Journal of Extension
www.joe.org

December 2020
Volume 58
Number 6
Article #v58-6rb5
Research In Brief

Determining the Professional Development Needs of Florida Integrated Pest Management Extension Agents

Abstract

With agriculture as the second largest economic industry in Florida, the state's Extension agents need subject matter expertise necessary for disseminating the latest in agricultural research information to agricultural producers. Using an exploratory sequential design coupled with a Borich model, we determined the professional development needs of Florida Extension agents working in integrated pest management (IPM). Through our needs assessment, we identified 16 IPM competencies and found that the highest priority relative to needed professional development was for the competency "determining pest thresholds." Extension personnel can use the list generated to assess perceptions of importance and ability level regarding IPM competencies among Extension professionals in their states.

Keywords: integrated pest management, professional development, needs assessment

Matt Benge
Assistant Professor
Department of Agricultural Education and Communication

Xavier Martini
Assistant Professor
North Florida Research and Education Center

Lauren M. Diepenbrock
Assistant Professor
Citrus Research and Education Center

Hugh A. Smith
Associate Professor
Gulf Coast Research and Education Center

University of Florida

Introduction

Agriculture is the second largest economic industry in Florida, and the state is listed as a leader for crop production in the country, having had $7.5 billion in farm cash receipts in 2017 (National Agricultural Statistics Service, 2018). In the state are 47,500 farm operations and over 9 million ac devoted to agriculture, with top-grossing crops including citrus ($1.21 billion), cucurbits ($339 million), tomatoes ($262 million), and strawberries ($337 million) (Florida Department of Agriculture and Consumer Services, 2017). Florida agriculturalists must be economically satisfied and well versed in up-to-date production methods to meet agricultural demand. Likewise, Extension agents who serve these agriculturalists must be knowledgeable and have the subject matter expertise needed to disseminate the latest in agricultural research information to agricultural producers (Cooper & Graham, 2001; Harder et al., 2010; Seevers & Graham, 2012). One subject matter competency area for which agriculture Extension agents need knowledge and expertise is integrated pest management (IPM).

The integration of pest management practices was introduced in the late 1950s for management of spotted alfalfa aphids (Stern et al., 1959) and has involved use of both biological and chemical controls to reduce

potential adverse effects on agricultural crops. Central to the IPM approach are the concepts of economic injury level (EIL), which is the lowest population density that will cause economic damage, and economic threshold, which is the density at which control measures should be determined to prevent an increasing pest population from reaching the EIL. Supporting these concepts was the pioneering idea that the presence of pests is acceptable if population densities are below the EIL. To prevent pest populations from reaching the EIL, IPM incorporates multiple preventive actions to decrease risks of pest outbreaks, including the regular monitoring of pest populations (University of Florida Institute of Food and Agricultural Sciences Extension, 2020). In IPM, a responsive action (i.e., application of chemical insecticide) should be decision based rather than calendar based. Since the introduction of IPM, the concepts of IPM have been applied to weed management and plant pathogens.

In 1977 the U.S. Department of Agriculture adopted a policy to develop and encourage use of IPM, including by supporting IPM research and demonstration activities (Farrar et al., 2016). However, despite the claim that IPM was used for approximately 70% of U.S. crops in 2000 (U.S. Government Accounting Office, 2001), pesticide expenditures in U.S. agriculture are still increasing, and in 2012 U.S. consumption represented 14% of the insecticide world market (Atwood & Paisley-Jones, 2017). Both agriculturalists and Extension agents need to be knowledgeable of IPM; however, a major barrier to proper implementation and teaching exists due to lack of relevant subject matter expertise among Extension agents (Rodriguez et al., 2009). Though the literature addresses research regarding IPM approaches that are commodity and clientele specific (Bennett et al., 2016; Vommi et al., 2013), the only published literature we identified relating to Extension agent knowledge of IPM focused solely on Extension agents in Eastern Uganda (Erbaugh et al., 2007). Specifically focusing on skills and knowledge needed to successfully implement IPM educational programs is paramount for an Extension agent's success in this realm (Harder et al., 2010) and can allow specialists to adjust their programming to meet identified knowledge gap needs of Extension professionals.

Purpose and Objectives

The purpose of our assessment was to determine the professional development needs of Extension agents working within IPM. The objectives for our study were

1. to identify the competencies needed by IPM Extension agents,

2. to describe agents' perceptions of the importance of identified IPM competencies and their ability levels with regard to identified IPM competencies, and

3. to compare importance and ability levels for each IPM competency to determine priority training needs for IPM Extension agents.

