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New Mexico Agronomy Technical Note No. 45

SUBJECT: ECS Cropland Roadside Survey Method

Effective Date: When received.

Filing Instructions: File in the Agronomy Technical Note Binder.

Explanation:

The attached "Cropland Roadside Survey Method" provides procedures for conducting cropland transect surveys. This process provides a reliable method to collect county- and watershed-level tillage, crop residue, and soil loss data .

For more information, contact the State Conservation Agronomist.

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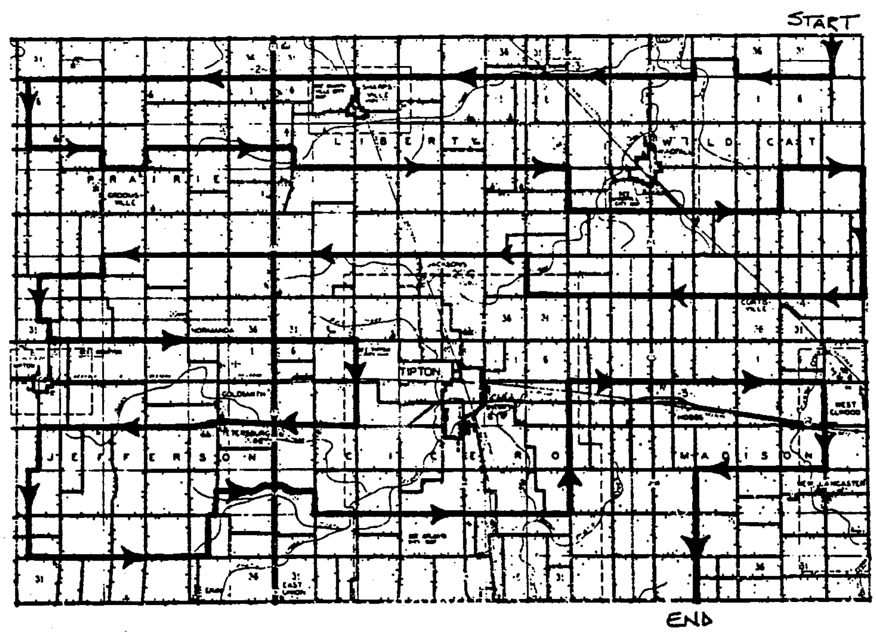
Attachment

Cropland Roadside Survey Method

Procedures for Cropland Transect Surveys for Obtaining Reliable County- and Watershed-Level Tillage, Crop Residue, and Soil Loss Data



Survey applicable regardless of county layout, county need not be square.

Conservation Technology Information Center

West Lafayette, IN

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Cropland Roadside Survey Method

Procedures for Cropland Transect Surveys

for Obtaining

Reliable County- and Watershed-Level Tillage,

Crop Residue, and Soil Loss Data

by Peter R. Hill

This publication was developed as an educational resource by Indiana's T-by-2000 Soil Conservation Education Program.

Table of Contents

Introduction

This cropland roadside survey method or road transect survey method is designed to gather information on various agricultural practices, primarily tillage and crop residue management systems. It can also be used to collect a variety of additional information.

For instance, in Indiana the survey includes information on percent slope, P-factor, ephemeral erosion, T-level, K-factor, slope length (feet) and a notation for the watershed code so data call be viewed at a watershed as well as county level (see sample, page 5).

Some states have found the data so valuable that it is collected on an annual basis by each county. Other states collected the data every three to five years.

The purpose of the survey is three-fold: (1) to evaluate progress achieved in reaching county or statewide goals, (2) to provide information that can be used by individual soil and water conservation districts in establishing priorities for educational or other programs, and (3) to provide accurate data on tillage systems and crop residue cover for the annual National Crop Residue Management Survey which is compiled and distributed annually by the Conservation Technology Information Center (CTIC). **This makes the survey an ideal tool for assessment as well as measuring progress for locally led conservation.**

How this survey method assists the national survey

Cropland surveys designed to estimate the amount of conservation tillage being used on the land are a relatively new concept. Since 1982, CTIC has been working with USDA Natural Resource Conservation Service field offices and conservation districts to collect acreage information on 13 crops and five tillage systems at the county level. This county-level information is annually fowarded to the NRCS state office in each state where it is combined and sent to CTIC which compiles and formats it for use in the National Crop Residue Management Survey.

