CONSERVATION INNOVATION GRANTS
Final Report

Grantee Name: Rodale Institute
Project Title: No-Till Plus: A One-Pass Cover Crop Roller/Planter System that can Reduce or Eliminate Herbicide and Chemical Fertilizer Use on Most No-Till Acres
Project Director: Jeff Moyer **Grant Administrator:** Stacy Glackin
Period Covered by Report: September 24, 2004 to December 31, 2008

Describe significant results, accomplishments, and lessons learned. Compare actual accomplishments to the project goals in your proposal:

Project Synopsis/Accomplishments:

This document represents the final report for this project, and includes new information on the planting season of 2008 through the compilation of 2008 research data and summer outreach activities, along with a synopsis of the overall project.

As this project concludes, it is appropriate to look back at the many accomplishments we have documented during the past four years. Many projects commence with enthusiastic goals and objectives only to fall short of their promise. This project is not one of those.

We began this project with realistic expectations that have been surpassed in every objective. The following three objectives were listed when the proposal was funded. Since that time, we have added two additional objectives listed later in this report.

Project Objectives:

The Rodale Institute developed an innovative crimper/roller tool designed to convert a standing cover crop into weed-suppressing, soil-building mulch without herbicides. The roller's unique front-mounted configuration makes it possible to plant into the residue in one field pass, minimizing soil compaction and saving time and fuel. The goals of this project were to:

- Test this easy-to-duplicate technology under diverse geographies and terrains with a wide variety of cover and cash crops, and document results;
- Disseminate this knowledge broadly to no-till farmers throughout the country, and
- Make it possible for the growing number of no-till farmers to reduce (or eliminate) the use of herbicides and chemical fertilizers in their no-till systems, with the potential to dramatically reduce surface and groundwater contamination.

We also listed in the Summary of Work section of this report a brief list of activities that were be included as task items. These, along with the tasks added in the extended grant period, were all completed. We conducted more research than was originally proposed due to the interest expressed by growers in each of the focal regions. We also had a more robust outreach program based on the desires of farmers in each region. And, finally, the DVD (video), continues to be disseminated at all events where the technology is showcased.

Projected Summary of Work:

- Built and tested10 rollers on farms in diverse regions of the country. Gave farmers assistance in modifying tractors, rollers, planters and transplanters to meet their specific conditions.

- Conducted additional trials at The Rodale Institute Research Farm.

- Documented equipment modifications and changes in soil quality, yields, input costs, labor and other variables on each of the test farms.

- Published the results and facilitated information exchange through New Farm.org, a how-to video, handbooks, technical specifications, conferences, trade shows and field days.

Researchers and our farmer collaborators have seen both successes and failures in the system across various crops and seasons. These results prove once again that, when dealing with innovative technologies, a broad approach is needed over multiple years to tease out the challenges growers can expect to see during their adoption phase and what adaptations will need to be incorporated in the system.

Activities for 2008

The growing season for 2008 saw many successes but also brought new challenges to light across all regions. Here at the Rodale Institute, we suffered through another unusual weather pattern in 2008. We started the season with normal temperatures but then fell into a cold wet period followed by above normal temperatures and extended dry periods, all of which disrupted the normal flowering period of many of the cover crops. This delayed the roller/crimper operations and reduced the impact of the activity allowing the cover crops to re-grow. The rye/soybean work continues to show the most promise in all regions with predictable results based on cover crop density and access to adequate water. Legume cover crops used for peanuts, cotton and corn seem to be less predictable and will require further research. Several growers have identified the need for new cover crop varieties bred specifically for traits of early flowering and winter hardiness to build in more predictability into the no-till system. To that end, work with Dr. Thomas Devine (USDA-ARS, Beltsville MD) has led to the release of the cultivated hairy vetch variety “Purple Bounty” in March 2007 that is now available to growers and is going through a seed increase program.

Purple Bounty was bred to flower early and survive winter in the northern United States, as requested by growers. Breeder's seed of Purple Bounty will be maintained by the Sustainable Agricultural Systems Laboratory, Animal and Natural Resources Institute, USDA-ARS, Beltsville, MD. Purple Bounty seed will also be deposited in the National Plant Germplasm System where it will be available for research purposes, including development and commercialization of new cultivars. Protection for Purple Bounty will be sought under the Plant Variety Protection Act.

For 2008, USDA-NRCS extended our project for an extra year through December 31, 2008, enabling us to work through another complete field season. This positioned our project to improve and enhance its impact in several ways. First, our team of collaborators and their farmer cooperators got another year of experience using the roller/crimper tool. Second, we were able to collect another year's worth of valuable data to help develop farmer recommendations. And we positioned the project to contribute to farmer adoption rate of the technology by writing an addendum to an existing Production Practice Standard, contribute to the writing of a Job Sheet and develop supporting technical notes. We also used this opportunity to create a book on the subject of using cover crops in conjunction with the roller/crimper as a means of using no-till to establish cash crops.

During the first quarter of 2008, we wrote the proposal for the book. This included the justification for the resource, the biography of the authors, an expanded table of contents, a list of references, and the first two chapters of the book. We also created a list of potential publishers for the work. We met via telephone with NRCS staff to discuss a proposed course of action regarding the inclusion of the information generated in this project into production practice language, technical notes, and job sheets.

