CONTEMPORARY CHALLENGES AND OPPORTUNITIES FOR IMPROVED LAWN WEED MANAGEMENT: INSIGHTS FROM U.S. LAWN CARE OPERATORS

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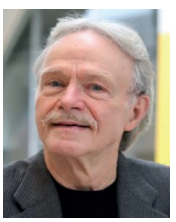
Summary

Lawn care operators (LCOs) report *Poa annua* (annual bluegrass) as a pest of concern in most regions. The lack of diverse, cost-effective chemical and non-chemical practices hinders effective control to avoid the evolution of herbicide resistance. Lawn weed management, including that of *Poa annua*, is geographically heterogeneous, making uniform treatment prescriptions inappropriate. A general, unmet need is the exchange of credible information on effective weed management practices between LCOs, their suppliers, and clients. Adopting integrated weed management in lawns will require new organization schemes that engage all stakeholders in discovering sustainable treatment approaches. University scientists are the most trusted information source and can lead the development of an information exchange network for lawn weed management.

Keywords: troublesome weeds, *Poa annua,* herbicide resistance, lawn weed control, information sharing, integrated management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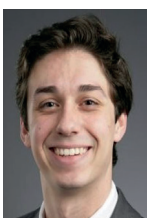
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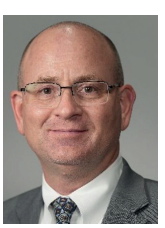
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Introduction

Lawns provide valuable ecological, economic and social services (Monteiro, 2017). Both the quantity and quality of the turfgrass affect the level of the services delivered. Unwanted weed infestations can degrade lawn quality and decrease the value of these services for lawn users and others. For example, Brosnan *et al*. (2014) reported that athletic fields with weed cover not only decreased aesthetic quality but also resulted in increased surface hardness and a concomitant increase in potential athlete injuries and soil erosion. Contemporary research pertaining to pest influences on lawn quality and management responses is sparse. We hope to begin filling that gap with findings from a recent study of U.S. lawn care operators about the challenges and opportunities of managing *Poa annua*, an emergent threat to sustainable lawn

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management (USDA-NIFA Specialty Crops Research Initiative (SCRI) Grants Program (award #: 2018-51181-28436).

Estimates for residential- and commercial-lawn cover in the United States (U.S.) range from 58,000 km^2 (Vinlove & Torla 1995) to 120,000 km^2 (Roberts & Roberts, 1987) with total turfgrass cover (inclusive of golf courses, parks, schools, roadsides) estimated at 163,800 km^2 (Milesi *et al*., 2005). The Federal Highway Administration (FHWA) estimated that there are 20,436 km^2 of grassed rights of way (roadsides) in the U.S. (USDOT, 2010). The total U.S. urban area in 2010 was estimated at 802,053 km^2 (CIESIN, 2013). Together, we can estimate turf cover between 7 and 18% of U.S urban areas, including lawns as the primary turf surface along with parks, athletic fields, golf courses, and roadsides.

The professional lawn care industry employed 295,000 workers and represented an $18.5 billion market value in 2002 (Haydu *et al*., 2006). Despite its size, the U.S. lawn care industry defies simple characterization in part due to its heterogeneity. Lawns may provide valuable ecosystem services, including wildlife habitat, water infiltration, and moderation of the urban heat-island effect as well as aesthetics and open space for recreation (Thompson & Kao-Kniffin, 2017). Apart from offering economic and ecological services, lawns and their management can be an important component of community social character and culture (Jenkins, 2015). Effective weed management in lawns assures sustainable delivery of all of these services, such that lawns are uniform and free from potentially troublesome weed species, such as *Poa annua* which ranks as the #1 most troublesome weed in turfgrass systems (Van Wychen, 2021).

Methods

We conducted five virtual focus groups in 2021 to begin building a contemporary knowledge base of lawn weed management and lay the foundation for future research and education. Focus groups have been used in scientific studies of herbicide resistance management to identify barriers to management practice adoption (Carroll *et al*, 2021). The discussions were held with 29 lawn care operators (LCOs) identified by the project co-authors to learn their concerns about lawn weed management and their experiences related to *Poa annua* (Great Lakes Marketing Research, 2021). Respondents were grouped into five regions: Midwest (MW), Southeast (SE), South (TX), Pacific Northwest (PNW), and East (E). All participants worked in the lawn care industry at the time of the focus group and held a state pesticide applicator license.

