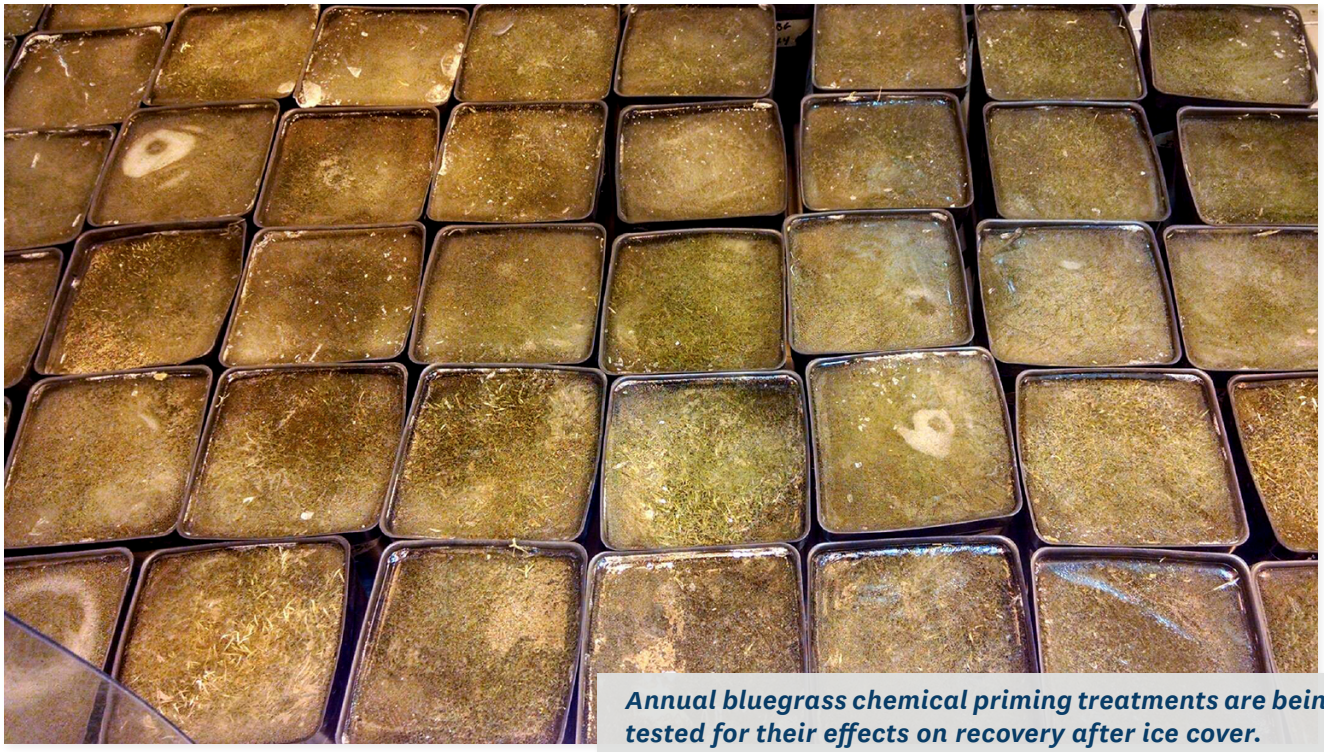
USGA
Green Section
RESEARCH YOU SHOULD KNOW
November 1, 2019



Annual bluegrass chemical priming treatments are being tested for their effects on recovery after ice cover.

CHEMICAL PRIMING TO IMPROVE ANNUAL BLUEGRASS RESPONSES TO ICE STRESS

BY GREEN SECTION STAFF

- Annual bluegrass plots treated with Civitas and Civitas + Primo had greater regrowth when compared to the untreated control for 40 and 80 days after initial freezing.
- When Primo was added to chemical-priming hormones, the dark green color index was greater than when chemical-priming hormones were applied without Primo.
- Hormone priming treatments with salicylic or jasmonic acid alone appear to have no significant effect on experimental measurements of ice stress tolerance in the field when compared to the untreated control.

Michigan State University scientists are evaluating ways to improve annual bluegrass winter survival in situations where there is ice stress. The researchers made applications of Primo, Civitas, salicylic acid (SA) and jasmonic acid (JA) in both freezer and field experiments. These applications are referred to as chemical priming. Chemical priming means that a given treatment helps the plant to tolerate subsequent stress.

Plant priming with SA and JA could boost the systemic acquired resistance (SAR) or induced systemic resistance (ISR) pathways. These two pathways are associated with plant defense to biotic stress but are also involved in promoting tolerance to abiotic stresses.

