Assessing Stomatal Conductance of Rose Cultivars in the Texas Panhandle

Summer Bowman
West Texas A&M University
sbowman1@buffs.wtamu.edu

Keywords: stomatal conductance, rose cultivars, environmental stress

Introduction

The harsh environmental conditions of the Texas Panhandle present significant challenges for ornamental plant growth and recovery, particularly following pest damage. Seasonal grasshopper herbivory can reduce leaf area and disrupt plant water balance, forcing plants to adjust physiological processes to maintain productivity. One such process is stomatal conductance, which reflects how plants regulate gas exchange and water loss through stomatal openings. Because stomatal conductance is closely tied to both photosynthesis and plant water status, it can serve as an early indicator of plant stress and recovery potential following tissue damage. This study examined how grasshopper herbivory influenced stomatal conductance across multiple rose cultivars to evaluate physiological responses associated with environmental stress tolerance in the Texas Panhandle.

Methods

Experiments were conducted at West Texas A&M University's Nance Ranch in Canyon, Texas. Five rose cultivars were selected for evaluation, with three individual plants per cultivar for a total of fifteen experimental units. On each plant, three healthy leaves were selected and marked for repeated measurements. Stomatal conductance was measured over a five-day period from October 21–25 using a LI-600 portable porometer/fluorometer. Measurements were taken twice daily, once in the morning and once in the afternoon, to assess potential diurnal variation in stomatal response. Data were analyzed using ANOVA to evaluate differences in stomatal conductance among cultivars and sampling times.

Results

Statistical analysis indicated no significant differences in stomatal conductance among rose cultivars. A rain event occurring on the final day of measurement resulted in skewed data that were excluded from analysis. However, a consistent trend was observed in relation to time of day. Morning measurements exhibited lower overall stomatal conductance, while afternoon and evening measurements showed elevated conductance across all cultivars.

Conclusion

Although no cultivar-specific differences in stomatal conductance were detected, the observed diurnal trend suggests that time of day may play a role in stomatal regulation following herbivory-induced stress. Lower morning conductance paired with higher afternoon values may indicate delayed stomatal opening or compensatory gas exchange in response to tissue loss under semi-arid environmental conditions. These findings provide a foundation for further research examining physiological stress responses in ornamental crops. Future studies incorporating environmental factors such as vapor pressure deficit, reference temperature or chlorophyll

fluorescence may improve understanding of recovery dynamics and stress tolerance among rose cultivars grown in the Texas Panhandle.

References

Croce, R., Carmo-Silva, E., Cho, Y. B., Ermakova, M., Harbinson, J., Lawson, T., ... & Zhu, X. G. (2024). Perspectives on improving photosynthesis to increase crop yield. *The Plant Cell*, *36*(10), 3944-3973.

Faralli, M., Matthews, J., & Lawson, T. (2019). Exploiting natural variation and genetic manipulation of stomatal conductance for crop improvement. *Current opinion in plant biology*, *49*, 1–7. https://doi.org/10.1016/j.pbi.2019.01.003

Farquhar, G. D., & Sharkey, T. D. (1982). Stomatal conductance and photosynthesis. *Annual review of plant physiology*, *33*(1), 317-345.

Kinhal, V. (2023, January 25). *Chlorophyll fluorescence: Importance and applications*. CID Bio-Science. https://cid-inc.com/blog/chlorophyll-fluorescence-importance-and-applications/

Neves, A. D., Oliveira, R. F., & Parra, J. R. (2006). A new concept for insect damage evaluation based on plant physiological variables. *Anais da Academia Brasileira de Ciências*, *78*(4), 821-835.