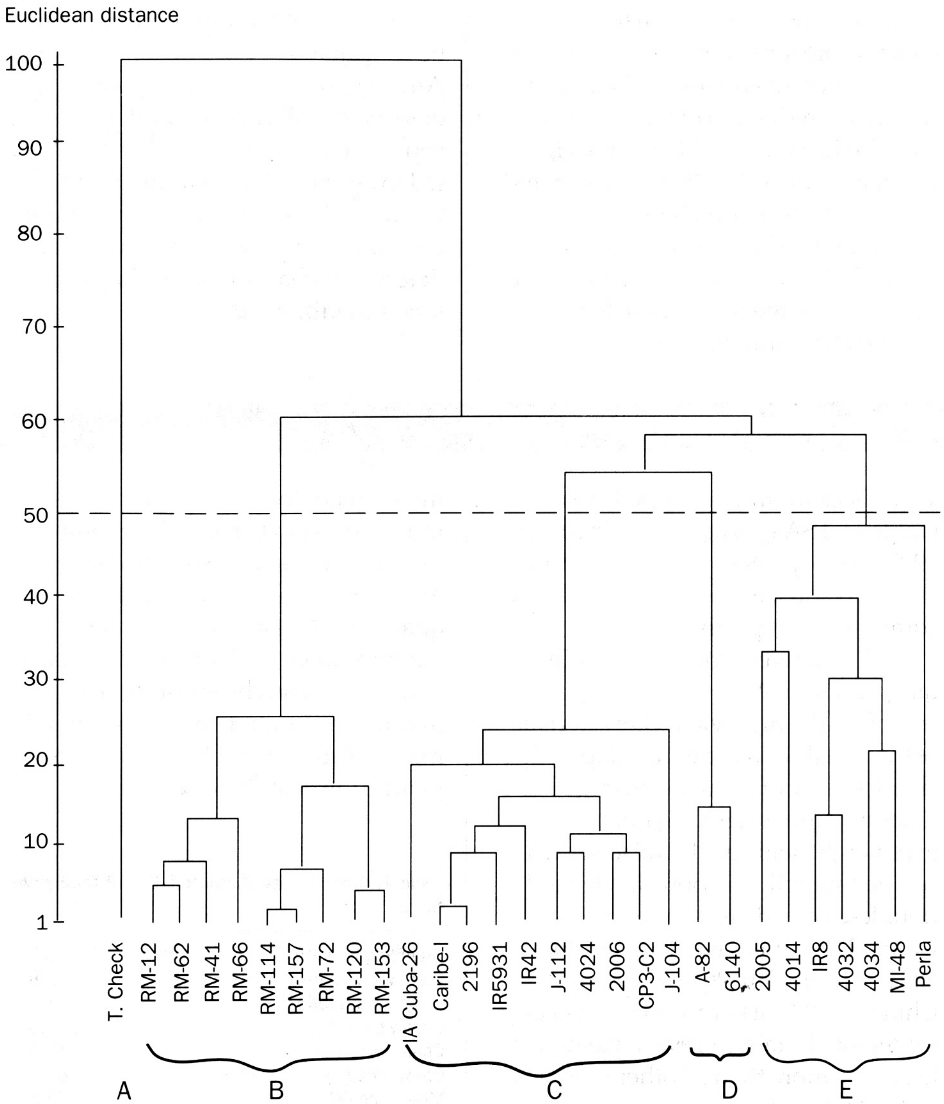

Dendrogram of clustering for radiomutants and varieties based on saline stress tolerance index for yield and yield attributes.

variability for salt tolerance. Cluster B, consisting of 9 mutants from the J-112 variety, had the highest mean for all attributes (see table), as well as the minimum value of intercluster distance with a theoretical check (cluster A), a result indicating that the mutants grouped in it were the most tolerant of those tested.

Clusters C and D consisted of 10 and 2 genotypes, respectively. These genotypes were intermediate in salt tolerance.