Methodology

We used a mixed-methods research design, specifically an exploratory sequential design (Creswell & Plano Clark, 2018). This methodology can be used to first identify and then assess the needs of a specific audience if the needs are unknown or understanding of the needs is incomplete (Greene et al., 2001; Witkin & Altschuld, 1995). We used qualitative research to satisfy our first objective and quantitative research to satisfy our second and third objectives. We targeted Florida Extension agents working within IPM to participate in our

study and obtained institutional review board approval prior to conducting the study.

We developed two questionnaires that were administered online through Qualtrics. The initial questionnaire was qualitative in nature and addressed the first objective of exploring the competencies that are needed for Extension agents working in IPM. We created a survey with two open-ended questions: (a) "What knowledge and/or abilities do you have regarding Integrated Pest Management?" and (b) "What knowledge and/or abilities do you need training for or development in regarding Integrated Pest Management?" We asked an expert panel comprising three state Extension specialists and one county Extension agent, all of whom had IPM responsibilities, to review the study. We asked Extension agents (n = 51) and state Extension specialists (n = 65) working within IPM to complete our first survey for maximum saturation. A total of 36 Extension agents and 38 state Extension specialists completed the survey, yielding response rates of 71% and 57%, respectively.

We conducted the initial analysis of the data using the constant comparative method (Merriam, 1998), which is used to reduce data into identifiable, recurring themes (Lincoln & Guba, 1985). We addressed trustworthiness in several ways. We collaborated on the final interpretation of the data in a form of triangulation, maintained an audit trail throughout the data analysis, and used direct quotes from respondents to create a thick description of the findings. Bias from researchers can affect the way qualitative data are analyzed and interpreted (Shenton, 2004). We are all Extension professionals; our lead author has prior experience as an agent in Florida and our other three authors have statewide IPM responsibilities. We made an effort to control our bias by conducting a peer debriefing with a university professor without an Extension background. Our analysis yielded 16 IPM competencies, which we incorporated into our second questionnaire.

Our second questionnaire was quantitative in nature and addressed the second and third objectives of our study. We asked only Extension agents working in IPM to complete the assessment (n = 51). Thirty-seven Extension agents completed the survey, yielding a response rate of 73%. We used a Borich model design to assess IPM competencies of Extension agents, asking participants to use a 5-point Likert scale to rate the level of importance of the competency and their ability level for the competency for each IPM competency statement. The Borich model is commonly used in Extension for assessing competencies and professional development needs (Hall & Broyles, 2016; Harder & Narine, 2019). The Cronbach's alpha for the 16 items assessing IPM competencies, which was measured after data were collected, was 0.89, indicating acceptable internal consistency (Cronbach, 1951). We asked respondents to rate each of the 16 competencies regarding importance and then ability using the following scale: 1 = *not important/none*, 2 = *of little importance/below average*, 3 = *of average importance/average*, 4 = *very important/above average*, 5 = *absolutely essential/high*. Means were interpreted as follows: 1.00–1.49 = *not important/none*, 1.50–2.49 = *of little importance/below average*, 2.50–3.49 = *of average importance/average*, 3.50–4.49 = *very important/above average*, 4.50–5.00 = *absolutely essential/high*.

We addressed the third objective by calculating a mean weighted discrepancy score (MWDS) for each competency (Borich, 1980). We first calculated 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. We then weighted the discrepancy score according to how important the entire sample believed the competency to be, which helped correct for potential errors in an individual's judgment. Finally, we calculated the mean of all the weighted discrepancies scores across the sample; this was the MWDS for the competency.

Respondents' formal educational backgrounds varied widely (Table 1). The majority of respondents reported having formal education in horticulture (*f* = 17), animal science (*f* = 6), or entomology/nematology (*f* = 4).

Table 1.

