

Collaborative Study of *Trimtect*[®] as a Plant Growth Regulator on Shrub Physiology and Drought Tolerance



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Background

Paclobutrazol is a synthetic plant growth regulator known to reduce the size of plants and improve drought tolerance in some species.¹ Paclobutrazol blocks a key step in the formation of gibberellic acid (GA), a plant hormone that stimulates growth and development, therefore resulting in modified growth (Fig. 1). *Trimtect*, a product made by *Rainbow Treecare Scientific Advancements* (Minneapolis, MN), incorporates paclobutrazol and is being formulated for commercial use, as some of the associated changes in growth are desirable from a landscaping maintenance point of view. However, a better understanding and record of physiological responses to *Trimtect* treatments are needed. Therefore, to better understand plant growth regulation, we partnered with *Rainbow Treecare Scientific Advancements* to study the effects of their current *Trimtect* formulation on the physiology of three common shrub species undergoing water stress. The information from this study is helping *Rainbow Treecare Scientific Advancements* refine formulations to improve their product for use in low maintenance landscapes.

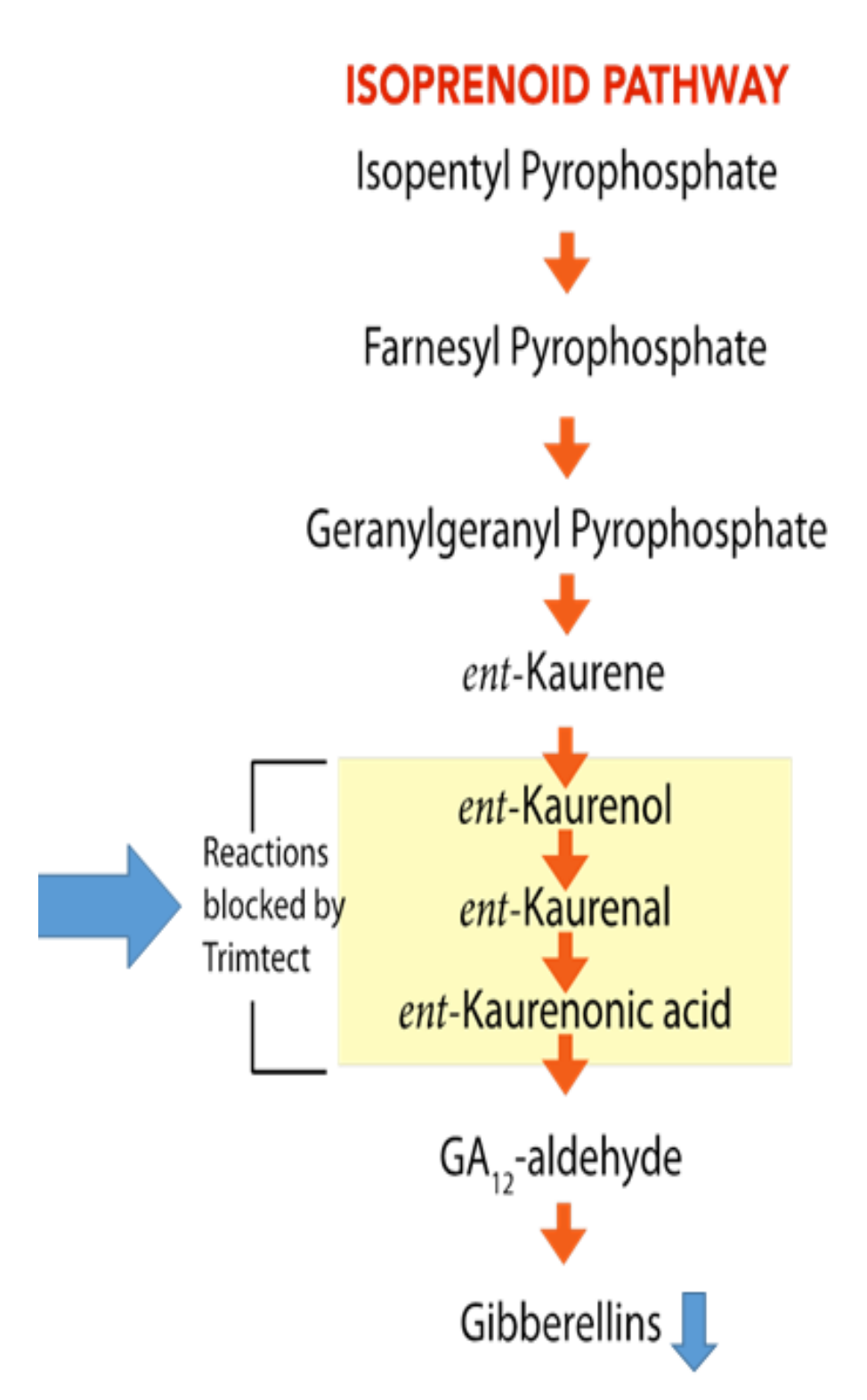
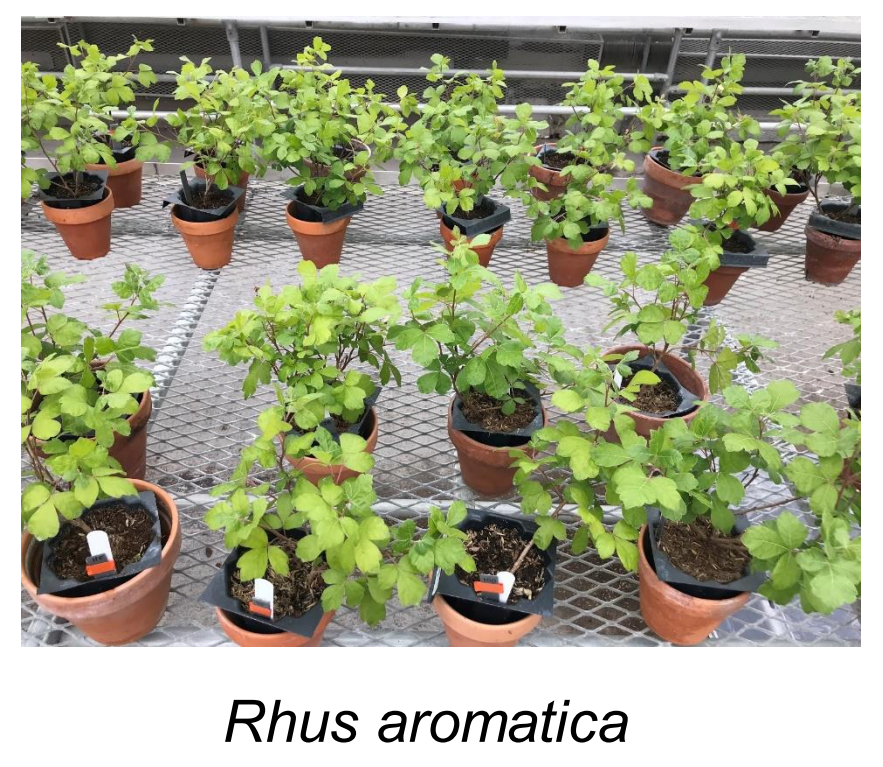


