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LEAF OXIDATIVE STATUS AND ANTIOXIDANT RESPONSES IN HYDROPONICALLY GROWN PRIMED AND NON-PRIMED RICE SEEDLINGS UNDER DROUGHT AND N-, P-, OR K-DEPRIVATION

Saddam Hussain
University of Agriculture, Pakistan

With increasing frequency and episodes of extreme climatic events, the crop plants are sometimes exposed to multiple abiotic stress factors at the same growth stage. In the present study, we investigated the behaviour of growth, reactive oxygen species and antioxidant defence system in primed (60 µM selenium or 100 mg L-1 salicylic acid priming) and non-primed rice seedlings to the combinations of drought stress and N-, P- or K-deprivation. Results indicated that drought stress as well as deprivation of any mineral nutrient severely hampered the seedling growth of rice. The N-deprivation alone or in combination with drought stress caused the maximum reduction in shoot length and biomass accumulation, although the N-deprived roots were longer. The beneficial effects of seed priming on shoot and root growth of rice were well indicated under drought stress and different nutrient management regimes. Drought as well as nutrient deprivation caused pronounced changes in the oxidative metabolism of rice leaves. The marked increase in the accumulation of ROS (O_2•−, OH--, H_2O_2) and activities of ROS- producing enzymes under the individual as well as interactive effect of drought and N-, P-, or K-deprivation, led to higher lipid peroxidation. The interaction of drought stress and N-deprivation caused the maximum oxidative damage, and recorded poor antioxidant activity, suggesting that N-supply is more crucial under drought stress. The N-deprivation also significantly decreased the levels of non-enzymatic antioxidants (GSH, vitamin C, Vitamin E), which are crucial for the drought tolerance of plants. The oxidative stress evoked by drought or/and nutrient deprivation, was effectively alleviated after seed priming. The leaves of rice seedlings emerged from primed seeds, recorded significantly lower accumulation of ROS and MDA, and lower activities of MAO and XOD. These attributes were well linked to priming-induced enhancements in the activities/levels of SOD, POD, GR, GPX, GSH and vitamin C in the rice leaves.

sadamhussainuaf@gmail.com