Short Communication

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Effect of Salinity on Growth and Chlorophyll Content in Rice·

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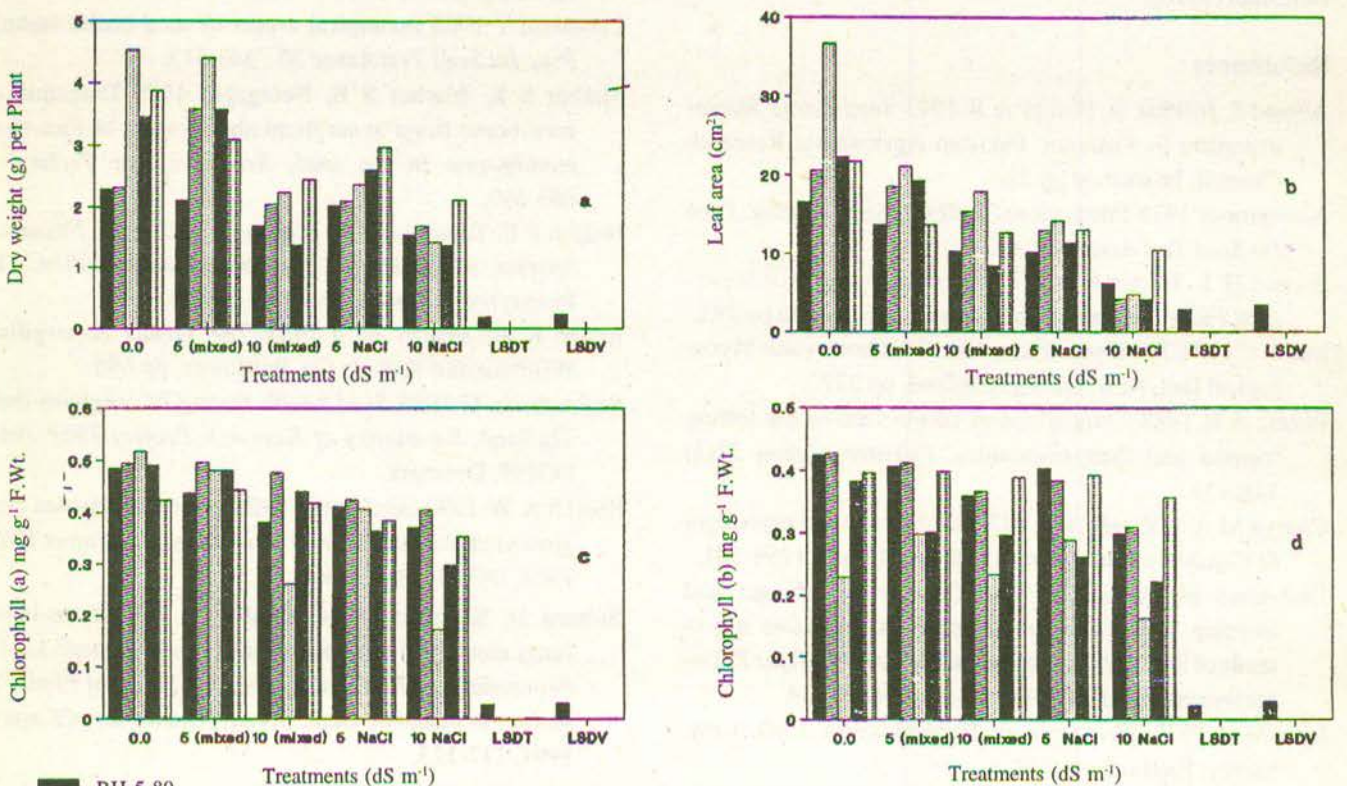
Plants are, generally, most sensitive to salinity during germination and early seedling growth (Ashraf *et al* 1991). In halophytes, however, reduced salinity is conducive to germination (Chapmaan 1975). Most of the studies on effect of salinity in rice are restricted to germination, fresh weight and yield; however, limited information is available on salinity induced metabolic changes during early seedling growth. Present studies show that salt sensitivity of different genotypes differ in their photosynthetic activity.