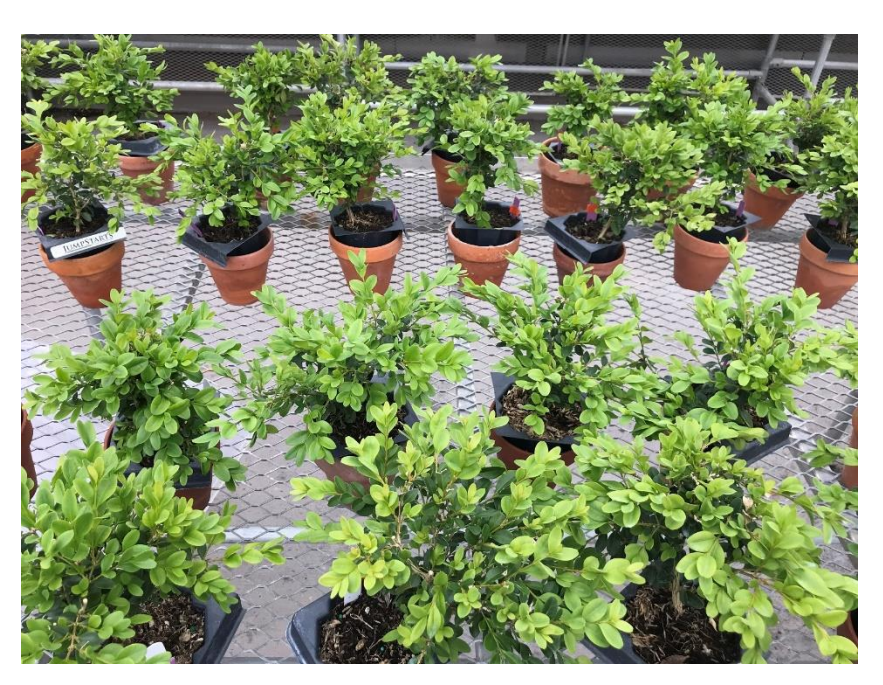
Figure 1. Effect of *Trimtect* of the Isoprenoid pathway

Methods

- The three woody shrub species treated and evaluated were *Hydrangea macrophylla*, *Buxus sinica*, and *Rhus aromatica*.
- Treatments included the plant growth regulator *Trimtect* (*Trimtect* treated, not treated), and drought (well-watered = "high," reduced water = "low").
- Measurements were taken at two time points
 - 22 days following *Trimtect* application ("1st drought"), low water availability = 200 mL of water every other day (N=10).
 - 180 days following *Trimtect* application ("2nd drought"), low water availability = water withheld for 3 days prior to measurements (N=6).
- Leaf net photosynthesis and stomatal conductance were measured using infrared gas analysis (LICOR Environmental, Lincoln, Nebraska).
- Leaf water potential was measured using a pressure chamber (PMS instruments, Albany, Oregon).
- All measurements were taken on the upper fully expanded leaves and the data was analyzed using a two-way ANOVA (JMP version 12.2.0).



Rhus aromatica



Buxus sinica



Hydrangea macrophylla

Figures and Results

How does the physiology of woody shrub species respond to *Trimtect* application?
Does *Trimtect* treatment affect shrub response to low water availability?

