Evaluation of Extension Agents' Sustainable Cotton Training Needs Using the Ranked Discrepancy Model (RDM)

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Introduction/need for research

Agricultural stakeholders have been tasked to increase cotton production by 40% while decreasing the environmental footprint in half by 2050 (USDA, 2021). Cotton production requires some of the most intensive use of pesticides of any major row crop (USDA National Agriculture Statistics Service [NASS], 2021). Additionally, cotton production in the West-Central region impacts at least four major aquifers (U.S. Geologic Survey, 2021). Greater implementation of sustainable production practices (Lee et al., 2021) in cotton has been shown to significantly reduce water and fertilizer inputs and associated costs, increase farmer income, and lead to more efficient use of resources (Imran et. al, 2018).

County extension agents are change agents (Ganpat et al., 2016; Strong & Israel, 2009) representing land-grant institutions in local communities (Benge et al., 2011; Harder et al., 2013). Priority Two of the *National Research Agenda* highlighted the need to understand new practices for the development and implementation of sustainable agricultural systems (Lindner et al., 2016). The research presented here was supported by USDA's Sustainable Agriculture Research and Education (SARE) grant number SPDP22-10 and USDA Hatch project 09890.

Conceptual or theoretical framework

Narine and Harder (2021) proposed the Ranked Discrepancy Model (RDM) versus the Borich model (1980) to assess training needs of a sample. RDMs are appropriate when: "(a) the census of a target population [is being evaluated] at one point in time, (b) data for each variable or item is paired on two ordinal scales with an equivalent number of response anchors, and (c) the objective is to assess discrepancies between two clearly identified states or conditions for each item" (Narine & Harder, 2021, p. 98). Beyond Borich, an RDM produces standardized scores symbolizing discrepancies in competencies juxtaposed to identified conditions of equilibrium. The purpose of the study was to examine agents' perceived proficiency and sense of importance in sustainable cotton production competencies, including soil and nutrient management, water management and conservation, integrated pest management, chemical applications, organic cotton production, fiber quality and post-harvest, and applied research. The objectives were to describe current competency levels of extension personnel and identify and rank discrepancies.

Methodology

The population of this survey research included county agriculture extension agents, district administrators, and state specialists located in cotton-producing counties or parishes in five states within the West-Central U.S. The population was identified through online agency directory searches cross-referenced with agriculture census and survey data from 2019-2021 (USDA-NASS, 2021). Invitations were sent to all 275 identified individuals.

A 48-item instrument was developed to determine county extension agents' sustainable cotton production training needs. Using a Borich (1980) needs assessment model, the instrument asked participants to identify perceived proficiency and importance of specific competencies using the following 4-point ordinal scale: 1 = *no proficiency or importance*, 2 = *low proficiency or importance*, 3 = *average proficiency or importance*, and 4 = *high proficiency or importance*. The response rate was 16% but four responses were deleted resulting in 40 responses to analyze. Differences in scores were utilized to identify knowledge gaps in areas of proficiency and importance. The instrument was reviewed for content validity by a four-member panel consisting

of one Texas A&M University (TAMU) faculty with expertise in evaluation, one TAMU faculty with subject matter expertise, and two former county extension agents specializing in cotton production. The instrument was distributed through Qualtrics following the Tailored Design Method (Dillman et al., 2014). Descriptive statistics were calculated using SPSS 27 and Negative Rank (NR), Positive Rank (PR), and Tied Rank (TR) scores were calculated for each competency item. The population itself was a limitation as the extension personnel were located across five West-Central states.

Results/findings

After applying weights to NR (-1), PR (1), and TR (0), the RDM illustrated discrepancies in each competency from the point of equilibrium (0) for the forty (N = 40) respondents. Organic cotton production yielded the highest negative rank (NR = 3, PR = 2, TR = 27) competency. When NR is the highest, NR indicates a gap in ability to perform the sustainable cotton production practice.

When PR is higher, a gap in ability to perform the competency does not exist. Water management produced the highest PR scores as sustainable cotton production competencies of agents (NR = 5, PR = 14, TR = 21). Other chemical applications produced a discrepancy of (NR = 7, PR = 13, TR = 20). Applied research yielded scores (PR = 8, NR = 4, TR = 28) and fiber quality and post-harvest, produced (NR = 6, PR = 10, TR = 25). Proficiency of soil types in your area, exhibited a positive rank (NR = 8, PR = 9, TR = 23) and integrated pest management tied with scores represented by (PR = 4, NR = 4, TR = 32) and had the final positive rank.

