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Adaptive Management for Conservation Practices

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Adaptive Management for Conservation Practices

Introduction

Adaptive management is a process of testing an idea (hypotheses) and learning from the experiences. Putting adaptive management within the context of conservation practices involves growers testing different ways to apply conservation practices on their land to adapt to site conditions and management style. Within NRCS conservation practices standards, there is a wide variation in how practices can be adapted to fit individual landscapes and management styles. The adaptive management concept is applicable to growers that are already using a given practice, but may be looking to improve the effectiveness of the practice, or can be useful for a producer using a practice for the first time to learn how best to apply that practice on their own unique landscape and their management style. The adaptive management process is used in normal day-to-day life as lessons are learned and processes are changed to improve efficiency.

This technical note offers an adaptive management approach that will enable growers to use a data-driven process to refine the application of conservation practices to better adapt to conditions encountered on their farms. The adaptive management approach can promote better conservation practice application on individual farms or throughout farming communities by means of systematic and user-friendly evaluations. The approach is effective on an individual farm. However, if resources are available, the approach is most effective when multiple farms evaluate one practice.

The adaptive nutrient management approach can be used to—

- Learn how best to apply a given conservation practice on an individual operation.
- Learn how to expand the application of a given conservation practice on an individual operation.
- Evaluate new technologies related to a given practice.
- Test and evaluate the performance of new tools or techniques to apply a given practice.
- Evaluate postseason site-specific data that can be used to establish future practice application methods.
- Establish groups of growers who cooperate with conservationists or consultants to learn together from results of evaluations on their farms.

Definition of Adaptive Management

Adaptive management is a process of testing an idea to evaluate and adjust the application of a conservation practice over multiple seasons. The process allows for continued adjustments of the NRCS conservation practice standards to achieve better practice efficiency.

State-approved adaptive management activities are considered to be part of the conservation practice implementation on a given land unit and part of the conservation planning process.

The Adaptive Management Process – Plan, Review, Learn, Adapt

Adaptive management is a systematic process to collect, monitor, analyze, and learn from results of evaluations of practices conducted on growers' fields. The goal of the adaptive management approach is to test and evaluate how a practice can best be applied on a given farming operation or site condition. Adaptive management differs by explicit and systematic incorporation of the evaluation as part of the planning process, then learning from the results to improve management in current and future years.

Adaptive management requires evaluation at least once a year when a crop is harvested or other measureable monitoring result of applying the practice

(e.g., wildlife counts, percent germination, plant establishment success, yield, ground cover, pest control, water infiltration, soil aggregate stability, etc.). For some practices, multiple measurements may be needed throughout the year. When a group of growers is involved in the adaptive management process, the most critical review takes place when a group of growers meet as a group or one-on-one with an advisor to discuss the results of the evaluations and ways to adapt management in the next season to increase efficiency.

How the Adaptive Management Process Works

Adaptive management is a process for evaluating and adjusting the management of conservation practices based on data collected at the field level following a set of protocols. Adaptive management (figure 1) can help growers make better-informed decisions on how best to apply a given practice to achieve the grower's objective and natural resource treatment.

Four basic steps are involved:

Step 1.—Develop the plan for the evaluation.

Step 2.—Implement the nutrient management plan.

Step 3.—Evaluate the plan based on lessons learned.

Step 4.—Adjust the nutrient management.

Adaptive Management Process

Adaptive management is an ongoing evaluation and learning process. Specifically, adaptive management tailors the practice application for the grower's unique farming operation. The evaluation helps growers to better tailor conservation practices that are best suited to their operations to address identified natural resource concerns.

