

Crop Production Systems Technology Transfer Project – Phase II

Introduction

The No-till Systems Technology Transfer Project was initiated in May 1997 for a two-year trial period. The success of the project (see attached Project Accomplishments – May 1997 to March 1999) has encouraged the newly founded conservation partnership to sustain its alliance by supporting Phase II of the No-till Systems Technology Transfer Project. Phase II of the project will consist of a two-year continuation starting in May 1999. Similar to the initial phase of the project, Phase II will continue to transfer technology through the 11 established teams across the state.

The *Hughes County Conservation District* in partnership with the USDA-Natural Resources Conservation Service (NRCS), SDSU Cooperative Extension Service (SDSU-CES), SDSU Agriculture Experiment Station (SDSU-AES), SD No-till Association, and Ducks Unlimited are the project sponsors.

Statement of Need

There are currently an insufficient number of individuals in South Dakota with the level of training and experience needed to assist farmers in making the switch from a conventional tillage system to an economically and environmentally viable no-till system. Operators cannot afford to learn through trial and error. They need planning and application assistance to properly implement an intensive no-till system. To attain the needed technical capability to assist these producers in a quality manner, additional personnel trained in the application of a "SYSTEMS" approach to no-till are needed in South Dakota.

Background

Cropping systems designed to leave large amounts of surface residue, especially no-till, have the ability to stop soil degradation processes and minimize ecological concerns if they are properly applied. Crop residue management can substantially reduce erosion. However, if other changes are not made along with the reduction in tillage, the increased residue can lead to pest problems, seeding equipment problems, poor seedling emergence, and phytotoxicity which in turn can result in negative economic impacts. Widespread adoption of sustainable practices hinges on implementing no-till systems that are at least economically comparable to commonly used tillage systems and successfully transferring no-till system technology to producers in South Dakota.

The difficulty in implementing the necessary technology transfer process lies in the material which needs to be transferred. Changing from a tilled system to one which does not use tillage brings about profound changes in all components in the farming system. Therefore, by necessity, innovative producers and research farms have employed a SYSTEMS approach where any change in one component was viewed in relation to how it affected other components and the system as a whole. Similarly, farmers wishing to make this change must utilize a systems approach in their component selection process. This means that not only the interested farmer but also the extension, agency, and industry personnel need to be trained on successful no-till SYSTEMS. Traditional methods of technology transfer focus predominately on components (soil fertility, machinery, weed control, diseases, soil conservation, etc.) and have worked quite well for the producer making incremental changes to established systems. SDSU(CES) specialists will play a valuable role in helping producers switching to no-till select appropriate choices; and will help fine tune the system once the switch is made.

Project Work Plan

The overall goal of the project is to improve the capabilities of the cooperating agencies and other people throughout South Dakota to provide information and technical assistance to producers on no-till cropping systems that are environmentally, agronomically, and economically sound. Phase II will continue to foster team development and increase the knowledge level of team members in developing no-till systems that provide a healthy environment.

Phase II will focus on transferring technology in four main areas:

1. Crop Production Systems Emphasizing No-till
2. Water Quality
3. Soil Quality
4. Precision Farming

1. Crop Production Systems Emphasizing No-Till

The progress made in developing a “farmer-to-farmer” network and educating the team members of the principles and practices of no-till systems has been successful. However, applying and tailoring the “basics” to individual regions across the state has been difficult and challenging due to the limited two-year time frame outlined in the initial project proposal.

Objective 1: To provide assistance in developing and implementing improved crop production systems emphasizing no-till systems in eastern South Dakota.

The number of no-till acres in eastern South Dakota has stagnated over the last few years as compared to other areas of the state. This stagnation can be attributed to the lack of adequate crop rotations and increased precipitation and their affects on overall farm profitability.

Current suggestions to attempt to increase the amount of no-till acres in eastern South Dakota are to:

1. Incorporate a small grain and/or perennial crop into the corn-soybean rotation.
2. Utilize cover crops and/or double crops in rotations containing small grains.
3. Attempt to plant a portion of the small grain acreage via dormant seeding.
4. Strip tillage vs. no-till trial comparisons.

These suggestions are believed to alleviate the problems associated with short rotations, increased wetness problems associated with no-till systems in the tall-grass prairie regions, and economic feasibility of alternative crops in eastern South Dakota. The suggestions could be accomplished at a SDSU research farm located at Beresford and/or at Lake Area Technical Institute (No-till farm) in Watertown and/or lead producer places throughout the eastern part of the state.

