

SOIL SMARTS

Specific Management and Resources Trainings
for Soil Health in Tennessee

TRAINING CURRICULUM

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TENNESSEE
STATE UNIVERSITY

Cooperative Extension

UT EXTENSION
INSTITUTE OF AGRICULTURE
THE UNIVERSITY OF TENNESSEE



This curriculum was developed through a Southern SARE grant and collaboration between Tennessee State University, the USDA-NRCS, and the University of Tennessee. The objective of this curriculum is to provide training on soil health and sustainable management practices for soil health to extension agents and local officials so that they may disseminate this information to their stakeholders.

Soil Smarts Training Curriculum

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MODULE 8. FINANCIAL BENEFITS OF COVER CROPS

Learning objectives:

Participants will be able to:

- Describe cover crop establishment costs.
- Utilize the USDA Cover Crop Economics Decision Support Tool
- Identify financial assistance for farmers planting cover crops

Materials:

- PowerPoint® slides “Module 8: Financial benefits of cover crops”
- Lesson guide: Use the notes in this lesson guide to present information for each presentation slide.
- Questions found at the end of this lesson guide can be used to test participants’ knowledge at the end of the presentation. This can be combined with clickers to improve audience engagement and create discussion.
- An evaluation of the presentation can be found in this lesson guide following the lesson questions.

Topics:

USDA Cover Crop Economics Decision Support Tool

Costs related to cover crops

Direct nutrient credit

Pesticide reduction

Yield increase

Erosion reduction

Additional benefits

Financial assistance

Slide 1

This module covers the financial benefits of cover crops.

Module 7 - Financial Benefits of Cover Crops

Danny Morris
Area Farm Management Specialist
UT Extension

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Slide 1

Slide 2

This is an outline of the different topics that will be discussed within this module.

Outline

- Partial budgets of cover crop establishment
- Tracking impact on profitability
 - Output
 - Input
- NRCS financial assistance for establishment of cover crops



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Slide 2

Slide 3

Follow material on presentation slide.

Cost of Cover Crop Establishment

- The cost of establishment depends on the cover crop species being planted.
- The more species being considered, the higher the cost to plant will be.
 - Some particular species such as daikon radishes and turnips can be quite costly per pound of seed.
- The application method chosen impacts the cost as well.
 - Airplane vs. Drilled vs. Spreader Truck
 - Coverage varies between each method.



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Slide 3

Slide 4

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Parameters for Budgets

- All costs are on a per acre basis.
- Seed costs were provided from NRCS and were part of a budget project in Gibson County, TN in 2015.
 - Seed costs do vary, but are still approximately the same in 2018 as in 2015.
- Application costs are estimates provided by NRCS and UT Extension.
- All budgets are approximations and farmer's actual expenses will vary.

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Slide 4

Slide 5

The largest difference between budgets will be the cost of application. On these first few slides, the species being planted will be the 5-way species. The only difference will be the application method. Each of the application methods has its own benefits and drawbacks.

Establishment Budget #1	
Planting Costs (Broadcast Per Acre w/ truck)	\$ 5.00
Seed Cost (5 Species Cover Crop)	
Cereal Rye at 20 lbs. per acre (\$0.42/lb.)	\$ 8.40
Wheat Rye at 26 lbs. per acre (\$0.32/lb.)	\$ 8.32
Crimson Clover at 4 lbs. per acre (\$2.38/lb.)	\$ 9.52
Turnips at 1 lb. per acre (\$3.92/lb.)	\$ 3.92
Radishes at 2 lbs. per acre (\$2.66/lb.)	\$ 5.32
Total Establishment Costs per acre:	\$ 40.48

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Slide 6

The only difference between Budget #1 and Budget #2 is the seeding method. The difference between drilling and using a spreader truck is estimated to be \$5.00 per acre. Another difference in production will be the stand coverage of the cover crop. The stand coverage from drilling tends to be better than simply broadcasting in crops such as wheat. However, the variance in seed sizes can be an issue with drilling. Producers will need to keep this in mind when drilling multispecies cover crops.

