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Cover Crop Management Considerations

Conservation tillage combined with high residue cover crops can benefit degraded soils typically found throughout the Southeast. High residue cover crops are arguably the most critical component, but they also require the most management to ensure grower success and maximize associated soil health benefits. In lieu of the upcoming winter cover crop season, we would like to share some things growers may consider as they prepare to implement, grow, and terminate cover crops on their farm.

By now, growers should have secured their seed supply to ensure they can plant their desired cover crop across their intended acres. An early start on this planning process alerts growers to any potential unexpected increases in costs or seed supply shortages, which allows them to make adjustments that assures seed is available at the earliest opportunity to plant. Average regional seed costs are provided on Fact Sheet FS04o: Cover Crops for the Southeast - Costs

(Available at <http://www.ars.usda.gov/SP2UserFiles/Place/64200500/csr/FactSheets/FS04o.pdf>).

Securing an adequate seed supply directly relates to one of the most important management aspects of winter cover crops - ***plant the cover crop as early as possible in the specified planting window.*** The ideal planting window for many cover crops across the Southeast is October to November, with a preferred completed planting date by Thanksgiving. However, growers must

Dynamically Speaking

It is harvest season and the NSDL is busy with data collection from experiments across the state. If you come by our laboratory, you are sure to notice that we have a brand new roof that has greatly improved the appearance of our main building. Inside, we also have changes to our staff. This summer Mr. Karl Mannschreck retired and we thank him for his service to NSDL and wish him the best in his retirement years. We also have some additions to our staff, with several international visiting scientists who will work with us for a year before returning home to their own country and research Institutions. We have two scientists who are visiting from China: Dr. Juian Wang and Dr. Quigfeng Zhang who are from the College of Natural Resources and Environment, Northwest A&F University, Yangling, China. Also visiting is Dr. Lina Sarunaite from Lithuania who won a one year research scholar award from the Baltic-American Freedom Foundation.



H. Allen Torbert
Research Leader

I hope you enjoy reading about some of the research efforts we have included in this issue of National Soil Dynamics Highlights, and please visit our web site for more information about our ongoing projects (<http://www.ars.usda.gov/sea/nsdl>).



Figure 1. Early spring cover crop growth attributed to a fertilized and non-fertilized rye cover crop.

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Recent Publications

Balkcom, K.S., Arriaga, F.J., Van Santen, E. 2013. Conservation systems to enhance soil carbon sequestration in the Southeastern U.S. Coastal Plain. *Soil Science Society of America Journal*. 77:1774-1783.

Ducamp, F., Arriaga, F.J., Balkcom, K.S., Prior, S.A., Van Santen, E., Mitchell, C.C. 2012. Cover crop biomass harvest influences cotton nitrogen utilization and productivity. *International Journal of Agronomy*. Article 420624, 12 pages. doi:10.1155/2012/420624. Available: <http://www.hindawi.com/journals/ija/2012/420624/>.

Lamba, J., Way, T.R., Srivastava, P., Sen, S., Wood, C.W., Yoo, K.H. 2013. Surface transport of nutrients from surface broadcast and subsurface-banded broiler litter. *Transactions of the ASABE*. 55(3):979-985.

Kornecki, T.S. 2014. A powered roller/crimper for walk-behind tractors to terminate cover crops in conservation agriculture. *Applied Engineering in Agriculture*. 30(2):153-159.

Price, A.J., Monks, C.D., Kelton, J.A. 2014. Cutleafgroundcherry (*physalis angulata*) density, biomass and seed production in peanut (*arachis hypogaea* L.) following regrowth due to inadequate control. *Peanut Science*. 40:120-126.

Runion, G.B., Prior, S.A., Price, A.J., McElroy, S., Torbert III, H.A. 2014. Effects of elevated CO₂ on biomass and fungi associated with two ecotypes of ragweed (*Ambrosia artemisiifolia* L.). *Frontiers in Plant Science*. 5:1-7. doi: 10.3389/fpls.2014.00500

Kurtener, D., Yakushev, Y., Torbert III, H.A., Krueger, E. 2013. Definition of zones with different levels of productivity within an agricultural field using fuzzy modeling. *Journal of Agricultural Science*. 5(5):176-181.

Watts, D.B., Arriaga, F.J., Torbert III, H.A., Busby, R., Gebhart, D.L. 2012. Non-composted municipal solid waste byproduct influences soil and plant nutrients five years after soil reclamation. *Soil Science*. 177:480-489.

