

Influence of salt stress on nutrient contents in rice (*Oryza sativa* L.) genotypes

C. Raja Babu and S. Ramesh*

Department of Crop physiology, Tamil Nadu Agricultural University, COIMBATORE (T.N.) INDIA

ABSTRACT

A field experiment was conducted under sodic soil condition prevailing at Anbil Dharmalingam Agricultural College and Research Institute, Tiruchirapalli to determine the effect of salt stress on nutrient contents in 10 rice (*Oryza sativa* L.) genotypes. The tolerant cultivars showed higher P content compared with other genotypes indicating their ability to take up and effectively utilize the nutrient for the metabolic functions than the susceptible ones. The K content which acts as an osmoticum under situation of unfavourable environment, invariably keeps the plant to withhold more water even in the presence of higher osmotic potential in the external salt solution. In the present study among the 10 genotypes tested the cultivars APMS 5B, IR 68885B, TRY(R) 2 and CO 43 recorded higher NPK content. The genotypes CORH 2, IR 68885B, APMS 5B and CO 43 expressed low Na/K ratio, which can be grouped as salt tolerant.

Key words : *Oryza sativa* L., Salt stress, Nutrient contents.

INTRODUCTION

Soil salinity is a major problem in arid and semi-arid regions, where rainfall is insufficient to leach salts and excess sodium ions move down and out of the root zone. Today, salinization of millions of hectares of land continues to reduce crop productivity severely worldwide. Of the approximately 13 billion hectares total land on earth, about 1 billion is affected by salinity/sodicity. According to a report, saline/sodic soils cover about 26 per cent of the cultivated land world wide (Alam *et al.*, 2001). Rice is considered to be a salt sensitive crop (Flowers and Yeo, 1981). However, considerable variability for salinity resistance among rice varieties is also apparent (Yeo and Flowers, 1982). This paper reports the effect of salt stress on nutrient contents of different rice genotypes.

MATERIALS AND METHODS

Field experiments were conducted under sodic soil condition at Anbil Dharmalingam Agricultural College and Research Institute, Tiruchirapalli. Ten rice genotypes were raised in the nursery under moderate level of soil sodicity. Transplanting of seedlings was done 28 days after sowing in the main field under sodic soil condition. Two to three seedlings per hill were planted in the main field in the spacing of 20 x 10 cm. The study was conducted in the wet season (2002-2003) in Randomized Block Design and each treatment was replicated thrice. Plant samples were collected at different phenological stages for assessing nutrient content of different rice genotypes. The total nitrogen content of the plant samples was estimated by microkjeldhal method as proposed by Yoshida *et al.* (1972) and expressed as mg g⁻¹ on dry weight basis. Phosphorus, sodium and potassium content was analysed as per the method (Jackson, 1973). The mean values of the above mentioned observations were subjected to the statistical analyses and the genotypes were tested for their significance by adopting the procedure of Panse and

Sukhatme (1961).

RESULTS AND DISCUSSION

High ion concentrations can injure plant cells by different mechanisms *viz.*, specific ion toxicity, ionic strength, ion imbalance or deficiency and osmotic imbalance. Sodium has specific ion effect, which differs from their osmotic effect. On the other hand, ion concentration can increase to such an extent that protein complexes fall apart due to interference with normal electrostatic interaction. For rice, high K/Na ratio in its shoot was proposed as criteria for salt tolerance (Balasubramanian and Sakham Rao, 1977; Hedge and Joshi, 1974). Dutt and Bal (1988) reported that rice varieties that accumulate less Na⁺ in the shoots at peak tillering stage are more tolerant to salinity than varieties that accumulate higher amounts of Na⁺. Krishnamurthy *et al.* (1988) reported that salt tolerant cultivars maintain higher level of total nitrogen than the salt sensitive cultivars when grown in saline medium. Sodicity resulted in sharp rise in Na/K ratio in shoot of each variety which further increased with the plant age. Tolerant variety had a low Na concentration and high K/Na ratio but it is reverse in susceptible variety. Low concentration of Na during early growth could be achieved either by restricted uptake and transport of Na to the shoot or faster rate of growth (Qadar, 1991).

The nutrient analysis of the cultivars for N, P and K status showed significant variation, among the rice cultivars tested. The hybrid CORH 2 had recorded higher contents for N, P and K indicating its tolerance to salt stress and this was followed by the cultivars APMS 5B, IR 68885B, , TRY(R) 2 and CO 43 (Table 1). Similar findings were reported by Wadleigh and Ayers (1945) and Benzioni *et al.* (1968). It was also observed that the salinity curtailed the ATPase bond vital for synthetic process thus affecting the P content yield (Strogonov *et al.*, 1974). The tolerant cultivars showed higher P content compared with other genotypes indicating their ability to take up and effectively utilise the nutrient for

* Author for correspondence, Present address : Department of Agronomy, Central Farm Unit TNAU, Coimbatore (T.N.)