the leaves than susceptible varieties. NC1626, IET3279, IET6148, and IET7614 were tolerant. ES29-5-3, RAU4004-127, and IR25890-82-5-3 had over 95% affected hills. The Zn content in the third leaf may be taken as a criterion for screening a large number of lines and can be used for genetic studies. □

# Genetic Evaluation and Utilization
## TEMPERATURE TOLERANCE

### Cold tolerance in dry season rice for deepwater areas of north Bihar, India

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We have studied growing irrigated rice in deepwater and low-lying areas during the Dec-May dry season since 1980. In the eastern part of Bihar, adjoining West Bengal, semidwarfs Jaya, Pusa 2-21, and local cultivars are grown on about 10,000 ha. In some regions, the temperature drops to 5 °C the last week of Dec to early Jan. Those areas need cold-tolerant lines.

An experiment with 20 genotypes was laid out during the 1984 dry season. Entries were seeded 27 Oct 1984 by the wet method and transplanted 22 Dec in a deepwater plot puddled with residual water. Plot size was 9.4 $m^2$ in a randomized block design with 2 replications. P and K at 26 and 25 kg/ha was basally applied and 40 kg N/ ha was topdressed at tillering and at panicle initiation. Six irrigations were given as necessary. Temperature reached 5 °C the last week of Dec and many varieties did not survive. However, 8 varieties had more than 50% survival

**Table 1. Cold tolerance in different rice genotypes. Bihar, India, 1984-85.**

| Designation | Seedling survival (%) |
|---|---|
| IET7617, IET7613, IET6223 | 81-100 |
| Rasi, CR251-55-54-1, IET7614 | 71-80 |
| IET3279 | 61-70 |
| Saket 4 | 51-60 |
| Br 34, RD201, Rewa 353-1 | 41-50 |
| Es 21-2-5 | 31-40 |
| IR19743-25-2-3 | 21-30 |
| Pusa 2-21, Sita, IET7564, Rewa 353-2 | 11-20 |
| IET6148, IET7970 | 0-10 |

**Table 2. Grain yield of promising cold-tolerant lines. Bihar, India, 1985-86 dry season.**

| Designation | cross | Grain yield (t/ha) |
|---|---|---|
| CR126-42-2 | Dungansali/IR8 | 1.04 |
| RP1451-1712-4319 | Rasi/Fine Gora | 1.19 |
| RP1888-4259-1529-126 | RP79-5/Tella Vadlu | 0.98 |
| CR222-MW10 | MTU15/Waikoku | 0.72 |
| Rasi | TN1/CO 29 | 0.62 |
| CR125-55-54-1 | WH18/MTU17//TN1 | 0.92 |
| RP1670-1418-2205-1582 | M63-83/Cauvery | 0.82 |
| Saket 4 (check) | TKM6/IR8 | 0.62 |
| CD (0.05) | | 0.14 |
| CV (%) | | 27.6 |

(Table 1). Br 34, a photoperiod-sensitive variety, did not flower. All other varieties flowered and were harvested in May.

The eight cold-tolerant lines were in yield trials during the 1985-86 dry season. Each entry was planted in 24-$m^2$ plots at 20- × 15-cm spacing in a randomized block design with 3 replications. The nursery was sown 25 Oct 1985 by the wet method and transplanted 23 Dec 1985 after plots were puddled with the receding water of deepwater plots. Fertilizer was 80-18-17 kg NPK/ ha. One-fourth N and all P and K were applied basal; one-half N was applied at maximum tillering, and one-fourth N at panicle initiation. Harvest was at the end of May.

Yield data show RP1451-1712-4319 and CR126-42-2 as promising (Table 2). Brown leaf spot was a problem at the seedling stage; stem borer at transplanting and harvesting. □

# Genetic Evaluation and Utilization
## DEEP WATER

### Sudha, a new deepwater rice variety in Bihar, India

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Sudha, the popular name given TCA72 (IET8977), has been released for rice areas with up to 100 cm water depth in Bihar. It can be direct seeded in deepwater areas in Mar or transplanted or direct seeded in May-Jun in rainfed lowland waterlogged areas (25-50 cm).

Sudha was selected for its non-shattering grain type and resistance to tungro and sheath rot (Table 1). It has drought tolerance at vegetative and reproductive stages. It is 150-200 cm tall, depending on water depth. It is photoperiod-sensitive, flowering around 22-25 Oct. Grain is long and slender (length 7.37 mm, width 2.37 mm, 1ength:breadth 3: l), and 1,000-grain weight is 27 g. The husk is straw colored and the kernel light red.

It is resistant to leaf spot and moderately resistant to bacterial leaf

blight and stem borer.

It has green foliage without basal leaf sheath pigmentation and can be used as a marker for identifying shattered grains of Janki, which has a purple basal leaf sheath, in deepwater plots.