Three objectives guided the focus group discussions:

1. Discover the concerns about lawn care weed management in general and *Poa annua* in particular;
2. Ascertain best practices used by lawn care operators for managing *Poa annua*;
3. Identify challenges and barriers to implementing integrated weed management in lawn care.

The research team developed a discussion guide that covered: (a) general concerns regarding weed control in lawns; (b) struggles with *Poa annua*; (c) best chemical and non-chemical practices; and (d) credibility and trustworthiness of information sources. The questions in each topic area were unstructured, which allowed the respondents to expound on each topic. The discussions progressed from general to more specific topics and yielded the following thematic findings (Great Lakes Marketing Research, 2021).

Focus Group Results

Concerns

Major concerns expressed include herbicide resistance, current and future pesticide regulations, information sharing within the industry, and the basic challenges of managing *Poa annua*.

Resistance – Participants reported most problem grasses as herbicide-resistant across all regions. *Poa annua* is a concern for many operators. They have specifically noticed suspected resistance to specific herbicide treatments such as Roundup (glyphosate) and Specticle® (indaziflam). Separate survey data collected in this USDA-SCRI project indicate that resistance is primarily confined to regions where warm-season turfgrass species are grown (Rutland *et al*., 2021). A lack of effective or consistent herbicide control options in cool-season turf (Reicher *et al*., 2011; Elmore *et al*., 2013) might drive the perception of resistance in those areas. One participant captured the concern with increasing resistance in *Poa annua* (region acronym noted at end)[1]:

> *"We were getting a lot of resistance, some yards looked like they weren't even treated. Every weed would be gone except for Poa annua."* **(SE)**

Regulations – Pesticide regulations have made it difficult to manage turfgrass properly (Wallace *et al*., 2016). Issues with regulations are common in all regions but are most heavily noted by those in the Pacific Northwest as they have more local and state regulations. In each state, a Department of Agriculture or similar agency regulates what pesticides can be used to treat turfgrass. One participant statement typifies this concern:

> *"One of the biggest issues is not only government regulations, but individual state and county regulations that we're facing."* **(MW)**

Federal EPA regulations are perceived to make it difficult for lawn care operators to diversify practices in managing resistant weeds properly. The following comment details the concerns:

1 To read more FG comments, see *Lawn Care Operator Views of Contemporary Challenges and Opportunities in Weed Management*. Report by Great Lakes Marketing Research, Toledo, Ohio. at https://drive.google.com/file/d/1OPh7CdN-2DPQNO9d2uO-Chu2I9fkJIA1s/view?usp=sharing

"The EPA takes longer to review pesticides now than ever, there's a lot more guidelines that manufacturers have to follow. We don't see new chemistries come into the market as quickly as we see the old chemistry being banned." (**MW**)

Information sharing – Participants felt that opportunities exist to improve the communication between operators, perhaps resulting in improved turfgrass management through sharing experiences. Groups on social media or even moderated message boards can help facilitate discussion between operators. Communication and collaboration should aim to be more inclusive of non-English speaking people or people to whom English is not their first language. This comment articulates dual rationales for information sharing:

"You get together with other stakeholders, and you can confirm some ideas you're having, but also learn some new ideas." (**PNW**)

Basic challenges in managing Poa annua – Due to herbicide resistance issues, *Poa annua* is a concern for many operators. Most report that they are seeking solutions rather than offering answers. Some LCOs have resigned themselves to the existence of "*Poa*" because it is not worth the time and money aggressively to remove it. The LCOs do not want to promise resolution to homeowners. Some operators have had better luck controlling *Poa annua* but worry that they will see herbicide resistance in the near future.

"Poa *is always an issue, it's one of those that we describe as 'we can probably win the battle, but we're not going to win the war.' It's just a matter of controlling those populations."* (**PNW**)

Best Practices

Best practices include chemical and non-chemical treatments as well as communicating with customers to ensure they exercise proper care of their lawn (i.e. mowing and irrigation). The domain of best practices constantly evolves with new chemistries and non-chemical advances, weather conditions, and regulations.