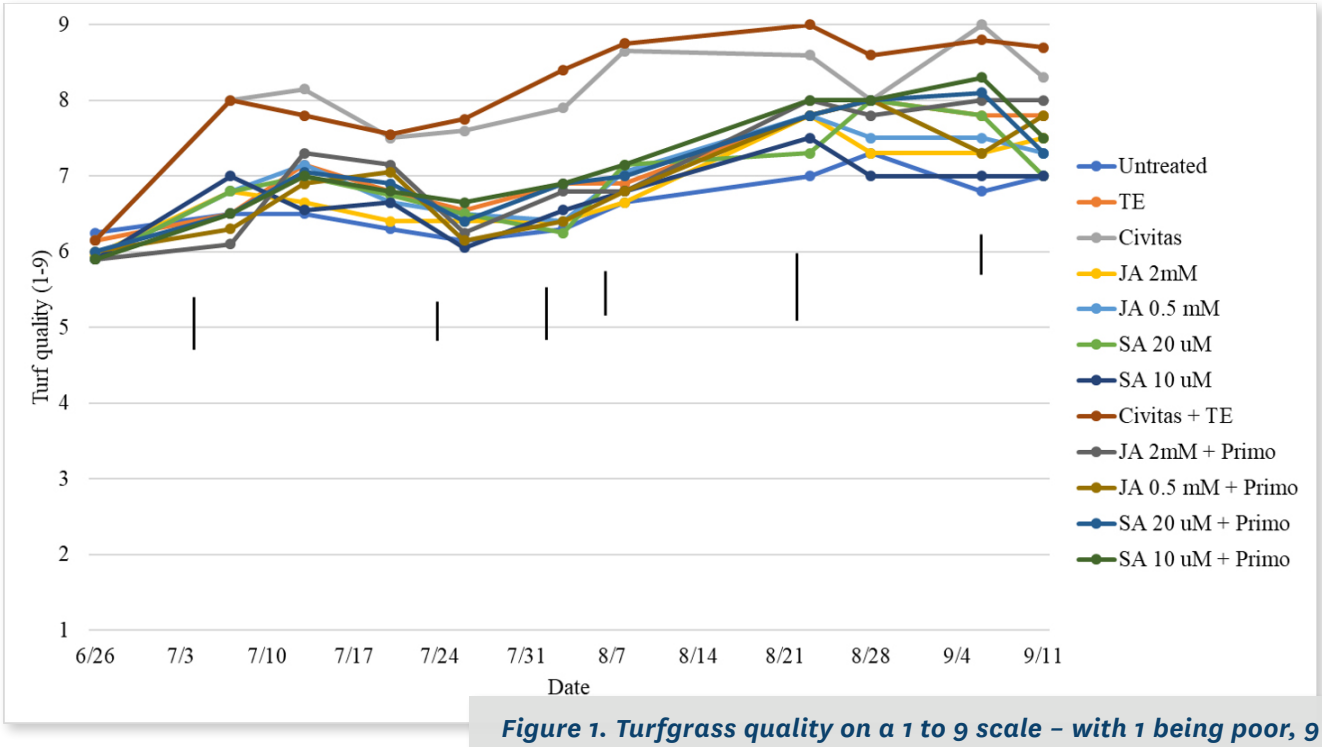


Figure 1. Turfgrass quality on a 1 to 9 scale – with 1 being poor, 9 being best and 6 being acceptable – of annual bluegrass under chemical priming treatments in 2017 and 2018.

Civitas is said to have an ISR stimulating effect on plants. In previous USGA-funded research, Civitas improved annual bluegrass survival under ice cover. Civitas-treated plants had a higher level of linolenic acid, a fatty acid precursor to JA, than control plants. In that same study, the plant growth regulator (PGR) Primo showed some evidence of decreasing ice tolerance of annual bluegrass; however, not on all days measured.

This current experiment was designed to determine whether priming of annual bluegrass with Civitas, SA and JA in combination with Primo improves or inhibits winter survival and spring greenup under natural field conditions, and whether priming improves ice stress tolerance in controlled freezer conditions.

Based on the Civitas program recommendations for use in the summer and fall months, all chemical treatments began on June 2, 2017, and were applied every two weeks through August 4, 2017. They also were applied once more on October 30, 2017. The treatments were:

1. Control
2. Primo (0.125 fl oz per 1000 ft2
3. Civitas Premixed (8 fl oz per 1000ft2)
4. JA (2.0 millimolar)
5. JA (0.5 millimolar)
6. SA (20 micromolar)
7. SA (10 micromolar)
8. Civitas Premixed + Primo (8 fl oz per 1000 ft2 + 0.125 fl oz per 1000 ft2)
9. JA + Primo (2.0 millimolar + 0.125 fl oz per 1000 ft2)
10. JA + Primo (0.5 millimolar + 0.125 fl oz per 1000 ft2)
11. SA + Primo (20 micromolar + 0.125 fl oz per 1000 ft2)
12. SA + Primo (10 micromolar + 0.125 fl oz per 1000 ft2)

Turf evaluation measurements for the field plots included turf quality, the dark green color index (DGCI) and normalized difference vegetation index (NDVI).