Establishment Budget #2	
Planting Costs (Drilled)	\$ 10.00
Seed Cost (5 Species Cover Crop)	
Cereal Rye at 20 lbs. per acre (\$0.42/lb.)	\$ 8.40
Wheat Rye at 26 lbs. per acre (\$0.32/lb.)	\$ 8.32
Crimson Clover at 4 lbs. per acre (\$2.38/lb.)	\$ 9.52
Turnips at 1 lb. per acre (\$3.92/lb.)	\$ 3.92
Radishes at 2 lbs. per acre (\$2.66/lb.)	\$ 5.32
Total Establishment Costs per acre:	\$ 45.48

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Slide 7

Again, the primary difference between establishment budgets is the seeding cost. However, with an airplane application, farmers have to increase seeding rates by roughly 25% to receive the same stand from either drilling or broadcasting with a truck. With the added cost of the plane, which can vary between \$9-\$14 per acre, and the increase in seeding rates, the choice to fly on a 5 species cover crop is \$23-\$28 higher than the other options.


Establishment Budget #3	
Planting Costs (Broadcast Per Acre w/ plane) *Seeding rates increased by 25%	\$ 14.00
Seed Cost (5 Species Cover Crop)	
Cereal Rye at 25 lbs. per acre (\$0.42/lb.)	\$ 10.50
Wheat Rye at 32.5 lbs. per acre (\$0.32/lb.)	\$ 10.40
Crimson Clover at 5 lbs. per acre (\$2.38/lb.)	\$ 11.90
Turnips at 1.25 lb. per acre (\$3.92/lb.)	\$ 4.90
Radishes at 2.50 lbs. per acre (\$2.66/lb.)	\$ 6.65
Total Establishment Costs per acre:	\$ 58.35

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Slide 8

Follow material on presentation slide.

Costs vs. Returns	
<ul style="list-style-type: none">When deciding to adopt cover crops, one must look at the return along with the costs.Returns typically come in the form of:<ul style="list-style-type: none">Higher yieldsReduced fertilizerReduced herbicide useAdded costs can also develop in the form of:<ul style="list-style-type: none">Increased pestsExpenses related to the termination of cover crops	

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Slide 9

Follow material on presentation slide.

Tracking Financial Impact of Cover Crops

- USDA/NRCS has developed a decision-aid tool
 - Economic Analysis of Cover Crops Spreadsheet
 - Developed by Lauren Cartwright (Missouri State Economist-USDA/NRCS) and Bryon Kirwan (Illinois State Economist-USDA/NRCS)
 - Spreadsheet that is designed to assist producers in deciding the cost of cover crop implementation and benefits provided from cover crops.
 - Decision-aid File can be downloaded from:
<http://www.conservationswebinars.net/webinars/cover-crop-economics-decision-support-tool/?searchterm=Economic>

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Slide 10

We are going to look at the impact of cover crops on a corn and cotton rotation. Given where corn and cotton prices are, this rotation will likely be widespread across West Tennessee in 2019.

Cover Crop Economics - Short Term Analysis

The Short Term analysis assesses the immediate cost and benefits, after comparing the short term analysis, an option is available to export the information to a long term analysis.

Please refer to the "Instructions" worksheet for more detailed guidance on using the tool and entering data.

To get started with a new model, select the current rotation type and then select the "Start New Model" button. Enter the information in the white boxes. To save an existing model, select the "Save Model" button and follow the instructions provided.

Default options: "How New Model" will allow you to select the start of the model.

Buttons: Start New Model | Clear Entries

Scenario Description

Cotton, Corn rotation: Producers incorporate cover crops in the fall after harvest of their cash crop.

Rotation

Cover Crop - Cash Crop 1: Cotton
Cover Crop - Cash Crop 2: Corn

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Slide 11

Follow material on presentation slide.

Entering in the Crop Data

You will need to enter in the yield for each crop along with an current price you can expect to receive for the crop.

