

**Episode Title:** Pesticide Application Technology: Drones vs Boom

**Summary:** In our final episode of season 2, we sit down with Tom Peters and ask him to talk about what he found out about differences in pesticide aerosols and drift when using new aerial drone technology versus the traditional land-application methods of the tractor operated boom sprayer.

**Expert:** Dr. Tom Peters

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**Episode Quote:**

*“One of the things that was interesting was that the boom had a lot of larger droplets, and those larger droplets were falling down and going deeper into the field. Which is a **good thing**. The droplets from the drone were smaller, and they **also wound up** in the field because the winds weren’t so high.”*

– Dr. Tom Peters, Department Chair of Occupational Environmental Health and in the College of Public Health, University of Iowa

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## Transcript

### A Proctor

Welcome to the FarmSafe Podcast brought to you by the Great Plains Center for Agricultural Health. In the blink of an eye, an injury can change your life and your farm forever. During each episode, we share first-hand stories and real-life tips for making safer and healthier decisions while on the farm.

Today we are sitting down with Dr. Tom Peters to discuss technology and agriculture. Dr. Peters, would you mind introducing yourself to our listeners?

### T Peters

My name is Tom Peters, and I am the Department Chair of Occupational Environmental Health and in the College of Public Health. And I have of many different interests, but one of them is pesticide application.

### A Proctor

Perfect. That’s great.

Doctor Peters has been involved in aerosol research, where he has developed methods and equipment to measure atmospheric and workplace particles. Some of his aerosol expertise was used to develop a test strategy to examine differences in pesticide drift between traditional boom sprayers on tractors and aerial applications by drones. Thank you, Tom, for speaking to us about your research in this area.

For our listeners, can you describe what you were looking for in your 2021 study?

### T Peters

We were looking at the comparison of the boom sprayers to these uncrude aerial vehicles in order to see how does drift change, what’s the drift for the larger vehicles and how does that relate to these smaller no boom type of drones.

### A Proctor

How did you set up equipment to measure sprayed particles in your study and what equipment did you use?

### T Peters

We used something that I had not used before, and these are spray cards where these cards, when droplets land on them, they actually change the color of the card from a yellow to a bluish color. We can take those cards; we can put them in the field in an array within the field. And then we can determine where the particles land and what happens to them, what sizes are produced and what sizes

actually land on the corn plants. We take those cards, and we bring them home and then we put them under a microscope. Actually, we put them in a scanner, and we can then determine the number of pixels per each droplet that has landed, and then we can get a size distribution of these different droplets. And it helps us to determine potential for drift and also, you know, what has landed.

**A Proctor**

What is pesticide drift?

**T Peters**

Yeah, so, kind of going back to the basics, pesticide drift is the pesticides that move away from the field and are not landing where we want them to. Various different reasons can happen why you might have drift, perhaps you're spraying too far away from the field or the wind is taking the droplets away, and so it's kind of a complex combination of droplet size, the application distance and also the meteorological conditions at the same time.

**A Proctor**

What are the ideal conditions for applying pesticides?

**T Peters**

The best conditions are going to be a low wind type condition. When you have low wind, you can have the droplets, even small droplets will eventually settle into the field where you want the pesticide. If you have the high wind, then you can move those droplets off from over the crop and then out to someone else's field or to other targets that you might not want to hit with pesticides.

**A Proctor**

Thank you for explaining that. Are there any ways to determine ideal conditions when applying pesticides like any monitors or sensors or any kind of technology that can assist with that?

**T Peters**

I think the best thing to use is some kind of anemometer, and the anemometer has some indication of wind direction and wind speed, and so they're not very expensive, and they can be purchased from many different places. Grainger, Theisens, things like that.

**A Proctor**

What were the results of your study? Did the drone do a better job spraying than a boom?

**4:47 T Peters**

One of the things that was interesting was that the boom had a lot larger droplets, and those larger droplets were falling down and going deeper into the field. Which is a good thing. The droplets from the drone were smaller, and they also wound up in the field because the winds weren't so high. And the main thing is that with the boom coverage is broader. And with the drone, you can do these key, pinpoint kind of spraying. And so, some of the technology is you have image recognition, so you've got a certain area of the field that has the need for pesticide where it doesn't have in other places and so you can fly over to that area. I think there's the drones at this point work well in that regard. So, I think there's probably a reason for both types of spraying applications.

**A Proctor**

That was a great answer, thank you. How does particle size coming out of sprayers then relate to human health hazards? Either occupational or for the consumer.