Seven genotypes comprised cluster E. These genotypes present a lower value of means for all attributes and a maximum intercluster distance value with cluster A (theoretical check), indicating they are the most susceptible. In this cluster were two varieties (MI 48 and IR8) that many breeders use as a susceptible checks. This finding confirmed our method used in varietal tolerance evaluation.

Our results indicated that the mutants grouped in cluster A were higher than the parent and other varieties for salt tolerance, indicating the possibility of generating heritable variation for this attribute in rice through gamma radiation. The varieties hold promise in salt-affected areas and may also serve as donor parents in breeding for salt tolerance. ■

Water relations in rice seedlings in saline medium

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We evaluated the seedling water content (SWC), leaf relative water content (LRWC), transpiration intensity (TI), and the cell sap concentr ation (CSC) in four rice varieties, differentiated by the degree of their salt tolerance. Pokkali and IR24 were tested for salt tolerance and MI 48 and Perla for susceptible behavior.

Seedlings of four varieties were sown in nutrient solution under controlled laboratory conditions using Hoagland nutrient solution (control) and Hoagland nutrient solution

Effect of salinity on some water relation variables in rice seedlings. Granma, Cuba. [a]

Variety	Seedling water content (%)		Leaf relative water content (%)		Transpiration (mg H_2O mg DW^{-1} h^{-2})		Cell sap concentration (% TSS)[b]	
	Control	Stress	Control	Stress	Control	Stress	Control	Stress
Pokkali	89 ± 0.84	82 ± 1.16**	88 ± 0.12	80 ± 0.90**	5.1 ± 0.10	3.6 ± 0.52**	5.9 ± 0.06	9.1 ± 0.17***
IR42	87 ± 0.76	80 ± 0.68**	87 ± 0.51	78 ± 1.25**	4.8 ± 0.65	3.2 ± 0.45**	5.5 ± 0.22	8.9 ± 0.03***
MI 48	89 ± 0.47	71 ± 0.46***	86 ± 0.23	69 ± 0.12**	6.0 ± 0.10	2.7 ± 0.22***	5.2 ± 0.10	8.2 ± 0.20***
Perla	92 ± 0.47	69 ± 0.48***	85 ± 0.82	69 ± 0.70**	5.4 ± 0.38	1.9 ± 0.06***	5.1 ± 0.20	8.3 ± 0.47***

[a]** and *** = significant differences for P <0.01 and P <0.001 by the Student-t test. [b]TSS = total soluble salts.

enriched with NaCl (0.7%,). The pH was kept at 5.0. The SWC, LRWC, and TI were determined by gravimetric methods and the CSC by refractometry in five replications at 21 d after planting. The SWC, LRWC, and TI significantly diminished under salinity stress in all varieties (see table) because plants could not absorb adequate water. The TI was more pronounced than SWC or LRWC. Plants adjust their T1 as a defense mechanism to compensate for water loss.

Salt-tolerant varieties Pokkali and IR42 had a reduction of 6-7% for SWC, 6-8% for LRWC, and 29-30% for TI, whereas in the salt-sensitive MI 48 and Perla, SWC decreased by 18-20%, LRWC by 16-17%, and TI by 60-67%. Varietal differences in salinity tolerance can be measured using these three plant water parameters.

CSC is another important factor to be considered in plant-water relations. An increase (66-67%) of CSC was observed in all varieties under stress conditions. Increase in CSC is attributed to an extensive accumulation of hydrophilic, osmotically active ions in cells and should not be regarded as a defense mechanism of seedlings under stress conditions. ■

Integrated germplasm improvement—Irrigated

Te-Shan-Ai No. 2, a high-yielding rice in China

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Te-Shan-Ai No. 2 (TSA), a high-yielding rice variety with wide adaptability, was developed by researchers at the Rice Research Institute, Guangdong Academy of Agricultural Sciences. It was released for cultivation in China in June 1996.

