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Effect of low temperature on germination percentage, germination relative index and vigour index of various genotypes of boro rice (*Oriza sativa* L.)

Seema* and A. K. Roy

Department of Bot. & Plant Physiology, Rajendra Agricultural University, Bihar, PUSA (SAMASTIPUR) INDIA

ABSTRACT

Boro rice crop exposed to adverse effect of low temperature during seed germination and seedling growth stage. High mortality of plants and severe yield loss under such conditions are the recurrent feature of rice ecosystem during boro season. In order to understand the impact of low temperature stress, six genotypes viz. Gautam, Richharia and Dhanlaxmi from cold tolerant group and Turauta, Jaya and Heera from susceptible group were selected for detailed study. A general decline in germination percentage, germination relative index and vigour index of germinating seeds in low temperature stress condition than under non stress condition was observed. Minimum values were recorded for Turanta, Jaya and Heera while the Gautam, Riccharia and Dhanlaxmi were affected relatively less. Electrical conductivity of the exudates obtained from low temperature stressed germinating seeds was higher than that obtained from germinating seeds under control, reflecting a damage to the integrity of the cell membrane affecting the metabolite retention potential of the genotypes. The reduction in the mobilization efficiency of germinated seeds in low temperature as compared to that in control indicated the adverse effect of low temperature stress on the overall turnover of metabolites between endosperm and embryonic axis with adverse consequence for establishment of the seedlings of the vigour in the field.

Key words : Boro rice, Seed, Cold, Germination

INTRODUCTION

Boro rice crop sown in November and December after the recession of flood water in deep water areas is benefited on account of the favourable residual moisture, fertility and chemical changes that take place in soil due to long submergence, high radiation, favourable ripening time and low insect and disease attack. As a result boro season rice produces more yields (2.5-4.5 t/ha) than the Kharif rice (1.5-2.7 t/ha) in the same ecology (Chatterjee *et al*., 1996). In Bihar average productivity is about 4 t/ha and the yield of 8.10 t/ha from high yielding varieties on farmers field have been reported

(Thakur *et al*., 1994). Among the problems, low temperature at germination and seedling stage has been identified as predominant abiotic stress affecting the sustainability of boro rice cultivation. Seedling survival is a serious problem under temperature below 10°C. Therefore, the present study of chilling response to seed germination and early seedling growth for their basic morphological and physiological parameters of tolerant and susceptible genotypes were undertaken for utilization of suitable characteristics in the breeding for improved varieties of boro rice.

MATERIALS AND METHODS

The experiment was conducted in rabi season during November to January of 2000-2001 and 2001-2002 at Rajendra Agricultural University Campus Pusa (Bihar) situated on the bank of the river Burhi Gandak at an altitude of 52.92 meters above Mean Sea Level and between 25°39'N and 80°40'E. The maximum and minimum temperature during the period ranged between 27.74 to 11.06°C in 2000-2001 and 23.53 to 11.88°C in 2001-02. During this period relative humidity at 700 hr ranged between 93-88 per cent and 1400 hr between 63-30 per cent in 2000-2001 while in 2001-2002 was 94 to 88 per cent and 82 to 46 per cent respectively. 26 genotypes of rice were obtained from rice section department of Plant Breeding, Rajendra Agril. University, Pusa and subjected to preliminary screening under Boro season. Genotypes were selected on the basis of their differential ability to tolerate cold condition at seedling stage. For detailed study six genotypes V_1 (Gautam), V_2 (Richharia), V_3 Dhanlaxmi were from tolerant and V_4 (Turanta), V_5 (Jaya), V_6(Heera) from susceptible type were selected on the basis of their cold tolerance score. The data presented in the mean value of the two years experiment. Seed germination was studied in January (T_2) under low temperature (3.22-16.6°C) and in November (T_1) under non-chilling low temperature (14.7-22.4°C).

RESULTS AND DISCUSSION

Result showed that germination was more in November which was significantly reduced on account of chilling temperature in January. The significant impact of low temperature was apparent in two ways germination inhibition and delay in germination. The values obtained for per cent germination (Table-1) and germination relative index (Table- 2) under the prevailing low temperature in January were, on the whole, lower by 31.52 per cent and 50.33 per cent than in November, respectively. Low temperature induced decline in germination has been attributed to (a) killing of imbibed seeds (b) structural lessons in the radicle during initial hydration (c) abortion of radicle and (d) disruption in metabolic process. It has been postulated that retarded flow of water at temperature below 9 to 27°C leads to low respiratory rate and the energy limitation results in very slow germination (Aleshin and

* Author for corrospondence.