National Soil Dynamics Laboratory

Highlights

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Contents

New Roller–Crimpers for Medium– and Small–Scale Conservation Systems

New roller/crimper designs are bringing conservation technology to medium– and small–scale farms.

Roller/crimpers are becoming common on larger farms in the southeast USA, where they are used to flatten and kill growing winter cover crops before summer cash crops are planted. Because standard models use weight to drive the crimper bar into the plant stem to scarify it, these implements are extremely heavy and can only be used by large tractors with at least 60 horsepower.

New designs by Dr. Ted Kornecki do not rely on weight; rather, they use springs to injure plant stems and kill the cover crop plants. This results in smaller, lighter rollers that require less horsepower to operate and can maneuver in smaller areas. These designs maintain or exceed cover crop termination effectiveness achieved by the earlier models.

Dynamically Speaking

H. Allen Torbert
Research Leader

The NSDL's primary mission is to solve problems for farmers in the southeast USA, and we have been busy conducting research for over 75 years. Funding for the NSDL comes primarily from the Federal Government and, while we have a long history, some of our funding was considered to be earmarks. Consequently, we lost a portion of our funding during the recent Federal Government cost cutting efforts. While the cuts were substantial and have resulted in a reduction to our staff, including two scientific research positions, we are glad to still be here and able to continue the important work of agricultural research. Fortunately, we have been able to absorb all of the staff reductions through attrition. One of the positions will come from the retirement of Dr. Hugo Rogers, whose career we highlight in this issue. Nevertheless, all of our programs are still in place and we continue to do research in the areas of *Conservation Systems*, *Global Change*, and *Waste Management*. Please visit our web site for more information regarding our research programs. I hope you will enjoy reading this issue of the National Soil Dynamics Laboratory Highlights.

The first roller is a smooth roller with an oscillating crimping bar (Figure 1). A cam mechanism is located on both ends of the shaft. As it rotates, it preloads the adjustable spring. Energy released from the spring is used to oscillate the crimping bar mechanism, slamming it into the crop material. This roller/crimper requires 30 to 40 horsepower.

Figure 1. Rolling rye with the smooth roller (dark-color) with crimping bar (red).

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Upcoming Events

Dates	Meeting	Location
Oct. 16–19	ASA-CSSA-SSSA Ann. Mtg.	San Antonio, TX
Oct. 18–20	Sunbelt Ag Expo	Moultrie, GA
Oct. 28–29	All AL Org. Farming Workshop	Tuskegee, AL
Dec. 7-8	SWCS Cover Cropping Conf.	Decatur, IL
Jan. 3–6	Beltwide Cotton Conf.	Orlando, FL
Jan. 18–21	Southern SAWG Ann. Conf.	Little Rock, AR
Jan. 23-25	So. Weed Sci. Soc. Ann. Mtg.	Charleston, SC
Jan. 31	Cons. Prod. Sys. Trng. Conf.	Hawkinsville, GA
Feb. 1	Cons. Prod. Sys. Trng. Conf.	Douglas, GA
Feb. 24–25	GA Organics Ann. Conf.	Columbus, GA

Recent Publications

Folgart, A., A.J. Price, E. van Santen, and G.R. Wehtje. 2011. Organic weed control in white lupin (Lupinus albus L.). Renew. Agric. Food Syst. 26(3):191-199.

Kelton, J.A., A.J. Price, E. van Santen, K.S. Balkcom, F.J. Arriaga, and J.N. Shaw. 2011. Weed seed band density and composition in a tillage and landscape variability study. Commun. Biometry Crop Sci. 6:21-30.

Kornecki, T.S., and F.J. Arriaga. 2011. Impact of different cover crops and types of transplanter mounted subsoiler shanks on tomato yield. HortSci 46:715-720.

Marble, S.C., S.A. Prior, G.B. Runion, H.A. Torbert, C.H. Gilliam, and G.B. Fain. 2011. The importance of determining carbon sequestration and greenhouse gas mitigation potential in ornamental horticulture. HortSci 46:240-244.

Price, A.J., K.B. Balkcom, A.S. Culpepper, J.A. Kelton, R.L. Nichols, and H.H. Schomberg. 2011. Glyphosate-resistant Palmer amaranth: A threat to conservation tillage. J. Soil Water Conserv. 66:265-275.

Prior, S.A., G.B. Runion, S.C. Marble, H.H. Rogers, C.H. Gilliam, and H.A. Torbert. 2011. A review of elevated atmospheric CO_2 effects on plant growth and water relations: Implications for horticulture. HortSci 46:158-162.

Watts, D.B., and H.A. Torbert. 2011. Long-term tillage and poultry litter impacts on soybean and corn grain yield. Agron. J. 103:1479-1486.

