Grape II

Tuesday afternoon 2:00 pm

Where: Grand Gallery (main level) Room D

MI Recertification credits: 2 (1C, COMM CORE, PRIV CORE)
OH Recertification credits: 0.5 (presentations as marked)
CCA Credits: PM(0.5) CM(1.5)

Moderator: Duke Elsner, Extension Educator, MSU Extension

2:00 pm Protecting Vines from Winter Injury

- Tom Zabadal, SWMREC, MSU Extension

2:45 pm Update on Powdery and Downy Mildew Management (OH: 2B, 0.5 hr)

- Annemiek Schilder, Plant, Soil and Microbial Sciences Dept., MSU

3:20 pm Unmanned Systems and Technology- Applications in Viticulture

- Ed Bailey, Technical Division Coordinator, Northwestern Michigan College
- Scott Swan, GIS & Remote Sensing Instructor, Northwestern Michigan College

4:00 pm Session Ends

Unmanned Systems and Technology
Applications in Agriculture

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Introduction

For decades, satellite and aerial sensor systems have been utilized for the management of natural resources such as forests and watersheds. Researchers established procedures for analyzing the output of these sensors to measure forest vigor and tree health, particularly in deciduous trees and plants.

Soon, operators of large farms realized that they could utilize the same data and procedures to measure and track the vigor of their leafy crops. This was a huge advantage to the farmers, as they could identify problem areas where their crops were suffering, possibly from over or under-watering, pest infestations, or problems in the soil. Instead of watering or applying pesticides to the entire plot, the farmer could focus efforts on areas of poor health. Precision agriculture was invented.

Many small and medium-sized farm operators are skeptical to adopt airborne sensor technology. In many cases, only large mega-farms are able to take advantage of these systems due to the prohibitive cost and effort involved, or due to limited availability of contractors capable of providing these services. The cost of hiring remote sensing specialists/equipment, pilots, fuel, insurance and other expenses related to manned flights has made access to this technology very restrictive.

The prevalence of UAS is growing rapidly in the United States and around the world. Currently, any non-recreational uses are severely restricted, pending soon-to-be-released FAA regulations, including the potential for required training and/or federal licensing. Once the regulations are in place, the agricultural industry is expected to be one of the top implementers of UAS. Some estimates are expecting agricultural UAS to become a $3B industry over the next three years.

The advent of affordable unmanned aerial systems (UAS) has opened up precision farming to a much wider audience. Remotely controlled and autonomous fixed-wing and rotary-wing aircraft can carry light-weight sensors at a much lower altitude, resulting in data at significantly higher resolution than manned aircraft can offer.

Sensors

Three common sensors for UAS use are digital cameras, thermal sensors, and multispectral cameras. The cellular phone/smart phone industry has forced digital cameras to become much smaller, lighter, use less battery power, and capture very high-resolution images. Digital cameras are the most common sensor systems found on a UAS. Most capture color imagery and/or video. Some capture high-definition imagery and/or video. A few are capable of transmitting live video back to the operator, providing a “first person view” or FPV.

Mounting thermal sensors on UAS’s gives operators the ability to measure temperature fluctuations and remotely identify areas of temperature variation. For agriculture, thermal data can be useful for identifying areas of excess or insufficient plant moisture in crops.

Multispectral sensors enable the UAS to capture reflected wavelengths that are beyond the range of human eyesight. Of particular interest to agriculture are the near-infrared (NIR) bands of reflected energy. Healthy leafy plants performing active photosynthesis reflect very brightly in the NIR. In fact, if humans

could see the NIR bands, leafy plants would not appear green, as the green wavelengths would be overwhelmed with the intensity of the NIR.

Geographic Information Systems

Geographic Information Systems (GIS) is a tool that enables large volumes of collected data to be visualized and analyzed over large geographic areas. GIS has the capability to process remotely sensed data and conduct analysis. For example, GIS can process multispectral data to calculate a Normalized Difference Vegetation Index, or NDVI. NDVI is calculated for each pixel in a multispectral image, using the NIR band and the red color band.

$$NDVI = (NIR - Red) / (NIR + Red)$$

The NDVI calculation provides a ratio that exaggerates pixels showing healthy, active photosynthesis. When measured over a period of time, GIS enables the operator to show areas of increased or decreased plant health and identify areas of concern.

With a UAS, NDVI can be collected and generated for a small fraction of the cost of manned aerial collection systems.

Regulatory and Application Issues

In the 1990's, the Federal Aviation Administration (FAA) halted UAS use in the national airspace, with the exception of recreational use by hobbyists. The FAA maintains a high level of concern about proper training for operators and certification for aircraft. The highest priority is the safety of manned aircraft and persons on the ground.

Regulations must keep pace with technology. Once proven and tested systems are able to successfully show the ability to avoid collisions, autonomous UAS's may be certified for use in the federal airspace. However, the technology is evolving quickly and it is difficult for government regulations to stay abreast of new developments. Currently, some operators have been approved for highly restricted use. The FAA Certificates of Authorization are approved only for specifically-defined locations and specific vehicles on a case-by-case basis.

Over the next year, the FAA will be announcing standard regulations. It is expected that the regulations will be similar to current requirements for manned aircraft with sUAS pilot certifications and aircraft certifications.