Adaptive Management Protocol

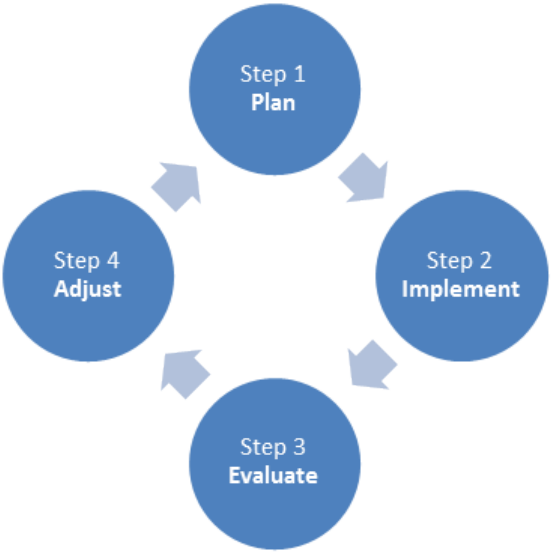
To make meaningful adaptive management decisions, a grower needs reliable data. The following is a how-to guide for farmers and professionals relating how to implement the adaptive management process. This protocol provides—

- A process and the guidelines for making objective evaluations.
- A process for learning from the results of the evaluations.
- Guidance relating how the adaptive management process can be used to evaluate new practice application strategies.

Growers can use on-farm field trial procedures to evaluate various conservation practice applications. By following the on-farm field trial procedures in this document, growers can objectively conduct a field trial on their land, interpret the results, and make adaptive management changes to their conservation practice strategy. Example evaluations may include evaluating different species of cover crops, different termination methods of cover crops, cover crop versus no cover crop, wildlife habitat, irrigation techniques, no till planting versus convention till planting, no till versus mulch till, grazing periods and recovery periods, crop rotations, integrated pest management strategies, mulch A versus mulch B, etc.

On-farm field trial comparisons need to be carefully planned to produce credible results. A simple side-by-side comparison of two different management systems will not provide the credible data needed to make informed decisions regarding changes in future management. Reliable data are also important to document changes across years in support of longer term practice planning.

Figure 1 Adaptive management process



Conducting on-farm field trials requires—

- Developing a hypothesis—"If I make this change, I expect these results."
- Planning of replicated plot trials.
- Determining the resources needed to carry out the plot trials.
- Measuring or "laying out" the replicated plot trials in the field.
- Collecting data important to evaluation of your hypothesis (may involve multiple data collections throughout the year).
- Analyzing the data collected.
- Summarizing of the data and conclusions.

Step 1: Develop the hypothesis.

Example hypothesis: Growing a cover crop after wheat harvest will improve the yield of the corn following the cover crop.

Step 2: Plan the replicated plot trials.

The plots must be randomized to minimize the bias contributed by differing soils, topography, pest infestations, etc., that may be present on one plot and not another.

Plot trials should have at least four replications. The minimum is three for confident analyses. Four replications increase the ability to detect changes due to treatment differences. Additionally, the fourth replication allows for the loss of one plot due to weather damage, pest problems, etc. Each treatment or plot in the replication is monitored per the established measurement (weight, plants per square foot, percent ground cover, number of nests, yield, etc.). The measured data for each treatment and replication are then averaged and the treatments are compared. The typical layout for a comparison for two treatments would look like the example in table 1.

Because of variations in year-to-year weather, pest problems, etc., the replicated plots should be conducted for at least 3 years to properly account for these variations. The reliability of the data can also be enhanced by increasing the number of identical plot trials. One way is to partner with neighbors who would evaluate the same variables on their farms having similar management systems and soils. This also increases the learning that occurs through the sharing of results, evaluations, and discussion of adjustments they may consider.

Individual plots should be planned to accommodate the width of the equipment that will be used in the plots. Typically, a plot width is twice the width of the harvest equipment. Depending on the evaluation being conducted the replicated plots may not always be side by side. For example, with grazing or wildlife evaluations the plots may be somewhat isolated from one another.

