Drones are making it big in the agricultural market with a wide range of applications, from assessing irrigation systems and estimating crop biomass to identifying nutrient and drought stresses in various crop systems. As plant pathologists, we are excited to use drones to better understand the disease progression of one of Oklahoma’s most notorious diseases: cotton root rot on alfalfa. Alfalfa is an excellent perennial forage legume crop with high nutritive values, making it an ideal fit in cattle feed rations. However, alfalfa production can be affected by cotton root rot disease, which limits the ability to establish profitable alfalfa stands in areas where this disease is prevalent, such as southern Oklahoma and Texas.

WHAT DOES COTTON ROOT ROT DISEASE LOOK LIKE IN AN ALFALFA FIELD?
Symptoms of the disease are visible during mid- to late summer when diseased plants begin to wilt and then rapidly die. The leaves remain firmly attached to the plant but turn brown, leaving a clear outline of dead plants at the disease front. Wilted plants have rotted roots with outer layers that slough off readily, enabling the root to easily be pulled out of the ground. At the field level, the disease manifests as numerous circular infested areas spreading away from the center, gradually merging and enlarging during the growing season and subsequent years. They resemble fairy rings – but unfortunately not the type you want to see in your field.

WHAT CAUSES COTTON ROOT ROT DISEASE?
Cotton root rot disease is caused by the fungus *Phymatotrichopsis omnivora*. The fungus is soil-borne and has the ability to damage a wide range of dicot (broadleaf) crops such as alfalfa but not monocots such as grasses. The disease is also a serious problem on commercial crops such as pecan and cotton, the crop from which the disease gets its name. Interestingly, cotton root rot disease is restricted to the southwestern United States, usually occurring in basic soils.

For more news, stay connected with Carolyn Young, Ph.D., of the Noble Research Institute’s mycology laboratory on Twitter @NobleFunGuys
HOW LONG CAN THE FUNGUS PERSIST IN SOIL?
The fungus produces sclerotia, overwintering structures that are about the size of an alfalfa seed, enabling the fungus to survive for very long periods in the soil. Anecdotal information from alfalfa growers suggests this disease starts to appear on 1- to 2-year-old alfalfa stands, even if they had been under native grasses for the past 30 years. In short, it is hard to get rid of the fungus once the field is infested.

HOW DO I MANAGE COTTON ROOT ROT DISEASE?
One management option is crop rotation with monocot (grass) crops. No alfalfa cultivars with resistance to cotton root rot disease are available on the market. Currently, Topguard fungicide, which is being used successfully in cotton, is the best strategy to manage this disease. However, this fungicide is not yet registered for use in alfalfa. Efforts are under way to make it available in coming years.

HOW DO DRONES HELP US STUDY COTTON ROOT ROT DISEASE?
When standing in an alfalfa field, it can be difficult to fully appreciate how severe the disease is, especially across a whole field. So, the ability to capture a series of aerial images that span a large area can help us monitor how the disease progresses during the life span of an alfalfa stand. We are using drones to acquire high-resolution aerial images that provide the ability to make bird’s-eye-view assessments of a large area as well as facilitate effective disease monitoring. In addition, we can generate disease maps (maps of an area that show where the disease has occurred over multiple years) from these images, which can help facilitate management decisions that are timely, economical and eco-friendly.

WHAT DOES DRONE RESEARCH MEAN FOR FUTURE COTTON ROOT ROT DISEASE MANAGEMENT?
Drone-acquired aerial images are helping us understand the emergence of new diseased areas and the progression pace of existing diseased areas within a growing season and across different years. The advantage gained from this information is twofold: We can assess stand loss to make informed management decisions regarding replanting, and we can create buffer zones that account for potential disease spread for precise fungicide applications. As more producers progress toward practicing precision agriculture, drone-acquired aerial images will find a unique place in their disease management toolbox.