Training agricultural professionals and extension educators manage crop environment and soil quality in high tunnel vegetable production

High Tunnel Training

2018 EVALUATION RESULTS

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Executive Summary

High tunnels, also known as hoop houses, are an increasingly common method to extend the growing season for vegetable producers. The increase is partially due to the Environmental Quality Incentive Program (EQIP), a cost share program offered by the USDA Natural Resources Conservation Service.

The Iowa State University (ISU) Department of Horticulture conducts research and provides education on sustainable vegetable production in high tunnels. In 2017, with support from USDA North Central Sustainable Agriculture Research and Education Professional Development Grant, ISU offered four trainings focused exclusively on high tunnel production: three workshops in the spring and one short course in the fall. One goal of these trainings was to educate farm service providers and agriculture educators about high tunnels, so they are better able to advise their clients about the potential benefits and challenges of high tunnel production.

We evaluated these high tunnel trainings by sending an electronic survey to participants in March 2018. We received 57 responses, for a 49 percent response rate. Most respondents were farmers who are currently growing in a high tunnel, but service providers, educators, and others responded. We also conducted interviews with one grower and two service providers.

Highlights of the evaluation results include:

- Farmers implemented what they learned at the trainings, with 77 percent making at least one change in practice. Changes to insect pest management and crop diversity were the most common.
- Respondents now have resources to continue learning about high tunnels, with 98 percent agreeing or strongly agreeing they know where to go or whom to ask for information regarding high tunnels.
- Similarly, over half (55 percent) of respondents have used the high tunnel manual they received at the training. Service providers and educators commonly used it to answer client questions, and growers have used it to make production decisions.
- Respondents are sharing what they learned with others, which was one goal of the training:
  - Sixty-six percent of respondents have shared information they learned during the workshop or short course with an estimated 235 people.
  - Eighty-three percent of respondents agreed they felt better equipped to answer questions on soil, pest, and disease management in high tunnel vegetable production as a result of the training.
- Respondents would like ISU Extension and Outreach to conduct more research on high tunnel vegetable production as well as insect, disease, and weed management; organic production; and irrigation management.

A few recommendations for next steps in high tunnel education emerged from the evaluation:

- Create an advanced high tunnel workshop for more experienced growers that shares more in-depth information on insect, disease, and weed management.

Work with NRCS to cross-promote ISU Extension and Outreach high tunnel programs and EQIP, host high tunnel educational events, and build expertise of NRCS personnel.

In future workshops, give greater emphasis not only to the importance of soil analysis, but also on how to interpret the results.

Introduction

High tunnels are becoming an increasingly common tool for vegetable farmers to extend the growing season, allowing them to grow vegetables during cold winter months. High tunnels are also known as hoop houses, as they are commonly built of a metal “hoop” frame covered with plastic. Unlike greenhouses, high tunnels are usually passively heated by the sun, and crops are planted in the ground (as opposed to containers).

In 2010, the USDA NRCS Environmental Quality Incentives Program (EQIP) began funding the Seasonal High Tunnel Initiative through a pilot program, which later became a full program in all 50 states. Through the program, farmers receive cost-share funds to purchase and erect a high tunnel on cropland.

Iowa State University’s Department of Horticulture conducts research on sustainable vegetable production, which includes research on high tunnel production. They have received funding to disseminate information about what they have learned to agriculture educators and service providers to equip them to educate others in the use of high tunnels. Iowa State University Extension and Outreach held three high tunnel workshops, each held in a different region of the state in April and May 2017. These were one-day workshops for beginners. They also held one high tunnel short course in November 2017 which was more in-depth, including topics related to high tunnel production as well as marketing.

Total attendance for all events was 141. Some individuals attended more than one event, with 134 unique individuals participating. The High Tunnel Short Course had the highest attendance, with 87 people attending. A mix of growers, service providers, and educators attended all events.

To evaluate the impact of ISU Extension and Outreach’s high tunnel educational programming, we conducted a survey with participants in March 2018, and interviewed key informants. This report summarizes the results from that evaluation.

Methods

The evaluation utilized two methods to collect data on the outcomes of ISU Extension and Outreach’s high tunnel education program.

First, we conducted interviews with key informants. We interviewed one farmer and two agricultural service providers. The interviews were semi-structured, using a common interview template for the two agricultural service providers, and a slightly different template for the grower. Arlene Enderton, evaluator for ISU Extension and Outreach’s Local Foods Program, conducted the interviews over the phone.

