



Drones in a GREENHOUSE?

Drone technology is finding new applications in the greenhouse. Read on to learn more about this innovation and what it can do for your business.

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There is no doubt that drones are an emerging technology, but do they have a place in greenhouses? The answer is clearly YES, but the types of applications we envision for open-field agriculture may need to be modified for greenhouses.

The structural nature of greenhouses makes it a challenging “flight” environment. Like any other business, greenhouse operators are interested in the labor savings, operational efficiencies and business advantages that drones might offer.

GREENHOUSE APPLICATIONS

While it may seem like a crazy thought to consider flying small unmanned aircraft systems (sUAS) inside a greenhouse, there may be some useful applications that greenhouse growers should consider. There are at least five applications that greenhouse growers might consider for sUAS:

- Safe inspection of structural components
- Sales and marketing
- Applying shading compound
- Crop scouting/monitoring
- Crop inventory

The first application is a no-brainer — safe inspection of structural components. How many greenhouses currently use a person to inspect gutters, covering materials, structural components and mechanical systems (e.g., cables, motors)?

The safe solution is to use a small drone

equipped with a live feed video so the operator can safely inspect these structural systems from the ground while one person serves as an observer. An observer will help the drone pilot for safe flying around the greenhouse.

One grower relayed the story how a worker fell from a gutter-connected greenhouse during an inspection and that single event was the final motivation to purchase an \$800 drone to tackle that same job. This application alone should be a major motivator to consider purchasing a sUAS.

The next application is also low hanging fruit. All agriculture/horticulture businesses should consider collecting some aerial video footage or still photographs for use in trade shows, social media and business websites for use in sales and marketing. How many TV commercials do you see today that use a short aerial video clip to promote a business? The perspective offered by images taken at these low altitudes is remarkable.

If you feel your need in this area is small, consider hiring an outside drone company to collect your aerial images (still or video) and then edit them into a final form using their software. When evaluating whether to do this in-house or not, you need to consider the costs of the aircraft, special insurance, camera/sensor, software and licensing. As with any of the other applications, it should be easy for you to find a local company that can provide the imagery products you need.

The third application, applying shading compound, may surprise you. Even in the U.S.,

many small (< 55 pounds) UAS sprayers are for sale that could be used for applying shading compound to greenhouse coverings. While it is possible to find unmanned aerial spray aircraft that weigh more than 55 pounds, from a regulatory standpoint, it is easier to fly aircraft that stay below that threshold. To be clear, that 55-pound cutoff is what the complete aircraft system (airframe, battery and payload) weighs at takeoff.

A limitation with this sUAS is the density of water (i.e., 8.3 pounds/gallon). For that reason, most sUAS sprayers have tanks that hold less than 3 gallons, thus limiting coverage in a single flight. Keep in mind the huge advantage compared to having someone applying shading compound manually and in a less safe manner.

The fourth application, of crop scouting or monitoring, may be a little further into the future. The challenge with crop scouting/monitoring with ornamental crops is the diversity of plants produced. We are likely closer to making strong correlations between a specific plant problem (e.g., nutrient deficiency, insect infestation, water stress, disease) and output from a sensor (e.g., thermal, multispectral) in a monoculture such as corn, rice, turf grass, and cotton than we are in diverse greenhouse crops. In the near term, simply using sUAS to alert a grower that something is wrong and needs attention may be a valuable enough justification to use this technology in a greenhouse.

The final suggestion for a sUAS application is for inventory purposes. Many researchers, including ourselves, have been working for years on automated ways to obtain inventory information using sUAS. As you can imagine, the most difficult scenario is when plant canopies overlap. There are already companies (e.g., DroneDeploy and Agremo) whose products may be able to help row crop farmers count plants in early stages of development. Whether that same software can count a diversity of greenhouse crops at different stages of production is not clear. Inevitably, we should be able to generate automated counts of greenhouse crops using sUAS.

There are certainly other applications that have been suggested (e.g., pollination) and even more that you can think of but this list should at least get your head moving in the right direction.

TYPES OF AIRCRAFT

Although there are two categories of sUAS airframes — rotary and fixed wing — the former is the type best suited for greenhouse applications. When considering a sUAS in a greenhouse, an intriguing consideration is the impact of object/collision avoidance features¹. While object avoidance might be a desired feature to have on sUAS used in outdoor applications, the same feature may be problematic for sUAS

used inside a greenhouse with many different structural elements.

Knowing the directions (e.g., forward only; forward and down) and distances being monitored by the sensors would be crucial in an indoor environment. To get a useful professional aircraft, you will likely spend between \$800 and \$5,000.

FLIGHT REGULATIONS

What flight regulations apply to fly inside a greenhouse? In August 2016, the Federal Aviation Administration (FAA) released permanent guidelines for flying drones in the national airspace. These guidelines are referred to as Part 107. Interestingly enough, the FAA is authorized to regulate aircraft in “free flight,” thus, technically, sUAS flown inside a structure or even under netting are not regulated by the FAA. But let's not get too carried away.

If your only use is inside a “closed” greenhouse, your interpretation may be correct but what if your ridge vents are open thus allowing the aircraft to fly outside the controlled greenhouse? Or what if you purchase a sUAS to fly inside your enclosed greenhouse for “crop monitoring,” but then you also want to fly outside to inspect the superstructure?

The bottom line is, under very limited circumstances, you might avoid the FAA, but

for the overall risk of your business it would be worth it to achieve Remote Pilot² status, register your aircraft and carry specific drone insurance.

In closing, although it may seem unlikely that small drones will be a useful technology for the greenhouse industry, maybe we have sown the seed for growers to consider this emerging technology to improve efficiencies and increase the bottom line. ■

REFERENCES

- 1) Fact Sheet on features to consider when purchasing a sUAS: <https://www.uaex.edu/publications/pdf/FSA-6151.pdf>
- 2) Fact Sheet outlining Remote Pilot Certification and Aircraft Registration: <https://www.uaex.edu/publications/pdf/FSA-6150.pdf>

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