Thiourea Application Boosts Crop Productivity and helps in Understanding of Redox Regulatory Mechanism in Plants

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In the face of challenges of food security and climate change, sustainable agriculture has emerged as key principle to nurture healthy ecosystems and support good management of land, water and natural resources. Under a collaborative program with Rajasthan Agriculture University (Bikaner, India), we have developed the application of thiourea as an easy and cost-effective technology for boosting crop productivity under farmer's field conditions. Thiourea is an organo-sulfur compound with formula $SC(NH_2)_2$. It is structurally similar to urea except that oxygen atom is replaced by a sulfur atom. Thiourea applicability has also been demonstrated for increasing grain filling under drought and arsenic stress conditions in Indian mustard and rice, respectively (Fig. 1). At physiological level, this is associated with enhanced metabolite translocation from source (leaves) to sink (pods) (Srivastava et al., 2008) and co-ordinated regulation of plant's source-to-sink relationship (Pandey et al., 2013).

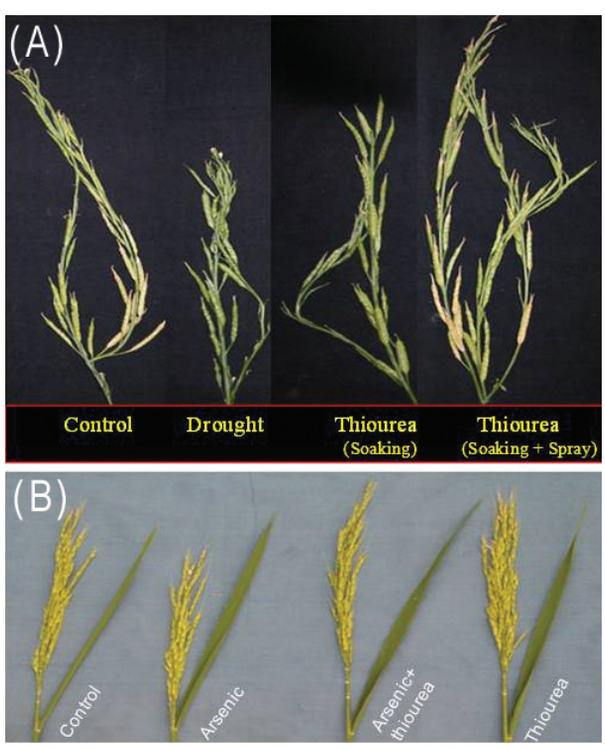

Fig. 1: Impact of thiourea application on agriculture. Thiourea application improves the performance of mustard and rice under drought (A) and arsenic (B) stress conditions

Apart from applied perspective, ROS scavenging action of thiourea is also utilized for understanding the significance of redox regulatory mechanisms associated with different abiotic stresses in plants. In our laboratory, we have developed the application of thiourea a tool to pinpoint the genes, miRNAs and other physiological and biochemical mechanisms which are directly regulated through cellular redox status. This is preferred over widely used redox probe GSH, as being a non-physiological thiol, gene expression changes associated with thiourea are more closely associated with redox state. Using thiourea as a tool, we have successfully identified the redox associated candidate genes associated with calcium and ABA signaling (Srivastava et al., 2010a) and plant-water homeostasis (Srivastava et al., 2010b) in mustard. We have also extended our study to identify redox regulatory mechanisms associated with arsenic stress tolerance and accumulation in rice (Srivastava et al., 2014).

Our future research is to utilize thiourea based research to advance our understanding of plant stress tolerance mechanisms and to provide effective, sustainable solutions to avoid crop losses under changing climatic conditions and enhance productivity.

References:

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