata* grown under different K levels (0, 10, 20, 30, 40, 50 ppm). The plant was grown on a N-free medium containing 40 ppm Mg, 40 ppm K, 40 ppm Ca, 20 ppm P, 0.5 ppm Mn, 0.2 ppm B, 0.1 ppm Mo, 0.01 ppm Cu, 0.01 ppm Zn, and 2 ppm Fe. Salt concentration in the control medium was 770 ppm.

To test salt tolerance, NaCl was added to the medium to make 1000, 1300, 1900, 2500, 3100, and 3700 ppm. Three grams of actively growing azolla plants were inoculated in a plastic tray (40- × 25- × 10-cm) containing 2 liters of the test medium. Cultures were incubated at 25 ± 2 °C under fluorescent light for 16/8 h light/dark cycle. Culture medium was changed once in 3 d. Plants were harvested after 21 d.

At lower concentrations of salts (1000 and 1300 ppm), azolla grew as well as the control. Salt levels 1900 ppm and higher significantly reduced biomass production, N content, acetylene reduction activity, and K accumulation (see table). Plants were killed at 3700 ppm salt level.

Growth and K accumulation increased with increasing level of K in the culture medium. Besides fixing N of *Anabaena azollae,* azolla plants efficiently accumulated K. □

Influence of salt concentration on growth and K accumulation in *Azolla pinnata.* **Baroda, India.**

Total salt concentration of the medium (ppm)	Fresh weight (g)	Dry weight (g)	N content (%)	C_2H_4 formed (nmol/g fresh weight per h)	K content (% by dry weight)
710	25.9	1.03	3.9	685	2.98
1000	25.7	1.02	3.9	680	2.93
1300	25.3	1.01	3.9	668	2.90
1900	17.6	0.72	3.8	530	2.61
2500	10.8	0.39	3.1	411	1.98
3100	7.2	0.07	2.8	213	1.14
LSD (0.05)	1.3	0.07	0.1	76	0.28