

Genotypic divergence on depression in root dry weight of rice genotypes with varying zinc efficiency

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ABSTRACT

An experiment was conducted to bring out the influence of zinc (Zn) stress on root dry weight of rice genotypes. Fifty six rice genotypes were raised under solution culture with graded doses of zinc (0.0, 0.025, 0.05, 0.1 and 0.2 ppm of Zn as ZnSO₄). Root dry weight was recorded at 30 days after transplanting and genotypes were classified as zinc efficient (a), moderately efficient (b) and zinc inefficient (c) based on the relative depression in root dry weight.

Key words : Solution culture, Rice genotypes, Root dry weight, Zinc efficiency.

Global studies initiated by FAO recorded Zn deficiency in 50% of the soil samples collected from 25 countries (Graham, 1991). The application of Zn fertilizers is not a totally successful strategy in alleviating Zn deficiency because of agronomic (subsoil constraints, disease interactions), economic (unavailability of Zn fertilizers for poor farmers) and environmental (pollution associated with excessive fertilizer use) factors (Hacisalihoglu, 2002). Plant response to Zn deficiency occurs in terms of decrease in membrane integrity, decreased synthesis of carbohydrates, cytochromes, nucleotide, auxin and chlorophyll. Shoot and root growth is distinctly reduced under zinc stress.

Hence the present investigation was conducted to screen rice genotypes for zinc efficiency based on depression in root dry weight.

MATERIALS AND METHODS

The experiment was conducted during 2002-03 in the Green house of the Department of Soil Science and Agricultural Chemistry, Tamil Nadu Agricultural University. Fifty six rice genotypes which include varieties, prerelease cultures and landraces were subjected to screening employing solution culture. Plastic plates with depressions, bottom severed with nylon mesh were countersunk into trays containing modified Hoagland solution (Hoagland and Arnon, 1950) as the nutrient medium. Pregerminated seedlings (five days old) were raised in the trays and the solution below was aerated with fabricated aerators. Five levels of zinc (0.0, 0.025, 0.05, 0.1 and 0.2 ppm as ZnSO₄) were imposed. The

experiment was laid out in factorial completely randomized design with each treatment replicated thrice. The seedlings were screened at ten days interval adopting Standard Evaluation System of Rice (IRRI, 1980).

The percent depression in root dry weight at 30 days was calculated as,

$$\text{Per cent depression in root dry weight} = \frac{\text{Root dry weight}_{\text{adequate Zn}} - \text{Root dry weight}_{\text{low Zn/excess}}}{\text{Root dry weight}_{\text{adequate Zn}}} \times 100$$

The adequate level of zinc for rice under hydroponics is 0.1 ppm. The data were subjected to Systat Multivariate Analysis (Systat, 2002) and the rice genotypes were grouped as a,b,c where 'a' represents highly zinc efficient, 'b', moderately zinc efficient and 'c', zinc inefficient genotypes.

RESULTS AND DISCUSSION

At Zn 0 mg L⁻¹, those genotypes with the depression ranging from 24.7 to 44.7 per cent was demarcated as 'a', from 49.4 to 62.5 per cent as 'b', from 64.0 to 76.4 per cent as 'c'. At Zn 0.025 mg L⁻¹, those genotypes with the reduction ranging from 14.4 to 26.7 is segregated under the category 'a', from 28.3 to 41.7% under the category 'b' and from 43.2 to 63.9 under the category 'c'. At Zn 0.05 mg L⁻¹, class 'a' grouped the genotypes with the reduction ranging from 4.49 to 17.3, class 'b' indicated those ranging from 17.9% to 30.3% and 'c' with the reduction ranging from 31.9% to 45.7%. At Zn 0.2 mg L⁻¹, those genotypes with the reduction ranging from -56.0% to -36.9% were classified under the score 'a', those with the reduction from -28.5 to -8.60 per cent under the score 'b' and with the reduction