

Small UAS and Precision Agriculture

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GEOG 270: Introduction to Small Unmanned Aircraft Systems

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December 8, 2020

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Throughout the world, the United States can be seen as an economic powerhouse due to a variety of reasons. One of those reasons can easily be identified from all the different industries the United States has within it. One of those major industries that the United States is a world leader in is agriculture. Throughout the entire United States agriculture can be seen anywhere you go within the states. The only things that differ from place to place as far as agriculture, are the different variety of crops and the scale at which it takes place. The reasons for these differences are because not every place in the United States has the same type of climate, land area, general geography, and all the way down to soil type. All of these factors do have a big impact on what types of crops can be grown in the different areas across the United States and the scale at which they grow and are harvested. With these limiting factors that mainly affect the scale at which crops are grown and harvested, new solutions are needed to maximize planted crop yield when they are harvested. This is where precision agriculture started to gain traction in the agriculture industry. What is precision agriculture and what are the benefits of it? It is the implementation of technology such as GPS to map fields which also gives directional guidance during planting time. This allows for the maximum number of crops to be planted in a field based on the size and shape. In recent years, there has been a new technology that has been emerging in the precision agriculture industry/field. This new technology is the use of small unmanned aircraft systems or in other terms “drones”. With this new technology starting to be implemented in agriculture, more advancements in precision agriculture will take place. Having small unmanned aircraft systems advance precision agriculture will positively impact the agriculture industry in the United States.

With small unmanned aircraft systems being implemented into the agriculture industry for specifically precision agriculture, new technology is being used and developed to help determine potential yield amounts from crops (corn, soybeans, wheat...etc.) planted in fields. This technology that drones utilize is called a multispectral camera/imaging device. According to DJI a small unmanned aircraft system developer (n.d.), “multispectral consolidates the process of capturing data that gives insight into crop health and vegetation management” (DJI, n.d.). How this technology works, it captures the wavelength of light crops give off (DJI, n.d.), and with the data gathered it can be compared to a standard of what a healthy or properly growing plant looks like. Having this technology analyze a field of crops and compare its data to the set “good” standard; will allow for farmers to see how well their crops are doing and allow them to tend to areas of the field that are not growing as well. This will be able to help increase yields for crops planted in areas that do not grow well because of either poor soil conditions, lack of water, and lack of essential fertilizer. If farmers know this data about their fields, they will be able to maximize their yields and will be able to produce more with less. If this technology is implemented across the United States, the agriculture industry will increase its yield or production of crops, which will not only help the United States but also will help different countries around the world that are dependent on the United States agriculture industry. There is one challenge drones will face when contributing to the agriculture industry in the United States. That is the length of time they can be used during an operation of them. In agriculture, especially dealing with crops in large fields, a single drone will not be able to complete its operation with only one charge or battery. A new developing technology or innovation for drones called “swarm” can help solve this problem drones face with limited operation time.

Overall, a swarm is the use of multiple drones to complete a specific operation. How does this type of technology contribute to precision agriculture and the overall agriculture industry? In an article from the newspaper Tri-State Neighbor titled *Drone Spraying Company Takes Flight in Mitchell* (2020), “the company Rantizo a drone spraying and application service from South Dakota explained that the use of a swarm of drones will be able to replace the traditional use of tractors and commercial sprayers for spraying chemicals onto fields” (Robinson pg. 12, 2020). How would this help in the agriculture industry and how would this solve the problem of drones not being able to finish an operation due to the size of a field? With the use of multiple drones in an operation, the “swarm” will be able to cover a larger amount of area or acres, if not the whole field in a shorter period and without the need to stop and charge a battery or replace it with another. This will allow for more efficient use of drones in precision agriculture, and also provide more efficient use of chemicals when spraying fields.

Since drones are substantially smaller and being an aerial vehicle, they can apply chemicals to a field more effectively and reduce potential damage to crops. In the same article from the newspaper Tri-State Neighbor (2020), Robinson explained that with the use of drones for spraying, soil compaction from traditional sprayers will not be a problem anymore and spraying can be to “inch-level accuracy” (pg. 13, 2020). Also, without using a traditional sprayer for crops that are not in wide-spaced rows, like wheat or oats, they will not get knocked down or damaged due to the tires of a sprayer or tractor. Losing none of the crops in the field from being run over, will increase the total yield of a field when it is harvested. Having drones precisely apply spray chemicals to fields with high accuracy will reduce overuse of chemicals because they can exactly target weeds instead of spreading chemicals over everything to make sure no weeds are missed. Exact targeting of weeds reduces the amount of spray that is needed, which

will help crop producers save money because of the smaller amount of chemicals they will need to apply to their field.

Reducing the amount of chemicals needed to spray a field, also positively impacts the environment. As stated earlier, with drones being able to apply chemicals down to “inch level accuracy” (Robinson pg. 13, 2020), more chemical is being applied to the weeds of a field and not being sprayed onto the ground which can end up being hazardous do to run-offs. When rain falls onto a field of crops, and if there is tile (field drainage system of moisture) in the field, all the excess moisture that remains in the ground will be channeled into the tile and carried out from the field and usually is directed to the closest waterway. If there was an excess of chemical applied to the field and a rain shower goes through, the excess chemical on the ground will be absorbed down into the ground and channeled into the tile making its way to the waterway that it drains into. This can cause harmful chemicals to pollute the water and cause many different environmental problems. Being able to apply chemicals with precision with drones, can prevent hazardous chemicals from damaging the environment because they are directly applied to weeds and nothing else.

With the agriculture industry in the United States being one of the largest industries in the U.S., new technology is always being developed to improve efficiency and grow the industry as a whole. This new technology that is specific to helping the agriculture industry is called precision agriculture. The new technology that is starting to help/impact precision agriculture is small unmanned aircraft systems or in other terms “drones”. With the introduction of drones, new technology has been developed that allows drones to analyze plant/crop health by looking at wavelengths of light given off by the plant/crop (DJI, n.d.). Crop health can be affected by multiple factors, and one common factor is the presents of weeds in fields of crops. To get rid of

weeds, crop producers use various chemicals and spray them to kill them. Spraying can be costly because of the large amount of it you need to spray a field. The amount needed can be reduced by using drones to accurately apply a spray to weeds and reduce the overuse of chemicals which can be harmful to the environment and overall reduce the cost of spraying for crop producers. To accomplish spraying a whole field, drones can use a developing technology/method called “swarm” or the use of multiple drones. Having these two different technologies working hand in hand will result in a major advancement in precision agriculture, which will benefit the agriculture industry in the United States. Implementing all these small UAS technologies together in precision agriculture and the whole agriculture industry across the United States will result in bigger yields for crop producers and the overall picture, grow and positively impact the industry.

References

DJI. (n.d.). *P4 Multispectral – Precise Plant Data – DJI*. DJI Official. <https://www.dji.com/p4-multispectral>.

Robinson, J. (2020, October 23). *Drone Spraying Company Takes Flight in Mitchell*. Tri-State Neighbor, pp. 1–36.