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Shoot and root phosphorus concentration of rice (*Oryza sativa* L.) seedlings as influenced by zinc stress

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ABSTRACT

An experiment was conducted to bring out the influence of rice genotypes with varying zinc efficiency on the phosphorus concentration in the shoot and root. Those genotypes which had high phosphorus (P) concentration in the shoot and root were found to be zinc inefficient. Antagonism existing between phosphorus and zinc is established.

Key words : Rice genotypes, Solution culture, Phosphorus, Zinc efficiency.

Cereals, wheat and rice in particular, suffer from Zn deficiency. Grain yield reduction up to 80% has been observed under Zn deficiency (Cakmak *et al.*, 1998). This has serious implication for human health in countries where consumption of cereal based diets predominate.

Zinc stress affects the uptake of other mineral nutrients especially phosphorus and iron. Antagonism between zinc and phosphorus was reported (Soltanpour, 1969). Hence the present investigation was conducted to bringout the influence exerted by zinc stress on the phosphorus concentration in the shoot and root of rice genotypes with varying zinc efficiency under solution culture.

MATERIALS AND METHODS

The experiment was conducted in the Department of Soil Science and Agricultural Chemistry, Tamil Nadu Agricultural University. Fifty six rice genotypes (varieties, prerelease cultures and landraces) were collected and raised in plastic plates with depressions, 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 $ZnSO_4$) were imposed. The adequate level of zinc for rice under hydroponics is 0.1 ppm. 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). Phosphorus concentration in the shoot and root were recorded on 35th day after transplanting.

The data were subjected to Systat Multivariate Analysis (Systat, 2002) and the rice genotypes were grouped as a,b,c where 'a' represents low phosphorus concentration, 'c', high phosphorus concentration and 'b', intermediate level between a and c.

RESULTS AND DISCUSSION

The mean value of phosphorus concentration over different levels of zinc as recorded at 35 DAS revealed that the root concentration of P was greater than the shoot concentration for majority of the genotypes. The shoot phosphorus concentration ranging from 0.10 to 0.15% grouped the genotypes to score 'a', from 0.15 per cent to 0.22 per cent to score b and from 0.23 per cent to 0.38 per cent to score c (Table 1).

In the roots, those genotypes with the concentration ranging from 0.10 per cent to 0.14 per cent was ranked as 'a', from 0.15 per cent to 0.21 per cent as 'b' and from 0.21 per cent to 0.29 per cent as 'c'. The genotypes ADT 41, ADT 43, ADT 46, ASD 16,ASD 18, ASD 20, PMK 1, PMK 2, TRY 1, Pusa Vikas, Norungan, Pokkali, Triveni, Mozikaruppu, Karuvali and Rasakudam had comparatively lower 'P' concentration in the shoot as against a higher concentration noted for ADT 2, ADT 3, ADT 12, ADT 14, ADT 15, ADT 19, ADT 37, ADT 38, ADT 39, TKM 10 and CSR 10.

Relatively high P accumulation in shoots and roots was accounted in Zn inefficient genotypes than the efficient ones. This result corroborates with the view of Parker (1993), who observed increased accumulation of P in the shoot tissue with reduced supply of Zn. Soltanpour (1969) established pronounced P-Zn antagonism. His