Chemical – Chemical applications (pesticides and fertilizers) vary by region. In the South and much of the East, the operators have considerable freedom to select the best herbicides and application schedules to solve weed issues. In areas where government and neighborhood oversight are more present, operators are given a list of acceptable chemicals and schedules that they must abide by.

Non-chemical -- Non-chemical or cultural control treatments are common in all regions and act as a complement to chemical practices, although these approaches vary by climate due to rainfall and turfgrass species that vary by region. The most common non-chemical practices are improved irrigation and a higher mowing height. According to the applicators and research (Youngner, 1959), a thicker, healthier lawn aids in the fight against *Poa*.

"Adjusting your irrigation or raising the height of your mower deck helps with Poa *control."* (**MW**)

Communication with homeowners -- LCOs typically communicate digitally with customers to educate them about their turf and how to work in harmony with the LCOs.

"We notify customers of their upcoming treatments, and we send out an email with what we're seeing, what we're expecting, and just the treatment that's coming. (**E**)

Roles and Cooperation

Lawn Care Operators – LCOs have considerable freedom to implement the chemical control program they feel is most appropriate for their clients and communities. In some regions, they are rarely questioned on their decisions, and in other regions they are involved in the committees and boards that decide what will be acceptable practices. There is also a worry about supply chain issues in the coming year.

"I make the decisions on what to use and if there's something that's not working, I do have to keep my ears and mind open to members of my team and our chemical sales reps." (**PNW**)

Homeowners – The role that homeowners play in turf management decisions and practices vary by region. Most notably in the South, homeowners do not question or show much interest in the work being done as long as results are accomplished. In the West, homeowners and local municipalities are much more involved in the process, including restricting what can be applied and when. Younger homeowners also appear to be more involved in the process, asking more questions and doing individual research on products before allowing the operators to use them. Homeowners have very limited control and influence over their neighbors' turfgrass management practices, despite the direct impact that these practices have on their lawn.

"We don't get much pushback from customers. We are blessed that people trust what we do, and they just want the job done as best we can make it happen." (**SE**)

Mowing services – Pesticide applicators often do not mow the grass. Thus, lawn care activities are often not coordinated. Landscaping services contracted to mow lawns are also believed to reduce the efficacy of treatments by improper mowing (height, timing, or frequency) and/or contribute to spreading seeds of undesirable turfgrasses and weeds with their equipment, further hindering lawn maintenance efforts.

"I don't think we moved weeds around like we do today back when everybody mowed their own yard. If one of those yards had a weed problem, he may have brought it to your yard. If he didn't bring it today, he'll bring it next week. We rarely used to see weeds and now we see them a lot. I think it's more due to the commercial grass cutters, moving the weeds around." (**SE**)

Trustworthy Sources of Information

Chemical suppliers – Chemical suppliers, and their sales representatives, are trusted sources of information. They are perceived as being honest and reliable sources of knowledge regarding the products they distribute despite making a commission on the sale. Sales representatives focus on chemical solutions, and as they continue to be assigned to larger geographic areas, they have less interaction with the LCOs they work with, making that communication line less available.

> *"Sales reps and the access that they have directly to the suppliers is valuable. They have great experience, and they do a lot of field trials. That's where most of my information comes from."* **(PNW)**

Universities – University scientists are the most trusted information source. They provide research and data that help operators explain the use of chemicals. Note that the role of universities could be exaggerated in these findings because the focus group participants were invited to participate through a university and in several of the focus groups university faculty listened to the discussions. Some felt universities could be a helpful resource in providing the EPA with data that would support allowing LCOs to use an expanded list of chemicals. Universities also offer valuable networking and collaboration opportunities for operators. These events give a valuable touchpoint to operators to ask questions and concerns along with giving a chance for informal collaboration between operators. LCOs could benefit from university-facilitated roundtables where they could exchange ideas and best practices amongst each other.

> *"We typically trust our university people. They give us good advice based on their trials. They let us know when to look at a product, or that they're seeing good results with a product. That means a lot to us." (SE)*

Industry Trade Groups – Industry associations provide a valuable resource for operators to discuss strategies and future developments. Those in the East were more pronounced in their utilization of these resources. Those in other regions thought industry trade groups could be more active.