Activities/Action Items:

- 1) Work with 4 lead producers in eastern SD to: a) incorporate a small grain in their no-till systems and plant a portion of the small grain acreage via dormant seeding methods and b) incorporate cover crops and/or double crops to increase crop rotation intensity.

RESPONSIBILITY

Jason Miller, NRCS,
DU Project Agronomist in cooperation
with SDSU(CES) Specialists,
Selected Lead Producers

2) Hold six region specific (county cluster) workshops that will provide SYSTEM components (fine tuning) for lead contact personnel at lead producer's farms and at research and demonstration sites throughout South Dakota. Topics identified by team members (to date) to be covered at these workshops include: Alternative crops and crop rotations (Diversity index and intensity rating), equipment modifications and row spacing affects and costs, ag waste management, precision farming technology and application, dormant seeded small grains, cover crops, strip tillage vs. no strip tillage.

RESPONSIBILITY

Jason Miller, NRCS, in cooperation
with SDSU(CES) Specialists,
Selected Lead Producers

3) Develop economic case studies of cropping systems in eastern SD.

RESPONSIBILITY

Doug Vik, NRCS,
Jason Miller, NRCS,
with SDSU (CES) economist,
Lead Producers

4) Assist and promote the Ducks Unlimited "Cropland Initiative Pilot Program" in northeastern SD. Coordinate no-till systems technology transfer activities in conjunction with the Cropland Initiative Pilot Program.

RESPONSIBILITY

Jason Miller, NRCS, in cooperation
With Ducks Unlimited

5) Develop no-till equipment modification handbook and video.

RESPONSIBILITY

Dr. Bill Campbell, SDSU,
Dr. Dwayne Beck, SDSU(AES)

6) Work with SD Corn Growers Association and SD Soybean Council to identify 2 willing producers in eastern SD to conduct on-farm research of alternative methods to achieve proper crop rotation intensity. Alternative methods will include side-by-side comparisons of tile drainage versus incorporating cover crops and/or double crops in the crop production system. Research data, such as, stand establishment, plant health, crop yield, crop quality, and water quality will be used for evaluation criteria.

RESPONSIBILITY

SD Corn Growers Association,
SD Soybean Council,
Jason Miller, NRCS,
DU Project Agronomist,
SDSU(CES) Specialists,
Identified Lead Producers

Activities 1-6 will demonstrate to producers in eastern South Dakota the importance of diversified crop rotations and cover crops in successful no-till systems. These activities will result in producers implementing no-till cropping systems that are environmentally, agronomically, and economically sound in eastern South Dakota.

See attached “No-Till Systems Technology Transfer Project - Training Sessions” document for Rural Development Telecommunications Network (RDTN) and In-Field Workshops for topics, dates, and instructors. RDTN will be utilized to reduce instructor’s travel expenses and maximize staff time.

Objective 2: To provide assistance in developing and implementing improved no-till systems in central and western South Dakota.

The number of no-till acres in central and western South Dakota has steadily increased over the last few years. However, if young, poorly developed no-till systems are being implemented in these areas; success can quickly become failures resulting in a decrease of no-till acres without adequate assistance. Poorly developed no-till systems in central and western South Dakota lack adequate crop diversity and intensity which can significantly affect overall farm profitability.

Activities/Action Items:

1) Hold six region specific (county cluster) workshops/tours that will provide SYSTEM components (fine tuning) for lead contact personnel at lead producer's farms and at research and demonstration sites throughout South Dakota. Topics identified by team members (to date) to be covered at these workshops include: Alternative crops and crop rotations (Diversity index and intensity rating), equipment modifications and row spacing affects and costs, ag waste management, precision farming technology and application, and dormant seeded small grains.

RESPONSIBILITY

*Jason Miller, NRCS, in cooperation
with SDSU(CES) Specialists,
Selected Lead Producers*

2) Develop economic case studies of cropping systems in central and western SD.

RESPONSIBILITY

*Doug Vik, NRCS,
Jason Miller, NRCS,
with SDSU (CES) economist,
Lead Producers*

3) Work with SDSU on developing soil moisture guidelines for central and western South Dakota.

RESPONSIBILITY

*Dr. Tom Schumacher, SDSU,
Jeff Hemenway, NRCS*

4) Develop no-till equipment modification handbook and video.

