



Introduction

Managing weeds is one of grower's most significant challenges, especially in organic vegetable systems. To manage weeds effectively several control tactics are necessary. Cultivation is common; however may harm soil structure and lead to erosion. Manual weeding is labor intensive, and conventional herbicide usage has raised health concerns. There is need for research on organic herbicides for their integration into organic weed management systems.

Objective

Evaluate efficacy of five different organic herbicides: citrus oil (Avenger[®]), ammonium nonanoate (AXXE[®]), acetic acid (Green Gobbler[®]), caprylic acid + capric acid (HomePlate[®]), and clove oil + cinnamon oil (Weed Zap[®]) on a variety of common weed species. Glyphosate (Ranger Pro[®]) was used as a positive control, and water as a control. Six weed species were tested: *Abutilon theophrasti* (velvetleaf), *Amaranthus retroflexus* (redroot pigweed), *Chenopodium album* (common lambsquarters), *Digitaria sanguinalis* (L.) Scop. (large crabgrass), *Portulaca oleracea* (common purslane), *Setaria viridis* (L.) Beauv. (green foxtail). Data presented on large crabgrass and common purslane. Efficacy of each herbicide was evaluated based on visual rating and above soil biomass.

Materials and Methods

Greenhouse Management: Research was conducted at the Iowa State University Greenhouses. Weed species were seeded in the greenhouse 2 Feb 2023 in a randomized complete split block by species design with four replications. Weed species were thinned to 10 plants per flat and sprayed when average plant height reached 5-7 cm. Herbicides were sprayed according to label recommendations. Visual injury ratings and digital images were recorded 24 hours, 3 days, 7 days, 14 days, and 21 days after treatment (DAT) of herbicides. 21 DAT above soil biomass was collected, dried, and later weighed.

Spray Chamber: Herbicide treatments applied using a laboratory spray chamber calibrated to deliver 60 gallons per acre (GPA) for all organic herbicides + control, except Green Gobbler, calibrated to 30 GPA. Glyphosate was sprayed at 20 GPA. All treatments were sprayed using an 80015EVS nozzle.



Figure 1. CO2-powered Spray Chamber at ISU Greenhouses



Figure 2. Herbicide Labels: Avenger[®] (A), AXXE[®] (B), Green Gobbler[®] (C), HomePlate[®] (D), Weed Zap[®] (E), Ranger Pro[®] (F)

Results

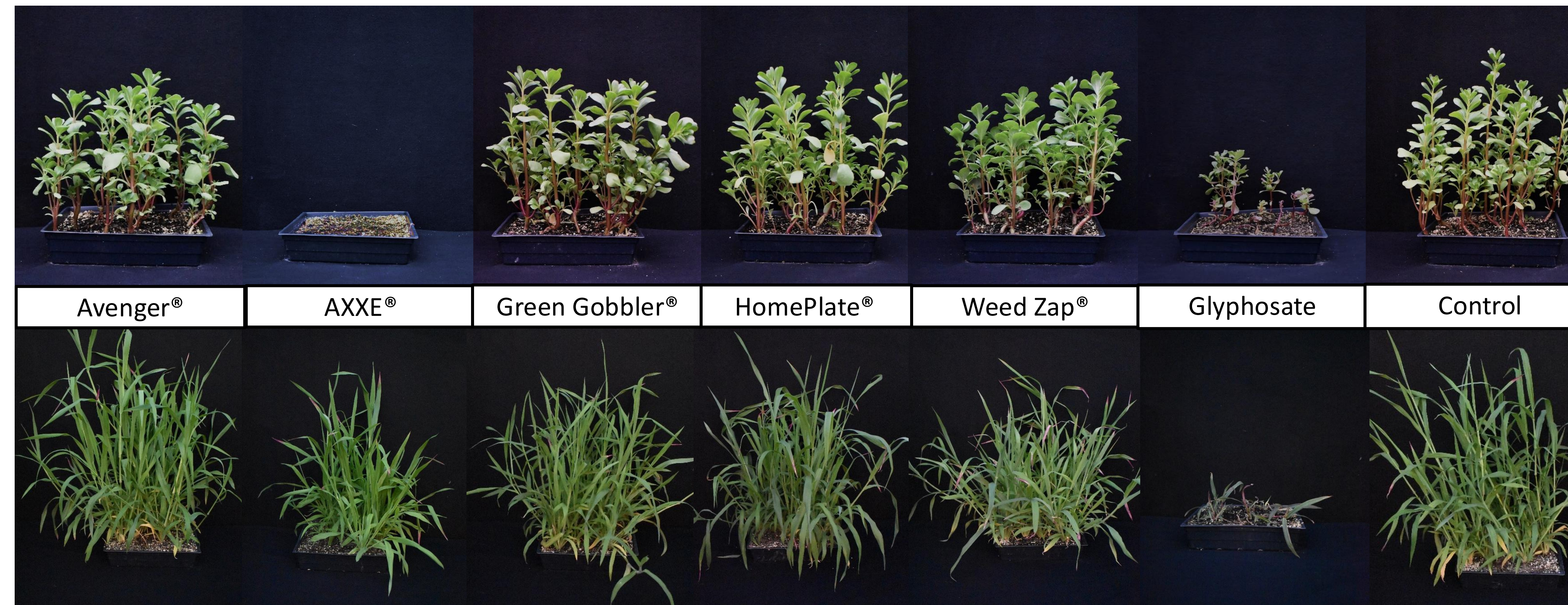


Figure 4. Top images: *Portulaca oleracea* (common purslane) 21 days after treatment (DAT) and lower images: *Digitaria sanguinalis* (L.) Scop. (large crabgrass) 21 DAT. From left to right: Avenger[®], AXXE[®], Green Gobbler[®], HomePlate[®], Weed Zap[®], Glyphosate, and Control treatments.