Conclusions

The use of RDM allows one to see the severity of a need and allows for direct comparison and priority ranking between competencies. Results from the differences in scores can be utilized to identify knowledge gaps in areas of importance within a group of extension professionals. However, the authors caution the data's use for generalizability. Specific items within a competency can move the ranked discrepancy score in either direction. While agents reported overall positive scores in integrated pest management, proficiency of soil types, fiber quality and post-harvest, applied research, other chemical applications, and water management, the data indicated agents need professional development respective to organic cotton production. The data's limitations are the number of respondents and though reliable, items within competencies potentially skewing the data.

Implications/recommendations/impact on profession

Improving extension personnel competencies are an annual professional development necessity (Ganpat et al., 2016). A discrepancy was identified and can now be used to develop training opportunities for agents to increase dissemination and adoption of sustainable organic cotton production practices among cotton producers (Narine & Harder, 2021). Field days, demonstration plots, farmer-field schools (Wynn et al., 2013), and virtual or online asynchronous trainings (Strong & Alvis, 2011) would assist agents to improve proficiencies in organic cotton production. Further studies are needed to better understand the impact of specific items within competencies to understand their final analysis impact and the plausibility of competency discrepancies. Professional development in sustainable cotton production will assist agents to improve program impact (Benge et al., 2011) for cotton stakeholders and to decrease negative impacts on farmer income and natural resources (Lee et al., 2021).

References

Benge, M., Harder, A., & Carter, H. (2011). Necessary pre-entry competencies as perceived by Florida extension agents. *Journal of Extension, 49*(5), 1–11. https://archives.joe.org/joe/2011october/a2.php

Borich, G. D. (1980). A needs assessment model for conducting follow-up studies. *Journal of Teacher Education, 31*(3), 39–42. https://doi.org/10.1177/002248718003100310

Dillman, D. A., Smyth, J. D., & Christian, L. M. (2014). *Internet, phone, mail, and mixed-mode surveys: The tailored design method*. John Wiley & Sons, Incorporated.

Ganpat, W. G., Ramjattan, J., & Strong, R. (2016). Factors influencing self-efficacy and adoption of ICT dissemination tools by new extension officers. *Journal of International Agricultural and Extension Education, 23*(1), 1–13. https://doi.org/10.5191/jiaee.2016.23106

Harder, A., Ganpat, W. G., Moore, A., Strong, R., & Lindner, J. R. (2013). An assessment of extension officers' self-perceived programming competencies in selected Caribbean countries. *Journal of International Agricultural and Extension Education, 20*(1), 33–46. https://doi.org/10.5191/jiaee.2013.20103

Lee, C. L., Strong, R., & Dooley, K. E. (2021). Analyzing precision agriculture adoption across the globe: A systematic review of scholarship from 1999–2020. *Sustainability, 13*(18), 10295. https://doi.org/10.3390/su131810295

Lindner, J. R., Rodriguez, M. T., Strong, R., Jones, D., & Layfield, D. (2016). Research priority area 2: New technologies, practices, and products adoption decisions. In Roberts, T. G., Harder, A., & Brashears, M. T. (Eds). *American Association for Agricultural Education national research agenda: 2016-2020*. Gainesville, FL: Department of Agricultural Education and Communication.

Narine, L., & Harder, A. (2021). Comparing the Borich model with the Ranked Discrepancy Model for competency assessment: A novel approach. *Advancements in Agricultural Development, 2*(3), 96–111. https://doi.org/10.37433/aad.v2i3.169

Strong, R., & Alvis, S. (2011). Utilizing Facebook to disseminate horticultural lessons to adults. *Journal of Southern Agricultural Education Research, 61*, 1–12. http://www.jsaer.org/pdf/Vol61/2011-61-001.pdf

Strong, R., & Israel, G. (2009). The influence of agent/client homophily on adult perceptions about Extension's quality of service. *Journal of Southern Agricultural Education Research, 59*, 70–80. http://jsaer.org/pdf/vol59Whole.pdf#page=73

United States Department of Agriculture. (2021). *U.S. Agriculture Innovation Strategy: A Directional Vision for Research*. https://www.usda.gov/sites/default/files/documents/AIS.508-01.06.2021.pdf

United States. Department of Agriculture National Agriculture Statistics Service. (2021). *Quick Stats*. https://quickstats.nass.usda.gov/

United States Geologic Survey. (2021). *Principal Aquifers of the United States*. https://www.usgs.gov/mission-areas/water-resources/science/principal-aquifers-united-states

Wynn, J. T., Coppedge, R. H., & Strong, R. (2013). Future IPM trends in Trinidad and Tobago: A qualitative study of farmers' perspectives. *Journal of International Agricultural and Extension Education, 20*(2), 65–76. https://doi.org/10.5191/jiaee.2013.20205