On a separate note regarding the production of the roller/crimper tool; I & J Manufacturing (a small fabrication shop located in Lancaster County, PA) has been building a roller/crimper based on the Rodale design for several years. In the spring of 2008 the owner contemplated an expansion of his shop area to accommodate the production demand. This is a case of identifiable rural development which was spurred by the allocations of these grant funds.

I&J Manufacturing built 55 rollers in 2008 and well over 100 since the initiation of this project. (As of writing time, I&J has also taken order for 40 more rollers, received since the beginning of 2009.) Several of these rollers were sent to research stations around the United States where they are being utilized to develop systems of cover crop management without tillage across many farming systems. Several more rollers were sent overseas, while most went directly to farmers who are adopting the system into their own operations. This is the most exciting outcome we could have hoped for.

Information Dissemination and The New Farm Website:

Information dissemination on our project continues to be a priority. The Rodale Institute continues to outreach the technology, knowledge and viability of the roller through the Rodale Institute website (http://www.rodaleinstitute.org/no-till_revolution), national and regional farm media (print, radio and TV), tradeshows and field days.

In the last quarter of 2007, we finished our educational DVD and one-page fact sheet on the roller/crimper. These tools were the cornerstone of our outreach program for the winter conference season. We showed the DVD on a large-screen monitor to thousands of conference attendees via rented booth space in exhibit halls and handed out hundreds to interested farmers.

As reported previously, journalists on our Communications staff created and launched a No-Till webpage that can be accessed through http://www.rodaleinstitute.org/no-till_revolution. The webpage features articles written by our staff on the progress of the project as well as other stories related to cover cropping and reduced-input, no-till farming. Since its initial web posting in April 2005, there have been over 75,000 visitors and over 160,000 page views for the no-till content. This trend shows no sign of slowing, as both January and February 2009 both registered over 8,000 views.

The page pulls together a wide range of resources related to organic no-till and biological-based weed management, including:

- a review article on the history of conservation tillage,
- a description of the development of The Rodale Institute's roller,
- guidelines for working with cover crops,
- profiles of No-Till Plus project participants,
- a no-till online resources list,
- a photo gallery of existing roller/crimper tools,
- a No-Till Plus discussion forum,

and much more. This particular page is one of the most targeted resource pages on our web site. Many users have commented on the depth and usefulness of information contained here.

The online No-Till discussion forum continues to be divided into four sections – General, No-Till Equipment, Cover Crops and Rotations, and All Organic. The No-Till Equipment section is the most popular, with over 84,859 views of posts listed as of March 2009. The General section is equally popular, with over 81,860 views, followed by Cover Crops and Rotations, and All Organic with over 54,380 and 33,490 views, respectively.

The Frequently Asked Questions (FAQ) section of the No-Till Plus page, launched in October 2006, addresses popular reader questions about no-till. This page answers 15 common no-till questions, and as of December 31, 2008 has registered over 5,060 visits.

Further evidence of interest in the project is in the high number of readers who have registered to download the free plans for the no-till roller available in PDF format on the

Rodale Institute's website. Since the plans were made available in May 2006, we have received over 930 registrations from farmers and other agriculture professionals from the United States, Canada, and 38 other countries including: Afghanistan, Algeria, American Samoa, Australia, Brazil, Denmark, France, Ghana, Greece, India, Netherlands, Nigeria, Pakistan, Panama, Philippines, Russia, South Africa, UK, Zimbabwe. The registered users manage almost 653,000 acres of land combined.

We will continue to track the project via the pages of our website to keep readers informed of our progress and involve them in project developments. We will be using our No-Till forum page as a discussion board for those interested in no-tilling into cover crops and to link the farmers and researchers involved in this project to the broader no-till community. We have also posted collaborators' progress reports to the website to keep all our readers up to date with the current status of our work.

Other Outreach Efforts via Field Days and Conferences:

Throughout the course of this project, over 100 presentations have been given at workshops, conferences and field day events by either Rodale Institute staff, one of the collaborating researchers or a farmer cooperator involved with this project. Thousands of farmers, researchers and individuals representing many organizations have been exposed to the information generated by this grant.

As one of our collaborators (Dr. Jeff Mitchell, UC Davis) said, "This project has done more to mobilize interest in a new agricultural topic than anything they've seen in their career." In 2008, field day/outreach events were held in every one of the 7 regions of this project area. They include events in Maryland (see attached photos), Pennsylvania, Virginia, Georgia, Iowa, Michigan, North Dakota, and California. While many farmers outside these geographic areas have implemented this technology on their farms, the adoption rate in the regions supported by this project has been greater, as documented by roller sales. This is a strong indicator that when research and outreach projects are supported in a specific region, the impact there is greater. Below is a short list of some of the outreach events:

- **May 2008** – Field Day event, Bill Mason Farm, Queen Anne, Maryland
- **July 2008 –** Rodale Institute Field Day, Kutztown, Pennsylvania; Guest Presenter Dr. Ron Morse (Virginia Tech)
- **July 2008 –** Lamberton, Minnesota Field Day event
- **October 2008** – Sunbelt Ag Exposition, Moultrie, Georgia
- **October 2008** – Carolina Farm Stewardship Annual Conference, Anderson, South Carolina

It was clear from all these events/workshops and field days that farmers need technologies that will reduce their energy consumption, improve their soil, and reduce their need for chemical weed control strategies. The information generated lively discussions in every venue.