Second, we conducted a follow-up survey with high tunnel short course and workshop participants in March 2018. The survey was sent electronically to 116 unique email addresses. The total number invited to take the survey was lower than the total number of unique individuals who participated, because some farms sent more than one participant who registered under the same email address. We received 57 responses, for a 49 percent response rate.

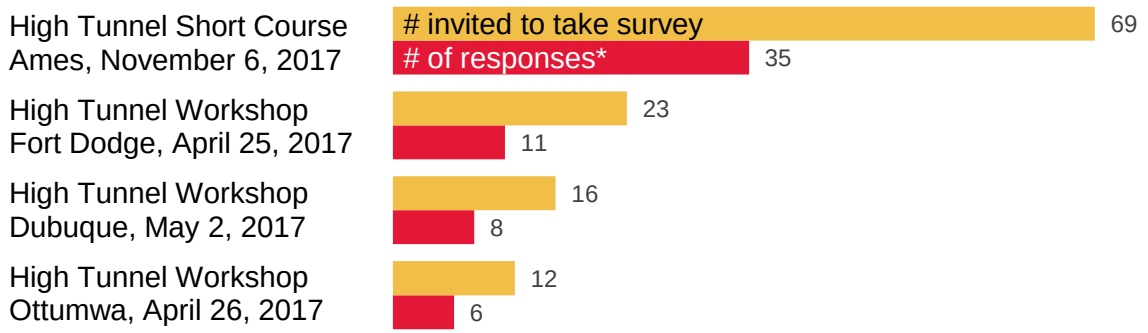
Results

Who responded to the survey?

Most respondents participated in the short course and most were farmers.
The vast majority of farmers who responded are currently growing in a high tunnel.

The survey respondents represented all four high tunnel educational events held in 2017. Figure 1 shows that we received the most responses from participants on the high tunnel short course, which is appropriate, because that event also had the highest attendance.

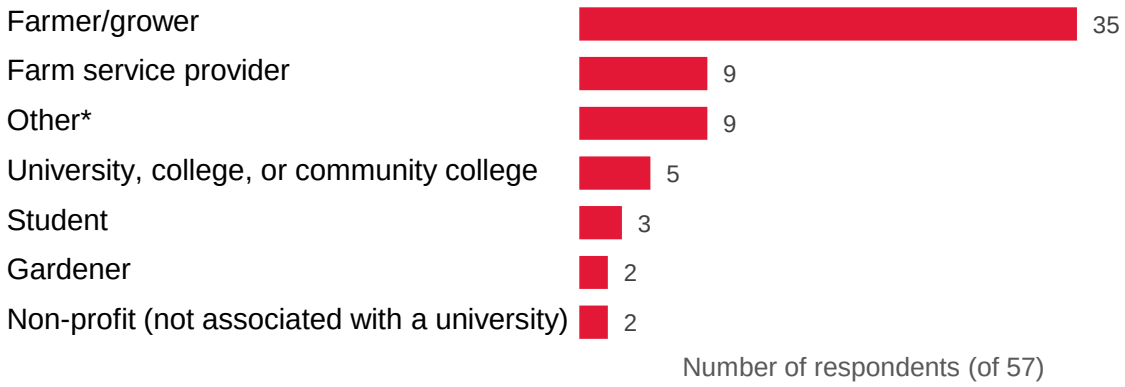
Figure 1: Respondents represented all high tunnel events.



*The total number of responses adds to 60, rather than 57, because some respondents participated in more than one event.

Figure 2 shows the occupation of survey respondents. Farmers were the most common respondents. The remaining respondents were a mix of farm service providers, who work for ISU Extension and Outreach, USDA, Iowa Department of Agriculture, etc.; university, college, or community college employees; students; gardeners; non-profit employees; and others.

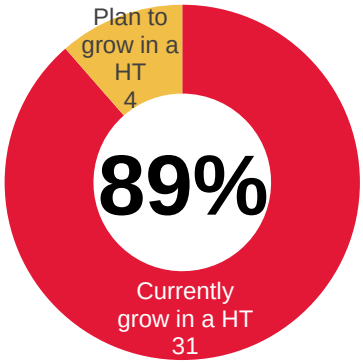
Figure 2: Most respondents were farmers/growers.



