# Abstract

*For original research articles*, use a compound abstract (up to 250 words) in a three-part format with uppercase headed sections:

BACKGROUND: provides a rationale for the study (understandable to a broad audience) and states the main aim(s).

RESULTS: describes the main findings, including important numerical values.

CONCLUSION: provides the main conclusions, including why the results are significant and advance the field.

BACKGROUND: Crop biophysical characteristics and management practices can affect weed population dynamics in various ways. To follow a common waterhemp (*Amaranthus tuberculatus* (Moq.) J.D. Sauer) population from seed in the soil seedbank to new seed deposition to the soil seedbank, we used a chain of six periodic matrices in each of nine crop environments to project population trajectories in two scenarios of plant fecundity, representing two levels of weed control efficacy (high and low). The chain of periodic matrices described the response to crop management activities of the population of interest throughout a calendar year. To parameterize the model, we used values derived from both scientific literature and our own field observations. Each crop environment identified a crop species (corn, soybean, oat, or alfalfa) in a rotation (2-year, 3-year, or 4-year). The crop sequences in the 2-year, 3-year, and 4-year rotations were, respectively, corn - soybean; corn - soybean - oat intercropped with red clover; and corn - soybean - oat intercropped with alfalfa - alfalfa.

RESULTS: Under the high control efficacy scenario, four waterhemp population sizes declined at the annualized rate of to , and two waterhemp population sizes slightly increased ( and ). Under the low control efficacy scenario, waterhemp population sizes increased the fastest in the 2-year rotation () and the slowest in the 4-year rotation (). The slower rates of population growth in the more diverse rotation were attributed to lower in the oat, red clover, and alfalfa crop environments (cool-season crops). In addition to population projection, we determined thresholds for seed production and mature plant density in the three rotations for stabilizing population size using the parameter inputs from the low control efficacy scenario.

CONCLUSIONS: The differences in seed production and mature plant density thresholds were more pronounced between the 2-year and 4-year rotations than any other pairwise comparison. When waterhemp control efficacy was high, the 3-year rotation appeared the most reliable in depleting the soil seedbank. When waterhemp control efficacy was low, the 4-year rotation appeared the least risky for preventing waterhemp outbreaks.