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Precision ag UAS research at Mississippi State expanding

By Patrick C. Miller | February 05, 2015

Mississippi State University's research using unmanned aerial systems (UAS) for precision agriculture has grown considerably since being authorized by the U.S. Federal Aviation Administration two years ago.

It began with an application to the FAA for a certificate of authorization using a small unmanned aerial vehicle. Today, MSU researchers are working on the development of automated computer programs that can recognize individual seedlings to quickly and accurately determine plant density across a planted field.

The research is being conducted by MSU's Geosystems Research Institute and the Mississippi Agricultural and Forestry Experiment Station where agronomists and MSU Extension Service specialists are using UAS in projects related to irrigation, plant growth, nutrient management and herbicide application.

Robert Moorhead, GRI director and professor of electrical and computer engineering at the MSU Bagley College of Engineering, compares the work to applying prescriptions to fields by using site-specific data.

"In the long run, I think it will become much more automated," Moorhead said of UAS precision agriculture technology. He also believes that most farmers, rather than operating their own UAVs, will instead rely on agricultural consultants to do the flying, data collection and analysis.

"The remote-sense imaging will allow them to do a prescription based on the data," Moorhead said. "The ag pilot will then know just where to apply fertilizer and how much, where to apply pesticide or where there's too much or too little irrigation."

Back in the 1970s, NASA began launching Landsat satellites that used near-infrared imagery to provide a wealth of data on the earth's vegetation. Moorhead said that when it comes to the sensors MSU uses, their researchers have been following the technology curve originally established by NASA.

"The sensor people discovered that near-infrared was a pretty good indication of plant health using a vegetative index," Moorhead explains. "With all the cameras, it's been a miniaturization process from what went on Landsat to what's carried on manned aircraft to what's being carried on these small UASs."

One of the advantages of using UAS to collect crop data is that they're less affected by weather than satellites and manned aircraft.

"Being only a hundred to 400 feet above the crops, we don't have anywhere near the atmospheric effects if you were at 3,000 feet or in low-earth orbit. It makes the data collection a whole lot cleaner," Moorhead said.

In addition, while one pixel on a Landsat image shows a 30-meter-square area, UAS imagery displays at a resolution of a quarter inch or even an eighth of an inch if needed, according to Moorhead.

In one MSU study, several corn hybrids were planted at varying times and densities. During a three-month period last year, 20,000 to 40,000 plants per acre were planted in Mississippi fields at Starkville, Brooksville and Verona. For the first time, UAVs were employed to collect plant population data, such as emergence progress, plant heights, growth stages, plants per acre and numbers of unfurled leaves.

Although Moorhead sees precision agriculture as one of the first commercial opportunities for UAS, other applications such as the inspection of power lines, pipelines and refinery stacks, as well as wildlife surveys, also have potential.

"Precision ag is one of probably six areas in which commercialization will occur early," he said. "There's a ton of cost-savings that could be had if the FAA would just accept the technology."

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Lee Hathcock with the Mississippi State University Geosystems Research Institute, launches a UAV at an experiment station in Brooksville, Mississippi.
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