*volunteer, landowner, permaculture designer, winery, garden supervisor, retired, agricultural business (not a grower), youth educator/teacher

Of the farmers who responded to the survey, 89 percent (31 of 35) are currently growing fruit or vegetables in a high tunnel. The remaining four plan to do so in the future, as shown in Figure 3.

Figure 3: In 2017 most growers grew fruits or vegetables in a high tunnel or planned to so in 2018.



out of 35 growers

What changes did farmers make as a result of what they learned?

Most farmers made at least one change in their high tunnel production following the workshop or short course; changes in insect pest management and crop diversity were the most common.

The vast majority (77 percent) of growers made changes in their high tunnel production as a result of participating in ISU Extension and Outreach high tunnel education. This demonstrates that the high tunnel workshops and short course shared practical information that farmers could use.

Figure 4: 77% of growers made at least one change in the managerment of their high tunnel following the workshop or short course.

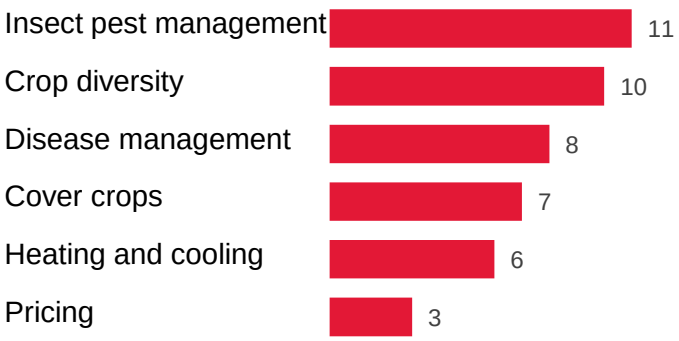


Figure 4 summarizes what types of changes they made, with changes to insect pest management and crop diversity being the most common. Growers also described the changes they made, which include (but are not limited to):

3 farmers implemented more intentional crop rotations. Two of them said**:**

> "I've had an informal crop rotation plan, but after this workshop I set up a 5 year plan for rotation."
> "[I] added one more high tunnel and hope to add two more so we can rotate the four high tunnels to prevent long term disease problems."

3 farmers implemented or plan to implement cover crops. Two of them said:

> "Doing cover crops increased crop diversity (specifically, I added sweet alyssum)."
> "The class helped with my plan to use cover crops in our entire farm."

2 growers chose more appropriate crops or cultivars. One of them said:

> "I've narrowed my variety of tomatoes to ones that work better in high tunnels."

2 growers installed heat in their high tunnel.

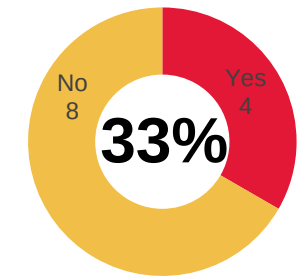
Of the four growers who are *not* currently growing in a high tunnel, three of them said they learned something at the short course or workshop, which they plan to implement in the future. Their plans regard planting for the market and crop rotations. One grower summarized what he/she learned:

> "I learned the importance of crop rotation for soil health and selecting and planting crops based on timing of the market."

Growers conducted soil analyses.

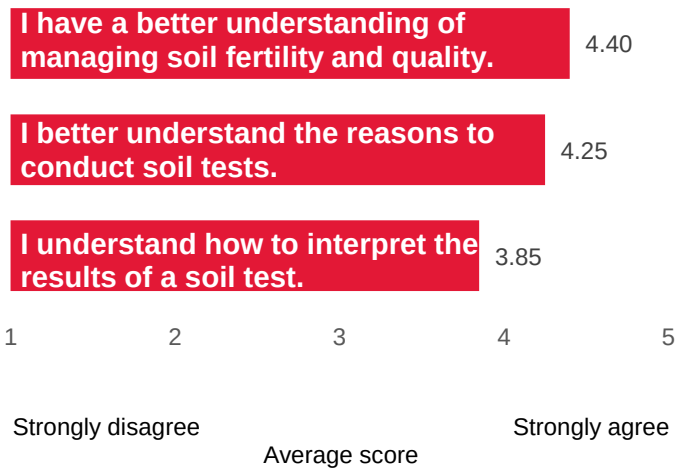
High tunnel workshops included education specifically about how to conduct a soil analysis and use the results to improve high tunnel production. Of the 12 grower respondents who attended a workshop (as opposed to the short course), four (33 percent) of them have since conducted a soil analysis with soil from their high tunnel, as shown in Figure 5. This is comparable to the percentage who made other types of changes listed in Figure 4, which ranged from 35 percent (insect pest management) to pricing (10 percent).

