The yield differences among the entries were significant in both years. DR cultivars recorded higher yields than IET or OR cultivars. DR83-1 and DR83-2 in both normal and drought years outyielded the other entries, indicating their drought tolerance capacity. □

### Response of rainfed upland rice to chlormequat chloride

*B. K. Ghosh and S. K. Sahu, Plant Physiology and Soil and Agricultural Chemistry Departments, College of Agriculture, Orissa University of Agriculture and Technology, Bhubaneswar 751003, Orissa, India*

Upland, rainfed rice yields in Orissa are very low because of continuous drought. The use of a growth retardant on rice may improve crop yield by enabling the plant to resist drought through root proliferation.

We studied the effect of chlormequat chloride on the grain yield of rice at the Regional Research Station, Semiliguda, in Jun-Sep 1979. The soil was a clay loam (Ochrept) with pH 5.5, 0.852% organic matter, 9.5 kg available P/ha, cation exchange capacity 8.5 meq/100 g soil, and water-holding capacity 45%. Parijat (100 d duration) and Subhadra (90 d) were the test varieties.

The crops suffered from intermittent drought at various growth stages (Table 1). After germination, chlormequat chloride at 500 and 1,000 ppm was sprayed once or twice.

Both varieties yielded significantly higher when 500 ppm chlormequat chloride was sprayed twice (Table 2). The response was higher in Subhadra than in Parijat. □

**Table 1. Stages of growth and drought spells suffered by the crop. Semiliguda, Orissa, India, Jun-Sep 1979.**

| Plant age | Drought conditions |
|---|---|
| *Seedling* | |
| Germination to day 4 | No drought |
| Day 5 to 19 | Drought |
| *Vegetative* | |
| Day 20 to 40 | No drought |
| Day 41 to 52 | Drought |
| Day 53 | No drought |
| *Reproductive* | |
| Day 54 to 60 | Drought |
| Day 61 to 62 | No drought |
| Day 63 to 68 | Drought |
| Day 69 | No drought |
| *Flowering and ripening* | |
| Day 70 until harvest | Drought |

**Table 2. Effect of chlormequat chloride on rice yield. Semiliguda, Orissa, India, Jun-Sep 1979.**

| Chlormequat chloride (ppm) | Sprays (no.) | Time of spray (d after germination) | Grain yield (t/ha) | |
|---|---|---|---|---|
| | | | Parijat | Subhadra |
| 0 (water) | – | – | 2.0 | 1.5 |
| 500 | 1 | 25 | 2.1 | 1.8 |
| 1000 | 1 | 25 | 2.2 | 1.8 |
| 500 | 2 | 25,40 | 2.4 | 1.9 |
| 1000 | 2 | 25,40 | 2.3 | 1.8 |
| CD (0.05) | – | – | 0.3 | 0.1 |

# Genetic Evaluation and Utilization
## ADVERSE SOILS TOLERANCE

### Screening for zinc deficiency tolerance in rice

*B. N. Singh and R. Sakal, Rajendra Agricultural University, Pusa (Samastipur), Bihar, India*

Zn deficiency is becoming a major nutritional problem limiting rice yield. Genetic variability for tolerating it exists in rice genotypes. During the 1985 wet season at Pusa, severe Zn deficiency was observed in a varietal trial of 16 entries grown in 15-$m^2$ plots in 3 replications. The symptoms were severe 25-30 d after transplanting. The soil was a light, extremely calcareous (free $CaCO_3$ 39%) sandy loam (organic C 0.48%, pH 8.6, EC 0.50 dS/m).

Scoring was based on percentage of hills affected in a plot (see table). Zn content of the third leaf from the top (five leaves from each replication, bulked) was determined with an atomic absorption spectrophotometer. Tolerant varieties had higher Zn concentration in

**Zinc tolerance in rice varieties. Bihar, India, 1985 wet season.**

| IET no. | Designation | Cross | Score[a] | Zn concentration (ppm) |
|---|---|---|---|---|
| 3279 | CR126-42-2 | Dungansali/IR8 | 3 | 28 |
| – | NC1626 | Selection from land races | 1 | 38 |
| 7614 | RP1451-1712-4319 | Rasi/Fine Gora | 3 | 29 |
| 7613 | RP1670-1418-2205-1582 | M63-83/Cauvery | 3 | 24 |
| 6148 | TNAU6464 | Bala/CO 13 | 3 | 28 |
| 7254 | TNAU(AD)103 | Tiruveni/Amravathi CO 3 | 3 | 27 |
| 7564 | RP1667-301-1196-1562 | IRAT8/N22 | 7 | 16 |
| 7616 | RP1888-4259-1529-126 | RP79-5/Tella Vadlu | 5 | 22 |
| – | IR25588-7-3-1 | IR19657-37-3/IR9129-209-2-2 | 7 | 14 |
| – | Pusa 4-11 | Tadukan/IRB | 7 | 16 |
| – | Pusa 33 | Improved Sabarmati/Ratna | 7 | 19 |
| – | Pusa 2-21 | IR8/TKM6 | 7 | 17 |
| – | ES29-5-3 | – | 9 | 13 |
| – | RAU4004-127 | – | 9 | 12 |
| 6223 | CR222-MW10 | MTUl5/Waikoku | 9 | 13 |
| – | IR25890-82-5-3 | RP825-714-ll/CR113-32// IR9129-209-2-2 | 9 | 13 |

[a]Based on percentage of hills affected in a plot: 1 < 1%, 3 = 1-5%, 5 = 6-25%, 7 = 26-50%, 9 = 51-100%.

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

*B. N. Singh and S. P. Sahu, Plant Breeding Department, Rajendra Agricultural University, Pusa, Samastipur, Bihar 848125, India*

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

*B. N. Singh, S. P. Sahu, and R. Thakur, Rajendra Agricultural University, Pusa, Samastipur, Bihar 848125, India*

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