THE ResistPoa Project ENTERS A NEW PHASE

By Jay McCurdy, Ph.D., Associate Professor, Mississippi State University

Resist Poa
USDA-SCRI ANNUAL BLUEGRASS COLLECTIVE

PHOTO 1: The ResistPoa team includes researchers from Texas A&M, University of Tennessee, Mississippi State, University of Georgia, North Carolina State, Clemson, University of Florida, Rutgers, Purdue, Virginia Tech, Penn State, University of Arizona, Portland State, Oregon State and Auburn.

The ResistPoa project seeks new and innovative strategies that help practitioners make informed decisions regarding annual bluegrass (*Poa annua*) control. The project is funded by a $5.6 million United States Department of Agriculture – Specialty Crop Research Initiative (USDA-SCRI) grant and involves 16 universities as well as their research laboratories and lab members. This is one of only a few federally funded turfgrass projects in the nation, and we're grateful to reviewers and stakeholders who were involved in its selection (Photo 1).

Our objectives are to characterize nationwide distribution of herbicide resistant annual bluegrass, seek out new and novel means of control, and identify socio-economic constraints that affect practitioner behavior.

The project is now in its second year. We are proud to have teamed up with Leading Edge Communications to bring our stakeholders an update through a series of podcasts and written communications.

A LONG-ROOTED HISTORY: *Poa Annua* Through the Years

Annual bluegrass (*Poa annua*) is a troublesome weed in managed landscapes and crops alike. It is one of the most widespread in the world. In fact, it has been reported on every continent, including Antarctica (Olech, 1996). Annual bluegrass is thought to have resulted from a cross between weak bluegrass (*Poa infirma*) and creeping meadow-grass (*Poa supina*) perhaps 2.5 million years ago during the interglacial ice age periods on the European continent. More recently, these two parent species have been shown to cross quite readily (Tutin, 1957).

Annual bluegrass is an annual comprised of numerous biotypes or "populations" – many of which are capable of perennating, meaning that they may exist in a vegetative state throughout the year, all along reproducing through aggressive tillering and seed production. Though perennial biotypes are much less common than annual biotypes, they tend to occur in frequently mown or grazed scenarios in temperate climates with adequate year-round soil moisture.

Poa in ancient Greek means 'fodder'; therefore, it should come as no surprise that temperate, cool-season pastures of the old-world have historically been comprised of at least some *Poa* species, including annual bluegrass and Kentucky bluegrass (*Poa pratensis*). In the temperate environments of England, *Poa annua* is in fact referred to as annual meadow-grass, while Kentucky bluegrass is called smooth meadow-grass.

Annual bluegrass has been a research interest since the early 1900's. An often-cited early publication concerning annual bluegrass control was published by the USGA Green Section in 1922 – "How we controlled *Poa annua* at Old Elm." This introspective piece is part self-congratulatory, part admission of defeat. It's easy to find and well worth the read.

In our interviews with co-authors, one thing is clear: annual bluegrass isn't going anywhere. We're just trying to keep up. The ResistPoa project has a unique role to play. John Kaminski, a Penn State investigator, summed this up well: "This has been a long battle that people have dealt with, and I don't think we're going to solve all those battles, but by consolidating all the people from various geographic regions that really have different management styles and practices based on where they're located, I think we're going to be able to come up with concentrated information for people managing turf in specific regions. I think that hasn't been done before."

Our Challenge

As a turfgrass weed, annual bluegrass's color and texture are an aesthetic problem. It disrupts athletic performance as well as ball roll. It can survive and reproduce at almost any mowing height. It results in thinned and vulnerable turfgrass stands. Practitioners and researchers alike find that controlling and managing it seems to be more art than it is science.

As an industry, we too quickly start our conversations regarding annual bluegrass by discussing chemical control options, but any astute turfgrass manager knows that we can't keep doing the same things if they're not working. We must also acknowledge societal and economic variables that influence our decision making. David Ervin at Portland State University and George Frisvold at University of Arizona are doing just that. Socio-economic investigations are collecting data through the use of focus groups and surveys. This approach challenges us to look beyond chemical control as a single dimension solution. Jim Brosnan from the University of Tennessee says: "This is the first time that I've been involved in an effort that is really trying to get at the sociological piece, the human element or decision-making piece of what we do. And my hope is that by trying to understand those dynamics, it's going to make the solutions that come from the research easier to adapt."

Beyond chemical control strategies, a critical objective of the ResistPoa project is to develop sound best management practices (BMPs) based upon a better understanding of the ecology and biology of annual bluegrass. "[W]hat it's going to do is expand our knowledge a little bit better on those aspects of *Poa annua* control that are now solely dependent on which synthetic herbicide to spray today or tomorrow or next week," says Shawn Askew from Virginia Tech. "We're looking more at the biology of the weed and trying to exploit its weaknesses."

Controlling annual bluegrass requires a diversified approach, incorporating proper cultural practices that favor the desired turfgrass species, appropriate herbicide application timings and combinations that account for known resistance issues.

Another objective is to understand seed production and seedling germination. Given adequate soil temperature and moisture, annual bluegrass seed germinate and establish relatively quickly. The project seeks to understand this through a series of experiments.

In ongoing studies, investigators at Georgia, Mississippi, Penn State, Purdue, and Tennessee have been studying the effects of growing degree day (GDD) accumulation on annual bluegrass seed formation and subsequent germination. In 2019 and 2020, we tracked GDD accumulation from January 1 through flowering and eventual seed ripening. Across sites, it appears that seed germination rates rise rapidly after 1,250 GDD (base 32°F) accumulation and that the highest germination rates occur for seed retained longest on the plant. Ongoing experiments at Texas A&M, Auburn, Clemson, Tennessee, Oregon State, Purdue, and Rutgers also seek to determine the effects of seed burial and persistence as well as seedling emergence patterns. Those efforts are complemented by studies investigating seedling emergence (led by researchers at Penn State) and other studies evaluating fraze-mowing as a mechanical means of depleting the soil seed bank (at Tennessee and Florida).