Step 3: Determine the resources needed to carry out the plot comparisons. Consider the following:

- The equipment to establish, manage, and monitor the plots.
- The materials to identify the boundaries of each plot. Markers should be easily found and identifiable throughout the season. A plot map should clearly indicate the boundaries and treatments applied.
- GPS requirements, if used.
- Calibrate the application equipment, harvesting equipment, weigh wagons, monitoring devices, etc.
- Plan for the proper equipment to accurately measure the required data elements.
- Determine the need for supplies associated with record keeping, recording, or evaluating data.

Table 1 Plot trial with two treatments replicated four times

Replication 1		Replication 2		Replication 3		Replication 4	
B Treatment	A Treatment	A Treatment	B Treatment	A Treatment	B Treatment	B Treatment	A Treatment

- Plan for the required analysis of plot results, including an evaluation of least significant difference (LSD). You may need a consultant or university expert assistance to properly analyze the data collected.

Step 4: Lay out the replicated plots.

- The replicated plots must be laid out in widths or areas based on the evaluation being conducted. Typically, the most limiting piece of equipment or management criterion will dictate the width or area of the plot.
- The plots should be laid out where soils, fertility, slope, and drainage are as uniform as possible.
- Clearly stake out and mark all treatments. Do not rely on memory. GPS can be used in addition to markers to document treatments.

Step 5: Collect the data.

- Record all monitoring data and other associated variables as needed (e.g., weather, rainfall, etc.). This will help in the final analyses of the data.
- Ensure monitoring measurement equipment is properly calibrated (includes combine yield monitors, weigh wagons, moisture testers, etc.).
- Make plans on how the data will be recorded. It is best to develop a form or spreadsheet that can be used to record all the data completely and uniformly.
- Record the data in the planned format at the time of measurement.

Step 6: Analyze the data.

Quick observations of monitoring data without statistical analyses of the data can lead to false conclusions. The data collected from the replicated plots must be analyzed to determine if there were significant differences in treatments. The LSD tool is often used to evaluate significant differences when plot results are compared.

Tables 2 and 3 and the following procedure are adapted from the "On-Farm Research Guidebook" (Anderson 1993) (Available at: http://www.aces.uiuc.edu/vista/abstracts/aGUIDEBK.html). These calculations illustrate how to record data and calculate the LSD.

To record and calculate the LSD (see table 2, sum of squares worksheet):

Step 1: Calculate the variance.

Variance = D^2 total = (r−1)

where

r = number of repetitions

D^2 total = 18.0

(r−1) = (4−1) = 3

18.0 / 3 = 6.0

Step 2: Calculate the variance of the means = variance ÷ r.

Variance 6.0 / r4 = 1.5

Step 3: Calculate the standard error.

Standard error = square root of the variance

Square root of 1.5 = 1.22 is the standard error

Step 4: Calculate the LSD.

a. Multiply the standard error in step 3 above by the appropriate t-value (confidence level).

b. Appropriate t-value found in table 3.

c. Use t-value = 3.18 (used an alpha of 0.05)

1.22 × 3.18 = 3.88 = LSD

d. Compare the LSD to the C average in table 2 = -8.0. Ignore the negative value. Since the C average of 8.0 is more than the LSD of 3.88, the observed difference is significant at the alpha level of 0.05 for the B treatment (cover crop).

Step 5: Application (Conclusion).—Growing a cover crop after the wheat harvest increased my corn yield.

Table 2 Example of worksheet (sum of squares calculation) (Anderson 1993)

	Treatments		Difference (C)	Deviation (D)	Deviation squared (D^2)
Blocks (r)	A No cover crop Bu/acre	B Cover crop Bu/acre	C = A – B	D = C – C average	D^2 = D × D
I	141	152	-11	-3.0	9.0
I	147	156	-9	-1.0	1.0
I	149	155	-6	2	4.0
I	151	157	-6	2	4.0
Totals	588	620	-32		D^2 total = 18.0
Averages	A = 146.5	B = 153.3	C = –8.0		

* N=Nitrogen

Table 3 Appropriate T-values

	T-Values		
Number of reps (r)	Alpha 0.05	Alpha 0.10	Alpha 0.30
2	12.71	6.31	1.96
3	4.30	2.92	1.39
4	3.18	2.35	1.25
5	2.78	2.13	1.19
6	2.57	2.02	1.16
7	2.45	1.94	1.13
8	2.37	1.90	1.12
9	2.31	1.86	1.11
10	2.26	1.83	1.10

Development of an Adaptive Management Program

The adaptive management process encourages active learning by doing and discussing new information about ways to improve the current practice either in groups or one-on-one with growers.

