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An Introduction to Drones: On-Farm Use and Safety Implications

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The use of drones can be a safe and productive addition to your farm. However, there are many considerations that must be taken into account before purchasing and using a drone. This introductory publication is not intended to be used as a comprehensive drone resource. Therefore, please contact AgrAbility Virginia at www.agrabilityvirginia.org for more information and suggestions on incorporating drones into your farm or ranch operations.

Introduction

Unmanned aerial vehicles (UAV), more commonly referred to as drones, are becoming increasingly popular. A new area of attention is the use of drones in agriculture. Though drones may be used by anyone, they may have special implications for those with physical challenges on farms. As the average population of America's farmers increases, so does the possibility that these farmers and ranchers will face physical injuries or illnesses that have the potential to slow down production and increase safety concerns. The drone maybe a way to address some of these issues.

This resource guide is meant to be an introduction to drones. In this document, we will discuss different types of drones and the ways in which they are typically utilized. We will then summarize how drones can be safely used in agricultural settings. We conclude with some regulations to consider and additional resources that are available to you.

What are Drones?

Knowing the differences between drones may help you decide on the right model for your own uses. The term unmanned aerial system (UAS) refers to the drone and its associated equipment and software necessary for its operation. This includes controller(s), computer, and flight planning software. In the text below, we will briefly cover the sizes and different types of drones. From this point on, we will simply refer to drones as unmanned aerial vehicles (UAV).

An *unmanned aerial vehicle (UAV)* is an aircraft without a human pilot on board and without human passengers. Its flight is controlled either autonomously by computers in the vehicle or under the remote control of a pilot on the ground or in another vehicle. There are many uses for these UAVs. Currently, they are being used for an array of uses that include anything from military operations to a hobby flight. There are small and micro UAVs, as well as different types of UAVs. Three main types include quadcopters, helicopters, and airplanes.

A small unmanned air vehicle (SUAV) or miniature UAV is an aircraft that is defined as weighing less than 25 kg. It is designed to be portable by the user if needed. It is this small unmanned air vehicle that may have the most potential for agriculture use. We will discuss the use of SUAV more in depth later.

Micro UAV (MAV) are extremely small. Modern crafts can be as small as one inch long (2.54cm). MAVs have been built for mostly hobby purposes. These hobbies can include aerial robotics contests and aerial photography. These drones are becoming very popular and are easy to purchase.

A *radio-controlled aircraft (RC airplane)* is a SUAV or small unmanned air vehicle that is mostly controlled remotely by an operator on the ground using a hand-held radio transmitter. However, it can have autonomous capabilities. The RC airplane is less expensive than its copter counterparts, but it is harder to fly and cannot hover. This inability makes it not as useful for collecting good quality photos. It can be used for gathering weather readings, collecting videos, aerodynamic modeling and testing, and even chemical spraying.

A *quadcopter* is an SUAV that is very stable and controlled by four rotors. Each of the four rotors on the quadcopter comprise of a motor and a propeller. These UAVs are only controlled remotely. They are not controlled via a pre-programmed onboard computer. Quadcopters are stable and can hover like a helicopter. The difference is that they balance themselves by the movement of the blades and not by the use of a tail rotor. Quadcopters can be used for many applications. They are most often associated with flying as a recreational hobby. Because of their ability to balance, they tend to be great for aerial photos. These types of UAVs are generally subject to less regulation than other types of drones and are often the least expensive.

A *radio-controlled helicopter (RC helicopter)* is a type of SUAVs that is constructed differently and often more complicated to fly than other UAVs. The complication is rooted in the many controls such as throttle, pitch and roll. These controls are needed for accurate flight. This is the most similar drone to full size helicopters. As such, mastering these controls enables the helicopter to perform the same maneuvers as a full-sized helicopter. This involves such complicated maneuvers as hovering and backwards flight. It also allows some maneuvers that a full-sized helicopter cannot perform, such as inverted flight. The RC helicopter can hover, but is not as stable as quadcopters. They are good for aerial photos, but they can be expensive.

How Can I use a Drone on my Farm?

Now that you are familiar with the different types of drones, we can discuss some ways in which they can be used in agriculture. Drones are gaining attention because of their potential uses on the farm. For example, farmers and ranchers are using drones to check on livestock, herd livestock, check land and crops, and spray insecticides and herbicides. These uses are not only convenient and save time and labor cost; they can be safer and assist those with physical challenges.

