Turfgrass Management Professional Development Needs Assessment of Extension Agents

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Abstract. **Turfgrass management includes many different components and without proper management turfgrass aesthetics will diminish. In addition, mismanagement of turfgrass systems could lead to negative environmental impacts. This situation creates the need for Extension agents to deliver turfgrass management educational and outreach programs to the various stakeholders and the general public. However, Extension agents require professional development in terms of turfgrass management. A needs assessment of [State] Extension agents was conducted at the University of Florida to determine the professional development needs relating to turfgrass management. Through this needs assessment, there were 51 individual competencies identified that were categorized into nine distinct competency domains. In general, the highest priority relative to professional development needs were related to the pest management (i.e., disease, insect, weeds, and nematodes) competency domains. Extension specialists can use the information from this needs assessment to adjust current and tailor new turfgrass management professional development programs to address the identified needs with the highest priority [i.e., greatest mean weighted discrepancy score (MWDS)]. Professional development programs could include creating new or adjusting educational materials and resources for the needs identified, in-service trainings for Extension agents to provide additional education, series of academies to provide baseline knowledge to Extension agents, and an online database to provide information and guidance. In addition, the results and needs identified from this needs assessment can be used as a basis for obtaining educational funding.**

In the United States, it is estimated that turfgrass accounts for 1.9% (163,812 km^2 ± 35,850 km^2) of total continental area (Milesi et al. 2005). Furthermore, turfgrass covers ≈11,570 to 17,770 km^2 in Florida (Hodges and Stevens 2010; Milesi et al. 2005). The turfgrass industry also makes a significant contribution to the national and state economies. In 2005, the US total economic output and value-added impacts of the turfgrass industry, not including athletic fields, were estimated at $62.2 billion and $37.7 billion, respectively, and the industry continues to grow in the United States (Haydu et al. 2018). In 2002, the Florida turfgrass industry generated a total value-added impact of $3.3 billion and it increased to $8.6 billion in 2019 with a total economic impact of $14.3 billion (Haydu et al. 2018; Khachatryan et al. 2020). This trend of increasing economic activity along with the forecasted population growth ranks Florida as the largest state in the United States for turfgrass-related economic activity (Khachatryan et al. 2020).

Turfgrass management is multifaceted and includes but is not limited to establishment, soil testing and amendments, nutrition and fertilization, irrigation, cultural practices, and pest management (Christians et al. 2017). Without proper management, turfgrass aesthetics will diminish and could lead to negative environmental impacts. Improper use or overuse of chemicals (i.e., fertilizer and pesticides) and irrigation inputs have the potential to negatively impact water quantity and quality (Carey et al. 2012; Gómez-Armayones et al. 2018; Stier et al. 2013). Thus, managing turfgrass has become a controversial issue in public policy because of conflicts over the potential of chemicals getting into water bodies and water consumption (Ghimire et al. 2019). However, a properly maintained, healthy, and actively growing turfgrass results in minimal pesticide and nutrient loss, and minimal sediment runoff (Erickson et al. 2001, 2005; Gómez-Armayones et al. 2018; Gross et al. 1990; Soldat and Petrovic 2008; Stier et al. 2013; Sun et al. 2021). In addition, turfgrass managed with University of Florida Institute of Food and Agricultural Sciences recommendations resulted in negligible nutrient losses in the various turfgrasses used in Florida (Gonzalez et al. 2013; Maia et al. 2021; McGroary et al. 2017; Shaddox et al. 2016; Telenko et al. 2015; Trenholm et al. 2012).

Turfgrass requires some level of inputs (i.e., labor, fertilizer, pesticides, etc.) to maintain aesthetic and functional value, but some turfgrass operations do not fully understand all the different aspects of turfgrass management (Soldat et al. 2020; Yue et al. 2021). This scenario creates the need for turfgrass management education and training. Furthermore, the factors of implementing turfgrass best management practices are based on the barriers to adoption, demographics, and the effectiveness of education and outreach programs (Eanes and Zhou 2020). Extension agents are critical in delivering these educational and outreach programs to the growers, stakeholders, and the general public (Barry et al. 2020). Thus, providing education and training on turfgrass management to Extension agents is paramount to ensure they have the knowledge and skills for their clientele.

