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INCREASING THE SUSTAINABILITY OF AGRICULTURAL SYSTEMS

ARS builds the science-based foundations for future farming systems that satisfy human food and fiber needs, sustain the economic viability of agriculture, enhance environmental stewardship, and improve quality of life. Through transdisciplinary research approaches that integrate information and technology, ARS provides producers with several options for increasing the sustainability of their production systems. The following FY 2019 accomplishments highlight ARS advances in farming for carbon capture, improving the sustainability of organic cropping systems, and optimizing water use.



Intercropping bioenergy crops with trees captures and stores atmospheric carbon in soil. ARS researchers in Temple, Texas, and collaborators at Washington State University and Texas AgriLife Extension determined that intercropping switchgrass among poplar trees increased soil organic carbon by 16 percent at depths of 0 to 15 cm. These results show that intercropping switchgrass with poplar can give foresters greater economic returns from biofuel production while also promoting ecosystem services such as improved water use, nutrient cycling, and carbon sequestration.

Innovative method for cover crop termination using engine exhaust heat. ARS researchers in Auburn, Alabama, prototyped an innovative method to control weeds and terminate cover crops: instead of using herbicides, the team developed a mechanical pusher that uses exhaust heat from a walk-behind tractor's gasoline-based engine. The prototype demonstrated that exhaust heat (otherwise lost to the environment) can be an effective and economical means of terminating cover crops.

Novel planter developed for small-seeded plants. Precisely planting small seeds can be difficult with standard planters. Small seeds are often pelleted so they can be planted with precision, but this process is expensive. An ARS researcher in Salinas, California, developed a simple planter, called the Slide Hammer Seeder, for precision hand-seeding of unpelleted, small-seeded species. The planter works well for seeding a variety of small-seeded herbs and vegetables.

Making decisions easier with Irrigator Pro. ARS researchers in Dawson, Georgia, and collaborators have developed the Irrigator Pro decision support for corn, cotton, and peanut irrigation scheduling. The tool has proven helpful for peanut growers, with documented increases in peanut yield and grade by 400 pounds per acre. These increases equate to increased net revenue of \$60.25 per acre, which then equates to \$5.5 million per year increased revenue in Georgia alone. In FY 2019, the team deployed the Irrigator Pro website and an app for smart phones and tablets.

Toolkit for monitoring daily water use in California Central Valley vineyards. Persistent and extreme drought has plagued California in the last decade with enormous implications on surface and groundwater resources for agriculture. ARS scientists in Beltsville, Maryland, have led the Grape Remote Sensing Atmospheric profile & Evapotranspiration eXperiment (GRAPEX) project with the goal of, for the first time, gaining accurate estimates of daily water use and stress from field to regional scales for high-valued perennial crops. This will inform more efficient irrigation management in the face of drought.