

2017-20-630

Title: Chemical Priming to Improve Annual bluegrass Responses to Ice Stress**Project Leaders:** Emily Merewitz and Kevin Frank**Affiliation:** Michigan State University**Objectives:**

1) Evaluate whether chemical priming and Primo applications influence winter survival and spring green up rates in Michigan in 2017 and 2018 (field experiment)

2) Determine whether chemical priming and Primo applications affects annual bluegrass performance under no ice and ice stress conditions (freezer experiment)

Start Date: 2016**Project Duration:** Two years**Total Funding:** \$20,000**Summary Text:**

Priming of plants means that a given treatment makes plants more prepared to take on a subsequent stress. Information from controlled research studies available on priming chemicals for turfgrass species in response to abiotic stress is lacking. Plant priming with salicylic acid (SA) and jasmonic acid (JA) could potentially boost the systemic acquired resistance (SAR) or induced systemic resistance (ISR) pathways, respectively. Both JA and SA are either already in turf products or have potential to be in turf products. These are two pathways that are primarily associated with plant defense of biotic stress but are also involved in promoting tolerance to abiotic stresses. CIVITAS Pre-Mixed is also said to have an ISR stimulating effect on plants. In our previous work funded by the USGA, we have found that this CIVITAS product was beneficial to annual bluegrass survival of ice cover. CIVITAS treated plants had a higher level of the fatty acid linolenic acid, a precursor to JA, than control plants (Laskowski et al, 2018). In that same study, PGRs such as Primo showed some evidence of decreasing ice tolerance of annual bluegrass; however, not on all days measured. This study aims to determine whether priming of annual bluegrass with CIVITAS Pre-Mixed, SA, and JA in combination with PGR treatment improves or inhibits winter survival and spring green-up under natural field conditions and ice stress tolerance in simulated controlled conditions.

All chemical treatments began on 2 June 2017 and were applied every two weeks through 4 August 2017, and then once more on 30 October 2017 based on CIVITAS program recommendations for use in the summer and fall months. All treatments were applied with a pressure-calibrated backpack sprayer (63.3-gal a⁻¹ at 275 kPa) equipped with four flat fan nozzles (DG8002 DS, Teejet Technologies, Wheaton, IL.). The treatments were: 1) Control 2) Primo (0.125 fl oz/1000ft²) 3) CIVITAS Pre-Mixed (8 fl oz/1000ft²) 4) JA (2mM) 5) JA (0.5mM) 6) SA (20μM) 7) SA (10μM) 8) CIVITAS Pre-Mixed + Primo (8 fl oz/ 1000ft² + 0.125 fl oz/1000ft²) 9) JA + Primo (2mM + 0.125 fl oz/1000ft²) 10) JA + Primo (0.5mM +0.125 fl oz/1000ft²) 11) SA + Primo (20μM +0.125 fl oz/1000ft²) and 12) SA + Primo (10μM +0.125 fl oz/1000ft²). Commonly measured turf evaluation parameters were measured in the field on all

plots including turf quality, the dark green color index (DGCI), normalized difference vegetation index (NDVI).

After only one year of data, CIVITAS or CIVITAS + Primo had the greatest turf quality when compared to the untreated control. On several dates and for turf quality, NDVI and DGCI, CIVITAS and Primo, JA and Primo, and SA and Primo treatment combinations had improved values compared to control plots and Primo alone (only for DGCI). Testing the effects of all treatments on the survivability of annual bluegrass under ice cover or no ice cover in the low temperature growth chamber is currently being conducted. Fatty acid analysis will be evaluated following the completion of the growth chamber treatments.

Summary Points:

- Chemical priming hormone treatments alone (JA only, SA only) appear to have no significant effect on experimental measurements in the field when compared to the untreated control
- When Primo was added to chemical priming hormones a synergistic effect of increasing DGCI was observed when compared to the untreated control and when compared to Primo alone on several dates.
- Civitas and Civitas + Primo had the greatest turf quality and DGCI during the summer and into the fall on several dates.

Literature Cited

Laskowski, K., K. Frank, and E. Merewitz. 2018. Chemical Plant Protectants and Plant Growth Regulator Effects on Annual Bluegrass Survival of Ice Cover. *Journal of Agronomy and Crop Science*. *Under Review*.