Figure 5: 1 of 3 growers who attended a workshop later conducted a high tunnel soil analysis.



out of 12 growers who attended a *workshop*

Figure 6: Growers increased their understanding of soil fertility because of high tunnel workshops.
(20 respondents)

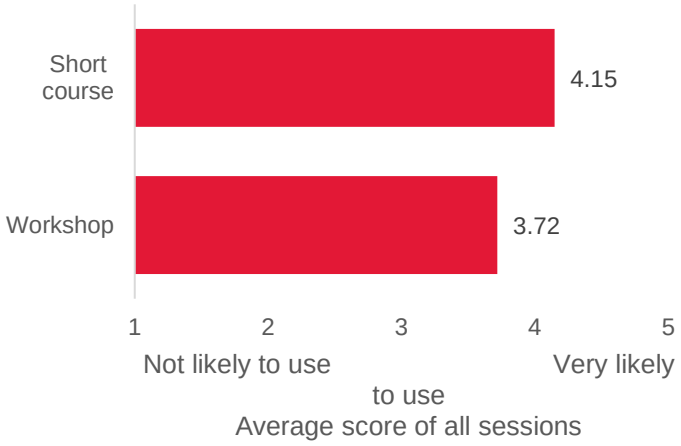


In addition, growers widely agreed they had a better understanding of soil fertility and the reasons to conduct soil tests following the high tunnel workshop, shown in Figure 6. Growers were slightly less likely to agree they understood how to interpret a soil test following the workshop, indicating that future workshops may need to give more emphasis to this topic.

How useful were workshop and short course sessions?

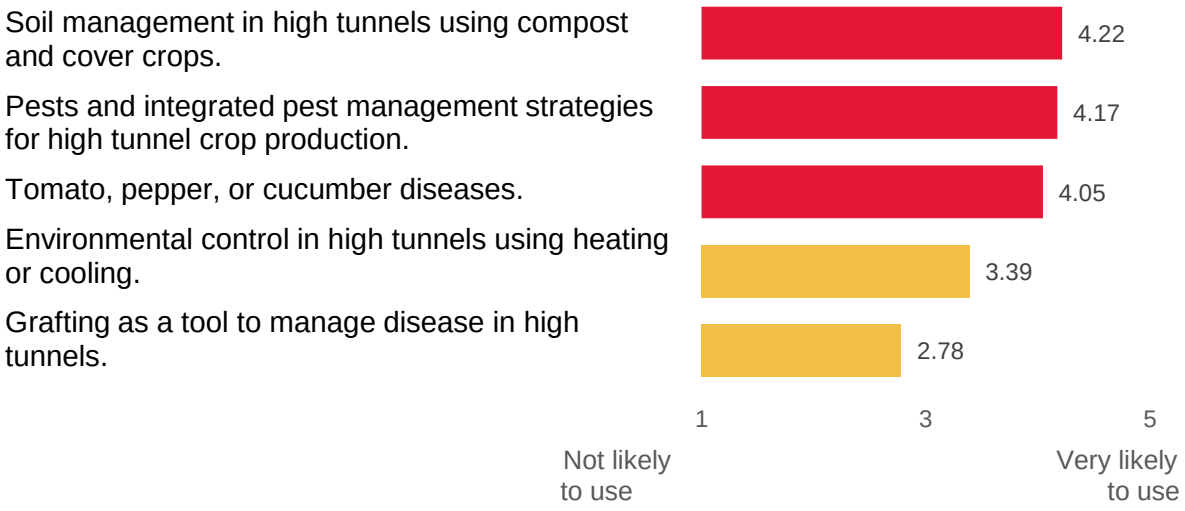
Respondents were asked to rate the likelihood they would use information from the high tunnel workshop and short course sessions. Both the workshops and the short course received high ratings, indicating they shared actionable information. On average, the short course sessions were rated as slightly more useful than workshop sessions, shown in Figure 7.

