

Objectives:

The objective of the drone program is to increase stakeholders' knowledge and interest in using drones in agriculture.

Program activities:

1. *Drones for Farmers:* Workshops/demonstrations for farmers on using drones in agriculture were held, fact sheets and videos were developed and published online. Trade publications were also produced.
2. *Certification Training:* Drone certification training was provided to extension agents, agricultural professionals, and high school teachers so they could earn their FAA remote pilot certification or teach their students to get their certification.

Teaching methods:

1. *Drones for Farmers:* Farmers had the opportunity to fly a Phantom 4 Pro drone and think about applications they might use them for. This was followed by presentations on different uses for drones in agriculture, drone laws and regulations, and drone options and costs. Fact sheets and videos on each of these topics were developed and published online. Three trade publications were also produced.
2. *Certification Training:* The training programs occurred in two different formats. One format was a 4 week (1 hour/week) webinar hosted by the American Society of Agronomy. The other was an on-ground or online 4-hour course. Both formats involved presentations, activities to enhance knowledge (see attachment), and a sample exam.

Results:

1. *Drones for Farmers:* The drone workshops for farmers were offered in 9 Tennessee counties between September 2019 and March 2020 and reached 142 participants. Four fact sheets were developed and published online:

- Agricultural Uses for Drones:
<https://www.tnstate.edu/faculty/jdekoff/documents/DronesinAg.pdf>
- Drone Laws and Regulations:
<https://www.tnstate.edu/faculty/jdekoff/documents/DroneLaws.pdf>
- Drone and Sensor Options and Costs:
<https://www.tnstate.edu/faculty/jdekoff/documents/DronesandSensors.pdf>
- Using Software to Capture Analyze Drone Images:
<https://www.tnstate.edu/faculty/jdekoff/documents/DroneSoftware.pdf>

Four videos were developed and published on the Tennessee State University YouTube Channel:

- Drones in Agriculture:
<https://www.youtube.com/watch?v=pHr4TVVVhIM>
- Drone Laws and Regulations:
<https://www.youtube.com/watch?v=POG6ovfOQKA>
- Drone Options and Costs:
<https://www.youtube.com/watch?v=AZsJnK8PYrY&t=5s>
- Using DroneDeploy in Agriculture:
https://www.youtube.com/watch?v=EbYPsq_BcvI&t=370s

Three trade publications were produced:

- Saini, P., and J.P. de Koff. 2020. Drones and dairy cows: Managing livestock. Dairy Global, 27 July, <https://www.dairyglobal.net/f2r/?returnurl=%2fSmart-farming%2fArticles%2f2020%2f7%2fDrones-and-the-dairy-cows-Managing-livestock-618713E%2f>
- de Koff, J.P. 2020. Beginner's guide to agricultural drones. Future Farming, 14 Apr., <https://www.futurefarming.com/Machinery/Articles/2020/4/Beginners-guide-to-agricultural-drones-569413E/>
- Birt, N. 2020. Q&A: Maximize drone ROI on your farm. Farm Journal <https://www.porkbusiness.com/news/hog-production/qa-maximize-drone-roi-your-farm> (I won the Farm Journal Story Lead Contest through eXtension and they interviewed me about my drone program).

2. *Certification Training*: The ASA webinars were held in September 2019 and February 2021 with a total of 80 participants. The on-ground trainings occurred in Knoxville, Jackson, and Murfreesboro, TN in 2019 (52 total participants) and Princeton and Lexington, KY (45 total participants) in February 2020. The online 4-hour course was held in May 2020, June 2020, and July for research and Extension personnel at the University of Georgia and high school teachers in Tennessee for a total of 181 participants.

Impact Statement:

1. *Drones for Farmers*: The workshops were covered by two media outlets that came to two separate events (http://www.news-herald.net/lcn/bringing-drones-to-farmers/article_2e2350fb-4e7e-5c6e-80f2-b46610e01a28.html and <https://youtu.be/gCJgmCfr9tg>). Evaluations from these workshops found 98% of respondents increased their knowledge, 55% indicated increased interest in purchasing a drone in the next 2 years, and 55% indicated increased interest in getting their remote pilot certification. Videos have received a cumulative total of over 7,000 views in less than one year. One of the fact sheets earned an Extension Education Award from the American Society of Agronomy. The trade publications have received a cumulative total of over 30,000 views in less than one year.

2. *Certification Training*: Evaluations from the ASA webinar in 2019 found that 100% of respondents increased their knowledge, the activities were helpful, and they were more likely to

get their certification. About 2 months after the training, 80% who had taken the test had passed and believed the webinar series helped them prepare for the exam. For the on-ground trainings, 88% and 84% of participants in Tennessee and Kentucky, respectively, increased their scores on the sample exam that was given as a pre- and post-test. Depending on the activity, 89%-100% believed the activities were helpful across both states. Also, 73% and 93% of participants in Tennessee and Kentucky, respectively, increased their likelihood of getting their drone certification. Across the 4-hour online course, 98% of participants indicated an increase in their knowledge and 98% felt the activities that were incorporated were helpful. Following the online course, 85% felt they were more likely to get their certification and 93% felt more confident about teaching it to their students.

Evaluation:

Evaluation was measured in this program either through retrospective-post surveys or pre-/post-test surveys.

In this program, I learned that having multiple workshops allowed me to tweak them along the way to enhance participant learning and understanding. I also found that 4 one-hour workshops could be very different from one 4-hour workshop. The 4 one-hour workshop method allowed participants to think about what they learned in between rather than having a lot of information thrown at them at once. The 4-hour workshop could be information overload leading participants to become less involved in learning the material.