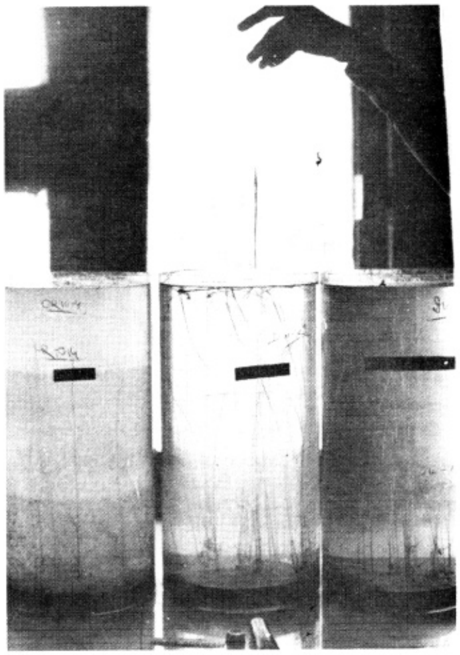

2. Glass jars used in screening deepwater rices. CRRI, Cuttack, India.

Nageribao, Habiganj DW2, and Molladigha grew and elongated to the surface of the 80-cm water column in 24 hours. They elongated fastest. Nhok Nhounh and Khao Gaew reached the surface in 36 to 48 hours. Pankaj did not reach the water level and it died. Elongation of the leaf sheaths and, in a few varieties, of the internodes caused the growth that enabled varieties to reach the water surface. In the glass jars as in the cement tank Nageribao, Sampatti, Habiganj DW2, and Molladigha grew relatively faster than the other varieties. Pankaj did not elongate beyond 15 cm.

Internode differentiation and elongation occurred earliest in Nageribao – 30 days after germination. Aswina 322, Habiganj DW1, Habiganj DW2, Sampatti, and Molladigha took 40 days; the other varieties, 50 to 60 days. In Jalmagna, a popular deepwater variety from Uttar Pradesh, internodal differentiation took place 50 days after germination. Nodal rooting was profuse and nodal tillering high in Nageribao, followed by Habiganj DW2, Sampatti, and Molladigha. Good segregants from crosses involving Nageribao can be obtained at CRRI.

The seed of 23 deepwater varieties were received from IRRI. Nageribao (from Assam), Jalmagna, and Pankaj were obtained locally. ■

Temperature tolerance

Two extremely cool-tolerant varieties

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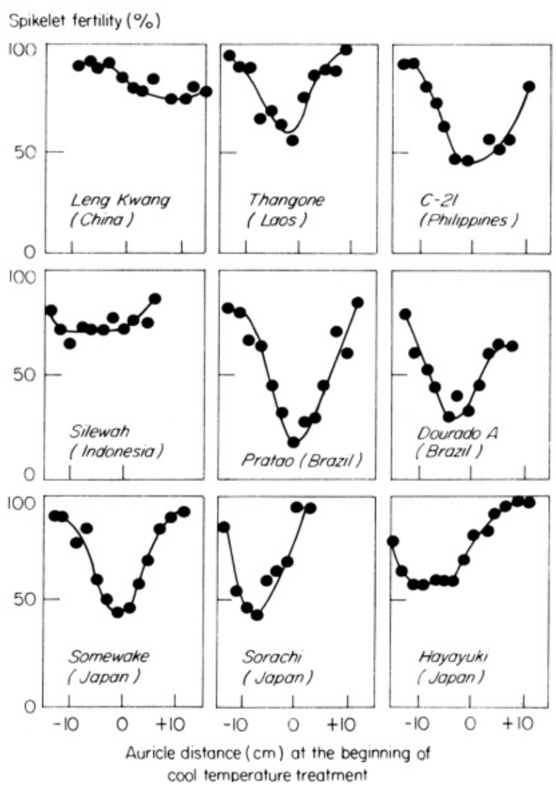
In 1976, IRRI selected 6 cool-tolerant indica rice varieties from 12,200 entries of the germplasm bank on the basis of growth duration, plant height, spikelet sterility, leaf color, and anthesis. The cool tolerance of the six varieties at booting stage was rechecked in the phytotron of the HNAES.

The materials tested were the six indicas and three japonicas found to be cool-tolerant in Japan. The indicas were Leng Kwang, Thangone, C-21, Silewah, Pratao, and Dourado Agulha; the japonicas were Somewake, Sorachi, and Hayayuki. Twenty seeds were sown in a circular pattern in a 4-liter plastic pot. The plants were grown at 26º/20ºC day/night temperature in an artificial light room for 12 hours at an intensity of 27.6 klux.

Auricle distance was used as a criterion to show the panicle developmental stage at the beginning of cooling. Plants at different panicle developmental stages were cooled at 12ºC for 4 consecutive days in the natural light room. After the treatment, the plants were returned to the artificial-light room. At maturity, spikelet fertility was determined for panicles of main stems grouped by auricle distance.