Rotation	
Cover Crop - Cash Crop 1 Enter cash crop name (e.g. corn, soybeans, wheat): Cotton	Cover Crop - Cash Crop 2 Enter cash crop name (e.g. corn, soybeans, wheat): Corn
Yield Units (e.g. bu, wet, tons): bu Baseline Yield (cwt/bu): 100 Value of Crop 1 (\$/bu): \$5.77	Yield Units (e.g. bu, wet, tons): bu Baseline Yield (cwt/bu): 150 Value of Crop 2 (\$/bu): \$3.65

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This is an example of the total cost of a cover crop system over 2 years. The first year cover crop is crimson clover, which was planted before a cotton crop. Costs include all establishment expenses at the required rate. The right column shows a three species cover crop mix of cereal rye, crimson clover, and brassica. The three species mix was planted in the fall prior to planting a corn crop.

Costs Related to the Cover Crop

Cover Crop Establishment and Management		Cover Crop Establishment and Management	
Default is to the cover crop that immediately precedes crop 1 if applicable (Use text box below to enter description of cover crop rotation: crimson clover)		Default is to the cover crop that immediately precedes crop 2 if applicable (Use text box below to enter description of cover crop rotation: cereal rye (25 lbs/ac), crimson clover (2 lbs/ac), wintering (1 lb/ac)	
Seeding Rate (lb/ac)	\$0	Seeding Rate (lb/ac)	\$4
Seed Cost (includes discount on seed) (\$/lb)	\$1.70	Seed Cost (includes discount on seed) (\$/lb)	\$9.96
Calculated Seed Cost (\$/ac)	\$0.00	Calculated Seed Cost (\$/ac)	\$39.04
Planting Cost (\$/ac)	\$20.00	Planting Cost (\$/ac)	\$20.00
Termination cost (\$/ac)	\$10.00	Termination cost (\$/ac)	\$10.00
Increased management costs (\$/ac)	\$0.00	Increased management costs (\$/ac)	\$0.00
Total Costs Cover Crop Est. & Mgt. (\$/ac)	\$30.00	Total Costs Cover Crop Est. & Mgt. (\$/ac)	\$69.04
Yield Decrease Enter if a yield decrease is expected Crop 1 Yield Decrease (%)		Yield Decrease Enter if a yield decrease is expected Crop 2 Yield Decrease (%)	
Crop 1 Decrease (\$/ac)	\$0.00	Crop 2 Decrease (\$/ac)	\$0.00
Other Costs (Enter description of cost in text box)		Other Costs (Enter description of cost in text box)	
Other Cost (\$/ac)	\$0.00	Other Cost (\$/ac)	\$0.00
Total Cost (\$/ac)	\$30.00	Total Cost (\$/ac)	\$69.04


Slide 12


Slide 13

Follow material on presentation slide.

Benefits of Cover Crops

- The decision-aid tool highlights four main benefits:
 - Direct nutrient credit (fertilizer reduction)
 - Pesticide reduction
 - Yield increase
 - Erosion reduction



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Slide 14

Follow material on presentation slide.

Direct Nutrient Credit

- The N, P, and K credit will vary based upon the cover crop species planted (i.e. legumes tend to provide more N).
 - Soil sample can provide this data.

Direct nutrient credit		Direct nutrient credit	
Enter Nutrient Values:			
Nitrogen (\$/lb):	\$0.39		
Phosphorus (\$/lb):	\$0.43		
Potassium (\$/lb):	\$0.37		
N, reduction in purchased N (lb/ac):	0	N, reduction in purchased N (lb/ac):	30
P, reduction in purchased P (lb/ac):	0	P, reduction in purchased P (lb/ac):	0
K, reduction in purchased K (lb/ac):	0	K, reduction in purchased K (lb/ac):	0
Total Nutrient Credit Benefit (\$/ac)	\$0.00	Total Nutrient Credit Benefit (\$/ac)	\$11.70

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Slide 15

The next section of the calculator is the influence on pesticides. You may find that your use of herbicides is reduced in a few years due to the cover crops providing a window of opportunity to suppress weeds. However, in some years and in some fields with extremely high weed populations, you may see that cover crops increase your herbicide use due to termination of the crop and persistent weeds.

Pesticide Reduction (or increase)

- The impact on herbicide use will take a few years to be viable.
 - Vary from field to field as well due to weed pressure.