A gravel culture experiment was conducted to study the effect of salinity on growth and photosynthetic activity of five rice genotypes in a growth cabinet maintained at 30/25+2°C day/night temperatures; a photoperiod of 10 h (25.5 Wm^2), Salinity was created by mixing Na_2SO_4, $CaCl_2$, $MgCl_2$ and NaCl salts (1.88635, 0.964, 0.26^0 and 0.6135 gl^{-1} respectively for 5 dSm^{-1} and double their quantities for 10 dSm^{-1}) and NaCl alone (10.2 meq l^{-1} NaCl is equivalent to 1 dSm^{-1}). Thirty days old seedlings of five rice genotypes i.e. BH-5-89, BH-3-89, RST-1-86, RST-2-84 and Bas-370 x NR1, were acquired from the Rice Section of Mutation Breeding Division of NIAB, Faisalabad, Pakistan. This experiment consisted of five treatments (0,5 and 10 dSm^{-1} EC (electrical conductivity) created with mixed salt and EC 5, 10 dSm^{-1} with NaCl only) with three replications in completely randomised block design. The plants were sown in plastic pots (dia.30 cm and length 25 cm.) filled with washed gravel (around 5 mm) containing full strength Hoagland solution (Hoagland 1919). The treatments were created by adding salt solutions from 2.5 d Sm^{-1} and maintained upto desired concentrations, for preventing a sudden shock to plant by salinity. The volume of the solution was maintained by adding Hoagland solution daily. The plants were harvested after one month. Dry weight per plant (after drying the plant in an oven at



Note: mixed = mixed salts
LSDT = LSD for Treatment at $p \leq 0.5$
LSDV = for Variety at $p \leq 0.05$

Fig 1. Effect of different levels of salinity on biomass (dry weight), leaf area, chlorophyll content (a&b) of different rice genotypes.

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70°C for 72 h), flag leaf area (Ashraf *et al* 1995) and chlorophyll contents (Arnon 1949) were determined.

The results indicated that biomass decreased in all the genotypes with increase in salt concentrations except at 5 dSm^{-1} of mixed salt where enhancement in growth was recorded in some rice genotypes (Fig 1 a). The maximum reduction in biomass was at 10 dSm^{-1} (NaCl). In BH-5-89, Bas-370xNR1 and BH-3-89, the reduction in biomass at 10 dSm^{-1} (NaCl) is less than 50 %. On the other hand, RST-1-86 and RST-2-84 have biomass only 31 and 33 % of their control at 10 dSm^{-1} (NaCl). Similar genotypic differences have been reported for rice (Flowers and Yeo 1981) sorghum (Khan and Ashraf 1988; Ashraf *et al* 1991; Ashraf and Khan 1994) and Wheat (Ashraf *et al* 1991).

Reduction in flag leaf area was observed in all the genotypes with increase in salt concentrations (Fig 1 b). The maximum decrease was at 10 dSm^{-1} (NaCl). The genotypes with higher biomass had higher flag leaf area (Fig 1 a & b). The minimum flag leaf area was recorded in RST-1-86 and RST-2-84. Husain and Ismail (Husain and Ismail 1994) also reported reduction in leaf area due to salinity in sunflower.

Chlorophyll (a & b) content of rice leaves also decreased with increased salinity and under both types of salinity (Fig 1 c & d). The lowest chlorophyll content was in RST-1-86 and RST-2-84. The reduction in chlorophyll content is to be expected since being membrane bound, salinity could affect the former through its adverse effects on membrane stability. The decrease in chlorophyll content under stress is a commonly reported phenomenon and in various studies, different reasons have been advanced for decreased chlorophyll content. However, in all such studies, the latter has been related predominantly to membrane deterioration. Biomass production is a function of photosynthetic activity (Terry and Waldron 1984) which is decreased due to decrease in leaf area and chlorophyll content. Thus decrease in leaf area and chlorophyll content caused reduction in area for interception and absorption of light (specific wavelength) necessary for photosynthesis. The results of present experiment showed that NaCl alone was more toxic and injurious than mixed salts and BH-5-89, BH-3-89 and Bas-370xNR1 are better and RST-1-86 and RST-2-84 are poor performing rice genotypes under saline conditions.

Key words: Rice, Salinity, Genotype, Chlorophyll.

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