Cool tolerance was highest in Leng Kwang and Silewah, and intermediate in Thangone and C-21 (see figure). The latter two indica varieties had about the same cool tolerance as the three japonicas. Pratao and Dourado Agulha, which were highly cool tolerant in the IRRI test (15ºC), were susceptible in this test (12°C).

Results at IRRI and at HNAES showed



Fertility of spikelets in rice plants subjected to cool temperature (12°C for 4 days) at different panicle developmental stages indicated by auricle distance of –5 to +10 cm. Hokkaido Experiment Station, Japan.

Leng Kwang and Silewah as extremely cool tolerant. The two varieties were crossed with a japonica breeding line, Hokkai 241, to incorporate their tolerance into japonica rices. The F_1 plants of the cross Leng Kwang/Hokkai 241 had high spikelet sterility, and those of Silewah/Hokkai 241 had high spikelet fertility. Leng Kwang is a promising parent for indica rice breeding programs to improve cool tolerance; Silewah is promising for japonica breeding programs.

Pest management and control

DISEASES

Effect of nontoxic chemicals on brown spot disease in rice seedlings

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The performance of 15 chemicals, known as phytoalexin inducers for different plant species, in inducing resistance to the brown spot pathogen *Helminthosporium oryzae* in susceptible rice plants was evaluated.

Three-week-old seedlings of the rice variety Dharial were sprayed with solutions of the test chemicals at concentrations that have little or no effect on spore germination at 2 days before inoculation. Promising chemicals were used in subsequent 24-hour seed soaking before sowing and in 24-hour root-dip treatment of 3-week-old seedlings before transplanting. The transplanted seedlings were left exposed to natural infection and the disease reaction was assessed 2 to 5 weeks later. The seedlings raised from treated seeds were grown in pots and spray inoculated, and the disease reaction was assessed 3 or 5 weeks later. Most of the test chemicals gave considerable protection to rice seedlings in different treatments (see table).

With foliage spray, symptoms were reduced by 42-92%. The most ef'fective chemicals were sodium malonate, DL-methionine, and indole-3-acetic acid (IAA).

The seedlings derived from seed treatments developed 35 to 60% fewer symptoms after 3 weeks. In the field, such seedlings also showed considerable resistance; they had 33 to 88% fewer symptoms after 3 weeks. The protective effect declined with time, particularly for barium chloride and nickel nitrate.

Transplanted seedlings in different treatments developed 19 to 50% fewer symptoms after 2 weeks and 12 to 32% fewer symptoms after 5 weeks.

The effectiveness of the phytoalexin inducers in developing resistance in rice seedlings is evident. Although foliage spray is effective, the significant persistence of the induced protective effect in the seedlings until 3 to 5 weeks after the seed treatment and, to a lesser

Mean disease index[a] of *Helminthosporium oryzae* infection[b] in rice seedlings (variety Dharial) treated with chemicals known as phytoalexin inducers.

Chemical	Concn.	Mean disease index (%)					
		Foliage spray (pot experiment)	Seed soaking			Seedling root-dip (field expt)	
			Pot expt (3 weeks)	Field expt			
				3 weeks	5 weeks	2 weeks	5 weeks
Water (control)		100.0	100.0	100.0	100.0	100.0	100.0
Barium chloride	10^{-3}M	42.3	51.9	66.0	90.6	62.1	13.5
Ferric chloride	10^{-4}M	43.2	40.0	11.3	56.5	65.1	78.4
Cadmium chloride	10^{-4}M	49.8	53.4	63.2	62.1	5 3.4	14.7
Mercuric chloride	10^{-5}M	58.2	64.5	41.2	55.2	81.1	88.0
Chromium chloride	10^{-3}M	55.0	–	–	–	–	–
Nickel nitrate	10^{-5}M	31.7	43.0	67.0	90.4	73.8	83.2
Sodium malonate	10^{-4}M	8.0	54.1	58.5	68.3	50.0	61.4
Sodium molybdate	10^{-4}M	41.6	43.7	44.3	92.4	56.8	71.3
Sodium iodoacetate	10^{-4}M	49.4	–	–	–	62.1	80.8
Sodium fluoride	10^{-3}M	65.9	–	–	–	–	–
DL-methionine	10^{-2}M	20.3	46.1	52.8	74.5	61.7	80.8
DL-norleucine	10^{-2}M	34.0	–	–	–	–	–
DL-norvaline	10^{-2}M	49.4	–	–	–	–	–
Indole-3-acetic acid	10^{-4}M	21.1	55.1	55.1	55.2	65.6	16.0
2,4,5-trichlorophenoxy-acetic acid	10^{-4}M	32.5	62.5	–	–	–	–

[a] Disease index was calculated for each plant taking into consideration both the number and size of brown spot lesions.
[b] In most experiments, plants were artificially inoculated with a heavy inoculum; only in root-dip treatment were they left exposed to natural infection.