"Whether it's a national association, or a landscaper's association as part of your state, there's opportunities there for education across different industries." **(MW)**

Misinformation – LCOs are concerned that misinformation leads to unfounded concerns about pesticide and fertilizer use. When consumers see applicators wearing personal protective equipment (PPE), they assume the product is dangerous. They do not understand that laws require the use of the PPE specified on the pesticide label and that applicators take extra safety precautions because of their daily exposure to pesticides. LCOs also believe that knowledgeable and licensed applicators can correctly use pesticides and fertilizers.

"I see an abundance of misinformation and biased opinions that have caused a lot of issues right now. The Roundup thing in California is an example. When you spray every day, it is different than an application on the lawn." **(PNW)**

Implications

Based on the focus group discussions and related research, we draw the following five implications and potential for improvements in contemporary lawn care weed management in the U.S.

1. Lawn care is regionally heterogeneous in its challenges and opportunities for improvements – ecological, economic and social conditions interact to shape the problems and possible productive responses. Lesson – uniform national or regional prescriptions for policies and practices to improve lawn weed management are unlikely to be successful.
2. *Poa annua* is a significant concern in most regions. LCOs are using mostly herbicides to keep *Poa annua* under control. They lament the lack of more cost-effective herbicide controls and feel lawn care does not get adequate consideration by EPA in approving new pesticides for weed control. However, the responsibility for introducing new pesticides is a shared responsibility between the registrants and EPA. Misunderstandings of the EPA approval process by some intensify those concerns as applicators misconstrue that the university is responsible for advocating with the EPA for increased product uses and not the pesticide registrant, which is the chemical company. The EPA registration process actively seeks input from stakeholders regarding their pesticide needs and integrates these requests into the decision-making process. Stakeholders should work with their turfgrass organizations to communicate to the EPA regarding their pesticides needs.
3. The authors concur that LCOs have considerable latitude in selecting the herbicide controls for lawn weed management. However, for many LCOs in competitive situations, the margin may be too low for them to apply more expensive herbicides that are either more effective against *Poa annua* or have other desirable attributes (i.e. a different mode of action).
4. Non-chemical practices are commonly used in most regions to complement chemical practices and help achieve more integrated weed management. However, insufficient longitudinal data exist to make persuasive arguments to get all service providers and property owners to undertake integrated weed management practices systematically, especially those that might be inconsistent with other landscape goals, are costly, or are time intensive. Most LCOs have little or no control over common non-chemical practices such as mowing or irrigation. This undermines their ability to develop and implement a sustainable approach to lawn weed management.
5. Fostering more integrated weed management in lawn care will require new information-sharing systems or organization schemes, in which all major stakeholders, e.g., chemical suppliers and lawn users, play significant roles. Unlike other turf sectors, lawn care, perhaps because of its heterogeneity or competition between LCOs in similar localities, does not have well-functioning information networks in most regions to share credible information on existing and emergent weed management practices. As university scientists and Extension specialists are the most trusted information source, they are in a prime position to lead these information-sharing improvements.

A Plan of Action for Improving U.S. Lawn Weed Management

These novel focus group discussions provide valuable insights into the challenges and possible opportunities for improving lawn weed management. Improving the coordinated management of landscapes between all parties (homeowner, mowing contractor, lawn care company, etc.) is needed to provide a coordinated weed management effort. Further, additional information sharing streams between LCOs, trade organizaitons, suppliers, universities, and policy makers would assist in the implementation of more successful strategies to mitigate herbicide resistance development. Given the small number of participants in our focus groups, identifying actionable strategies to improve lawn weed management requires more investigation of a representative sample of LCOs. This mixed methods approach of using focus groups to inform a broader scientific survey has been used to probe the causes and treatments for herbicide resistance in agricultural crops (Ervin *et al* 2019). In that vein, our major findings, e.g., *Poa annua* resistance awareness and limited information sharing among LCOs, can inform hypotheses to be tested with scientific surveys of U.S. lawn care professionals. Given the heterogenous lawn care sector, such an investigation will require a high level of coordination, collaboration and participation to make the findings credible and useful.

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