There are three general approaches for setting up the learning portion of an adaptive management program. The most effective approach is based on meetings of farmers in small groups to learn from the results of the evaluations of their practices. Two other approaches, not as effective as group meetings, but more effective than simply mailing the results of evaluations to farmers, are learning by individual growers when only their evaluations and field histories are available and learning by individual growers when summaries of evaluations and field histories from other farmers in the county, region, or State are available.

Meeting Rationale: Effective Learning for Effective Improvement

Improving management requires fine-tuning generalized recommendations usually from land grant universities or NRCS, which results in improvements in the practices being implemented by the growers on their farming operation. Both the fine-tuning and the changes involve learning new ideas and having the confidence to apply the new ideas. Learning and making changes are not easy for adults, especially when there is a risk of losing money. Recent advances in adult learning have shown ways to overcome the natural reluctance of adults to move beyond the safety of routine practices. One of the principle findings is that adults learn best when ideas and data are discussed in an interactive format. Traditional lecture and classroom-style training (including agricultural demonstrations and field days) are highly effective if a problem is well defined (such as information about corn hybrids), but less effective in helping adults develop proficiency in solving problems that are ill-defined and complex, such as cover crop management.

Cover crop management is not well suited to mailing results of evaluations to farmers for a number of reasons. The four primary reasons are as follows:

- There is no one “right” answer to the best species, method of establishment, termination time, etc.

- Solutions must be developed within the context and resources of farms themselves.
- Learning new approaches often requires "unlearning" old methods.
- Growers need direct, concrete evidence that new methods work.

There are a number of key steps in developing and implementing an adaptive management program: recruitment of farmers, implementation of the adaptive management practice by the farmers, analysis and summary of the data, and farmer discussion meetings and decisions about management changes.

Step 1: Recruit growers and consultants to work with growers.

Adaptive management is a process that is most effective when farmers are connected in a group, learning not only from evaluations from their own farm and fields, but also from other farms in the area. Individual farm data becomes significantly more meaningful when put in context of evaluations on other farms in the county or watershed. For example, results from a plot trial comparison on 1 farm are valuable, but it is much more meaningful if a similar comparison is done on 5 or 10 farms in the area.

An ideal group is a "mix" of growers that will stimulate engaged discussions of the management involved with the practices during the meetings that are a required part of the adaptive management process. This mix should include growers that are more willing to try new ideas or practices and ones more reluctant. The meetings serve as one of the main processes that make adaptive management an effective method for growers to learn about and then adopt improved management techniques and practices.

Growers do not need to be connected in a group for adaptive management to be effective. Meeting with growers one-on-one also is an effective method for farmers to learn from the evaluations of their practices. The farmers will have more confidence to make changes on their farms if summaries of evaluations completed on farms with identical or similar practices in the same county, region, or State are available. The key to all learning is have the results and field history information summarized for easy understanding and to discuss the information in the context of the growers' knowledge about their fields and practices.

Step 2: Implement the adaptive management plan and adaptive management practices.

After recruiting participants, next identify the management to be evaluated and the adaptive management tools to be used to conduct the evaluations, gather the necessary baseline information (field-by-field histories of management), and implement the practices identified in the initial management plan. There are usually two major types of practices implemented in an adaptive management program: 1) a practice that requires close cooperation between the farmer and a farm advisor, such as a plot trial, and 2) a practice that requires minimal cooperation and involvement by the farmer, such as an evaluation of the nutrient status of fields using tools such as soil testing, cornstalk nitrate testing, or aerial imagery.