Through a literature search, the authors could not identify any peer-reviewed publications focusing on the needs of Extension agents related to turfgrass management. The purpose of this assessment was to determine the professional development needs of Extension agents that have turfgrass management educational and outreach programs, specifically focusing on the knowledge and skills needed to successfully implement turfgrass management programs, which can be used to adjust the specialist programming to meet the identified knowledge gaps of Extension agents (Benge et al. 2020).

Materials and methods

The research reported here sought to determine the professional development needs of agricultural and

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horticultural Extension agents relating to turfgrass management. The objectives of this study were to 1) identify the turfgrass competencies needed by agricultural and horticultural Extension agents, and 2) assess the importance and ability levels for each turfgrass competency to determine priority training needs of agricultural and horticultural Extension agents. Before this research was carried out, the research protocol was submitted to the authors' institutional review board and was deemed exempt.

A mixed methods research design, specifically an exploratory sequential protocol, was carried out for this study in 2022 to 2023 (Creswell and Plano Clark 2018). This exploratory sequential design was used to first identify, and then assess (Witkin and Altschuld 1995) turfgrass competencies needed by agricultural and horticultural Extension agents. This study used a two-step data gathering process in which a qualitative research process was used identify the turfgrass competencies, and then a quantitative research process was used to assess the training needs of the turfgrass competencies.

We specifically targeted Florida agricultural and horticultural Extension agents for this study; however, there was no list of agents that conduct programs or answer turfgrass questions. A master list of 360 Extension agents with broad program areas was retrieved from the Florida Extension Business Services office. The authors removed all agents they knew did not work with turfgrass clientele (i.e., 4-H, sea grant, Family and Consumer Sciences, and livestock Extension agents), yielding a viable population of 146 Extension agents for this study.

For objective 1, we developed a questionnaire that was administered through Qualtrics. The questionnaire was qualitative in nature and asked two open-ended questions to explore and identify the turfgrass competencies: 1) What knowledge and/or abilities do you have regarding turfgrass management? and 2) What knowledge and/or abilities do you need training for or development in regarding turfgrass management? An expert panel comprising two state Extension specialists and one county Extension agent, all of whom had turfgrass management responsibilities, reviewed the questionnaire (Ary et al. 2006). We asked the Extension agents (n = 146) and state Extension specialists working with turfgrass management (n = 9) to complete the first survey for maximum saturation. A total of 58 Extension agents and six state Extension specialists completed the survey, yielding response rates of 40% and 67%, respectively.

The constant comparative method (Merriam 1998) was used for analysis of the data for the qualitative survey, which was used to reduce the data into identifiable, recurring themes (Lincoln and Guba 1985). Trustworthiness refers to the validation and accuracy of research through descriptions provided by both researcher and participants (Creswell 2007). Trustworthiness in qualitative research is similar to reliability and validity in quantitative research, as it provides a systematic process that enables the researcher to generate unbiased findings that contribute to the field of research (Adler 2022). Trustworthiness was addressed through member checking (Lincoln and Guba 1985), triangulation (Creswell 2007), thick rich descriptions (Korstjens and Moser 2018), and an audit trail (Wolf 2003). The analysis yielded 51 turfgrass management competencies, which were incorporated into our second questionnaire.

For objective 2, a questionnaire was developed that was also administered through Qualtrics, and a Borich model design was used to assess turfgrass management competencies of Extension agents. The Borich model is commonly used in Extension for assessing competencies and professional development needs (Benge 2023; Benge et al. 2020). We asked participants to rate the level of importance of the competency and their ability level for the competency for each turfgrass management competency statement using a 5-point Likert scale. The rating scale for the 51 competencies regarding importance were as follows: 1 = not important, 2 = of little importance, 3 = of average importance, 4 = very important, 5 = absolutely essential; and then for ability were as follows: 1 = none, 2 = below average, 3 = average, 4 = above average, 5 = high. The Cronbach's alpha for the 51 items assessing turfgrass management competencies, which was measured after data were collected, was 0.86, indicating acceptable internal consistency (Cronbach 1951).

After the data were collected, an MWDS was calculated for each competency (Borich 1980). First, the difference between a respondent's perception of the importance of a competency and the respondent's perception of their ability to perform the competency was calculated. Second, the discrepancy score was weighted according to how important the entire sample believed the competency to be, which helped correct for potential errors in an individual's judgment. Finally, the mean of all the weighted discrepancy scores was calculated across the sample; this was the MWDS for each competency item. For a 5-point rating scale, the MWDS could range from −4 to 20, in which a larger MWDS indicates a greater need for training, and competency domains and items with the largest MWDS signify the highest priority areas for training (Borich 1980; Caillouet and Harder 2022; Narine and Harder 2021).