Figure 7: Short course sessions were rated as slightly more useful than workshop



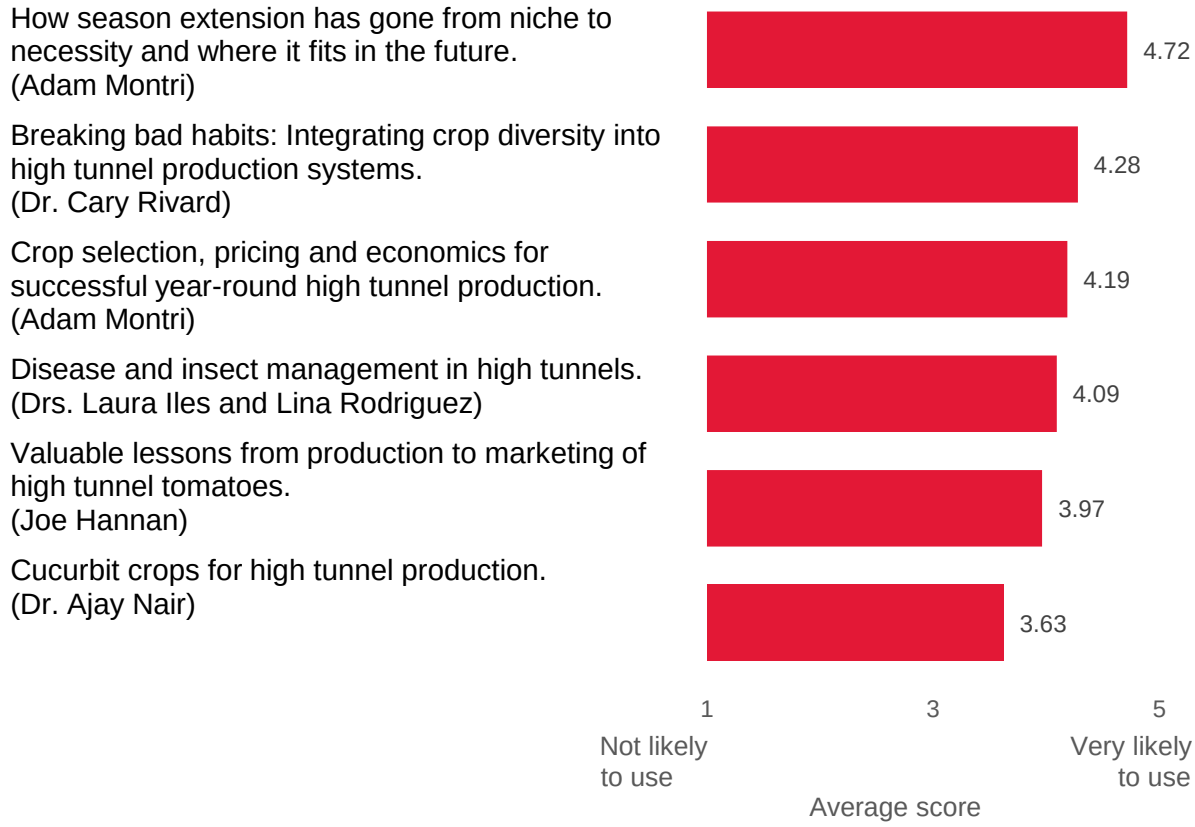
Of the workshop sessions, three stood out as most useful: soil management in high tunnels using compost and cover crops, pests and integrated pest management strategies for high tunnel crop production, and tomato, pepper, and cucumber diseases, as shown in Figure 8. In contrast, respondents are not as likely to use the information they learned about environmental controls using heating and cooling or grafting. That is not to say that no one used the information from those two sessions, as two respondents did say they added heat to their high tunnel.

Figure 8: High tunnel *workshop* participants are especially likely to use information from three sessions.



In contrast, respondents are likely to use information they learned from every session of the high tunnel short course, shown in Figure 9. They are especially likely to use information from the first session with Adam Montri about how high tunnels have gone from niche to necessity, giving it an average rating of 4.72 on a scale from 1 to 5, where five equals very likely to use. The two least popular sessions, on tomatoes and cucurbits, may have been rated as less useful because they covered specific crops, which some growers may not grow or plan to grow.

Figure 9: High tunnel *short course* participants are likely to use information from all sessions.



More advanced high tunnel training may need to be developed.

A few comments suggest the high tunnel education offered in 2017 is a good fit for beginners, but may not meet the needs of more experienced growers. For example, one service provider said in an interview that he/she went into the short course with no knowledge of high tunnel production and thought the short course was mostly at his/her level (although some things "may have gone over his/her head"). In contrast, a more experienced grower said that the short course session on disease management left him/her with more questions than answers and "the high tunnel manual is helpful in starting, but not for growers with a year or two under their belt." This suggests that more advanced education may need to be developed as grower experience with high tunnels in Iowa grows.