Fields of Education of Responding Florida Integrated Pest Management Extension Agents

Education field	***f***	**%**
Horticulture	17	41%
Animal science	6	15%
Entomology/nematology	4	11%
Soil and water science	3	8%
Plant pathology	2	5%
Agricultural and Extension education	2	5%
Agronomy	2	5%
Wildlife ecology and conservation	1	2%
Agricultural economics	1	2%
Plant medicine	1	2%
Aquatic biology	1	2%
Environmental education	1	2%

Findings

Competencies Needed by Florida IPM Extension Agents

Sixteen distinct competencies were identified by our sample of Extension agents and state Extension specialists working in IPM. These competencies are as follows:

- identifying insects/arthropods and their life cycles,
- identifying weeds,
- identifying diseases/pathogens,
- identifying damage caused by insects/arthropods,
- identifying damage caused by weeds,
- identifying damage caused by diseases/pathogens,
- understanding the role of beneficial insects,

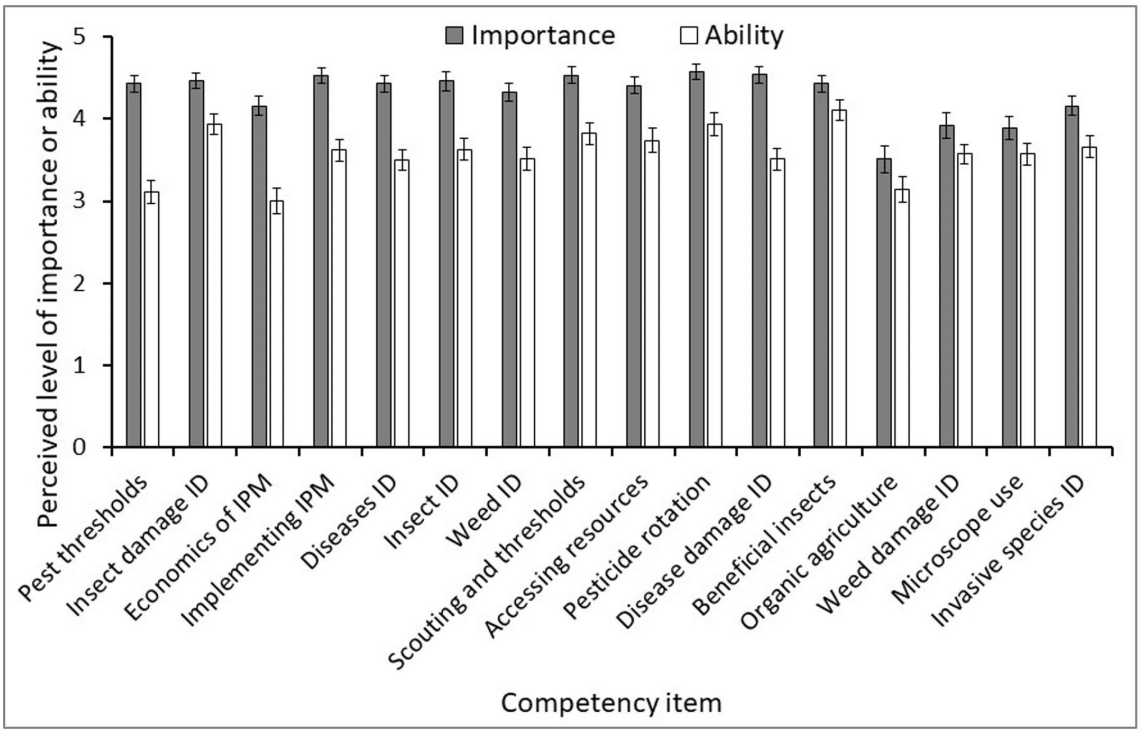
- implementing pesticide rotation and use,
- scouting and understanding thresholds for management,
- identifying invasive species,
- determining pest thresholds,
- developing and implementing basic IPM plans,
- using microscopes,
- understanding economics of IPM strategies,
- accessing diagnostic resources, and
- understanding organic agriculture.

Agent Perceptions of Importance and Ability Levels Regarding Florida IPM Competencies

Four of the 16 competencies were perceived as essential by responding IPM agents, with the remaining 12 competencies perceived as very important. Agents perceived the most important competency to be implementing pesticide rotation and use (M = 4.57, SD = .55) and the least important to be understanding organic agriculture (M = 3.51, SD = .99). For 13 of the 16 competencies, mean perceived ability level was above average; for the three others, mean perceived ability level was average. Agents perceived themselves to have the most ability in understanding the role of beneficial insects (M = 4.11, SD = .76) and least ability in determining pest thresholds (M = 3.11, SD = .83). All means for importance and ability are shown in Figure 1.

Figure 1.

Florida Integrated Pest Management (IPM) Extension Agent Perceptions of Importance and Ability Levels Regarding IPM Competencies



Note. Means were interpreted as follows: 1.00–1.49 = *not important/none*, 1.50–2.49 = *of little importance/below average*, 2.50–3.49 = *of average importance/average*, 3.50–4.49 = *very important/above average*, 4.50–5.00 = *absolutely essential/high*.