Objectives accomplished in 2008; No-Till Plus –Phase II:

We used the project extension to collect another year of field data on the roller/crimper across all regions of the country as each of the cooperators continued their field trials. We also expanded the research umbrella to include new players like North Carolina State University (NCSU), the University of Wisconsin (UW) and Penn State University (PSU). These were activities we didn't anticipate when we initiated this project four years ago. The information gained from all the field trials points to the need for further research on specific cash crop/cover crop interactions, and on the timing of specific management practices. As we move forward to promote this technology, we'll also need to seek solutions to unanticipated challenges that may come up in crop-specific systems regarding insect or disease management.

We will continue to disseminate information via the very useful DVD, and our continued findings and results will be promoted widely through our array of media and venues – from tradeshows and field days to web sites and national and regional farm publications.

Along with these outreach activities, we are channeling this information into a book format to be utilized by farmers as a reference manual and by institutions of higher learning as a text book.

No-Till Plus - Phase II objectives were as follows:

Objective One: To package current result information along with newly collected data into USDA-NRCS formats that will facilitate the writing of an addendum to an existing standard. This shift in effort allowed us to build on our previous work in a manner that has a direct impact on farmer adoption rates of this useful technology. By being included in the list of production practice standards, farmers who are interested in adopting this technology will be eligible for cost sharing opportunities. The mere fact that this technology will become a USDA-approved practice, coupled with possible cost sharing opportunities, makes the system very attractive to farmers looking to reduce or eliminate herbicides and nitrogen fertilizers while promoting on-farm soil building through the intensive use of cover crops.

The addendum is currently being revised to include edits and comments from the National Agronomist (Norm Widman) and NRCS offices. We are continuing to build on our previous no-till research by working closely with NRCS staff to write language into one of their production practice standards, job sheets and technical notes, making it possible for farmers across the country to gain access to information and possible cost sharing, in order to acquire their own roller. This work should speed the adoption rate of this valuable technology. Even though the funding period is over for this project we will see this activity through to completion by the end of 2009.

Objective Two: Write a book/manual on use of roller crimper technology for management of cover crops. Throughout 2008, we worked to write the text of a book on use roller/crimper technologies to manage cover crops without tillage. The manuscript has been completed and submitted for publication. Though several competent publishers were interested in producing the book, after much discussion we decided to partner with Acres USA to create this publication. This decision was based not only on their proven ability to produce quality books, but also on their demonstrated marketing ability. We will continue our efforts to promote roller-crimper through the Rodale Institute web site, national and regional farm media (print, radio, TV), the "how-to" video, technical specs and conferences, tradeshows and field days. A copy of the book table of contents is attached for your review.

The Rodale Institute has developed sophisticated print, web, and broadcast outreach, as well as educational tools that we use to reach producers and their support systems (such as agricultural associations, relevant trade media, and extension). We will employ these outreach venues, as well as the web sites of companies that provided in-kind or financial support to this project, to promote the video and web-based materials (research, analysis, farmer profiles, photo essays) developed in Phase I, as well as the book and Practice Standard Addendum to be developed in Phase II.

As mentioned above, project outcomes were also presented to interested farmers, extension agents, other agricultural professionals, policy makers and members of the public at annual field days held in each research region and at the Rodale Institute. At each location, field day activities were planned, publicized, and coordinated by the regional project collaborator, with assistance from the Rodale Institute as needed. The goal of these field days was to give local farmers the opportunity to see organic no-till equipment and practices in action, and to exchange ideas and information to further improve the efficacy of these practices in their area.

We worked with regional collaborators to develop and administer field day participant surveys customized to each event. We then interpreted the collected data to assess the impact, strengths and weaknesses of the activity. These survey data were then shared among the collaborators to improve the quality of the field day activities as the project progressed. Surveys taken from participants of the Institute's July 2008 Field Day on Cover Crops, Weed Management, and Organic No-Till Systems (drawn from 63 of the 93 field day attendees, for a response rate of 68%) showed that:

1) 87% of respondents were considering use of cover crops as a result of the event;
2) 68% were planning to use or promote other sustainable practices offered at the event; and
3) Participants wanted more information and assistance to help them move forward with those practices.

Suggestions for future field days included small classes with hands-on instruction, specific guidance from an email consultant, reports on cover crop planting dates, rates, and equipment design for no-till systems, and more information, including classes, on the web. We often heard comments like "this was the most interesting and useful field day

event I ever attended". Comments like this, along with the exit survey data have proven useful in steering this work and the continuation of similar efforts.

We are currently working on several peer-reviewed publications that will summarize the research data from this project. By conveying project information and conclusions to the scientific community, agricultural researchers will be able to build on project findings and develop new avenues of organic no-till experimentation.