Herbicide/insecticide/fungicide input reduction		Herbicide/insecticide/fungicide input reduction	
Costs include chemical and application		Costs include chemical and application	
Herbicide Costs (\$/ac)	\$80.00	Herbicide Costs (\$/ac)	\$30.00
Percent Reduction	30%	Percent Reduction	10%
Insecticide Cost (\$/ac)	\$0.00	Insecticide Cost (\$/ac)	\$0.00
Percent Reduction	0%	Percent Reduction	0%
Fungicide Costs (\$/ac)	\$0.00	Fungicide Costs (\$/ac)	\$0.00
Percent Reduction	0%	Percent Reduction	0%
Total Reduced Herbicide/insecticide/fungicide benefit (\$/ac)	\$24.00	Total Reduced Herbicide/insecticide/fungicide benefit (\$/ac)	\$3.00

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The stated yield increase should be based on your actual production records. The yield increase brings in the stated price that you input at the top of the spreadsheet. Also, keep in mind, that the value for soil loss is very subjective based on the price you place on the soil.

Yield Increase and Erosion Benefit

Yield Increase		Yield Increase	
Enter 0 if no yield increase is expected		Enter 0 if no yield increase is expected	
Crop 1 Yield Increase (%)	10%	Crop 2 Yield Increase (%)	0%
Crop 1 Increase (\$/ac)	\$77.00	Crop 2 Increase (\$/ac)	\$0.00

Erosion Reduction		Erosion Reduction	
On Site Lost Fertility Value (\$/ton)	\$2.10		
Off Site Water Quality Damages (\$/ton)	\$4.93		
Enter the amount of erosion in tons/acre that is prevented from leaving the field by the addition of cover crops.		Enter the amount of erosion in tons/acre that is prevented from leaving the field by the addition of cover crops.	
Erosion Reduction (tons/acre)	4	Erosion Reduction (tons/acre)	4
Enter other costs prevented due to reducing erosion such as machinery costs to repair erosion in the field or ditches.		Enter other costs prevented due to reducing erosion such as machinery costs to repair erosion in the field or ditches.	
Erosion Repair (\$/ac)	\$0.00	Erosion Repair (\$/ac)	\$0.00
Total Erosion Benefit (\$/ac)	\$28.12	Total Erosion Benefit (\$/ac)	\$28.12

Value is very subjective.

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Slide 17

You can also use the grazing, baling, and seed production section to add the additional benefits provided from using cover crops. Some producers that graze the cover crops would benefit from adding in the expense of fencing off the areas being grazed, installing waterers, and any increase in labor expenses. However, the added poundage from feeding the cover crops needs to be accounted for as well.

Other Benefits Embedded in Tool

Other Benefit (\$/ac) 0.00 Other Benefit (\$/ac) 0.00

Close Grazing

Grazing Infrastructure Costs

Fence (\$/ac) 0.00

Watering Facilities (\$/ac) 0.00

Added Labor/Management (\$/ac) 0.00

Grazing Costs (\$/ac) 0.00

Grazing Stockers

Additional Expected Daily Gain (\$/head/day) 0

Value of Gain (\$/lb) 0.00

Days of Grazing 0

Grazing Rate (head/ac) 0

Grazing Benefit (\$/ac) 0.00

Total Grazing Benefit (\$/ac) 0.00

Open Grazing

Open Seed Production

Additional sections of production that cover crops can benefit.

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If a farmer is baling or raising cover crop seed, there are sections for that as well built into the spreadsheet.

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The short term analysis results provide the most immediate economic benefit of using cover crops. This information is sufficient to make a planting decision. However, many adopters of cover crops are in it for the long haul. So, the long-term analysis is worth looking at.

Short Term Analysis Results

The final product of the tool is designed to show you the economic benefit over the two years being evaluated.

Total Benefit (\$/ac) \$129.12 Total Benefit (\$/ac) \$42.82

Short Term Analysis Results

Cover Crop - Cash Crop 1 Results Explanation

Total Cost (\$/ac) \$89.00

Total Benefit (\$/ac) \$129.12

Net Benefit (\$/ac) \$48.12

Continue to Long Term Analysis

Cover Crop - Cash Crop 2

Total Cost (\$/ac) \$89.04

Total Benefit (\$/ac) \$42.82

Net Benefit (\$/ac) -\$46.22

Cover crops are a long-term investment. So, you the long-term analysis is worth taking a look at.