In the 1990-91 regional tests in southern China, the mean grain yield of TSA was 8.6 t ha^{-1}, 14%) more than the local check and 5% more than the hybrid check. In the 1990-93 regional tests in Guangdong and Guizhou provinces, the mean grain yield was 6.9 t ha^{-1}, 14%) more than the local check in double-cropped areas; mean grain yield was 8.4 t ha^{-1}, 13%) more than the local check in single-cropped areas (Table 1). TSA was registered in March 1992 and July 1995 by the Guangdong and Guizhou Crop Variety Evaluation committees, respectively.

TSA is derived from the cross Te-qing /Shan-Er-Ai. It successfully combines the high-yield characteristic of the female and the wide adaptability characteristic of the male. In large-scale demonstrations, TSA has not only given high yields but has also shown wide adaptability in both single- and double-cropped areas in southern China. The variety was planted on 685,500 ha in 1991-96 in southern China. In 1994, it became a new check for regional trials. In 1996, it yielded at least 10% more than all other varieties tested (Table 1).

TSA is moderately resistant to blast and resistant to bacterial blight. The average amylose content is 26.4%, and the alkali spreading value is 7.0 (Table 2). One major gene and seven minor genes located on seven chromosomes seem to control the semidwarf character of TSA. The character grain weight plant^{-1} is related to five quantitative trait loci located on chromosomes 1, 2, 3, 4, 5, and 8. A major gene located on chromosome 4 and a minor gene located on chromosome 2 may control the number of panicles plant^{-1} (Lin et al 1996). ■

Table 2. Grain quality characteristics of Te-Shan-Ai No. 2.

Grain length (mm)	5.3
Grain width (mm)	2.8
Length-width ratio	1.9
Chalky grain (%)	100.0
Chalky area (%)	12.0
Brown rice (%)	81.3
Milled rice (%)	73.5
Head rice (%)	58.4
Gelatinization temperature (°C)[a]	7.0
Gel consistency (mm)	32.0
Amylose content (%)	26.4
Protein content (%)	9.2

[a]Indexed by alkali spreading value: low, 6–7; intermediate, 4-5.

Table 1. Performance of Te-Shan-Ai No. 2 (TSA) in regional tests in China. 1990-96.

Character	South China		Guangdong		Guizhou		South China
	1990 (8 sites, 5 provinces)	1991 (19 sites, 11 provinces)	1990 (17 sites)	1991 (21 sites)	1992 (8 sites)	1993 (8 sites)	1996 (16 sites, 10 provinces)
Grain yield (t ha^{-1})	8.8	8.3	6.7	7.2	9.4	7.3	8.4[a]
Grain yield over check (t ha^{-1})	+5.2[b]	+14.1[c]	+8.4[d]	+19.8[d]	+11.9[c]	+14.9[c]	
Growth duration (d)	139.5	138.2	136.0	132.0	155.6	155.3	139.2
Growth duration over check (d)	–1.0	+1.9	+2.0	+3.0	+2.7	+3.5	
Plant height (cm)	104.4	105.6	97.8	99.2	85.7	94.2	104.6
Productive panicles m^{-2} (no.)	351.0	312.0	307.5	388.5	294.0	297.0	282.0
Spikelets panicle^{-1} (no.)	122.8	127.2	109.4	117.7	143.8	126.4	132.6
Filled grains panicle^{-1} (no.)	101.9	104.0	93.5	96.2	124.2	99.7	111.6
Seed set (%)	83.0	81.8	85.5	81.7	86.4	78.9	84.2
1000-grain weight (g)	26.6	26.4	26.9	26.6	26.9	26.9	27.2

[a]TSA ranked first and outyielded all other varieties significantly at the 1% level. [b]Check is Shanyou 63. [c]Check is Gui-Chao No. 2. [d]Check is Shan-Er -Ai.