

# Annual progress report

Status: NIFA REVIEW

<b>Project Director</b> Antonio DiTommaso	<b>Organization Project Number</b> NYC-125838	<b>Accession Number</b> 1018540
<b>Start &amp; End Date</b> 12/12/2018 - 09/30/2023	<b>Organization</b> Cornell University	<b>To Project / Program</b> "Development of a Weed Emergence Model for the Northeastern United States"
<b>Primary Critical Issue</b> Agriculture and Food Systems		<b>Fiscal Year</b> 2022

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## In 2-3 sentences, briefly describe the issue or problem that your project addresses.

There is an urgent need for the development of time-specific weed management tools to help address the frequently asked, yet to be answered, question of *when is the "right" time to control weeds?* Post-emergence management carried out too early, i.e. before most problem weeds have emerged, will yield low returns for the effort, investment, and ecological cost of the management (herbicide off-target effects, soil compaction, etc.), as weed seeds that have yet to germinate are often unaffected. Post-emergence management carried out too late is largely ineffective, as most weed species are able to survive management after a certain growth stage. Providing seedling emergence information so that farmers can effectively time their weed management operations can increase efficacy of control, reduce labor costs, and minimize any negative environmental impacts (e.g. reduce the likelihood that repeat applications of an herbicide or cultivation may be required for late germinating/emerging weeds).

## Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

**Goal:** The overarching goal of the project is to work collaboratively across the Northeast to optimize the ability of farmers to manage weeds in agricultural systems, despite the challenges of a changing climate and increasing prevalence of herbicide resistant weeds. Recent advances in weed ecological research and technology in general have opened the door to more targeted weed management decision support tools, and developing such tools will bring weed management in the Northeast into the 21st century.

**Objective 1.** Link Northeastern weed emergence timing data to existing weed emergence models and modern weather prediction models to create an online tool for farmers that will help them plan their weed management for optimal weed control. This tool will include three weeds that are problematic across the region: common lambsquarters (*Chenopodium album*), redroot pigweed (*Amaranthus retroflexus*) and large crabgrass (*Digitaria sanguinalis*). Common ragweed (*Ambrosia artemisiifolia*) will also be included in the northern portion of the Northeast and morningglory species (*Ipomoea* spp.) in the southern portion of the region. Individual participating states may also include one additional species of particular interest to their state.

Our initial modeling iterations did not match well across all of the states which our project covers. In FY2022, we reassessed the models and determined that in addition to more field data, we also needed more information on emergence factors from the literature. We conducted a scoping review of the literature on weed emergence modeling, extracted all the relevant data from the resulting 97 articles, and are in the process of synthesizing the data.

Our partners at the Northeast Weather Applications and at Cornell's Atmospheric Sciences developed a web portal for our decision support tool; once the weed model is updated, we will make the tool available to the public.

**Objective 2.** Collect weed emergence data across the region to validate and refine the existing weed emergence models to fit Northeastern data, and refine the decision support tool through testing by select farmers and extension staff.

Also in FY2022, an additional year of field data were collected in New York, Pennsylvania, Delaware, New Jersey, and Virginia. These data will be used to validate the models developed from Objective 1.

**Briefly describe how your target audience benefited from your project's activities.**

Outcomes of this project will be increased weed control efficacy by farmers, ideally coupled with a reduction in weed management activities, particularly herbicide use. We anticipate that farmers and extension educators will use the tool to time their weed management activities for optimal weed control within their available window of treatment.

**Briefly describe how the broader public benefited from your project's activities.**

This research will assist farmers in producing crops more efficiently and sustainably. Importantly, this work will also increase the economic viability of farms as weed management tactics will be more timely and more targeted. This will, in turn, result in greater food security and less deleterious impacts on the environment which will benefit society as a whole.

**Comments (optional)**

We have encountered difficulties with our emergence modeling, a combination of regional variability in weed emergence and unforeseen personal life events of some of our major collaborators. We have reassessed our timeline and anticipate publication of the tool along with our expanded species list in 2023. We will disseminate our results to weed scientists and extension associates at Northeastern Weed Science Society (NEWSS) annual meeting, and to regional grower communities through our network of multistate participants. In the final year of funding, we plan to collect a final year of field data to assist with incorporating new weeds of interest, completing emergence modeling and publishing the decision support tool, and publishing a review of the weed emergence modeling literature.