

Confirmation and Management of Herbicide Resistance in Annual bluegrass (*Poa annua* L.) Populations on Texas Golf Courses

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Annual bluegrass (*Poa annua* L.) is one of the most problematic weeds for golf course superintendents throughout the country and Texas is no different. While there are approximately 25-30 herbicides and 10 modes of action (MOA) registered for Annual bluegrass control in turf, resistance to these products has become an extensive problem in recent history (Figure 1). The size and scope of this issue has yet to be documented in Texas despite the widespread prevalence of resistant populations in other southern states including Alabama, Tennessee, South Carolina, Georgia, and others. As a result of this, the USGA funded a survey for researchers at Texas A&M University to investigate and document herbicide resistance on Texas golf courses.

In spring 2015, a notice was sent out to Texas golf course superintendents to notify Texas A&M University turfgrass faculty if they have Annual bluegrass populations with suspected herbicide resistance. Respondents included 28 golf courses (Table 1) from which samples were collected and placed in growth chambers in College Station, TX. Plants from each golf course were allowed to mature at which point seeds were harvested for herbicide resistance screening.

Dormant seeds were exposed to cold treatment (-20°C) for 2 months before being moved to 4°C for 2 weeks and then placed at room temperature for one week to break dormancy. Seeds were sterilized in 10% sodium hypochlorite supplemented with 0.1% enzyme grade Tween surfactant for 5 minutes followed by washing with water before setting for germination. Seeds were placed into 9-cm-diameter Petri-dishes containing moistened filter paper (Figure 2) and incubated in a growth chamber at day/night temperatures of 27/22°C. Incubated seed samples germinated in approximately 2-3 days, at which point 2cm seedlings were transplanted into 6-cell trays filled with commercial potting-mix in a greenhouse with day/night temperatures of 27°C/23°C until they reach maturity (Figure 3).

Each of these plant populations are being screened for herbicide resistance to various products based on discussions with each golf course superintendent regarding their history of product use, turf type, location, etc. (Table 1). Current results of the survey indicate that most golf course superintendents suspect resistance to Acetolactate synthase inhibitors (Revolver, Monument, others) and Photosystem-II inhibitors (Simazine, Atrazine, others), but we are screening for resistance to other herbicides and modes of action as well. If herbicide resistance is confirmed, future studies will be conducted to investigate the presence of cross- and multiple-resistances in these biotypes and also to understand the mechanisms behind resistance so that appropriate management tactics can be developed and delivered.

Summary

- Annual bluegrass populations with suspected herbicide resistance were collected from 28 Texas golf courses during the spring of 2015 based on survey responses from golf course superintendents.
- Seed from resistant populations were harvested, exposed to cold treatments in the lab to ensure germination, and planted in petri dishes before being moved to the greenhouse for herbicide resistance screening.
- Plant populations are currently being screened for resistance to various products and modes of action commonly used for Annual bluegrass management
- Results from this research are expected to be available in early 2016 and any findings will be reported to the USGA, Weed Science Society of America (WSSA), Herbicide Resistance Action Committee (HRAC) and Texas golf course superintendents through various research and extension publications

Figure 1. Annual bluegrass biotypes that have survived an application of Revolver (foramsulfuron) herbicide adjacent to those that were successfully controlled.



Figure 2. Seeds from Annual bluegrass plants with suspected herbicide resistance germinating in a petri dish for screening using various products and modes of action (MOA).



Figure 3. Germinated seedlings in the greenhouse to be used for herbicide resistance screening with various products and modes of action (MOA).



Table 1. 2015 USGA Herbicide Resistance Screening on Texas Golf Courses

Location	Site Description	Suspected Resistance	Mode of Action (HRAC, WSSA Classification*)
Georgetown, TX	Fairway	Revolver	Acetolactate synthase inhibition (B,2)
Georgetown, TX	Fairway	Revolver	Acetolactate synthase inhibition (B,2)
Houston, TX	Nursery Green (Collar)	Revolver	Acetolactate synthase inhibition (B,2)
Pearland, TX	Putting Green	Revolver	Acetolactate synthase inhibition (B,2)
Humble, TX	Collar	Revolver	Acetolactate synthase inhibition (B,2)
Humble, TX	Collar	Revolver	Acetolactate synthase inhibition (B,2)
Humble, TX	Putting Green	Revolver	Acetolactate synthase inhibition (B,2)
Bryan, TX	Chipping Green (Rough)	Revolver	Acetolactate synthase inhibition (B,2)
Waco, TX	Putting Green	Revolver	Acetolactate synthase inhibition (B,2)
Houston, TX	Practice Green (Collar)	Revolver	Acetolactate synthase inhibition (B,2)
Houston, TX	Putting Green	Revolver/Simazine	Acetolactate synthase inhibition (B,2)/ Photosystem-II inhibition (C1,5)
Houston, TX	Putting Green	Revolver/Simazine	Acetolactate synthase inhibition (B,2)/ Photosystem-II inhibition (C1,5)
Houston, TX	Approach	Revolver/Simazine	Acetolactate synthase inhibition (B,2)/ Photosystem-II inhibition (C1,5)
Woodlands, TX	Rough	Revolver/Simazine	Acetolactate synthase inhibition (B,2)/ Photosystem-II inhibition (C1,5)
Woodlands, TX	Fairway	Revolver/Simazine	Acetolactate synthase inhibition (B,2)/ Photosystem-II inhibition (C1,5)
Spring, TX	Chipping Green (Approach)	Revolver	Acetolactate synthase inhibition (B,2)
Houston, TX	General Use area	Revolver	Acetolactate synthase inhibition (B,2)
Dallas, TX	Collar	Glyphosate	Enolpyruvyl shikimate-3 phosphate inhibition (G,9)
Dallas, TX	Collar	Glyphosate	Enolpyruvyl shikimate-3 phosphate inhibition (G,9)
Houston, TX	Putting Green	Simazine	Photosystem-II Inhibition (C1,5)
Houston, TX	Putting Green	Simazine	Photosystem-II Inhibition (C1,5)
Houston, TX	Putting Green	Simazine	Photosystem-II Inhibition (C1,5)

Houston, TX	Putting Green	Monument/Simazine	Acetolactate synthase inhibition (B,2)/ Photosystem-II inhibition (C1,5)
Houston, TX	Putting Green	Monument/Simazine	Acetolactate synthase inhibition (B,2)/ Photosystem-II inhibition (C1,5)
Houston, TX	Putting Green	Monument/Simazine	Acetolactate synthase inhibition (B,2)/ Photosystem-II inhibition (C1,5)
McKinney, TX	Rough	Ronstar	Protoporphyrinogen oxidase inhibition (E,14)
Overton, TX	Putting Green	Monument	Acetolactate synthase inhibition (B,2)
Benbrook, TX	Putting Green	Revolver	Acetolactate synthase inhibition (B,2)

* Herbicide Resistance Action Committee (HRAC) & Weed Science Society of America (WSSA)