Watts, D.B., T.R. Way, and H.A. Torbert. 2011. Subsurface application of poultry litter and its influence on nutrient losses in runoff water from permanent pastures. J. Environ. Qual. 40:421-430.

Way, T.R., D.B. Watts, K.E. Smith, and H.A. Torbert. 2011. Calculation of effective gas flux from soil following band appplication of manure or fertilizer. Trans. ASABE 54:337-345.

All of our publications are available on our web site:
http://www.ars.usda.gov/msa/auburn/nsdl

… roller–crimpers

The second roller is a two-stage roller with a primary smooth drum to flatten the cover crop and a spring–preloaded secondary drum with crimping bars (Figure 2). The second drum is isolated from the main frame, reducing vibrations transmitted to the tractor operator. This model also requires 30-40 horsepower to operate.

A smaller version has recently been adopted for small, walk-behind 14–HP two–wheel tractors.

Figure 2. Two-stage roller/crimper. Smooth roller in front; Independent crimping drum in rear.

On small organic vegetable farms the planting area is often confined and the tractor may be limited to a self-propelled walk-behind garden tractor. To address these restrictions, a third roller/crimper type was developed in 2010. This is a PTO–driven powered roller/crimper to work with a self-propelled tractor, allowing growers with small acreages to successfully flatten down and terminate cover crops (Figure 3).

Because the crimping bar's force comes from compression springs, not from its weight, the machine is much lighter than traditional roller/crimpers. It requires less horsepower (14 HP) in the field and is much easier to handle and transport. The crimping frequency can be manipulated both through the engine RPM and the speed of the tractor. Results are similar to those found with traditional (larger & heavier) roller/crimpers. There is a considerable interest in this model from the organic farming community in the southeast USA.

Figure 3. Powered roller/crimper for small, walk-behind two-wheeled tractors.

Dr. Hugo Rogers Retires

Dr. Hugo Rogers

Dr. Hugo Rogers, a Plant Physiologist for Global Change at the National Soil Dynamics Laboratory retired after 35 years of service with USDA–ARS. He received a B.S. in Botany (1969; honors) and an M.S. in Plant Physiology (1971) from Auburn University, and a Ph.D. in Environmental Science and Engineering from the University of North Carolina at Chapel Hill (1975), where he worked in the laboratory of Dr. Lyman Alonzo Ripperton. Rogers' first job was in the Division of Engineering, Research Triangle Institute in North Carolina (1975) studying the control of airborne particulates by vegetation. In 1976 he began research as a Plant Physiologist in Dr. Walter Heck's Air Quality/Vegetation Effects Program, USDA–ARS, Raleigh, NC. He served on the adjunct faculties of North Carolina State University and the University of North Carolina at Chapel Hill (1976-84). In 1984, he moved to the National Soil Dynamics Laboratory. He holds adjunct appointments in the Department of Biology, Duke University, Department of Agronomy & Soils and the School of Forestry & Wildlife Sciences, Auburn University.

His primary interest has been the interface between agriculture and the atmosphere with emphasis on belowground processes. His principal focus for the past 30-odd years has been plant response to atmospheric changes, mainly the increase in atmospheric CO_2 concentration. His development of experimental methods has been pivotal to much of this research. Rogers' earlier work included environmental toxicology and kinetics of air pollutant uptake by plants. Continuous stirred tank reactor (CSTR) design and theory (from the field of chemical engineering) were adapted to generate test atmospheres for plant gas exchange research. Studies included both nitrogen dioxide (a common, but key, photochemical air pollutant) and ammonia (an important volatile from agriculture); flux kinetics with conventional monitoring and stable isotopic tracing (of nitrogen-15 dioxide) were used to measure the sorption rates of gases by plants. Later, field scale systems for the study of plant response to elevated atmospheric CO_2 (a major global change variable) were developed; investigations of the effects of CO_2 on agronomic and forest species were also initiated. Aboveground results led to questions about processes below the ground. Root measurements, first with shovel and foot ruler, soon led to soil coring and optical scanners, then to minirhizotron observations and nuclear magnetic resonance imaging. He has authored or co-authored nearly 200 publications with work appearing in Science and the Proceedings of the National Academy of Science.

Dr. Rogers has mentored numerous undergraduates, graduate students, and post-doctoral scientists, and has often lectured to classes. For twenty years, he was on the Donald E. Davis Arboretum Committee. He has served on the Editorial Boards of Environmental Pollution, Agronomy Journal, Journal of Environmental Quality, and Global Change Biology.