Step 3: Analyze and summarize data.

Collected data must be summarized, analyzed, and presented in a format that gives context and meaning to the farmer. The most effective way to do this is to present the data (for an example of typical data, see Step 5, "Collect Data") in tables and graphs, which will then be used in the group meetings or when meeting with farmers one-on-one. The tables and graphs should display the data in three ways:

- Geographically.—By farm; by farms in a county, region, or watershed; by farms in a State; and, if two or more States are cooperating, by farm across States.
- According to Management.—Grouped by the practices being evaluated.
- Temporally.—By that individual year and cumulatively over multiple years. If one-on-one learning is planned by using results and field histories from only the farmer in the meeting, and then only summaries from one farm are needed. A technical advisor familiar with summarization of data in this manner should create the tables and graphs. The data should be examined for patterns in the assessments to identify categories that can reduce the variability of the assessments. Factors such as previous field history, manure or fertilizer management, weed infestations, etc., are used to search for categories to reduce variability.

To ensure productive discussions at the meetings, the technical advisor who analyzes the data should

send a concise hardcopy summary of the assessment results to the farmers and their advisors at least 1 week before the scheduled meeting. The advisor who will be leading the meeting should create and use an effective presentation or handouts to guide the discussion. It is helpful to present the most important results of the assessments, and then to show some individual farm results to engage the farmers in discussion.

Step 4: Conduct discussion meetings.

Program coordinators bring the growers together either in groups or in one-on-one meetings to discuss the results of the assessments. Meetings should be held at a convenient time for the growers. It is important to have a person who is both knowledgeable about the adaptive management tools and experienced in promoting discussions guide the meetings. The meetings should focus discussion on the categories of management shown by the assessments to have the greatest effect on practice efficiency in the field. Things to remember when planning meetings:

- Meeting Format.—There are various ways to set up the groups to encourage discussion. Groups can be composed of growers with similar knowledge about the test used for the assessment. This is effective because in the first year meeting much of the discussion is often about understanding the rationale for the test used in the assessments. In the second year, the discussion shifts to discussion about categories of data and what improvements can be made for more efficient practice management. Two other ways to set up groups are by geographic area such as a county or by commodity, such as having only dairy farmers in a meeting.

The ideal format for group meetings is for 15 to 30 growers to meet for 2 to 4 hours. This size and length is best suited for generating the two-way discussion needed for learning and understanding. Fewer than 15 farmers increases the cost per farmer, while meetings with more than 30 farmers make it difficult to stimulate the discussion needed for effective learning.

One-on-one meetings with growers should be designed to encourage discussion about how the results from evaluations match what the farmer thinks the results should be. Farmers, like all adults, need to time to explore new information that conflicts with or provides an alternative view of the most efficient practice or practices for their farm.

- Discussion, Not Lecture.—Unlike many grower educational efforts, adaptive management is a two-way discussion in which the grower plays a key part in the decision about what the information means and how to put it to the best use to improve management. As a result, an adaptive management leader is more of a facilitator than a lecturer.

Through practice, a leader will learn if a question should be answered with a question or should be answered with information. Questions about technical details of a test or procedure, such as a question about how a plot trial was established or how a sample for the corn stalk nitrate test was collected, should be answered with information. Questions about how a farmer should change a management practice based on assessments of that practice completed on the farmer's fields should be answered with a question.

For example, a farmer asks what rate of N should be applied to a field with 2 consecutive years of cornstalk nitrate concentrations greater than four times the threshold for excessive N availability. The answer should be a conversation with the farmer structured by a series of questions. Typical questions to the farmer could be:

- What rate of N do you think should be applied?
- What rate did you apply in the past 2 years?
- How confident are you in the results of the cornstalk test?
- How green was the corn a few weeks after tasseling?
- What is your perception of the amount of risk you would take if you reduced the amount of N applied by half?