Priority Training Needs of Florida IPM Extension Agents

The MWDSs for the identified IPM competencies are shown in Table 2. There were no negative MWDSs. Competencies for which professional development needs were of highest priority were determining pest thresholds (MWDS = 5.82), identifying damage caused by diseases/pathogens (MWDS = 4.93), and understanding economics of IPM strategies (MWDS = 4.64). Competencies for which training needs were least critical were understanding organic agriculture (MWDS = 1.50) and using microscopes (MWDS = 1.56).

Table 2.

Borich Model Assessment of Integrated Pest Management (IPM) Extension Agent Perceptions of Importance and Ability Levels Regarding IPM Competencies

Competency	MWDS
Determining pest thresholds	5.82
Identifying damage caused by diseases/pathogens	4.93
Understanding economics of IPM strategies	4.64
Developing and implementing basic IPM plans	4.13
Identifying diseases/pathogens	4.03
Identifying insects/arthropods and their life cycles	3.69

Identifying weeds	3.46
Scouting and understanding thresholds for management	3.19
Accessing diagnostic resources	2.98
Implementing pesticide rotation and use	2.87
Identifying damage caused by insects/arthropods	2.49
Identifying invasive species	2.26
Understanding the role of beneficial insects	1.65
Identifying damage caused by weeds	1.57
Using microscopes	1.56
Understanding organic agriculture	1.50

Note. MWDS = mean weighted discrepancy score.

Implications and Recommendations

Florida agriculture plays an integral role in the state's economy (Florida Department of Agriculture and Consumer Services, 2017), and agriculture Extension agents need to be well versed in the current trends, controls, and strategies for increasing the profitability of and simultaneously reducing potential threats to agricultural commodities (Rodriguez et al., 2009). The results of our needs assessment suggest a priority ranking for professional development needs of Florida Extension agents working in IPM, with the top four areas of professional development need being for the competencies of determining pest thresholds, identifying damage caused by diseases/pathogens, understanding economics of IPM strategies, and developing and implementing basic IPM plans. Florida IPM Extension specialists can tailor and adjust current professional development programs and in-service trainings to help close gaps identified by the study. Therefore, we recommend that Florida Extension (a) create a series of IPM-focused Extension agent in-service trainings to meet the needs described above; (b) create an IPM academy for new Florida agriculture Extension agents to ensure that they have a baseline of IPM competency within their first year on the job; (c) identify existing resources, materials, and fact sheets from other institutions that meet the identified areas of need; and (d) develop an online repository of trainings, recorded webinars, and resources that provide information and guidance on IPM content and competencies. Extension personnel in other states could use the competency list we generated to assess perceptions of the importance of IPM competencies and ability levels related to those competencies among Extension professionals elsewhere.

A substantial finding of our study was the lack of formal education related to entomology/nematology, with only 11% of responding Florida Extension agents working in IPM having such a background. This situation presents a challenge for Florida IPM Extension agents who, although interfacing with agriculturalists, are entering Extension lacking critical skills and knowledge required to create educational programs and provide on-demand recommendations to local agriculture clientele. These same challenges extend to Florida Extension specialists, who must do more for IPM Extension agents who are not proficient in IPM subject matter upon entering Extension. Beyond the scope of our study, we can assume that similar challenges exist regarding other competency areas for which individuals entering the agriculture Extension profession need knowledge

and skills. We recommend that Florida Extension administrators, agriculture program leaders, and Extension specialists assess Florida agents' knowledge and skills in other programmatic areas to ensure that professional development meets Extension professionals' needs.

Author Note

Correspondence concerning this article should be addressed to Matt Benge. Email: mattbenge@ufl.edu

References

Atwood, D., & Paisley-Jones, C. (2017). *Pesticides industry sales and usage*. U.S. Environmental Protection Agency Biological and Economic Analysis Division. https://www.epa.gov/sites/production/files/2017-01/documents/pesticides-industry-sales-usage-2016_0.pdf

Bennett, B., Hurley, J., & Merchant, M. (2016). An integrated pest management tool for evaluating schools. *Journal of Extension*, *54*(2), Article v54-2tt4. https://joe.org/joe/2016april/tt4.php

Borich, G. D. (1980). A needs assessment model for conducting follow-up studies. *Journal of Teacher Education*, *31*(3), 39–42.