Rogers' honorary memberships include Phi Beta Kappa, Sigma Xi, Phi Kappa Phi, Gamma Sigma Delta, Gamma Beta Phi, and Alpha Zeta. He is a Fellow of the American Society of Agronomy, Fellow of the Air and Waste Management Association, and Fellow of the American Association for the Advancement of Science. He was ARS Scientist of the Year in 1993, Mid-South Area.

Trash Revegetates Army Grounds

The U.S. Army has teamed up with the NSDL to convert trash into pulp that can be used to help improve soil fertility and native grass establishment.

There are two environmental problems the Army is trying to address. 1) Space for trash disposal; and 2) Heavily utilized training areas are becoming bare of vegetation due to constant heavy equipment and foot soldier use. This leads to soil erosion problems, making it difficult to revegetate these areas.

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… revegetating army grounds

Instead of placing garbage in landfills, a conveyor system is used to separate garbage into useful material that can be ground into a pulp form. This system also uses high-temperature and high-pressure steam to sterilize and help break down the garbage. After the garbage is dried and further separated, the final pulp product looks like home insulation material.

This pulp has a neutral pH and contains nitrogen, phosphorus, and potassium. Working with the Army, native grasses were planted on two Army bases utilizing this pulp material. ARS scientists, led by soil scientist H. Allen Torbert, are studying the soil chemical properties after the introductino of pulp as a source of nutrients. Soil scientists Dexter Watts and Francisco Arriaga are studying the physical and chemical properties of the soil five years after pulp was added.

Research plots located in Fort Campbell, Kentucky and Fort Benning, Georgia were judged to be successful revegetation efforts with the use of the pulp. The native grasses were successfully established and a significant increase in plant biomass occurred between the first and second year of study. Even five years later, positive responses in plant growth and soil conditions were found where the pulp was added. Currently, there is great interest in expanding these projects to other Army bases and bases of other military branches. More details regarding the pulp can be found at http://www.intechopen.com/articles/show/title/new-municipal-solid-waste-processing-technology-reduces-volume-and-provides-beneficial-reuse-applica.

National Soil Dynamics Laboratory

411 S. Donahue Drive

Auburn, AL 36832-5806

334-887-8596

http://www.ars.usda.gov/msa/auburn/nsdl

Happenings

Dr. Ted Kornecki spoke on cover crop management in conservation tillage systems using rolling/crimping technology at the *Principles of Integrated Weed Management in Organic Crop Production Conference* in Tifton, GA. **Corey Kichler** demonstrated rolling cover crops using a prototype walk-behind tractor-powered roller/crimper.

Dr. Kip Balkcom participated in expert panels at two grower meetings in Tanner and Montgomery, Alabama, sponsored by the Alabama Cooperative Extension System. Dr. Balkcom discussed aspects of wheat production including tillage operations and fertility management with special emphasis on nitrogen

Drs. Kip Balkcom, **Ted Kornecki**, and **Andrew Price** spoke at an organic conservation tillage vegetable production field day in Tuskegee, AL. **Corey Kichler** demonstrated innovative equipment designed for small farms, including roller/crimpers for small tractors and two-wheeled, walk-behind tractors.

Drs. Kip Balkcom and **Andrew Price** spoke at a conservation farming field day near Dothan, AL as part of a *NRCS Conservation Innovation Grant* project highlighting the benefits of conservation tillage and high residue cover crops.

Dr. Ted Kornecki hosted the annual meeting of the *American Society of Agricultural and Biological Engineers, Alabama Section* at the USDA NSDL, and demonstrated conservation systems equipment. **Drs. H. Allen Torbert** and **Tom Way** presented the 75-year history of the NSDL.

Dr. Ted Kornecki presented *Equipment Development in Conservation Cropping Systems* at the USDA-ARS Eastern Regional Research Center (ERRC), Wyndmoor, PA. The seminar was part of a consultation with ERRC scientists regarding cover crop termination by rolling technology with a new energy source for faster cover crop termination.

Dr. Ted Kornecki presented *Managing Cover Crops in No-Till Organic Systems Using Rolling Technology* at the *Organic Farming Systems Conference* in Washington, D.C.

Dr. Francisco Arriaga is serving as interim instructor for AGRON 7590 (Soil Physics) for the the 2011 Fall semester in the Auburn University Department of Agronomy and Soils.

Dr. Ted Kornecki, **Corey Kichler**, and **Kirk Iversen** presented an information exhibit on conservation systems to 1200 attendees at the Southern SAWG Annual Conference in Chattanooga, TN.

Dr. Ted Kornecki presented *Effects of Rolling Operations on Cover Crops Termination, Soil Moisture, and Soil Strength in a Southeastern US No-till System* at the World Congress of Soil Science in Brisbane, Australia.

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