The answers the farmer provides to the questions will guide the conversation. The conversation should end when the farmer has answered the question for him or herself. Following up with an endorsement of the farmer's decision will build confidence necessary to make decisions based on data from their farm, and foster a strong relationship between the group leader and the farmer.

- Being Prepared.—The leader should always have an available presentation with background information about assessments used to

improve the practice being discussed. Include all the slides shown at the earlier meetings describing the assessments and example slides of typical assessment results. The slides should be used to guide discussions and can be used to demonstrate important concepts. Examples of useful slides for enhancing learning could be slides showing the variability of N needs inside fields from assessments completed using active sensors of the greenness of corn, or a summary of results of plot trials completed in a State showing the yield response to three rates of N lower than the rate typically applied by the farmers in the group.

Summary

Adaptive management using the on-farm field trials protocol enables growers to make well-informed and documented decisions on how to adjust their management to be more profitable and sustainable. The protocol helps the grower establish and test a hypothesis in consideration of the biological processes taking place in their fields. The process provides an analytical method for determining if a significant difference occurred between the existing and proposed treatments.

Adaptive management is dependent upon following well-accepted protocols for planning and then evaluating accurate results. By following a well-designed planning and evaluation procedure, true differences among tested treatments can be determined, and superior management options can be determined, and superior management options can be selected and applied.

Reference

Anderson, D. 1993. On-Farm Research Guidebook. Department of Agricultural Economics. University of Illinois Extension, Urbana, IL.

Guide Sheet – Implementing Adaptive Management

Conservation Practice Standard Code 329 – Residue and Tillage Management, No Till

Introduction and Purpose

Adaptive management is a systematic process to collect, monitor, analyze, and learn from results of evaluations of practices conducted on growers' fields. The goal of the adaptive management approach is to test and evaluate how a practice can best be applied on a given farming operation or site condition.

The purpose of this guide sheet is to provide guidance to plan and implement adaptive management of the NRCS Conservation Practice Standard (CPS) Code 329, Residue and Tillage Management, No Till. An NRCS payment schedule scenario was developed within the CPS Code 329, Residue and Tillage Management, No Till, to provide financial assistance to support adaptive management.

Guidelines for Adaptive Management Application for No Till:

1. Follow the guidance in the Agronomy Technical Note 190-AGR-10, Adaptive Management for Conservation Practices.
2. The evaluation should be carried out for at least 3 years and preferably on the same area each year. There may be cases where this is not practical.
3. The application and hypothesis of at least one variable must address and meet the criteria and specifications of the CPS Code 329, Residue and Tillage Management, No Till, for at least one of the purposes. Example trials/evaluations may include:
    a. Compare no till vs convention till or mulch till.
    b. Compare no till in a cover crop to no till without a cover crop.
    c. Compare different no till or mulch till planter types or configurations (e.g., cross slot planter vs a hoe drill).
    d. Evaluate different coulter or residue clearing devices.
    e. Evaluate strip till vs no till.
4. The evaluation should include the services of a consultant with knowledge of no till farming to help plan the evaluation, layout the plots, monitor the plots during the season, assist in gathering the required data (yield, soil tests, residue counts, soil health measurements, etc.), and analyze the data that will support the purpose of the evaluation.
5. The evaluation can focus on one or more results, e.g., may collect data to not only address yield but also changes in soil health parameters (aggregate stability, infiltration, organic matter, etc.).
6. Analyze the data each year and at the end of the trial period, usually 3 years.
7. The annual and final results and analysis should be jointly reviewed with NRCS, the grower, and consultant involved.

Guide Sheet – Implementing Adaptive Management

Conservation Practice Standard Code 340 – Cover Crop

Introduction and Purpose

Adaptive management is a systematic process to collect, monitor, analyze, and learn from results of evaluations of practices conducted on growers' fields. The goal of the adaptive management approach is to test and evaluate how a practice can best be applied on a given farming operation or site condition.