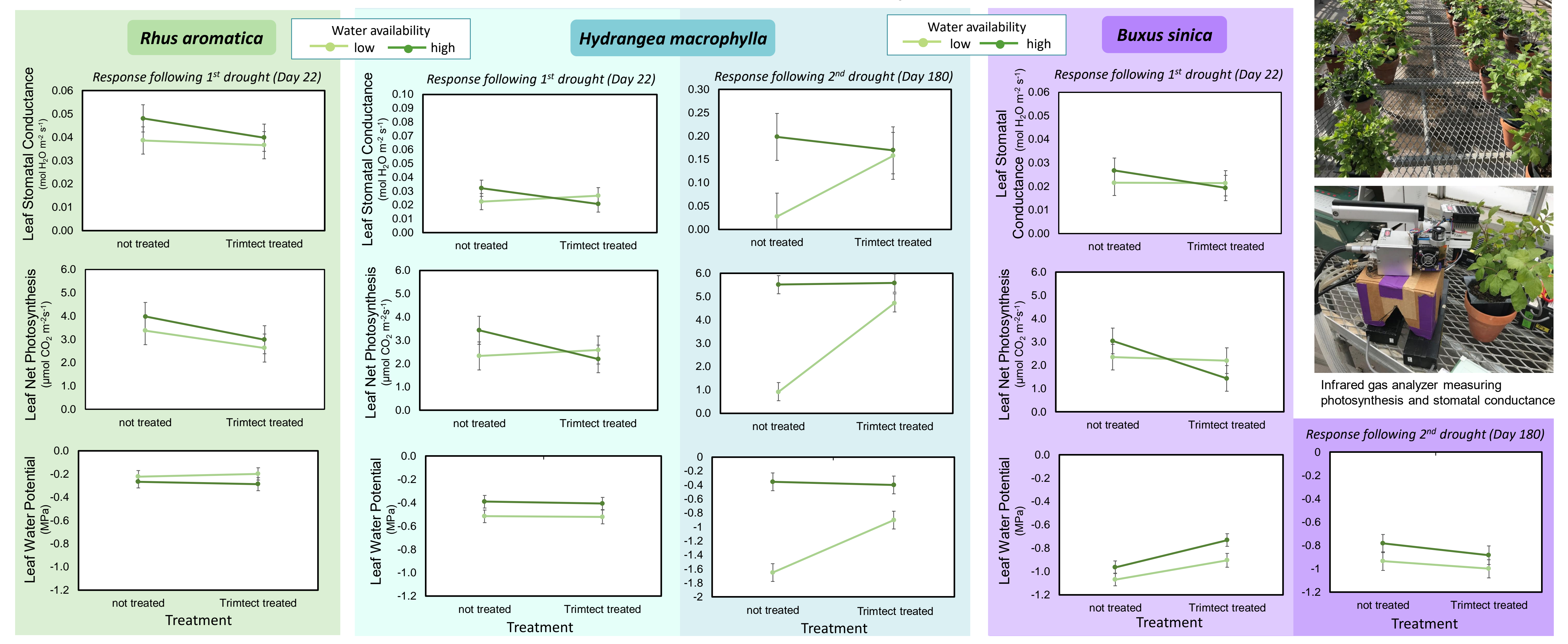


Figure 2. Leaf-level physiological responses to *Trimtect* and water availability treatments. Shown are means and standard error. (1st drought N=10 plants/treatment combination; 2nd drought N=6 plants/treatment combination)

1st drought (day 22)

- Leaf physiology of *Trimtect* treated plants did not differ significantly from those not treated.
- Droughted plants showed slightly reduced leaf water potential and photosynthetic responses compared to those well watered, and this varied some by species. However, *Trimtect* did not affect how plants responded to drought.



2nd drought (day 180)

- Stomatal conductance and photosynthetic rates (only measured on hydrangea) were not as negatively impacted by low water availability in *Trimtect* treated compared to not treated plants (*Trimtect**water p<0.0001, ANOVA).
- Leaf water potentials were reduced in low water treated plants compared to high water treated plants, however only in hydrangea were *Trimtect* treated plants able to maintain higher leaf water potentials under low water stress compared to those not treated (*Trimtect**water p=0.0053, ANOVA).

Conclusions and Future Research Goals

- The effects of *Trimtect* appear to take time to manifest and vary among species.
- Our findings suggest that *Trimtect* does not independently affect leaf-level physiology of plants, however, *Trimtect* can effectively increase the tolerance of some species to low water availability. Yet, this is only if enough time has passed since *Trimtect* was applied.
- This effect may help reduce the maintenance and water required by woody shrubs used in landscaping.
- The information provided by this study is helping *Rainbow Treecare Scientific Advancements* refine formulations of their products for optimal consumer use. Their formulation based on these results is currently being evaluated by the current Biol 318 *Plant Form and Function* class.

Acknowledgments and Citations

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¹Jungklang, J., Saengnil, K., Uthabutra, J. (2015). Effects of water-deficit stress and paclobutrazol on growth, relative water content, electrolyte leakage, proline content and some antioxidant changes in *Curcuma alismatifolia* Gagnep. Cv. Chiang Mai Pink. *Saudi Journal of Biological Science*. 24, 1505-1512.