Do participants have the resources they need to continue learning about high tunnels?

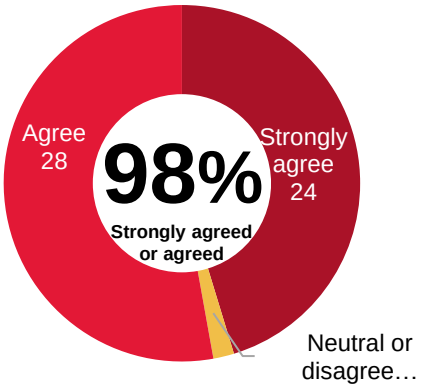
No educational program can teach participants everything they need to know about high tunnels. Thankfully, respondents widely agreed (98 percent) they know where to go or whom to ask for information they might need in the future regarding high tunnels, as shown in Figure 10.

In addition, workshop and short course participants received a high tunnel manual to keep as part of the course. The survey asked if respondents have since used the manual and, if so, how.

Over half of respondents said they had used the manual since receiving it. When asked how they had used it, the most common answers (given by five respondents each) were that service providers and educators used the manual to answer clients' questions, and growers used it to make production decisions.

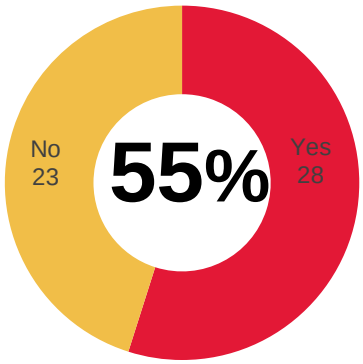
For example, one agricultural educator said, "I answered questions from local gardeners, farmers, and high tunnel owners in my capacity as a Master Gardener coordinator and Extension employee." One grower said, "I used it to pick a site for our NRCS high tunnel that we will build this year." Another said, "[I used the manual to plan] better spacing and for planning the crops I will plant. I am using it to consider other crops I have not planted in the past."

Figure 10: Respondents know where to go or whom to ask for information regarding



out of 53 respondents

Figure 11: Over half of respondents have used the high tunnel manual.



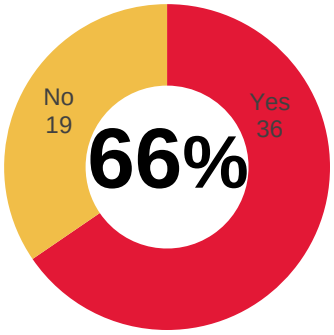
out of 51 respondents

Is the “train the trainer” model working?

One goal of the high tunnel workshops and short courses was to build high tunnel expertise among farm service providers and agricultural educators, such as people working for extension, the USDA, or the Iowa Department of Agriculture and Land Stewardship. These people work on a daily basis with farmers and need to understand the opportunities as well as the constraints of high tunnels so they can properly advise their clients.

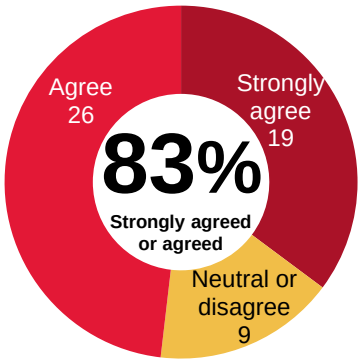
We asked two questions to determine if high tunnel workshop and short course participants are teaching others. First, 66 percent of respondents said they have already shared information they learned with an estimated 235 people. This demonstrates that participants do, indeed, teach others.

Figure 12: 2 of 3 respondents have shared information they learned during the workshop or short course with an estimated 235 people.



out of 55 respondents

Figure 13: Respondents feel equipped to answer questions about high tunnels.