Results and discussion

Fifty-one distinct competency items were identified by our sample of Extension agents and state Extension specialists. The competency items are organized in no particular order by each competency domain (i.e., broader turfgrass management areas), which are turfgrass weeds, insect, integrated pest management (IPM), disease, nematode, turf, fertilizer, irrigation, and soil (Table 1).

Table 2 provides a summary of the MWDS scores by turfgrass management competency domain. Results indicated the professional development domains of highest priority were "disease" (MWDS = 5.89) and "insect" (MWDS = 4.59). The least critical competency domain training needs were "turf" (MWDS = 2.56) and "soil" (MWDS = 1.58). MWDS values greater than zero indicate a need for training and larger MWDS values signify a higher priority. The results of the needs assessment (i.e., all MWDSs were greater than zero) suggest that all competency domains identify a need for further education and training. Furthermore, in general, turfgrass pest management competency domains resulted in the greatest MWDS values indicated a higher priority for training relative to other competency domains.

Table 3 provides a summary of the MWDS for individual competency items within each domain, from highest to lowest needs, related to turfgrass management. There were no negative MWDS, meaning all items demonstrated a need for training and development. Results

Table 1. Turfgrass management competency item list by competency domain.

Competency domain	Competency item (knowledge/skill)
Weeds	Weed identification
Weeds	Manage/control/treatment for weeds in turf
Weeds	Herbicides (general knowledge)
Weeds	New or emerging herbicides
Weeds	Herbicide recommendations
Weeds	Homeowner herbicide options
Insect	Insect identification
Insect	IPM
Insect	Manage/control/treatment for insects in turf
Insect	New or emerging insects
Insect	New or emerging insecticides
IPM[i]	Troubleshooting dead/problem areas
IPM	IPM installation and maintenance
IPM	IPM action thresholds
Disease	Disease identification
Disease	Disease diagnostics/troubleshooting
Disease	Manage/control/treatment for disease in turf
Disease	Communicating diseases to clientele
Disease	New or emerging fungicides
Disease	Lethal Viral Necrosis management/options
Nematodes	Nematode identification
Nematodes	Manage/control/treatment for nematodes in turf
Turf	Turf identification
Turf	Sod issues
Turf	Turf species selection
Turf	New cultivars
Turf	Multispecies & mixed lawns
Turf	Turf alternatives
Turf	Best management practices in turf
Turf	Equipment for turf management
Turf	Basic maintenance recommendations
Turf	Mowing heights
Turf	Establishment and planting material (sod, plugs, sprigs, seed)
Fertilizer	Managing blackout periods
Fertilizer	Fertilizer recommendations
Fertilizer	Spreader calibration
Fertilizer	Fertilizer schedules
Fertilizer	Fertilizer calculations
Fertilizer	Fertilizer/nutrient management
Irrigation	Irrigation recommendation
Irrigation	Irrigation management
Irrigation	Irrigation schedules
Irrigation	Irrigation efficiency
Irrigation	Irrigation technology
Irrigation	Reclaimed water for irrigation
Soil	Soil management
Soil	Soil testing procedures
Soil	Soil testing interpretation and recommendations
Soil	pH management
Soil	Compost and amendment additions
Soil	Age of landscape

[i] IPM = integrated pest management.

indicated the professional development needs of highest priority stem from the disease domain and were "Manage/control/treatment for disease in turf" (MWDS = 7.02), "Disease diagnostics/troubleshooting" (MWDS = 6.33), "New or emerging fungicides" (MWDS = 6.29), and "Disease identification" (MWDS = 6.20). The least critical training needs were from the turf and soil domains and were "Mowing heights" (MWDS = 0.80) and "Soil testing procedures" (MWDS = 0.17).

