16. Response of rice genotypes to cold temperature in *boro* season

V. TIWARI, S. K. RAUTARAY and U. D. SINGH
Regional Rainfed Lowland Rice Research Station, Gerua, Kamrup-781102 Assam India

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Introduction

Assam state stretches between 24º and 28ºN latitude and 90º and 96ºE longitude comprising mostly plains and valleys. Boro rice is cultivated during October/November to May/June Boro rice was observed to be cultivated up to an elevation of 600 m asl. Areas under boro rice can be broadly delineated into three categories on the basis of land and water source: (i) rainfed swampy, flood prone ecology; (ii) irrigated flood prone ecology; and (iii) irrigated flood-free ecology (Pathak et al., 2000). In Assam state of India, *boro* rice cultivation has been adopted by farmers to supplement the yield from the wet season crop, which is prone to natural vagaries. Local sorts and wet season cultivars are generally grown during *boro* season and there is need for developing improved cultivars possessing cold tolerance at seedling stage along with high yield. Cold tolerance at seedling stage is the primary requirement of *boro* cultivars as seedlings are raised during the cold months of November and December. The present study was made to screen some working collection lines for reaction to low temperature at seedling stage for identifying the tolerant lines and to observe the response based on duration of exposure and intensity of low temperature.

Materials and Methods

The study material comprised of 150 entries from the working collection consisting of native cultures and improved cultivars. IR36 and Jaya were used as tolerant checks while Bhoi was the susceptible check. The lines were sown in nursery bed at fortnightly intervals in three different dates viz., 15th November (D_1), 30th November (D_2) and 15th December (D_3). The final recording of cold tolerance reaction and measurement of seedling height was done in 60d old seedlings before uprooting the seedlings for transplantation. The recording of cold tolerance was done following the Standard Evaluation System for Rice developed by IRRI in 2002. The scale for seedling cold tolerance ranged from 1-9 as follows: score-1: Seedlings dark green; score-3: Seedlings light green; score-5: Seedlings yellow; score-7: Seedlings brown; score-9: Seedlings dead. All the genotypes were rated for their response to cold tolerance on the basis of their seedling colour and assigned scores accordingly.

Results and discussion

During the period of nursery raising in boro season 2004-05, the maximum temperature was around 26℃ from 2nd week of November to 2nd week of December 2004. Thereafter, it was around 20-22℃ from 3rd week of December till January end of 2005. The temperature started to rise again from 2nd week of February. The night temperature started falling from the 4th week of November and average minimum temperature ranged between 10-12℃ up till the first week of February. Extreme low temperature around 6-8℃ was experienced in last week of December 2004. Dew formation, which enhances the susceptibility to cold temperature, was observed all through the duration of nursery raising.

The native cultures, which are preferred by farmers, showed the maximum cold tolerance score of 1-2 in all the three sowing dates (Table 1). These entries belonging to the resistant group are suitable as donors for cold tolerance in crop improvement work for *boro* situation. The entries showing cold tolerance score between 3-4 in all the sowing dates are given in Table 1. The entries in this group include both native cultures and improved strains showing moderately resistant type of reaction are suitable as donor for cold tolerance as well as high seed yield.

Although the effect of duration of exposure and intensity of low temperature was not visible in the tolerant genotypes, its influence on susceptible genotypes was very marked. Genotypic differences were observed both for response to duration of exposure and intensity of low temperature. The seedlings in D_1 were exposed to cold temperature for the longest period in nursery bed and genotypes in this sowing showed high cold tolerance score (7 and above) while their reaction was not so intense in D_2 and D_3. Such genotypes included ARC 539-12859, ARC 432-14789, SBG 11-2, Saket 4, Warda 42, Shrabani, Shabnam, Sarathi, IET 16958, MTL 145-2, Luit and Prabhat. These entries are not suitable for November sowing and these can be used for later sowings. The influence of intensity of cold temperature was revealed by reaction to low temperature occurring during the last week of December by seedlings raised during D_2 and D_3. The entries in D_2 were affected most severely, ie., showed higher score than D_1, included SBG 108, ARC 17-124463, Vandana, Warda 39, SBG 12, Chaita and Annapurna. These entries are suitable for late sowing whereas early sowing will allow them to escape the intense cold due to their more seedling age.

Seedling height was also measured to know the influence of different dates of sowing on reaction to cold temperature. Seedling height was highest in D_1 (12-38cm) followed by D_3 (11-33cm) and D_2 (10-32cm). The seedlings in D_2 were shortest in height as they experienced very low temperature in early seedling phase and took time to recuperate.

This study has given an opportunity to select genotypes for cold tolerance for their utilization in crop improvement for *boro* condition in Assam state of India

Table 1 Entries suitable as donor for cold tolerance

1. *Entries showing cold tolerance score 1-2* Boro 1 (Assam, India), Boro 2 (Assam, India), Sungal Boro (Assam, India), ARC 554-15861 (Assam, India) and Gajapati (Orissa, India)
2. *Entries showing cold tolerance score 3-4* Surendra (Orissa, India), Chandrama (Orissa, India), CR 898 (Orissa, India), CRK 7 (Orissa, India), CR 918-18 (Orissa, India), ORS 199-5 (Orissa, India), Bishnu Prasad (Assam, India), Annanda (Orissa, India), Ananga (Orissa, India), Dhanlaxmi (Uttar Pradesh, India), Konark (Orissa, India), SBG 60 (Bihar, India), SBG 44(Bihar, India), Rupsundari (Assam, India), Gautam (Bihar, India), RR 380-10-3 (Jharkhand, India), Jaya (Orissa, India), P 1080 (Colombia), P 834 (Colombia), MTL 250 (Vietnam), IET 17148 (Andhra Pradesh, India), Pusa 44 (India), Khitish (Orissa, India), Daya (Orissa, India), Govind (Uttaranchal, India), Pankaj (Orissa, India), Biplab (Bangladesh), IR 36 (IRRI), Warda 87 (WARDA, Africa) and Kolong (Assam, India)

Reference

Pathak P. K., Saud R. K., Bora D. K., Singha K. D., Pathak A. K., 2000. Status of boro (summer) rice in Assam: a case study. International Rice Commission Newsletter 48: 60-66.