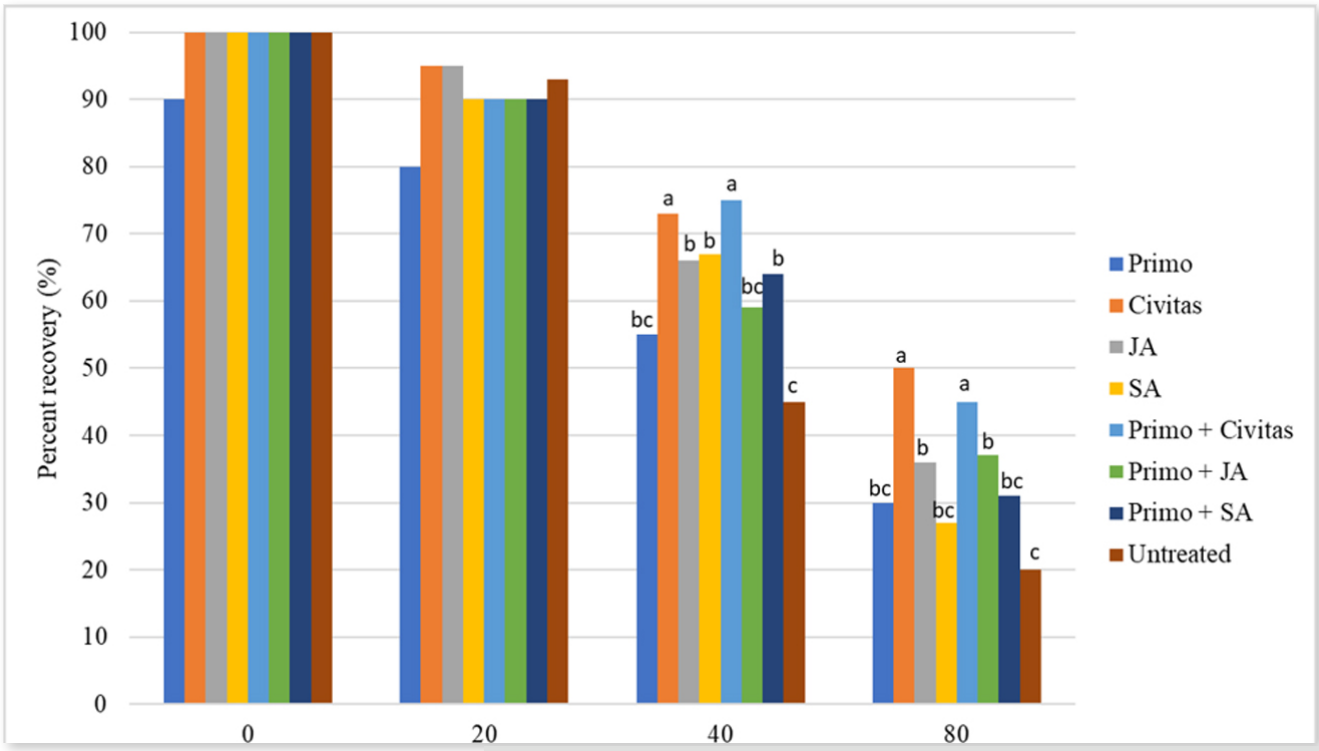


Figure 2. Percent recovery of annual bluegrass under chemical priming treatments after zero, 20, 40, and 80 days following initial growth in 2017. Bars with different letters are significantly different due to treatment within a given day.

After only one year of data, Civitas or Civitas + Primo had the greatest turf quality when compared to the untreated control (Figure 1). 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 for the second year. After one year, annual bluegrass treated with Civitas or JA had greater recovery when compared to the untreated control for 40 and 80 days after the initial freezing (Figure 2). The fatty acid analysis will be evaluated following the completion of the growth chamber treatments.

Source: Emily Merewitz Holm, Michigan State University

Additional Information:

Chemical Priming to Improve Annual bluegrass Responses to Ice Stress

Evaluation of Crown Membrane Health and Gas Accumulation in Response to Ice Stress

and Management Practices of Creeping Bentgrass and Poa Annua

Chemical Plant Protectants and Plant Growth Regulator Effects on Annual Bluegrass Survival of Ice Cover

Effects of Ethylene Inhibition on Creeping bentgrass and Annual bluegrass Survival of Ice Cover

Stress