Results Continued

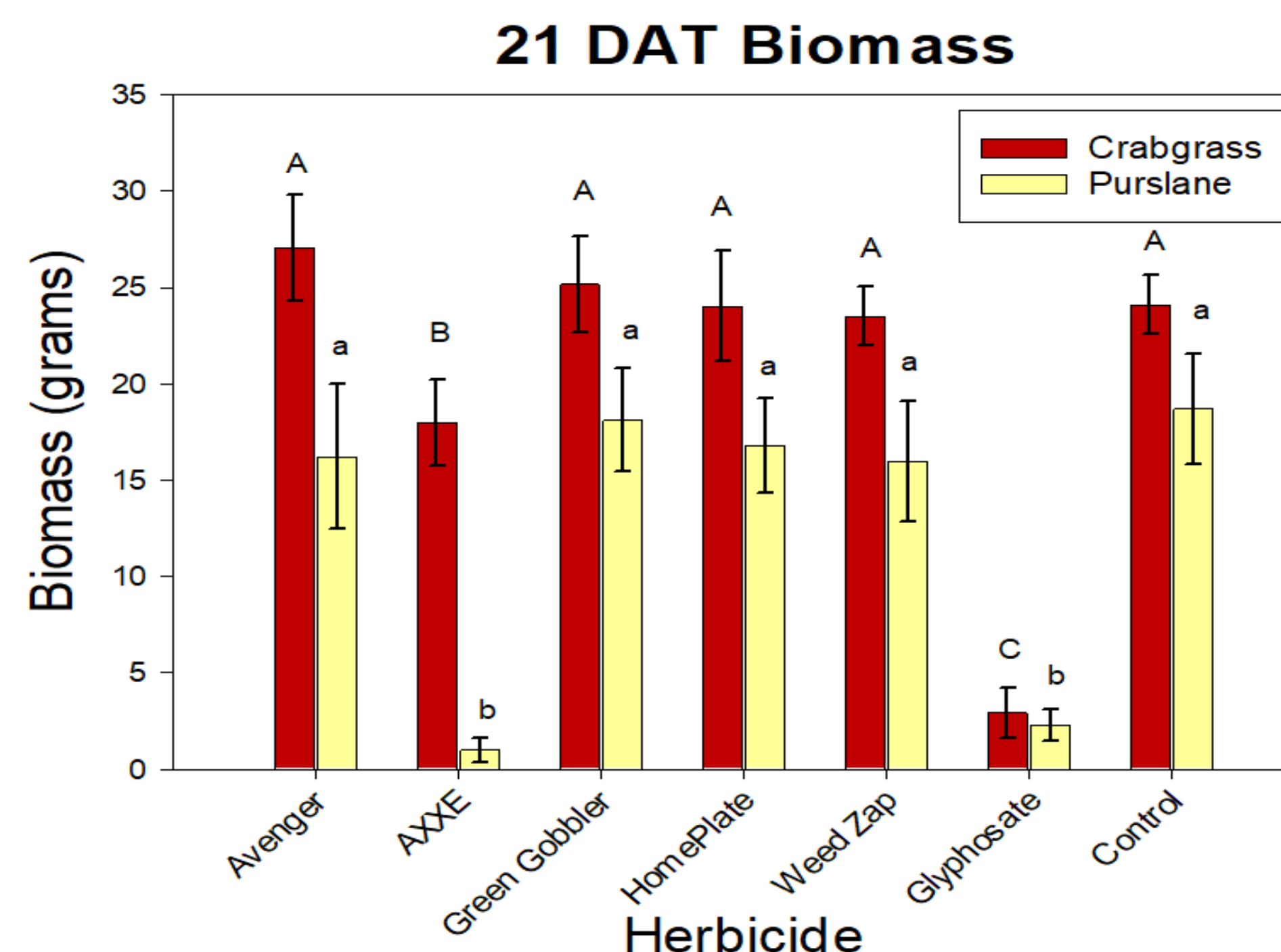


Figure 3. Mean dried biomass (grams) (\pm standard error) 21 days after treatment (DAT) of large crabgrass and common purslane. Means, within species, followed by different letters are significantly different ($P < 0.05$).

Conclusion

- AXXE[®] herbicide had significantly lower weed biomass than Avenger[®], Green Gobbler[®], HomePlate[®], and Weed Zap[®] at 21 DAT in common purslane and large crabgrass.
- Numerically, AXXE[®] was more effective than glyphosate on common purslane (and other broadleaf species tested); however not statistically different.
- Avenger[®], Green Gobbler[®], HomePlate[®], and Weed Zap[®] showed no significant difference in weed biomass at 21 DAT compared to the control.
- Thorough coverage of herbicide is necessary for control but is costly and not always achievable on a large scale.
- Further research should investigate the impact of organic surfactants on organic herbicide efficacy.

Acknowledgments

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