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The economic analysis shows the results in the short term and long term. Also, the financial analysis shows the results of the cover crops by year. You can look at multiple years to track the long term impacts of cover crops over a long period of time, up to 50 years. In this example, I have only entered in two years of data and the model shows that 2 year crop rotation repeating every other year.

Analysis Results

Profitability versus Affordability: (Economic versus Financial Analysis)

The Economic Analysis Results compares the amortized costs and benefits and answers the question: Is this management change profitable over the lifespan of the analysis? The answer is yes if the Net Benefits (\$/ac/yr) is positive. The Net Benefits equals the total amortized benefits minus total amortized costs. If the Economic Analysis Net Benefits result is negative, then this is not a good investment overall.

The Financial Analysis Results answers the question: Is the management change affordable? Depending on the variables in the model, on a year to year basis there may be a negative net benefit, especially in the first few years of utilizing cover crops. In the rotation until the longer term soil benefits are realized. In a partial budget framework, such as this analysis, a short term negative net benefit indicates the cost of the investment in the soil in order to benefit from the long term benefits of improved soil health. The producer can use this analysis to determine if he/she can afford this investment, or use the model to assess alternative to make the investment more affordable for the operation.

Economic Analysis Results:

Summary:

Analysis Lifespan (years) 25

Short Term Benefits (\$/ac/yr) \$97.99

Long Term Benefits (\$/ac/yr) \$18.79

Total Costs (\$/ac/yr) \$70.61

Total Benefits (\$/ac/yr) \$106.78

Net Benefits (\$/ac/yr) \$36.17

Financial Analysis Results:

Year	Costs (\$/ac)	Benefits (\$/ac)	Net Benefit (\$/ac)
1	\$81.00	\$129.12	\$48.12
2	\$89.04	\$42.82	-\$46.22
3	\$81.00	\$129.12	\$48.12
4	\$89.04	\$42.82	-\$46.22
5	\$81.00	\$129.12	\$48.12
6	\$89.04	\$42.82	-\$46.22
7	\$81.00	\$129.12	\$48.12
8	\$89.04	\$42.82	-\$46.22
9	\$81.00	\$129.12	\$48.12
10	\$89.04	\$42.82	-\$46.22
11	\$81.00	\$129.12	\$48.12
12	\$89.04	\$42.82	-\$46.22
13	\$81.00	\$129.12	\$48.12
14	\$89.04	\$42.82	-\$46.22
15	\$81.00	\$129.12	\$48.12

Menu Options:

View Graphs

View Print Summary

Save Model

Manage Default Scenarios

Return to Short Term Analysis

Slide 19

Slide 20

Follow material on presentation slide.

Financial Impact of Cover Crops

- There is not a single cover crop mix that is a **guaranteed** to increase yield or reduce expenses.
- When it comes to financial impact, cover crops advantages and disadvantages will vary from farm to farm and from year to year.
- Example:
 - In a dry year, cover crops can help hold moisture to improve yields.
 - In a wet year, cover crops may delay planting to the point that yields are reduced.

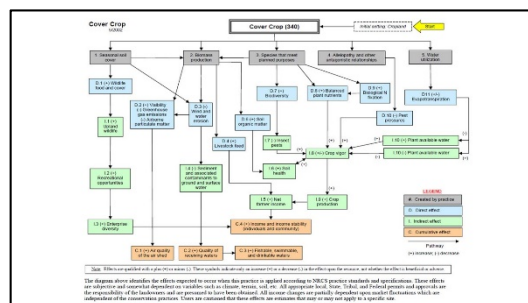
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Slide 21

This chart shows the complexity of cover crops. This is shown to highlight the many factors that go into evaluating cover crops and why it can be hard to determine financial impact.



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Slide 22

Follow material on presentation slide.

Financial Assistance Available to Farmers

- Funds are available to help farmers with the establishment of cover crops.
- NRCS allows farmers 3 years to gain experience planting cover crops.
- Funding is through EQIP
- Payment rates based on seed mixture.
- Contact your local NRCS office for more details.