out of 54 respondents

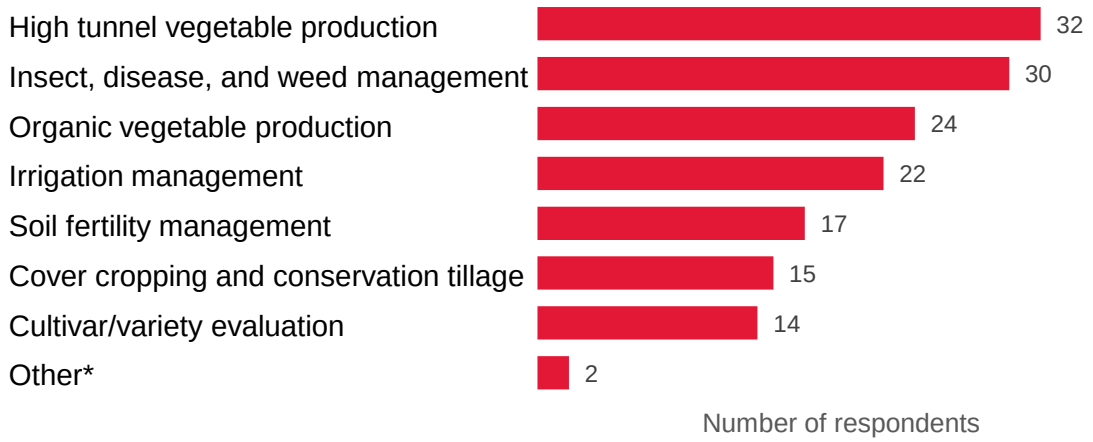
Similarly, 83 percent of respondents agreed or strongly agreed they felt better equipped to answer questions on soil, pest, and disease management in high tunnel vegetable production following the short course or workshop. As one service provider said in an evaluation interview, “I feel more knowledgeable and have a better idea of how to help growers.” As mentioned earlier, service providers and educators also commonly said they used the high tunnel manual they received to educate others about high tunnels.

Yet, we also know that growers often look to one another when they have a question, making it important that growers are able to answer one another’s questions, too. Eighty-five percent of growers agreed or strongly agreed they feel better equipped to answer questions on soil, pest, and disease management in high tunnel vegetable production as a result of participating in the training.

What more can ISU Department of Horticulture research do to benefit fruit and vegetable growers?

Finally, respondents were asked to select the topics they would most like the ISU Department of Horticulture to conduct research on in the future. They could select up to three topics. Not surprisingly, because this was a survey of people who chose to participate in high tunnel education, high tunnel vegetable production was the topic they most want more research on, as shown in Figure 14. Respondents were also interested in research on insect, disease, and weed management; organic vegetable production; and irrigation management. Although the Iowa Commercial Horticulture Food Crop Survey showed that a minority (37 percent) of vegetable producers use irrigation (Enderton et al., 2017), high tunnel producers must irrigate, which makes this a topic of interest to this particular audience.

Figure 14: Respondents are interested in future research on several topics related to sustainable vegetable production.



* Companion planting; Maximizing production in small plots through planting strategies; Cover crop usage for small scale vegetable producers.

Along the same lines of future opportunity, one interview participant suggested that ISU Extension and Outreach partner more closely with NRCS to host educational events regarding high tunnels, cross-promote one another's programs, and build the expertise of NRCS employees. "I think we should maybe get a specialist in our agency. We have grazing specialists, but we didn't have that with high tunnels or local foods."

Another interviewee suggested an idea for education, rather than research. This person requested a one-page fact sheet with basic information about high tunnels and a list of resources or links with more information, which service providers could give to farmers who request information. This document could be fillable, with a space to list the local Extension office and Farm Service Agency office.

Conclusions and recommendations

Overall, growers, service providers, and educators found the high tunnel workshops and short courses useful. As evidence of this, three out of four growers indicated they have already implemented changes in how they use their high tunnel following their attendance. Both growers and service providers have used their high tunnel manuals, to make production decisions and to share information with others.

The "train the trainer" model does seem to work, as the majority of respondents indicated that they have shared information they learned from a workshop or the short course with others. They also feel more confident that they can answer questions related to high tunnels.

A few recommendations for next steps in high tunnel education emerged from the evaluation:

> Create an advanced high tunnel workshop for more experienced growers that shares in-depth information on insect, disease, and weed management.
>
> Work with NRCS to cross-promote ISU Extension and Outreach high tunnel programs and EQIP, host high tunnel educational events, and build expertise of NRCS personnel.
>
> In future workshops, give greater emphasis not only to the importance of analyzing soil, but also on how to interpret the results of a soil analysis.

References

Enderton, A., Bregendahl, C., Swenson, D., & Adcock, L. (2017). The Iowa Commercial Horticulture Food Crop Survey Results, Appendix B. https://www.iowaagriculture.gov/Horticulture_and_FarmersMarkets/pdfs/2017/Hort%20Survey_APPENDICES_final.pdf