**Insights into the role of silicon in improving the nodulation-related traits in lentil plants during drought stress.**

Biju S1, Gupta D1

*sajitha.biju@unimelb.edu.au*

1School of Agriculture, Food and Ecosystem Sciences, Faculty of Science, University of Melbourne, Parkville, Australia

Drought severely impacts lentil (Lens culinaris Medik.) yield worldwide. Our previous studies demonstrated that silicon supplementation improves lentils' ability to withstand drought, focusing mainly on aboveground traits. Building on this, this study explores whether Silicon can also affect below-ground traits and enhance symbiotic nitrogen fixation (SNF) during drought (Biju et al. 2023a, 2023b).

A controlled-environment study was conducted using two lentil cultivars, which were subjected to moderate (40-45% field capacity-FC) and severe (20-25% FC) drought at the anthesis stage, with or without Silicon. Results indicated that Silicon significantly increased nodulation-related traits in drought-stressed lentils with increased nodules number and biomass, alongside higher content of protein, leghemoglobin, total nitrogen, antioxidants, flavonoids, amino acids, and carbohydrates. Silicon enhanced the activity of enzymes linked to carbon-nitrogen metabolism and the rate of photosynthesis with improved aboveground biomass and seed yield compared to untreated plants (p≤0.001).

Principal component analysis revealed a total variance of 86.56% (PC1=70.89%; PC2=15.66%) with three distinct clusters, signifying the impact of Silicon across the studied cultivars and drought levels. The clustering relies on the positive correlations noted among amino acids, antioxidants, and flavonoids in PC2 (r=0.83-0.85) and nodulation traits, nitrogenase, and rate of photosynthesis in PC1 (r=0.91-0.98). These findings align with our previous research, demonstrating that Silicon modulates the gene expressions related to antioxidant defence and carbon-nitrogen metabolism, thereby assisting lentils in drought recovery (Biju et al., 2023b). This modulation likely contributes to improved nodulation, suggesting that Silicon supplementation could serve as a viable option to enhance SNF in drought-stressed lentils.

***References:***

[1] Biju, S. et al., Regulatory role of silicon on photosynthesis, gas-exchange and yield related traits of drought-stressed lentil plants, Silicon, vol. 15, no. 14, 2023a, 5981-5996.

[2] Biju, S. et al., Novel insights into the mechanism (s) of silicon-induced drought stress tolerance in lentil plants revealed by RNA sequencing analysis. BMC Plant Biol, vol. 23, no. 1, 2023b, 498.