In 1982-86 deepwater rice yield trials, average yield at Pusa experiment station was 1.6 t/ha, compared to 1.4 t/ha for check variety Janki (Table 2). In 77 deepwater minikit tests in farmers' fields 1984-85, it yielded an average 2.1 t/ ha compared to 1.8 t/ha of check. In all India coordinated trials during 1984, its average yield at deepwater locations was 2.4 t/ha, compared to 2.1 t/ha of checks. Maximum yields were 3.2 t/ha in 1985 on-farm trial at Deoria Kothi, East Champaran, and 3.7 t/ha in 1984 at Malda, West Bengal. Breeder seed is being produced at Pusa, Bihar. □

**Table 1. Varietal reaction to diseases and pests in Bihar, India.**

| Variety | Disease score[a] | | | | |
|---|---|---|---|---|---|
| | Tungro | Brown spot | Bacterial blight | Sheath rot | Stem borer |
| Sudha | 3 | 3 | 5 | 1 | 5 |
| Janki | 3 | 5 | 7 | 3 | 6 |
| Br 8 | 7 | 5 | 7 | 7 | 6 |
| T141 | 7 | 5 | 7 | 7 | 6 |

[a] By the *Standard evaluation system for rice* 0-9 scale.

**Table 2. Yield performance of Sudha in Pusa, India, 1982-86.**

| Variety | Grain yield (t/ha) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1982 | 1982 | 1983 | 1984 | 1985 | 1986 | Average |
| Sudha | 2.0 | 2.1 | 2.0 | 1.0 | 0.8 | 1.7 | 1.6 |
| Janki | 1.8 | 1.7 | 1.9 | 0.8 | 0.8 | 1.6 | 1.4 |
| CD (0.05) | 0.25 | 0.26 | 0.49 | 0.33 | ns | – | |
| CV (%) | 19.4 | 8.3 | 17.5 | 19.0 | 47.9 | – | |
| Maximum water depth (cm) | 50 | 30 | 80 | 120 | 90 | 95 | |

## NC493, a promising variety for rainfed deepwater areas

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The 1985 Annual Rice Workshop of the Directorate of Rice Research, Hyderabad, has recommended NC493 (IET8989); a pureline selection identified at Chinsurah, as a promising variety for semideep water (50-100 cm) in West Bengal, Uttar Pradesh, Bihar, and Tripura. In 9 state adaptive trials 1979-82, NC493 averaged 39% higher grain yield than checks Pankaj, Mahsuri, and Tilakkachari (see table).

NC493 is photoperiod sensitive and flowers in late Oct. It is medium tall (I 50 cm) and tillers moderately (7-9). The panicle is about 25 cm long with good exsertion and golden color glumes. The glumes are 10.1 mm long; shape index is 3.9; 1,000 grain weight, 23 g. Seed dormancy is strong. It is resistant to bacterial blight and blast, moderately resistant to brown spot, and moderately susceptible to sheath blight, bacterial leaf streak, and yellow stem borer.

NC493 yielded an average 3.1 t/ha (2.4 t/ ha for check) over 46 locations and has been recommended for minikit demonstration trials in farmers' fields. □

**Performance of NC493 in state and national trials, India, 1979-85.**

| Trial | Sites | Local check | Yield (t/ha) | | Max water depth (cm) |
|---|---|---|---|---|---|
| | | | NC493 | Local check | |
| | | *1979-82* | | | |
| State adaptive | Nine sites | Pankaj, Mahsuri, and Tilakkachari | 3.9 | 2.8 | 75 |
| | | *1983* | | | |
| PVT-5 | Chinsurah | IET7976 | 4.6 | 2.5 | 46 |
| | Cuttack | Tilakkachari | 4.2 | 2.6 | 42 |
| | Patna | Tilakkachari | 2.6 | 1.8 | na |
| | Pusa | Tilakkachari | 1.6 | 1.5 | 65 |
| | Gaghraghat | Tilakkachari | 0.7 | 0 | 60 |
| | | *1984* | | | |
| UVT-5 | Malda | CN540 (Suresh) | 5.0 | 4.2 | 40 |
| | Hyderabad | IET9168 | 3.9 | 2.4 | 50 |
| | Cuttack | CR210-1018 | 3.5 | 0.7 | na |
| | Sabour | Jantu | 3.1 | 2.2 | na |
| | Karimganj | NC492 (Sabita) | 2.6 | 2.2 | na |
| | Bhubaneswar | OR142-105 | 2.3 | 1.9 | 100 |
| | Pulla | Mahsuri | 1.5 | 1.2 | 70 |
| Physiology screening | Four sites | NC492 (Sabita) | 3.1 | 2.7 | na |
| | | *1985* | | | |
| UVT-5 | Arundhutinagan | Pizam | 7.4 | 4.5 | na |
| | Patna | Janki (C64-117) | 3.6 | 1.8 | na |
| | Malda | Janki (C64-117) | 3.6 | 2.7 | 70 |
| | Cuttack | CR1030 | 3.0 | 3.1 | na |
| | Gaghraghat | Madhukar | 2.8 | 2.0 | 53 |
| | Aduthurai | CR1009 | 2.6 | 2.6 | 50 |
| | Masodha | Tl00 | 2.4 | 0.8 | 34 |
| | Ranital | CR 1009 | 2.3 | 1.2 | 45 |
| | Karimganj | Janki (C64-117) | 2.0 | 1.3 | 90 |
| | Pulla | PLA1100 | 1.0 | 0.7 | 70 |
| Physiology screening | Five sites | NC492 (Sabita) | 3.1 | 2.8 | na |
| | Mean | | 3.1 | 2.1 | |

[a] na = not available.