RESPONSIBILITY

*Dr. Bill Campbell, SDSU,
Dr. Dwayne Beck, SDSU(AES)*

Activities 1-4 will demonstrate to producers in central and western South Dakota the importance of adequate crop diversity and intensity in successful no-till systems. These activities will result in producers implementing no-till cropping systems that are environmentally, agronomically, and economically sound in central and western South Dakota.

See attached “No-Till Systems Technology Transfer Project - Training Sessions” document for Rural Development Telecommunications Network (RDTN) and In-Field Workshops for topics, dates, and instructors. RDTN will be utilized to reduce instructor’s travel expenses and maximize staff time.

2. Water Quality

“No-till systems reduce soil erosion and water runoff of pesticides, both the sediment-adsorbed pesticide and the dissolved pesticide. In fact, no-till has sometimes resulted in complete elimination of pesticide runoff from fields.” “Additionally, more microbes live in carbon-rich soils to quickly degrade pesticides and better protect groundwater quality.” (Source: CTIC, ‘Conservation Tillage: A Checklist for U.S. Farmers’)

However, research on the impacts of surface applying livestock animal waste in no-till systems conclude conflicting results. Some research indicates that surface applying composted livestock waste in no-till systems presents no environmental concerns; while other research indicates surface applying livestock waste in no-till systems will be detrimental to water quality.

The Clean Water Action Plan (CWAP) has required the USDA and EPA develop a Unified National Strategy to minimize the water quality and public health impacts of animal feeding operations (AFOs). A draft strategy has been developed that establishes national performance expectation that all AFO owners and operators develop and implement technically sound and economically feasible Comprehensive Nutrient Management Plans (CNMPs). A CNMP includes the following: 1) feed management, 2) handling and storage strategies, 3) land application plans, 4) land management, 5) recordkeeping, and 6) plans for alternative manure uses.

Current suggestions to ensure surface water quality preservation in no-till systems and Unified AFO Strategy compliance are to:

1. Encourage and support SDSU research on impacts of the application of livestock animal waste in various tillage systems in South Dakota.
2. Demonstrate (liquid waste) subsurface injection machinery.
3. Provide information to producers about proper livestock waste management in crop production systems.

Objective 3: To identify and address potential surface water quality concerns (nutrient management – livestock waste management) in no-till systems in eastern South Dakota.

Activities/Action Items:

- 1) Assist in demonstrating improved Best Management Practices for livestock waste application in no-till systems by holding 3 livestock waste application equipment demonstrations.

1. Dakotafest demonstration

RESPONSIBILITY

SDUS(CES) Bill Campbell

NRCS Nutrient Mang. Team

Jason Miller, NRCS

Doug ViK, NRCS

Econ. SDSU-CES Specialist

- 2) Develop economic case studies of livestock waste handling options.

RESPONSIBILITY

SDUS(CES) Bill Campbell

NRCS Nutrient Mang. Team

Jason Miller, NRCS

Doug ViK, NRCS

Econ. SDSU-CES Specialist

3) Gather, organize, and/or develop and disseminate information regarding proper livestock waste management in no-till systems. Information, such as, proper composting procedures and the development of a database of active livestock composting facilities.

RESPONSIBILITY

SDUS(CES) Bill Campbell,

Chuck Ullery

NRCS Nutrient Mang. Team

Jason Miller, NRCS

Doug ViK, NRCS

Activities 1-3 will demonstrate proper livestock waste management in no-till systems to producers in eastern South Dakota. These activities will result in producers implementing no-till cropping systems that are environmentally, agronomically, and economically sound in eastern South Dakota.

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3. Soil Quality

Soil quality or soil health can be defined, simply as, the ability of the soil to function. Properly designed no-till systems implemented on cropland fields that have a history of tillage are expected to increase soil health. However, it is not exactly known how, what, and why no-till systems positively impact soil quality properties on a given soil and if the soil health can be returned to the quality as it was prior to human impacts.

