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Adaptation of Palmer amaranth to the upper Midwest

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ABSTRACT

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Keywords: Text Text Text Text Text Text Evolution Weed

INTRODUCTION

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MATERIAL AND METHODS

Plant material and growing conditions

The study was performed with a *A. palmeri* accession (Per1) from Perkins County, Nebraska. Per1 accession collection is documented in (Oliveira et al., 2021), with no reported herbicide resistance. Three weeks prior to the field experiment, seeds were planted in plastic trays containing potting-mix. Emerged seedlings (1 cm) were transplanted into 200 cm-3 plastic pots (a plant pot-1). Palmer amaranth seedlings were supplied with adequate water and kept under greenhouse conditions at Arlington, Clay Center, Lincoln, and Macomb; and kept outdoors in Grant. Palmer amaranth seedlings were kept under greenhouse/outdoors until the onset of the experiment (7 to 10 cm height).

Field study

The experiment was conducted in 2018 and 2019 under field conditions at five locations: Arlington (Washington County, Wisconsin), Clay Center (Clay County, Nebraska), Grant (Perkins County, Nebraska), Lincoln (Lancaster County, Nebraska), and Macomb (McDonough County, Illinois).

The experimental unit were adjacent 9.1 m wide (12 rows at 72.2 cm row spacing) by 10.7 m long. Each experimental unit was planted with corn or soybean, or left fallow. Palmer amaranth seedlings were transplanted to the field experiment by making a whole in the soil (6 cm deep and 8 cm wide); and gently transferring in the ground (potting mix + two seedlings). After a week, if both plants were alive, one was

eliminated. There were two transplant timing: early (June 1st) and late (July 1st). There were 24 Palmer amaranth plants in each crop/fallow and timing, with a total of 144 plants. The study was repeated twice.

After transplanting, Palmer amaranth flowering was monitored until the end of the study. When a plant started flowering, the day was recorded, plant sex was identified as male or female, and plant height was measured from soil surface to the plant top. Then, aboveground plant biomass was harvest near soil surface and oven dried at 65 C until reaching constant weight before the weight of biomass (g plant^{-1}) was recorded.

Statistical analyses

The statistical analyses were performed using R statistical software version 4.0.1.

The cumulative Palmer amaranth flowering estimation was determined using a asymmetrical three parameter log logistic Weibull model of the drc package (Ritz et al., 2015).

$$Y(x) = 0 + (d - 0)exp(-exp(b(log(x) - e)))$$

In this model, *Y* is the Palmer amaranth cumulative flowering, *d* is the upper limit (set to 100), and *e* is the XXX, and *x* day of year (doy).

The doy for 10, 50, and 90% Palmer amaranth cumulative flowering were determined using the *ED* function of drc package. Also, the 10, 50, and 90% Palmer amaranth cumulative flowering were compared among crop/fallow and timings using the *EDcomp* function of drc package. The EDcomp function compares the ratio of flowering timing using t-statistics, where P-value < 0.05 indicates that we fail to reject the null hypothesis.

RESULTS

Subsection 1

You can use `R` chunks directly to plot graphs.

Subsection 2

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1 DISCUSSION

DISCLOSURE/CONFLICT-OF-INTEREST STATEMENT

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

AUTHOR CONTRIBUTIONS

The statement about the authors and contributors can be up to several sentences long, describing the tasks of individual authors referred to by their initials and should be included at the end of the manuscript before the References section.

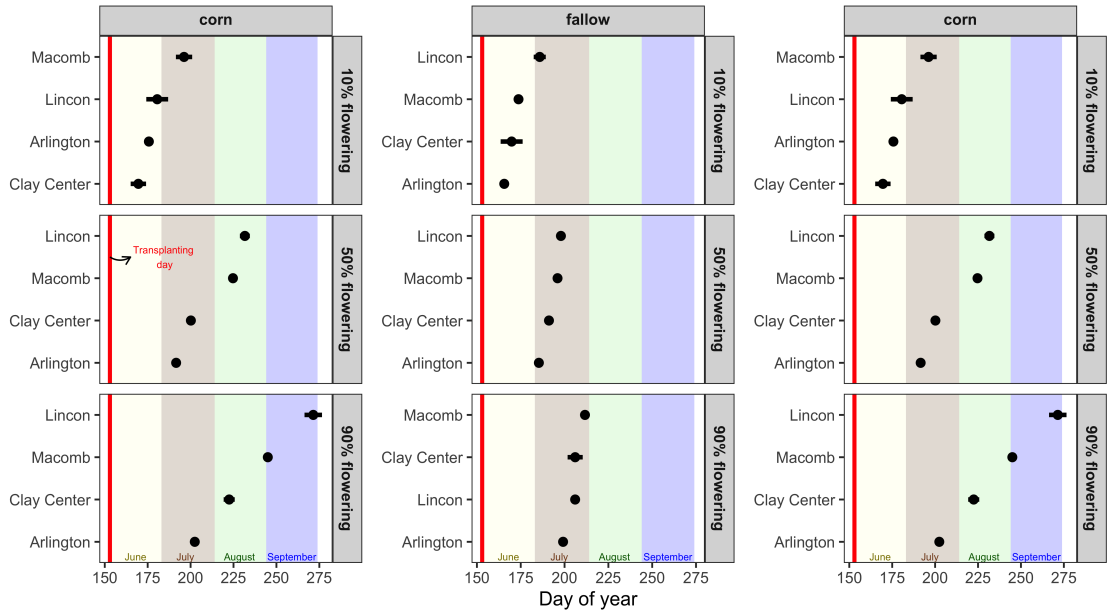

Figure 1. Figure caption

ACKNOWLEDGMENTS

Funding:

2 SUPPLEMENTAL DATA

Supplementary Material should be uploaded separately on submission, if there are Supplementary Figures, please include the caption in the same file as the figure. LaTeX Supplementary Material templates can be found in the Frontiers LaTeX folder

3 REFERENCES

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FIGURES

Oliveira, M. C., Giacomini, D. A., Arsenijevic, N., Vieira, G., Tranel, P. J., and Werle, R. (2021). Distribution and validation of genotypic and phenotypic glyphosate and PPO-inhibitor resistance in Palmer amaranth (Amaranthus palmeri) from southwestern Nebraska. *Weed Technology* 35, 65–76. doi:10.1017/wet.2020.74.

Ritz, C., Baty, F., Streibig, J. C., and Gerhard, D. (2015). Dose-Response Analysis Using R. *PLOS ONE* 10, e0146021. doi:10.1371/journal.pone.0146021.