

Flying Dangerous – Drones & the Nursery Industry[©]

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Small unmanned aircraft systems (sUAS), or drones, are an emerging technology that is envisioned to be used in a variety of agricultural applications, including the nursery industry. There are lots of issues related to sUAS use that needs to be addressed including types of aircraft, sensors, BIG data, flight regulations, liability, privacy, and applications. Until recently, the greatest challenge to the wide-scale adoption of this technology has been regulatory issues. However, the issuance of permanent flight regulations for commercial use in 2016 has provided clarity for users.

AIRCRAFT

Growing interest in sUAS is reflected in the rapid increase in the number and types of aircraft available. To illustrate the explosion in the number of aircraft options, on 21 Dec 2015 a website (<http://drones.specout.com/>) that compares drones listed 271 models. On 17 April 2017, the number had increased to 1,410 (420% increase over 16 months). Increasing focus by manufacturers on this emerging technology has led to tremendous advancements in aircraft systems and a reduction in cost. Of the two types of platforms, rotary and fixed-wing, it is most likely that rotary aircraft will be the predominant type used in the nursery industry due to the

smaller crop areas and a greater diversity of crops. One of the most exciting advancements in the past three years has been the refinement of autonomous flight software which enhances flight performance and makes flying safer and easier. Currently, the biggest limitations of aircraft are the payload capacity and flying time (i.e., battery life).

SENSORS

Realistically the types of sensors that will be used on sUAS are no different than what has already been used with ground-equipment or manned aircraft. However, the size and weight are reduced to make sensors compatible with these smaller aircraft. Likely the most common sensors that will be used in the nursery industry will be a traditional camera (RGB), multispectral, and thermal. Currently, due to their low cost, a modified RGB camera that can yield near-infrared (NIR) images, is the sensor with the most attention. Data from a modified camera or multispectral sensor can be correlated to useful biophysical crop parameters such as leaf area index, nitrogen content, and crop water status. Currently, one of the most popular applications is to use a low-cost NIR camera to generate a normalized difference vegetation index (NDVI). The concern for the nursery industry is the current lack of research-based information to correlate these outputs to useful information. Unlike crop monocultures that are associated with traditional row crops (e.g., rice, corn, soybeans, wheat) or turfgrass - the nursery industry produces an extremely diverse number of crops that will make developing recommendations more challenging.

BIG DATA

A part of the learning curve in using sUAS to collect aerial imagery is the huge datasets that are typically associated with this activity. To minimize the financial risks, nursery users will need to understand the different types of hardware and software required to process useful imagery.

Nurseries will need to explore to what degree they will process imagery in-house or whether they would be better off to use an outside vendor.

FLIGHT REGULATIONS

The issuance of permanent flight regulations by the FAA on August 29, 2016, was a major advancement for commercial users in the U.S. The clarity provided by having these permanent rules will allow for more predictable growth of this technology. Nursery producers must recognize that the FAA considers their use of a sUAS as COMMERCIAL even when the aircraft is being used on their business property. Although the permanent regulations require Remote Pilot Certification to fly sUAS commercially, the requirements are vastly reduced from the previous system using waivers. Registration of aircraft has also gotten much easier with a simple online system.

LIABILITY

Commercial use of sUAS is in its infancy, so the industry is still working through issues related to liability. Each nursery business must explore with their insurance carrier the potential coverage under their current liability coverage. Many insurers now require additional specific coverage for sUAS uses.

APPLICATIONS

The reason most often cited for using sUAS is affordable access to very high-resolution images on a fairly 'as needed' basis. Five uses are envisioned within the nursery industry. The uses are:

- 1) Crop monitoring for nutrients, water, pests, or general health
- 2) Chemical or nutrient applications
- 3) Asset tracking or management
- 4) Crop inventory (count, size, quality) and crop insurance

5) Marketing & sales

CROP MONITORING

Long term, crop monitoring will become very routine and important in the nursery industry. However, as stated earlier, achieving this outcome will be more challenging for the nursery industry due to production related issues (e.g., non-continuous canopy; large diversity of crops). Initially, nursery growers should find value in simply using an RGB image to assess general production issues quickly (e.g., missed irrigation; localized pest problem).

CHEMICAL OR NUTRIENT APPLICATIONS

Considering that average acreage for specialty/horticulture crop production is smaller than acreage for traditional row crop agriculture, it is likely that chemical and nutrient applications will play a more critical role in sectors such as the nursery industry. Applying low volume pesticides to small blocks of nursery crops would be a more sustainable and environmentally sound approach than current methods. Regulatory clarity will be required before this application can be used on a routine and widespread basis.

ASSET TRACKING OR MANAGEMENT

Although little has been said publicly about this application, the use of sUAS is envisaged for 3-D mapping to estimate materials such as the size of bark piles, for monitoring glazing, structures, and systems in greenhouses, monitoring perimeter fence integrity, and monitoring irrigation systems.

CROP INVENTORY AND CROP INSURANCE:

Currently, a collection of plant inventory data is time-consuming, often inaccurate, and costly. Combining a sUAS with image processing software may prove beneficial to horticultural producers in obtaining inventory and yield data in a more efficient and cost-effective manner. It

is also envisioned that growers may use an inventory system that combines RFID with a sUAS. Recent hurricanes in the U.S. emphasize the need for a quick and effective aerial-based system to validate structures and crops pre- and post-catastrophic events.

MARKETING & SALES

Although rarely cited as an application for agricultural users, using sUAS for marketing a business or to sell the crop, will likely be a 'low hanging fruit' application since the cost to enter is so affordable. The ability to obtain and process high-quality videos of production fields and facilities from a low altitude will provide customers with a unique perspective of the nursery business.

Over the next five years, we anticipate that most medium or large nurseries will own their sUAS to collect marketing imagery and monitor general plant health and that smaller growers will use commercial services to provide the same services but may own a small unit for to produce marketing & sales videos/images.