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Supplementation of Sodium Nitroprusside Upregulate Photosynthetic Machinery, Antioxidative Defense System and Nutrient Status in *Brassica juncea*

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Nitric oxide acts as gasotransmitter-diffusible plant growth regulator and play an important role in growth and development of plant. Therefore, in present study mustard plants were sprayed with different concentrations of sodium nitroprusside (0, 10^{-4} M, 10^{-5} M and 10^{-6} M SNP) at 25 days after sowing (DAS) to assess different physiological parameters. The results indicate that foliar application of SNP up-regulate chlorophyll content, photosynthetic efficiency along with gaseous exchange parameters and ultimately leads to increase in overall photosynthetic machinery. Compound and scanning electron microscopic studies also revealed a remarkable increase in stomatal aperture. Further, a gradual increase in carbon metabolism (total reducing sugars, total carbohydrate content, glucose, fructose and sucrose content) was also observed in SNP-treated plants as compared to control. Nutrient status (carbon, nitrogen, phosphorus, sulfur, potassium and magnesium) of leaves also showed a significant increase. The activity of various enzymes associated with nitrogen metabolism, CO_2/HCO_3- homeostasis, glycolysis, Calvin cycle and Krebs cycle (nitrate reductase, carbonic anhydrase, hexokinase, rubisco, fumarase and succinate dehydrogenase) were also increased. It was also reported that superoxide, hydrogen peroxide and malondialdehyde content was decreased in SNP-treated samples. SNP application also up-regulate antioxidative defense system by increasing the activity of antioxidant enzymes, i.e., catalase, peroxidase and superoxide dismutase. Thus, it can be concluded from the present observation that SNP at lower concentration proved beneficial and alter most of the parameters studied which ultimately leads to increase the efficiency of photosynthesis in mustard plants.