All of our publications are available on our web site:
<http://www.ars.usda.gov/sea/nsdl>

Upcoming Events

Dates	Meeting	Location
Oct 28-29	Southern Ag. Cover Crops Conf.	Jonesboro, AR
Nov 2-5	Agronomy, Crop Science, and Soil Science Societies' Annual Meeting	Long Beach, CA
Nov 12-13	Cotton Inc's Crop Mgmt Seminar	Tifton, GA
Dec 15-16	AL Corn and Wheat Short Course	Auburn, AL
Jan 5-7	Beltwide Cotton Conference	San Antonio, TX
Jan 14-17	Southern Sustainable Ag Working Group (SAWG) Conference	Mobile, AL
Feb 1-3	Agronomy Society Southern Branch Meeting	Atlanta, GA
Feb 3	Conservation Prod. Sys. Conference	Dooley Cty, GA
Feb 6-7	AL Fruit and Vegetable Growers Mtg	Opelika, AL
Feb 20-21	GA Organics	Athens, GA

... Cover Crop Management cont.

balance this activity with fall harvesting. Timely planting enhances overall biomass production and subsequent benefits. Growers should also consider applying some form of N equivalent to at least 30 lb N per acre to also stimulate biomass production (Image 1).

The next major consideration for growers, with regards to cover crops, will occur in the spring and involves when they **terminate the cover crop** (Image 2). This decision is influenced by many factors that may also interact with one another. Due to the complexity of these factors, we have provided an entire fact sheet (FS11) dedicated to describing how each of these factors affect termination timing (Available at <http://www.ars.usda.gov/SP2UserFiles/Place/64200500/csr/FactSheets/FS11v4.pdf>).

One of the most common questions regarding cover crop termination involves **soil moisture at termination**, particularly for sandy, non-irrigated soils. Growers must balance the need to terminate a cover crop late enough to achieve adequate biomass production with the need to terminate early enough to allow for a rain event to occur that will re-charge the soil profile, prior to the most appropriate planting date for the cash crop. The decision of when to terminate the cover crop is farm specific, field specific, and year specific, and typically changes each year due to different climatic patterns and/or crop rotations.

These considerations may not cover all scenarios that growers may encounter on their farms, but if considered with respect to their operations, they can expect to maximize cover crop benefits with minimum risk.



Image 2. High residue rye being rolled down with a cover crop roller in conjunction with chemical termination.

Effects of Elevated Atmospheric CO₂ on Cogongrass

Cogongrass, a perennial grass native to Southeast Asia, was introduced into the southeastern U.S. in the early 1900s for forage, erosion control, and as packing material. It is a widespread invader to warmer regions (over 1.2 billion acres worldwide); is tolerant of shade, poor soils, and drought; and naturalizes aggressively in dense monocultures which displace native plants. Cogongrass is one of the top ten worst weeds in the world, a Federal Noxious Weed, and declared noxious in numerous states. Cogongrass is a major problem in the Southeast on disturbed lands such as forest plantations and roadsides and may become problematic in agricultural lands (Image 1 and Image 2). It is present in five or more varieties, including a red-leaved ornamental ('Red Baron') sold by nurseries in some states that may lack invasive characteristics.



Image 1. Cogongrass invasion of a forest plantation.

Dr. Edzard Van Santen (Department of Crop, Soil and Environmental Sciences, Auburn University) provided plants from five ecotypes collected across the southeastern U.S., plus the 'Red Baron' variety. These plants were grown in containers in open top chambers under ambient and elevated (ambient plus 200 ppm) atmospheric CO₂. Plants were harvested after six months of exposure.

Averaged across ecotypes, elevated CO₂ increased dry weight by about 10 %, a response typical for grasses. Elevated CO₂ increased height, carbon content, photosynthesis, and both nitrogen and water use efficiencies, but lowered tissue nitrogen concentration; again, these are typical plant responses for grasses to elevated CO₂. The hybrid ecotype tended to exhibit the greatest growth (followed by Louisiana, North Alabama,

and Florida ecotypes) while 'Red Baron' and Mobile ecotypes were smallest. There were few interactions of CO₂ with ecotype; when these were significant, the hybrid, Louisiana, Florida, and/or North Alabama ecotypes showed a positive response to CO₂ while the Mobile and 'Red Baron' ecotypes did not. Cogongrass is a problematic invasive weed in the southeastern U.S. and some ecotypes will likely become more so under elevated atmospheric CO₂ levels.



Image 2. A cogongrass clump showing the extensive, fibrous root systems through which it spreads.

