Agricultural weeds are undoubtedly the most important crop pest plaguing crop production throughout the world (Pimentel et al. 2005). Herbicides have been an effective mechanism to deter losses due to weeds in the past decades, but are losing efficacy with the development of herbicide resistant weed species. Currently, there are 447 biotypes within 244 species of weeds known to have herbicide resistance worldwide (Heap, 2015). In the Midwest, giant ragweed (Ambrosia trifida) is one of the most competitive agricultural weeds (Webster et al. 1994), and has developed resistance to multiple herbicide biochemical sites of action (Heap 2015). As weeds resistant to multiple herbicides become more prevalent, alternative and integrated methods of weed control will become increasingly important to maintain adequate levels of weed control.

One approach to improving weed control is by optimizing planting dates, cultivation schedules, and herbicide applications to target weeds when they are most vulnerable (Menalled & Schonbeck, 2011). However, this requires the ability to accurately predict seedling emergence, which can be achieved through the development of emergence models. Several models predicting the emergence of giant ragweed have been developed, but none have been analyzed in the context of alternative crops and crop rotations (Archer et al. 2006, Davis et al. 2013, Schutte et al. 2008, Werle et al. 2014). Giant ragweed emergence patterns may differ in various crops due to their differential influence on soil environmental conditions (Liebman and Dyck, 1993). To evaluate the prediction accuracy of current emergence models under various crops and crop rotations, we monitored giant ragweed emergence from 2012-2015 in southern Minnesota in six different crop rotations, containing corn (C), soybean (S), alfalfa (A), and wheat (W) (CCC, SCC, CSC, SWC, SAC, AAC). Soil environmental factors, including soil temperature and moisture in each crop were also monitored. Our objectives are to determine the prediction accuracy of previously established emergence models in each crop and crop rotation using soil environmental data collected in each crop, and to select the best model to predict giant ragweed emergence using various model selection criteria.

Historically, giant ragweed has been one of the earliest emerging agricultural weeds in the Midwest, often exhibiting a large early-season flush with a steep drop-off in emergence (Hartzler, 2004). Utilizing spring tillage to control early-emerging populations of giant ragweed is one option currently being proposed to manage herbicide-resistant biotypes. Utilizing tillage not only reduces the reliance on herbicide applications for weed control, but also reduces the density and unifies the height of later emerging weeds, making post-emergent applications of herbicides more effective. However, soil disturbance may stimulate additional germination and thus increase the total number of seedlings emerging. To determine the effect that tillage has on giant ragweed emergence patterns and to determine the applicability of current emergence models.
models in different tillage timings, an additional series of experiments is planned at multiple locations in 2015 to evaluate the effect of spring tillage on giant ragweed emergence patterns. This study will include a series of no-till and various timings of conventional spring tillage (at emergence onset, at 14, 28, and 42 days after emergence onset, and at onset + 28 days after onset) to determine the accuracy of current emergence models under various tillage timings. Similar studies have been conducted with giant and common ragweed, and have found spring tillage does not stimulate additional emergence (Barnes et al. 2014; Werle et al. 2013). If this trend is also shown in Minnesota biotypes of giant ragweed, spring tillage can be confirmed as being an effective method to control herbicide-resistant populations of giant ragweed in Minnesota. Our objectives are to determine if tillage has an effect on giant ragweed emergence patterns, and if soil environmental effects from various tillage timings effect prediction accuracy of current giant ragweed emergence models.

The ability to effectively incorporate accurate giant ragweed emergence models into weed management practices under a wide variety of rotational and tillage practices will allow growers to optimize timing of planting dates, cultivation schedules and herbicide application dates in a wide variety of management settings (Menalled & Schonbeck, 2011). These field experiments will allow the determination and verification of the best emergence models for predicting giant ragweed emergence in a wide variety of crop management practices. The ability to verify model accuracy will provide growers an additional tool to both proactively and reactively manage herbicide-resistant giant ragweed.

References