Cooper, A. W., & Graham, D. L. (2001). Competencies needed to be successful county agents and county supervisors. *Journal of Extension*, *39*(1), Article 1RIB3. https://www.joe.org/joe/2001february/rb3.php

Creswell, J. W., & Plano Clark, V. L. (2018). *Designing and conducting mixed methods research* (3rd ed.). Sage Publications, Inc.

Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika*, *16*(3), 297–334. https://doi.org/10.1007/BF02310555

Erbaugh, J. M., Kibwika, P., & Donnermeyer, J. (2007). Assessing extension agent knowledge and training needs to improve IPM dissemination in Uganda. *Journal of International Agricultural and Extension Education*, *14*(1), 59–70. https://www.aiaee.org/index.php/vol-141-spring-07/123-assessing-extension-agent-knowledge-and-training-needs-to-improve-ipm-dissemination-in-uganda

Farrar, J. J., Baur, M. E., & Elliott, S. F. (2016). Adoption of IPM practices in grape, tree fruit, and nut production in the western United States. *Journal of Integrated Pest Management*, *7*(1). https://doi.org/10.1093/jipm/pmw007

Florida Department of Agriculture and Consumer Services. (2017). *Florida agriculture overview and statistics.* https://www.fdacs.gov/Agriculture-Industry/Florida-Agriculture-Overview-and-Statistics

Greene, J., Benjamin, L., & Goodyear, L. (2001). The merits of mixing methods in evaluation. *Evaluation*, *7*(1), 25–44.

Hall, J. L., & Broyles, T. W. (2016). Leadership competencies of Tennessee Extension agents: Implications for professional development. *Journal of Leadership Education*, *15*(3), 187–200. https://journalofleadershiped.org/jole_articles/leadership-competencies-of-tennessee-extension-agents-implications-for-professional-development/

Harder, A., & Narine, L. K. (2019). Interpersonal leadership competencies of Extension agents in Florida. *Journal of Agricultural Education*, *60*(1), 224–233. https://www.jae-online.org/index.php/volume-60-number-1-2019/2207-interpersonal-leadership-competencies-of-extension-agents-in-florida

Harder, A., Place, N. T., & Scheer, S. D. (2010). Towards a competency-based Extension education curriculum: A Delphi study. *Journal of Agricultural Education*, *51*(3), 44–52. https://www.jae-online.org/index.php/back-issues/37-volume-51-number-3-2010/84-towards-a-competency-based-extension-education-curriculum-a-delphi-study

Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry*. Sage Publications.

Merriam, S. B. (1998). *Qualitative research and case study applications in education*. Jossey-Bass.

National Agricultural Statistics Service. (2018). *2018 state agriculture overview*. U.S. Department of Agriculture. https://www.nass.usda.gov/Quick_Stats/Ag_Overview/stateOverview.php?state=FLORIDA

Rodriguez, J. M., Molnar, J. J., Fazio, R. A., Sydnor, E., & Lowe, J. M. (2009). Barriers to adoption of sustainable agriculture practices: Change agent perspectives. *Renewable Agriculture and Food Systems*, *24*(1), 60–71. https://doi.org/10.1017/S1742170508002421

Seevers, B., & Graham, D. (2012). *Education through Cooperative Extension* (3rd ed.). University of Arkansas.

Shenton, A. K. (2004). Strategies for ensuring trustworthiness in qualitative research projects. *Education and Information*, *22*(2). http://www.crec.co.uk/docs/Trustworthypaper.pdf

Stern, V. M., Smith, R. F., van den Bosh, R., & Hagen, K. S. (1959). The integration of chemical and biological control of the spotted alfalfa aphid: The integrated control concept. *Hilgardia*, *29*(2), 81–101. https://doi.org/10.3733/hilg.v29n02p081

University of Florida Institute of Food and Agricultural Sciences Extension. (2020). *Integrated pest management (IPM)*. https://sfyl.ifas.ufl.edu/sarasota/gardening-and-landscaping/horticulture-commercial/integrated-pest-management/

U.S. General Accounting Office. (2001). *Agricultural pesticides: Management improvements needed to further promote integrated pest management*. https://www.gao.gov/assets/240/232048.pdf

Vommi, H. K., LaVergne, D. D., & Gartin, S. (2013). Growers' perceptions and adoption practices of integrated pest management in West Virginia. *Journal of Extension*, *51*(2), Article v51-2rb5. https://joe.org/joe/2013april/rb5.php

Witkin, B. R., & Altschuld, J. W. (1995). *Planning and conducting needs assessments: A practical guide*. Sage Publications.