Livestock Handling

Livestock handling is one of the leading causes of injury on a farm. Drones can be part of assisting farmers in handling livestock in a safer way. Whether it is herding or checking a sick animal, drones can assist in areas such as:

- Counting animals
- Checking on sick and all other animals
- Herding animals (such as herding to the working facility or into another pasture)
- Monitoring feed bunkers and feed consumption in feedlots

Managing Crops and Land

Walking the land can take hours. It also has the potential to cause harm to a farmer or increase challenges to those farmers with physical injury or illnesses. Drones can help to reduce these risks in areas such as:

- Mapping fields using infrared imagery to detect how crops are growing
- Checking for problems in crops without walking entire fields by doing spot checks
- Checking ponds
- Checking fences

Spraying Chemicals

Spraying chemicals and personal protective equipment can be expensive and dangerous. It is conceivable that many of the chemicals being sprayed can cause harm to farmers. Drones can provide a safer alternative by keeping farmers at a distance from the chemical being sprayed. Spraying from a drone may also be more accurate and quicker in its application of the following:

- Spray insecticides
- Spray herbicides

Drone Application Risks and Challenges for Farmers

There are many benefits that can result from the use of drones; nevertheless, they can also present some risks and limitations. It is important to consider such things as individual restrictions and uncontrollable environmental restraints when deciding whether to operate a drone. The following are a few risks and issues to keep in mind:

Environmental Risk

- There is the possibility of losing control of a drone from a system failure or loss of signal (most newer drones will have a "return to home" feature that will allow the drone to return to the operator when the signal is lost or battery becomes low).
- Weather such as rain and/or high winds can be a complication.
- There can be damage from foreign objects, such as bird strikes and other UAVs.

Individual Awareness and Concerns

- As farmers age, their eyesight may become a challenge and could have the potential to impede drone operations.
- Increasing age can, if not addressed, decrease hand flexibility and the capacity to control drones.
- Drones used for agricultural purposes must be registered with the FAA.
- Farmers must pass FAA Part 107 remote pilot certification exam to use drones for agricultural purposes on their farms.

Regulations (e.g. Hobby Drone use according to the FAA)

- You must be able to see your drone at all times.
- You cannot fly drones above 400 ft.
- It is forbidden to fly drones over moving cars.
- You are not permitted to fly drones over large activities, such as sporting events.
- A drone cannot weigh over 50 lbs.
- It is against regulations to fly drones at night.
- Unless you seek permission, it is against regulations to fly drones within 5 miles of an airport or heliport.
- Drones should not be flown within 3 miles of a hospital.
- Drones should not be flown over people who do not know you are flying it.
- Drones cannot interfere with manned aircraft operations or fly in a reckless manner.

Alternatives to Purchasing a Drone

Drones and equipment can be expensive or complicated to use. There are times when it is not economically feasible, or the farmer cannot operate the drone safely. In cases where farmers may not be able to obtain a drone, the options below may be considered.

- Drone rental services such as for pesticide spraying are available.
- There are companies that offer services that include operating drones for clients.

Flight Planning Software

Flying a drone for use in agriculture is often done autonomously by what is called flight-planning software. This allows the operator to pre-plan the flight of the drone. This can be done by the inter-workings of some drones, but most often is done by allowing the operator to enter the flight path on the drone atop of an electronic map of the area to be flown. This is a valuable tool when checking crops or the condition of livestock.

Operating a Drone Safely

The utmost safety and attention should be used anytime you are around or operating a drone. Of course, having knowledge of what potential hazards may be present is key to staying safe. The information below should help guide you to specific safety information on drone use.

Additional Drone and UAV Resources	
Drone Safety and Regulation Information	Know Before You Fly was founded by the Association for Unmanned Vehicle Systems International (AUVSI) and the Academy of Model Aeronautics (AMA). The campaign is conducted in partnership with the Federal Aviation Administration (FAA), the federal agency charged with keeping the U.S. national airspace safe Find more information at: http://knowbeforeyoufly.org/ The FAA has a website that covers safety tips for drones. They developed a safety checklist that you, drone pilots, should use whenever piloting a drone: https://www.faa.gov/news/updates/media/2015-FAA-383-UAS_Holiday_Pre-flight-checklist_1200x627_ae05.pdf For more information visit: https://www.faa.gov/news/updates/?newsId=84326
Safety and Additional Videos on Drones	There is a variety of information available on drones. Please watch: https://www.youtube.com/watch?v=uChEeTpgGbE Rules can vary so check AirMap or your local aviation authority. It is your responsibility to make sure that your drone stays within this safety limit at all times. For more information watch: https://www.airmap.com/rules-to-fly-recreational-drones/ or https://www.youtube.com/watch?v=h8_9F6J7qw8

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