USDA NRCS
United States Department of Agriculture
Natural Resource Conservation Service

Cover Crop Benefits & Opportunities

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Slide 23

This is the cost share reimbursement rate. Participants will receive this amount regardless of the actual cost. Farmers should contact their local NRCS office for the latest information regarding funding for cover crop cost share.

Reimbursement Rates

Fiscal Year	Effective Date	Single Species	Multi Species (5)	*Note
2018	October 1, 2018	\$51.50 - \$72.61	\$74.04 to \$88.85	
2019	October 1, 2017	\$20.27	\$45.39	*Actual values could vary upon species planted.

*Note: These are the cost share reimbursement rate. Participants will receive this amount regardless of the actual cost.

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Follow material on presentation slide.

Conclusion

- Financial impact of cover crops is a combination of the impact on both inputs and outputs.
- Cover crops are a long term investment.
 - To truly realize their economic benefit, farmers have to look at multiple years of data on **their farms**.
- NRCS and universities have created many tools to help with the measure the financial impact of cover crops.
- NRCS provides cost share in establishing cover crops.

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For more information, contact Danny Morris, UT Area Farm Management Specialist.

Questions?

Danny Morris
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Email: danhmorr@utk.edu

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Test their Knowledge - Questions for the audience

Cover crop establishment costs are largely based on the species planted and the method of establishment.

Q: What financial returns might be expected from using cover crops?

A: Higher yields, reduced fertilizer application, reduced herbicide use, erosion reduction

Q: What tool can be used to determine the costs and benefits of using cover crops?

A: The Cover Crop Economics Decision Support Tool by the USDA/NRCS

Q: How long does the NRCS offer cost share funding for cover crop establishment?

A: 3 years

Q: What NRCS program offers cost share funding for cover crop establishment?

A: EQIP



Soil Health Evaluation



Name of Activity: Financial benefits of cover crops	Date of Activity:
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A. Instruction	Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree
1. The agent/specialist was well prepared.	①	②	③	④	⑤	⑥
2. The agent/specialist presented the subject matter clearly.	①	②	③	④	⑤	⑥

B. General Learning and Change	Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree
1. I have a deeper understanding of the subject matter as a result of this session.	①	②	③	④	⑤	⑥
2. I have situations in which I can use what I have learned in this session.	①	②	③	④	⑤	⑥
3. I will change my practices based on what I learned from this session.	①	②	③	④	⑤	⑥

C. Specific Learning How much <i>did you / do you</i> know about these subjects?	Before this program I knew...					Now I know....				
	Very little	Little	Some	Much	Very Much	Very little	Little	Some	Much	Very Much
1. <i>The USDA/NRCS Cover Crop Economics Decision Support Tool</i>	①	②	③	④	⑤	①	②	③	④	⑤
2. <i>How to calculate financial costs and returns from cover crops</i>	①	②	③	④	⑤	①	②	③	④	⑤
3. <i>USDA/NRCS cost share available for cover crop establishment</i>	①	②	③	④	⑤	①	②	③	④	⑤

D. Specific Practices To what degree <i>did you / will you</i> do the following?	Before this program I did...					In the future I will realistically do....				
	Very little	Little	Some	Much	Very Much	Very little	Little	Some	Much	Very Much
1. <i>Measure different field indicators of soil health</i>	①	②	③	④	⑤	①	②	③	④	⑤
2. <i>Incorporate sustainable agricultural methods for soil health</i>	①	②	③	④	⑤	①	②	③	④	⑤
3. <i>Seek additional NRCS information on financial and/or technical assistance for improving soil health</i>	①	②	③	④	⑤	①	②	③	④	⑤

E. Satisfaction with Activity	Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree
1. <i>I would recommend this program to others.</i>	①	②	③	④	⑤	⑥
2. <i>As a result of this program, I am more likely to seek additional information from UT/TSU Extension.</i>	①	②	③	④	⑤	⑥

F. Any suggested changes, additions, etc. to the curriculum?
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Thank you for participating in this survey!