



July 31, 2023

Dear Multistate Action Committee,

We thank the three reviewers and the MAC for this helpful feedback on our Multistate NE_TMP2338 proposal. Please find below our responses to reviewer and MAC comments.

Sincerely,

Caroline Marschner, Project Manager
Antonio DiTommaso, Principal Investigator

Reviewer and Comment Responses

Reviewer 1

Understanding how weed seed germination and weed seedling emergence might respond to our changing climate may help to anticipate future challenges and problems associated with timely weed management. However, I often doubt that farmers will use this sort of information because they are contending with a complex set of moving pieces when making decisions about when to apply control measures. That said, the goals of this proposed regional project are interesting from a weed science perspective.

We agree that weed emergence timing is one of many factors that determine treatment windows for farmers. However, application outside of the optimal window of emergence and early growth is drastically less effective. Better information on emergence timing will be especially helpful for newer farmers. With many of our experienced farmers aging out of farm management, new farmers are likely to become more common in the next decade.

How will the OTCs alter other important environmental signals besides soil and air temperature? The enclosures will surely also impact light quantity and quality, which are key signals governing dormancy status for many weed species. It's an age-old problem: how do we impose experimental treatments without also imposing other changes that may affect our results?

Many experiments have evaluated impacts of temperature on weed emergence, but they have mostly been conducted in growth chambers. The benefit of OTCs is their ability to elevate soil and air temperatures under real field conditions, thereby providing a more realistic model of weed

responses to climate change. We feel that OTCs are the best available tool for increasing temperature in the field.

OTC enclosures are built out of plastic designed to allow 95% light transmission. Light measurements taken under similar OTCs in Pennsylvania in the late afternoon recorded 6–10% light interception by the OTCs in the center of the plot (Carolyn Lowry, personal communication). It is possible that reduced light transmission will alter plant growth, although many species already receive saturating levels of light on sunny days.

Germination is often more strongly impacted by light quality (wavelength). We do not have data on how OTCs affect light quality. The plastic from which the OTCs are constructed is translucent white, which is unlikely to alter the R/FR ratio of light. We can test for any effects once we have funding and OTCs.

Why omit crops from the experimental plots? The absence of a crop canopy creates an artificial environment that does not resemble real agroecosystems subjected to weed management. Removing the weeds as they emerge may also create similar unrealistic environments that weed species may respond to, especially later-emerging weeds that are becoming more of a management problem. Crop and weed canopies alter the magnitude of soil temperature fluctuations as well as light quantity and light quality reaching seeds at shallow soil depths. All these factors can exert a profound influence on germination and emergence behavior. Each weed species also may respond differently to the same set of signals. Because you are imposing experimental treatments that do not resemble realistic crop-weed canopies, your results may not be relevant to these environments.

Our collaborators across the multistate project work in several different commodity groups — field crops, vegetables, forage, berries, and more. We chose a no-crop condition to produce general information that would apply to many different commodities. Data from this project can provide a baseline for crop-specific research.

Finally, do you intend to consider base temperatures for germination and emergence when summing GDDs for each weed species? If the species of interest have very different base temperatures, ignoring this component could be a source of error in your models.

We will incorporate base temperatures, as they are a critical component of weed emergence modeling. Base temperatures have been reported in the literature for our species of interest.

Reviewer 2

I think the participants should consider a 'common garden' component, where the same species and/or seedlot of one or two key species are included at all sites. Given all the work involved in constructing the OTCs and monitoring emergence, this would be a relatively low effort type of

control that would might provide additional insights. The team is highly qualified and I expect will tweak the protocols as needed and collect and publish results that will be beneficial to both the weed science community and farmers.

We wholeheartedly agree that common garden experimentation would be an excellent addition to this project. There is an ongoing research project at the Pennsylvania State University that involves common garden experiments related to our previous multistate project (NE 1838). This work will address seed dormancy variability.

The funds provided through the multistate funding mechanism do not cover the costs of experimentation for most of our collaborators. The funds available to the lead institution would not be sufficient to cover the currently proposed field work, project management, and high-quality execution of a common garden experiment. Among other things, a common garden experiment would require careful prevention of cross-pollination during a single-location generation to remove any maternal effects, prior to the actual research season. We feel that a common garden project would be an excellent avenue to pursue under another funding mechanism, perhaps building on results of the multistate project proposed here.

Reviewer 3

I think this approach has sound merit and will provide a good tool for growers and extension, but I agree with some of the previous reviews that genetic variability and seed dormancy will play a significant role in robustness and utility of the platform. While those species represent significant challenges, I would also like to see some mention of how this work can be translated for other species and other cropping systems.

We agree that weed emergence patterns and the effects of climate change vary within and between weed species. Our previous project was limited to four common species and four additional species of regional interest. To collect more general data for this next project, we chose to focus on the ten most common species in the fields selected by multistate partners. This approach will help provide a broader dataset while also ensuring that each species counted in a field occurs at a high enough frequency for reliable modeling in that field. The downside to this approach is that the data will by necessity be more shallow for most species. For each species, our data set will capture genetic variability and seed dormancy polymorphisms that occur within fields. It is likely that many species will be tracked at multiple fields, and therefore our research will also provide some insight into geographic variability. These data will create a preliminary picture of how temperature affects weed emergence trajectories under field conditions. This work could later be expanded with experimental research and simulation on the effects of intraspecific, interspecific, and cropping system factors.

MAC questions

The Multistate Activities Committee (MAC) has also requested that the proposal clearly indicate what was accomplished during the lifetime of NE1838. The MAC appreciates the citations provided by institution in the “Related, Current and Previous Work”. Of the work listed in this section, what was accomplished as components of NE1838? The MAC also requests that the editing team include in the response to the reviews, an explanation of why the project team did not hold any authorized meetings during the term of NE1838 and did not file annual reports. The annual reports are required elements of a multistate research project and highlight the milestone accomplishments, collective outputs, outcomes, and impacts.

The multistate group has met annually during the funded portion of the grant cycle, although due to the pandemic we have met remotely since 2020. We did not realize we needed to authorize the meetings to trigger a NIMSS report. The Cornell University collaborators on this project were funded through an AES project for NE1838 and provided project management for the multistate effort. Cornell staff reported all activities conducted by all partners in the project annually for the Cornell AES project, not realizing that there was a separate report needed for the umbrella project. We will enter past years’ reports into the NIMSS system if there is a way to do that retroactively. Moving forward, we will follow the correct procedure to authorize our annual meeting and submit the annual report into NIMSS. We will also shift back to in-person meetings for the next funding cycle if that is the preferred meeting format. With the return of the in-person Northeastern Weed Science Society conference, we will have a convenient venue to meet in person.