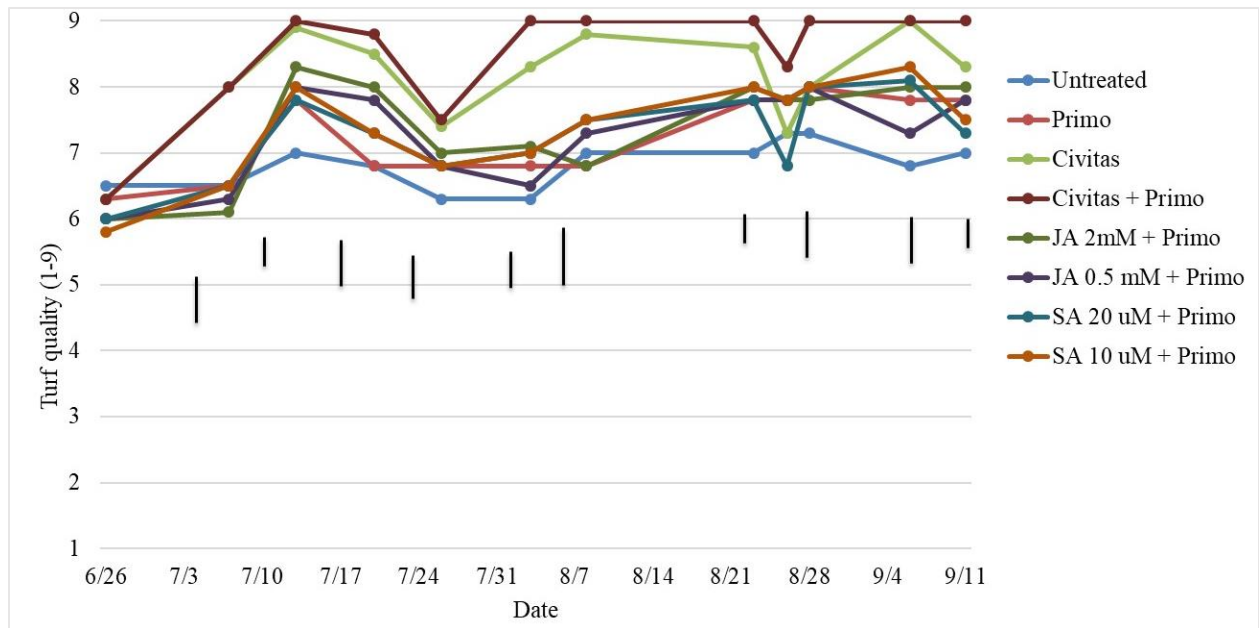


Figure 1. Turfgrass quality (1–9 scale with 1 (poor) and 9 (best), with 6 being acceptable) of annual bluegrass under chemical priming treatments in 2017. Bars represent Fisher’s protected least significant difference at $P \leq 0.05$ for the comparison of means on each date.