**T Peters**

Well, that's a great question. If the droplets are small enough, they can get into the respiratory system. And that's a very concerning place for them because the respiratory system is fragile. The large droplets from the boom sprayer are, they're large. Most of the very large ones are not going to get into your respiratory system. The ones that do drift are the smallest ones, unfortunately, and those are

the ones that can get in either if it's from the drone or from the boom sprayer. Both of them represent an inhalation hazard. There's also hazards of contact and people, dermal type of expose. I think that they're not as important as the inhalation hazards though.

**A Proctor**

Can drones be used for other agricultural purposes besides pesticide application?

**T Peters**

Well, if we just stay on the pesticide application, we looked at corn and I think that the company Rantisi who gifted us the money for this study, they've been having a lot of luck with vineyards. Some more specialty places where you don't need to spray pesticide everywhere, like a boom sprayer does. You can be a little bit more pinpointed are the types of areas that are the most suited for drones.

There are also fertilizing applications and so fertilizing applications can be pinpoint as well. Where you need more fertilizer, you can get it there in a way that's more efficient.

And then the last thing would be, if you have these infestations you can you know find where the infestation is – a lot of times by image analysis and then automatically fly a drone into the right spot and not have to cover the entire area. So by having less coverage, you're going to have less stuff emitted and you're going to have less drift.

**A Proctor**

Is pesticide drift more likely with drones or with ground application.

**T Peters**

That's a bit of a tough question to answer. If you're doing precision spraying, you're not spraying as much, and so you have less quantity, you can have less drift because of that. The boom spray, that's going to have larger droplets. They're not going to move as far even though you're spraying a bigger area, you might not have as much drift. You know, we did one study-- it was a relatively small study, and it depends on how you have your nozzle set up and it depends on if you're trying to cover the entire field with a unmanned air vehicle, then you're probably going to have more potential, but I think with the targeted applications you have less.

**A Proctor**

What are the different components to a drone used in agriculture like the sensors, the lenses, the nozzles like you mentioned?

**T Peters**

It's pretty interesting. You can buy these advanced drones off the shelf and most of the companies that are using these things are buying these drones, they have like 6 motors. They can be very stable, and they can also have a payload of a little under 50 lbs. And so that 50 is an important limit because of the FAA. So, the drones, there's nozzles on the each of these arms underneath where the motors are and so the you have nozzles at these locations and the nozzles then have feed rate of liquid, so the feed rate of the solution with the pesticide: you can change your pesticide solution, the concentration, in order to, you know, change your delivery. And then some of them have – there's actually booms for drones, and so you can have delivery out of a boom or you can have it right off the arms that are holding the motors. So, there's quite a few variables there and more things to study than we could study for sure.

**A Proctor**

Great, thank you. How common are drones in agriculture?

**T Peters**

That's a question that I don't know the answer to. I think that there's definitely the startup company here who funded the work has made it for years, and so that's a good sign that things are moving forward in a positive direction.

**A Proctor**

Perfect. Thank you. And how do you see drones impacting the future of agriculture?

## 11:04 T Peters

I think that one of the main real advantages is the ability to not have as much potential for occupational exposure. If you design the pesticide to be, handled as minimally as possible, and then you've got this drone is then taking the payload and going off and spraying this and then assuming that you get the particle size correctly in your spraying in a low wind situation then I think that it has a high potential to work well. The other thing is that you can get it to go where you want it to and to do that pinpoint type of spraying. Some places might need lower coverage, other ones might need higher and so you can do all those adjustments on the fly, and I think that makes it really powerful. People's time becomes a little bit less incorporated into the equation. You can have this drone flying around and then come back, get new batteries, fly out again and there's not the gas of a tractor. There's not the expensive of a tractor. There's a lot of things that might be cut out there.

## A Proctor

Thank you, Dr. Peters, for sitting down and talking with us today. We cover topics such as pesticide application with drones, pesticide drift and pesticide particle size. We learned about ideal conditions for pesticide application and the different components of drones. We have also linked to pesticide drift resources by state as well as ways to reduce pesticide drift and runoff. After this episode, we will be taking a break, and then we will be back for Season 3 of the FarmSafe podcast!

## A Proctor

Listen in on the FarmSafe podcast to join in on the conversation about keeping safe on the farm.

We want to hear from you. Share your stories about health and safety issues on the farm, about injuries that made you change the way you work, or about the ways you keep yourself and others safe on your farm. Also let us know if there's questions you have or topics that you want to hear about on the air. You can visit our website, [gpcah.org](http://gpcah.org), or email us.

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## Episode Resources

- [Pesticide Drift Prevention](#), National Pesticide Information Center
- [Report a Pesticide Drift Occurrence \(by state\)](#), National Pesticide Information Center
- [Pesticide Drift Story Map](#), GPCAH

## Photo