The purpose of this guide sheet is to provide guidance to plan and implement adaptive management of the NRCS Conservation Practice Standard (CPS) Code 340, Cover Crop. An NRCS payment schedule scenario was developed within the CPS Code 340, Cover Crop, to provide financial assistance to support adaptive management.

Guidelines for Adaptive Management Application for Cover Crops:

1. Follow the guidance in the Agronomy Technical Note 190-AGR-10, Adaptive Management for Conservation Practices.
2. The evaluation should be carried out for at least 3 years and preferably on the same area each year. There may be cases where this is not practical.
3. The application and hypothesis of at least one variable must address and meet the criteria and specifications of the CPS Code 340, Cover Crop, for at least one of the purposes. Example trials/evaluations may include:
    a. Compare cover crop vs no cover crop.
    b. Compare species of cover crops.
    c. Compare a mixture of species of cover crops vs single species.
    d. Compare 2 different termination methods or times.
    e. Compare 2 different seeding methods.
4. The evaluation should include the services of a consultant with knowledge of cover crops to help plan the evaluation, layout the plots, monitor the plots during the season, assist in gathering the required data (yield, soil tests, residue counts, soil health measurements, plants per square foot, biomass produced, etc.), and analyze the data that will support the purpose of the evaluation.
5. The evaluation can focus on one or more results, e.g., may collect data to not only address yield but also changes in soil health parameters (aggregate stability, infiltration, organic matter, etc.).
6. Analyze the data each year and at the end of the trial period, usually 3 years.
7. The annual and final results and analysis should be jointly reviewed with NRCS, the grower, and consultant involved.

Guide Sheet – Implementing Adaptive Management

Conservation Practice Standard Code 345 – Residue and Tillage Management, Reduced Till

Introduction and Purpose

Adaptive management is a systematic process to collect, monitor, analyze, and learn from results of evaluations of practices conducted on growers' fields. The goal of the adaptive management approach is to test and evaluate how a practice can best be applied on a given farming operation or site condition.

The purpose of this guide sheet is to provide guidance to plan and implement adaptive management of the NRCS Conservation Practice Standard (CPS) Code 345, Residue and Tillage Management, Reduced Till. An NRCS payment schedule scenario was developed within the CPS Code 345, Residue and Tillage Management, Reduced Till, to provide financial assistance to support adaptive management.

Guidelines for Adaptive Management Application for Reduced Till:

1. Follow the guidance in the Agronomy Technical Note 190-AGR-10, Adaptive Management for Conservation Practices.
2. The evaluation should be carried out for at least 3 years and preferably on the same area each year. There may be cases where this is not practical.
3. The application and hypothesis of at least one variable must address and meet the criteria and specifications of the CPS Code 345, Residue and Tillage Management, Reduced Till, for at least one of the purposes. Example trials/evaluations may include:
    a. Compare no till vs reduced till.
    b. Compare reduced till with a cover crop to mulch till without a cover crop.
    c. Compare different mulch tillage tools or configurations to compare yield and surface residue management.
    d. Evaluate different high disturbance drills or configurations of the drills.
    e. Evaluate different chisel points or rolling baskets.
    f. Evaluate reduced till vs conventional till.
4. The evaluation should include the services of a consultant with knowledge of reduced till (residue management) farming to help plan the evaluation, layout the plots, monitor the plots during the season, assist in gathering the required data (yield, soil tests, residue counts, soil health measurements, etc.), and analyze the data that will support the purpose of the evaluation.
5. The evaluation can focus on one or more results, e.g., may collect data to not only address yield but also changes in soil health parameters (aggregate stability, infiltration, organic matter, etc.).
6. Analyze the data each year and at the end of the trial period, usually 3 years.
7. The annual and final results and analysis should be jointly reviewed with NRCS, the grower, and consultant involved.