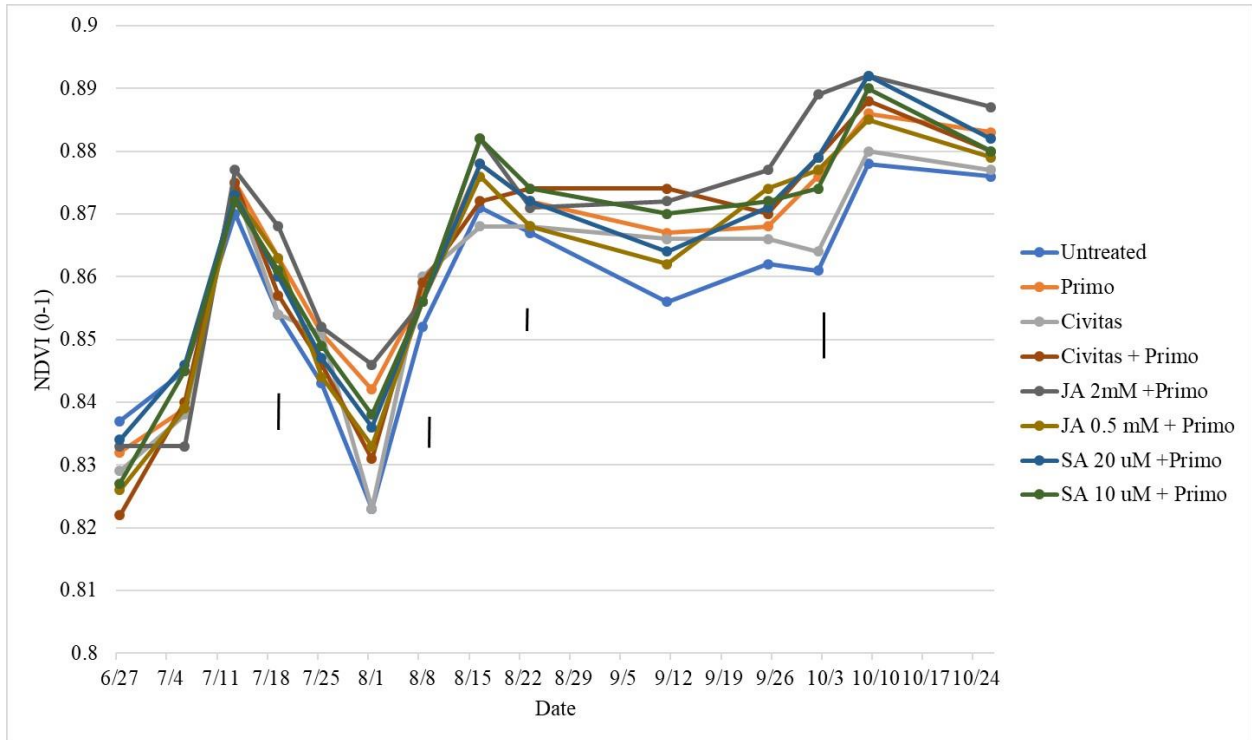


Figure 2. Normalized difference vegetation index of annual bluegrass under chemical priming treatments in 2017. Bars represent Fisher’s protected least significant difference at $P \leq 0.05$ for the comparison of means on each date.

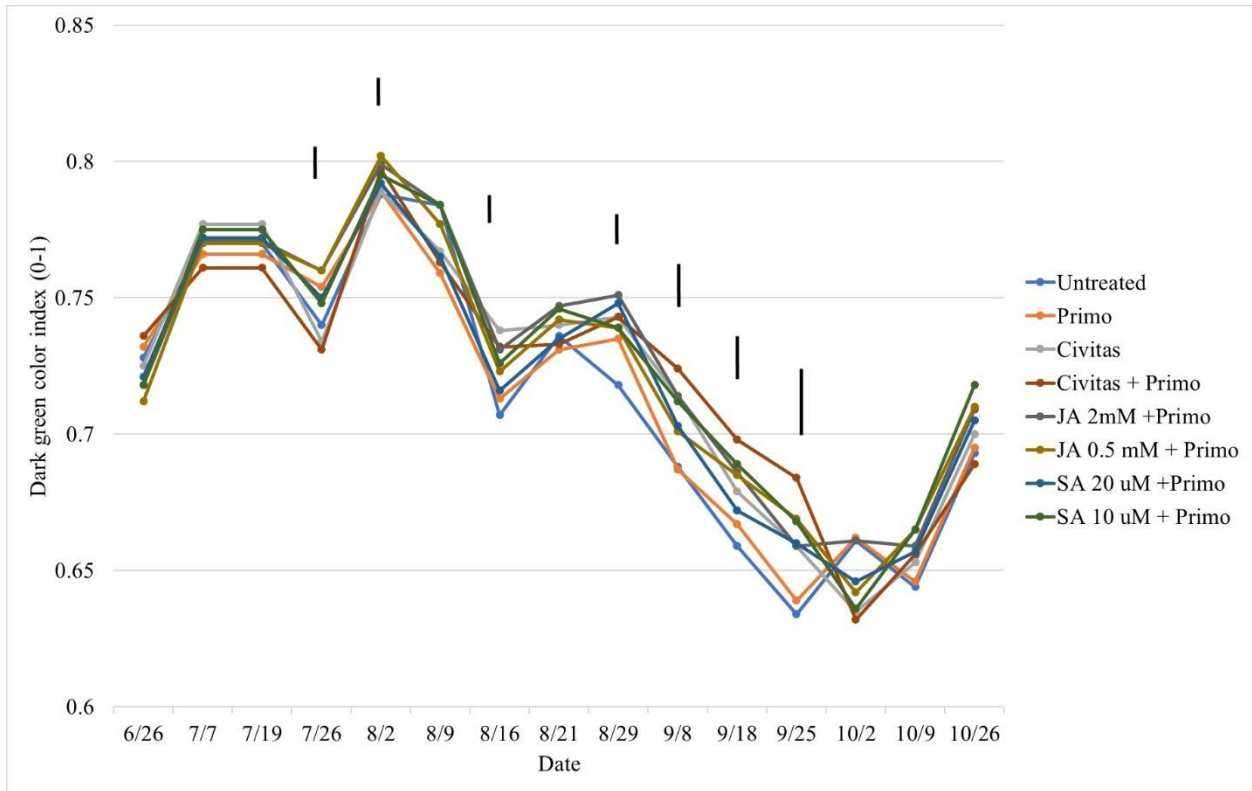


Figure 3. Dark green color index of annual bluegrass under chemical priming treatments in 2017. Bars represent Fisher's protected least significant difference at $P \leq 0.05$ for the comparison of means on each date.