

## **Modulatory effect of Nitric oxide molecule on the heavy metal stress in *Triticum aestivum***

Narayan Singh<sup>1,2\*</sup>, Shalinder Kaur<sup>2</sup>, Harminder Pal Singh<sup>2</sup>, Daizy Rani Batish<sup>2</sup>

<sup>1</sup>Department of Botany, Sai School of Biosciences, Sri Sai University, Palampur, Himachal Pradesh, India-176081

<sup>2</sup>Department of Botany, Panjab University, Chandigarh, India-160014

### **Abstract**

This study investigates the impact of nitric oxide (NO) on heavy metal (HM) stress in *Triticum aestivum*. For this, heavy metals (Cr as K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> and Ni as NiSO<sub>4</sub>) at concentrations of 50µM and 100µM and NO as sodium nitroprusside (SNP; 50µM) were given hydroponically (alone and in combination). Stress parameters in the roots of test plants were assessed after 72h of treatment. In response to HM treatment, the levels of ascorbic acid (a natural antioxidant) significantly declined (23.35±0.67 to 13.24±1.27 & 14.35±0.4 µM/g fresh weight within 72h for 100µM Cr and Ni, respectively). However, in the HM+SNP combination levels was observed at 22.65±1.22 & 22.78±1.25 µM/g fresh weight, respectively (SNP alone= 21.952±0.403). HM exposure also led to increased levels of stress indicators such as H<sub>2</sub>O<sub>2</sub> content, superoxide anions, and other stress markers (including total glutathione-S-transferase, peroxidases, polyphenol oxidases, lipoxygenases, monodehydroascorbate reductase, and malondialdehyde content). The NO demonstrates an alleviating effect when applied with HM's, lowering the levels of stress indicators. Antioxidative enzymes such as superoxide dismutase (~250%; SNP=113%), ascorbate peroxidases (~160%; SNP=2% decrease), and guaiacol peroxidase (~60%; SNP=7% decrease) showed increased activity, whereas catalase had reduced enzymatic activity (~296% in the case of Cr and ~307% for Ni; SNP= 113% increase) in response to the HM stress. When SNP was supplied with HM's, significant positive changes in the above parameters were observed, indicating the protection it offers against heavy metal toxicity. Also, both heavy metals exhibited similar toxic effects on the test plants. Overall, in our study, the NO molecule acts as a stress inducer when applied separately in some parameters. However, in combination with both Cr and Ni, it acts as a stress reliever suggesting its possible use in agricultural systems located in areas abundant in these two heavy metals.

**Keywords: Nitric Oxide, Heavy metal stress, Antioxidants, Hydroponics**