Herbicide resistance

One of the most comprehensive objectives of the ResistPoa project is a national survey of herbicide resistant annual bluegrass. This has proven to be a challenging objective. With more than 30 researchers involved, we have standardized procedures for population collection and developed workflows that keep whole greenhouses of plants alive at more than a dozen locations. We have developed techniques for rapid screening of an unprecedented number of annual bluegrass populations. Our findings will be made relevant through the development of a user-friendly decision-support tool that helps facilitate herbicide mode of action rotation, as well as the incorporation of effective cultural practices.

To date, we have screened more than 1,500 annual bluegrass samples for postemergence resistance to the following herbicide modes/sites of action (and respective herbicides):

- 4-hydroxyphenylpyruvate-dioxygenase or HPPD (mesotrione)
- 5-enolpyruvylshikimate-3-phosphate synthase or ESPS (glyphosate)
- acetolactate-synthase or ALS (trifloxysulfuron, foramsulfuron, and others)
- glutamine synthetase (glufosinate)
- microtubule assembly (pronamide)
- photosystem I (diquat)
- photosystem II (simazine)

And preemergence resistance to the following herbicide modes/sites of action:

- inhibition of cell wall biosynthesis (indaziflam)
- microtubule assembly (prodiamine and pronamide)

In year 1 of our study, we identified suspected resistance to many sites of action studied. Most of the resistant populations were from southern states. Of 776 samples collected in winter of 2018/2019 from Alabama, Georgia, Mississippi, North Carolina, Tennessee, and Virginia, 13% were suspected resistant to ALS-inhibiting herbicides, 8% to glyphosate, 5% to simazine applied postemergence, 3% to pronamide applied postemergence, and 5% to microtubule synthesis inhibitors applied preemergence.

Our work analyzing for herbicide resistance has only just begun. Suspected resistant populations that escaped preliminary screens of labelled rates are now moving though secondary rate-response screens to confirm and quantify resistance. Confirmed resistant populations will then move through target-site resistance screens at Auburn, where researchers will analyze for mutations within the genetic sequence for targeted enzymes. Unique cases (for instance, populations with multiple-herbicide-resistance) will then be screened for non-target site resistance by researchers at North Carolina and Georgia.

PHOTO 2: *Poa annua* survives where few others can.

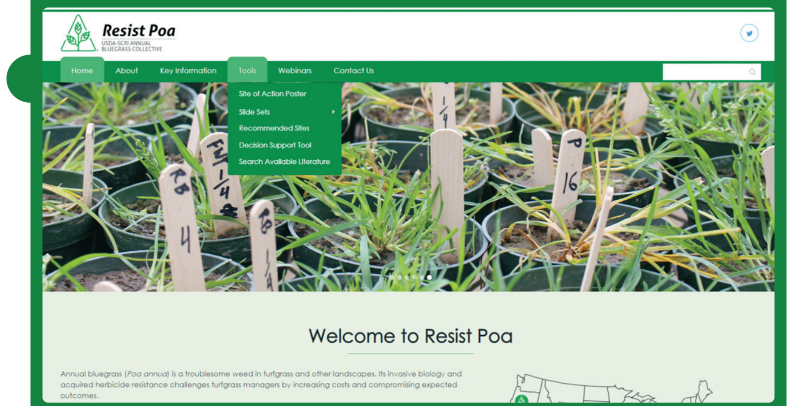
Find out more

The best way to keep track of our results is by monitoring our @ResistPoa Twitter handle. We're posting updates and re-tweeting relevant information there. The website ResistPoa.org is a handy tool for stakeholders. We have included a search function that allows folks to look for published information by State, Turf Type, and Control Method. There are educational videos and a repository of webinar recordings. We'll be adding a decision support tool over time. This tool should account for herbicide application history, site/mode of action, and much more.

We look forward to sharing knowledge and best management strategies with you in the future.

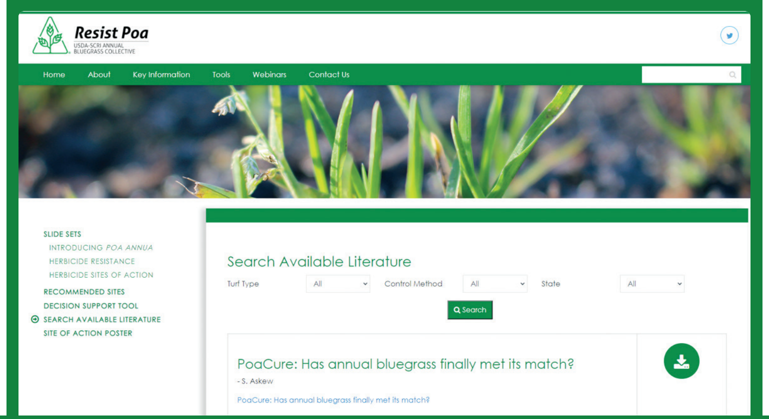
FOR MORE INFORMATION, please visit **ResistPoa.org**, follow us on Twitter (**@ResistPoa**), and listen to podcasts at the **TheTurfZone.com**.

PHOTO 3: ResistPoa.org offers resources for turf managers.



3A (ABOVE): The tools tab provides links to support best management practices for controlling annual bluegrass.

3B (BELOW): The search feature allows visitors to find targeted information using filters for turf type, control method and state.



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