The results from the needs assessment indicate that all turfgrass management competency domains and individual competency items (i.e., all MWDSs were greater than zero) showed a need for education, training, and professional development. Turfgrass management Extension specialists can use this information to adjust current and tailor new professional development programs and in-service trainings that focus on the highest priority (i.e., greatest MWDS values) turfgrass management competency domains. Furthermore, within each competency domain, Extension specialists can prioritize educational material and training on the most critical competency items. Benge et al. (2020) suggest multiple ways to help close the gaps identified in this study and include the following: 1) create new and/or identify existing materials and resources from other institutions that meet the areas of need that were identified in the needs assessment; 2) use a series of turfgrass management in-service trainings for Extension agents to meet the needs described previously; 3) create a turf management academy or series of academies for new Extension agents to ensure that they have a baseline competency in each of the identified domains; and 4) create and develop an online source of trainings, recorded webinars, and resources that provide turfgrass management information and guidance. In addition, Extension specialists could use the results of this needs assessment to prioritize budget and time restrictions, in which low-priority areas could be addressed via low-cost trainings (i.e., webinars, blogs, etc.) and high-priority areas could be addressed through more expensive and time-consuming

Table 2. Mean weighted discrepancy score (MWDS) by competency domain.

Competency domain	MWDS
Disease	5.89
Insect	4.59
Weeds	4.29
Nematodes	4.18
Irrigation	3.97
IPM[i]	3.89
Fertilizer	3.45
Turf	2.56
Soil	1.58

[i] IPM = integrated pest management.

Table 3. Mean weighted discrepancy score (MWDS) by competency item.

Domain	Competency item	MWDS
Disease	Manage/control/treatment for disease in turf	7.02
Disease	Disease diagnostics/troubleshooting	6.33
Disease	New or emerging fungicides	6.29
Disease	Disease identification	6.20
Weeds	New or emerging herbicides	6.11
Insect	New or emerging insecticides	5.96
Insect	New or emerging insects	5.68
Irrigation	Irrigation management	5.59
Weeds	Herbicide recommendations	5.42
Disease	Lawn management/options	5.09
Insect	Manage/control/treatment for insects in turf	4.91
Nematodes	Manage/control/treatment for nematodes in turf	4.81
IPM[i]	Troubleshooting dead/problem areas	4.73
Disease	Communicating diseases to clientele	4.46
Irrigation	Irrigation technology	4.38
Irrigation	Irrigation efficiency	4.33
Weeds	Herbicides (general knowledge)	4.25
Weeds	Homeowner herbicide options	4.25
Fertilizer	Fertilizer/nutrient management	4.22
Turf	New cultivars	3.83
Fertilizer	Spreader calibration	3.72
IPM	IPM action thresholds	3.56
Nematodes	Nematode identification	3.55
Weeds	Manage/control/treatment for weeds in turf	3.48
Irrigation	Irrigation recommendation	3.45
Insect	Insect identification	3.39
Fertilizer	Fertilizer schedules	3.39
IPM	IPM installation and maintenance	3.38
Turf	Turf identification	3.30
Turf	Sod issues	3.27
Fertilizer	Fertilizer calculations	3.27
Irrigation	Reclaimed water for irrigation	3.23
Fertilizer	Fertilizer recommendations	3.19
Insect	IPM	3.02
Fertilizer	Managing blackout periods	2.92
Irrigation	Irrigation schedules	2.85
Turf	Best management practices in turf	2.78
Turf	Establishment and planting material (sod, plugs, sprigs, seed)	2.78
Turf	Turf species selection	2.76
Turf	Multispecies & mixed lawns	2.57
Soil	Soil management	2.36
Turf	Basic maintenance recommendations	2.35
Weeds	Weed identification	2.25
Turf	Equipment for turf management	2.19
Soil	Age of landscape	2.08
Soil	Soil testing interpretation and recommendations	1.98
Soil	Compost and amendment additions	1.66
Turf	Turf alternatives	1.60
Soil	pH management	1.25
Turf	Mowing heights	0.80
Soil	Soil testing procedures	0.17

[i] IPM = integrated pest management.

trainings (i.e., hands-on or in-person training). Furthermore, the results from this needs assessment can be used as a basis for obtaining educational funding for all turfgrass management training, because all MWDSs were above zero, and specifically for the high-priority competency domains and items.

In conclusion, a follow-up needs assessment could be conducted after implementing the professional development programs developed from this needs assessment to assess if the Extension agents' needs were met. In addition, Extension efforts in other states could use the competency domains and individual competencies generated from this needs assessment to evaluate

perceptions of the importance of turfgrass management knowledge and ability levels related to those competencies among their Extension professionals (Benge et al. 2020).

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