The impacts of properly designed no-till systems on soil health are (Source: CTIC):

1. **Improved long-term productivity** – Carbon in the soil accounts for about half of the organic matter. The latest research shows the less you till, the more carbon you keep in the soil to build organic matter and promotes future productivity.
2. **Improved water quality** – Crop residues help hold soil particles and associated nutrients and pesticides on the field – cutting herbicide runoff rates in half. Additionally, more microbes live in carbon-rich soils to quickly degrade pesticides and better protect groundwater quality.
3. **Reduced soil erosion** – Crop residues on the soil surface reduce erosion by water and wind. Depending on the amount of residues present, soil erosion can be reduced by up to 90% compared to an unprotected, intensively tilled field.
4. **Improved soil tilth** – No-till increases soil particle aggregation (small soil clumps) which makes it easier for water to move through the soil and allows plants to use less energy to establish roots.
5. **Reduced release of carbon gases** – Less tillage keeps naturally occurring carbon in the soil for use as organic matter. Intensive tillage releases soil carbon into the atmosphere as carbon dioxide where it can combine other gases to contribute to global warming.

Objective 4: To assist project sponsors (SDSU and SD No-till Association) in identifying the impacts of no-till systems on soil quality properties and overall farm profitability and transferring this information to producers in central South Dakota.

Activities/Action Items:

1) Serve as a liaison for the International Arid Lands Consortium grant researchers and selected lead producers. Develop no-till technology training materials and activities designed for individuals involved with technology transfer. Develop case studies from the information gathered from grant participants demonstrating the economic impacts of no-till systems.

RESPONSIBILITY

Jason Miller, NRCS

Tom Schumacher, SDSU

Mike Lindstrom, ARS

Doug ViK, NRCS

SDSU-CES Econ. Specialist

2) Hold 2 in-field soil quality workshops for project team members demonstrating soil quality measurements and interpretations.

RESPONSIBILITY

Soil Quality Team, NRCS

Jason Miller, NRCS,

Lead Producers

Activities 1-2 will identify and quantify soil quality parameters of various tillage systems in central South Dakota.

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4. Precision Farming

The goal of precision farming (site-specific management) is to manage each parcel of agricultural land appropriately while protecting or improving natural resources. Site specific farming strategies preserve or improve environmental quality through the use of economically-based practices such as integrated weed, nutrient, and insect management plans that account for field variability. Site-specific farming allows the producer to develop a knowledge base to ultimately apply the right management, at the right place, in the right way. It has been estimated, approximately 3-5% of the producers in South Dakota are using precision farming activities.

Some precision farming activities include using: topographical information, soil electrical conductivity, aerial/satellite NIR imagery, and digitized orthophotoquads to identify **management zones** (areas having similar soils and productivity potential); global positioning system (GPS) and yield monitor to generate yield maps; variable rate planting, fertilization, and herbicide application to target inputs where they are needed; and detailed economic analysis prior to making management decisions concerning fertilizer and herbicide applications.

Objective 5: To inform and educate crop production project team members of the technology and application of precision farming (site-specific management) in South Dakota.

Activities/Action Items:

1) Hold 2 workshops for project team members on precision farming technology and application.

RESPONSIBILITY

SDSU(CES) G. Carlson

Jeff Hemenway, NRCS

Jason Miller, NRCS,

2) Hold 2 in-field workshops at lead producer's farms and/or research farms to demonstrate hands-on the technology and application of precision farming.

RESPONSIBILITY

SDSU(CES) G. Carlson

Lead Producers

Jeff Hemenway, NRCS

Jason Miller, NRCS

3) Work with 4 lead producers with precision farming background to assess NRCS's soil databases and their applicability as a tool in the "precision farming tool box".

RESPONSIBILITY

Jerry Schaar, NRCS

SDSU(CES) G. Carlson

Lead Producers

It is anticipated that site-specific management will improve economics of crop production, while simultaneously decreasing environmental impacts. Activities 1-3 are designed to educate team members about the advantages, techniques, and equipment of site-specific management practices in South Dakota.

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Project Evaluation

The project will be evaluated based on information provided by program beneficiaries. Criteria that will be used includes:

1. Estimating the adoption of properly designed no-till systems in South Dakota via CTIC reports.
2. Completion of project activities.
3. Quality of the extension and education products developed.
4. Detailed critical analysis by farmer cooperators of demonstration activities conducted on their farms.
5. Number of collaboration projects conducted.
6. Findings from on-farm research and demonstration trials will be used to calculate potential impacts of no-till systems on South Dakota resources – soil, water, air, plants, and animals.
7. Determine the change in team member's skill level of the application and adaptability of no-till systems. Skill levels can be determined by: (1) workshop participation and (2) application of field-scale practices which were demonstrated by on-farm research.
8. Hits on the web pages which indicates the general interest of the project.

Project Budget

Milestone Table

01/12/00

8