Weed community composition and waterhemp (*Amaranthus tuberculatus* ([Moq.](https://en.wikipedia.org/wiki/Alfred_Moquin-Tandon" \o "Alfred Moquin-Tandon)) J.D. Sauer) population dynamics in simple and more diverse cropping systems suitable for the Midwestern USA

Integrated weed management (IWM) provides reliable weed control methods over the long run, but the complexity and diversity of weed communities and the involvement of numerous components in an IWM program pose difficulties to customization and implementation of weed management programs for specific cases. Three main reasons why the general IPM (Integrated Pest Management) frameworks that were developed for insects are not readily applicable for weeds are: 1) different ecology, population biology, and history of adaptation to control measures between insects and weeds; 2) species-specific responses of individual weed species to applied control factors (tillage, fertilizer, or mulch); and 3) divergent responses of the target weed community under different crop rotations crossed with management practices combinations. Researchers have directed relatively little attention toward weed community composition in rotations with crop species other than corn (*Zea mays* L.), soybean (*Glycine max* (L.) Merr.), and wheat (*Triticum aestivum* L.), especially in fully phased settings.

This dissertation described weed community abundance and composition in oat (*Avena sativa* L.), red clover (*Trifolium pratense* L.), and alfalfa (*Medicago sativa* L.) grown in rotations with corn and soybean. In addition, this dissertation used waterhemp (*Amaranthus tuberculatus* ([Moq.](https://en.wikipedia.org/wiki/Alfred_Moquin-Tandon" \o "Alfred Moquin-Tandon)) J.D. Sauer) as a model organism in a periodic matrix model that tracked female individuals throughout their life cycle in nine crop identities crossed with two corn weed management regimes. The periodic matrix model employed data empirically measured at Iowa State University’s Agronomy Research Farm and from the literature.