Development of New Methods to Measure Soil Carbon

Soil carbon is a fundamental component of soil, influencing almost every aspect of how the soil functions. It is not only a part of soil fertility, but also soil structure, soil biological activity (including root growth), and soil water holding capacity. Soil carbon is so important to soil productivity that it is the most common measurement made to assess soil quality. However, measuring soil carbon can be difficult and expensive, requiring multiple soil samples at multiple soil depths to accurately measure content. In some situations, such as rocky soils or forested soils, collecting soil samples can be almost impossible. After collecting, soil samples have to be prepared by drying, sieving, and grinding before being processed through expensive laboratory equipment to determine carbon content. At the NSDL, research is underway to develop a new method of measuring soil carbon that does not require soil sampling. This method uses radiological processes to measure soil from the soil surface without collecting soil samples from the ground. Researchers have developed a new method based on measuring gamma-ray spectroscopy emissions from soil when induced by inelastic neutron scattering which can detect soil total carbon content. This process measures soil to a depth of approximately one foot, but can accurately measure soil carbon in the top two inches. A mobile version

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... New Methods cont.

of the instrument using this method called the Mobile Inelastic Neutron Scattering (MINS) system allows these measurements to be made from a cart that can be pulled behind a tractor across the field. The current prototype is designed to operate under field conditions (Image 1 and Image 2). Currently, there are two scientists, Galina Yakubova and Alexander Kavetskiy, who are specialists in nuclear spectroscopy, working on this project at the NSDL. The ongoing research is focused on improving the system and demonstrating that it can reliably measure soil carbon under a variety of soil and cropping conditions. The objective is to have a system that can easily measure soil carbon regardless of where it is found.



Image 1. Mobile Inelastic Neutron Scattering (MINS) system used to make soil carbon measurements in the field without soil samples.



Image 2. MINS being pulled across the field behind a tractor.

National Soil Dynamics Laboratory

411 S. Donahue Drive
Auburn, AL 36832-5806
334-887-8596

<http://www.ars.usda.gov/sea/nsdl>

Happenings

Dr. Leah Duzy, attended the 42nd annual Universities Council on Water Resources (UCOWR) Conference at Tufts University in Medford, MA. She made the following presentation: Conservation Cropping Systems: Increasing Water Use Efficiency and Lowering Production Costs.

Drs. Kip Balkcom, Ted Kornecki, Andrew Price, and Leah Duzy, hosted the Soil Resources and Conservation class from the Crop, Soils, and Environmental Science Department at Auburn University, and undergraduate agronomy students from the Universidad Nacional de Agricultura, Catacamas, Honduras. Students heard presentations from each of the scientists about their research areas related to conservation systems, viewed equipment used in conservation systems, and toured the NSDL facility.

Drs. Leah Duzy and Dexter Watts participated in a Canola Field Day in Florence, AL. Dr. Duzy made a presentation on the economics of incorporating canola into a conservation system. Dr. Watts presented the benefits of canola on succeeding crops.

Dr. Kip Balkcom, attended an ARS sponsored workshop titled, "Long-term Agroecosystems Research Partners/Stakeholders Workshop" at the UGA Tifton campus conference center, Tifton, Georgia. He also attended a Precision Ag Data Workshop titled "Big Data: Managing your most elusive farm asset" at Iowa State University in Ames, IA, covering topics such as understanding the value of data, data ownership and privacy, and data standards in agriculture.

Drs. Leah Duzy, Ted Kornecki, and Andrew Price, attended the 69th Soil & Water Conservation Society International Annual Conference in Lombard, IL. The researchers made the following presentations, "Net Returns and Risk for Cover Crop use as an Integrated Pest Management Practice in Alabama Cotton Production" (Duzy); "Roller/Crimper Designs for Cover Crops Management on Different Farm Scales using Conservation Practices" (Kornecki); and "Managing Weeds in Conservation Systems: Overcoming Herbicide-Resistant Weeds in the Mid-South and Southeastern U.S." (Price).

Dr. Steve Prior, received an Honorable Mention in the 2014 Unsung Hero Awards. Dr. Prior was honored for his significant long-term contributions to his unit's Safety and Environmental Management System programs.

Dr. Ted Kornecki attended the AGENG 2014 International Conference of Agricultural Engineering in Zurich, Switzerland. He presented a research paper, "Effect of roller/crimper designs in terminating rye cover crop in small-scale conservation systems".

Drs. Kip Balkcom, Leah Duzy, Ted Kornecki, and Andrew Price, attended and presented at the 2014 Southern Agricultural Cover Crops Conference, co-sponsored by the USDA NRCS and Arkansas Association of Conservation Districts, in Jonesboro, Arkansas.

Dr. Allen Torbert was invited to present "Gypsum in Land Application and Phosphorus Remediation" at the Southeastern Sustainable Soils Forum held in Raleigh, NC.

Send updated contact information, questions, comments, and/or suggestions to: NSDL-Highlights@ars.usda.gov

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