The current way survey data is gathered for the National Crop residue Management Survey usually involves a meeting of minds and data. NRCS field office personnel (usually district conservationists) in each county are annually urged to utilize area ag statistical data and meet with others who may have information to arrive at "best estimates" for the national survey. District conservationists are often assisted by soil and water conservation district personnel, county extension agents, agribusiness, local farm organizations, and other interested parties to complete a survey form that denotes these best estimates which are generally based on personal knowledge.

That's why the cropland roadside survey method is such an important tool for assisting in the national survey. **As a physical survey of cropland, data from the (cropland roadside) survey can be compared against these annual "best estimates" and used to periodically confirm and or revise them for greater accuracy.**

Statistical reliability of the cropland roadside survey method

When conducted properly, this cropland survey (transect procedure) provides a high degree of confidence in the data summaries. As described in the appendix (see page 8), users can have 90% or more confidence in the accuracy of the results. This level of reliability translates into data summaries that can help guide the local or state decision-making process. Several states have used transect data to allocate cost-share funds, develop new resource management goals, and to provide information to the general public about the positive impact of progress on land use trends. In general, few data sources have such a high level of reliability combined with quick data collection!

Survey Method

Step 1 - Establishing and Marking the Route

The first step in conducting a tillage and crop residue cover survey is to establish a driving route. The person who establishes the route should not be familiar with the county's agricultural practices, particularly areas where a high concentration of conservation tillage systems is known to exist.

Using a county highway map and a published soil survey, draw a route that passes through all soil regions that are heavily used for crop production. Avoid large urbanized areas and heavily traveled federal and state highways when possible. Orientation or direction of the route (east to west or north to south) is not significant; however, it should be at least 110 miles long. Routes for counties with more than 300,000 cropland acres should pass through townships at least twice, particularly in areas where the land is heavily used for crop production. This avoids large gaps between passes through a county even though the mileage traveled is considerably longer. Routes typically traverse east to west through a county five to eight times (see Figure 1). Traveling east and west results in less handling of the soil survey atlas sheets as compared to traveling north and south.

When the route is completed, transfer it to the soil survey map sheets (or individual atlas sheets if the soil survey is not published) using a highlight marker. Since the route will extend through several map sheets, it might be helpful to use a lettering/numbering system. For example, if a route leaves Sheet 1 and continues on Sheet 2, mark the letter "A" at the border where the route leaves and enters the sheets to ensure that the route is being followed correctly. Similarly, when it leaves Sheet 2 and enters Sheet 3, put a "B" on the borders of the sheets.

Step 2 - Establishing the Survey Date and Team

Once the route is established and marked, schedule a date for conducting the survey. It should be after the majority of corn, soybeans, and other main crops have been planted (usually late May to early June for Indiana) but before the first row cultivation takes place or the crop canopy closes. If a high percentage of fall-seeded crops are also grown, the transect should be conducted in the fall or even two times per year in order to capture the tillage systems being utilized. Conducting the survey at this time allows for easy "windshield observations" without stopping at each field.

Since the dates for conducting the county survey will depend upon local spring planting progress, flexibility in scheduling is recommended. For example, the northern half of a county may have had more rain than the southern half; therefore, a local team may survey the southern half of the county one week and finish the northern half the following week.

Next, assemble a survey team. Ideally, it should consist of: the county Extension agriculture agent, the NRCS (Natural Resources Conservation Service) district conservationist, the FSA (Farm Service Agency) county director, and a fourth person (perhaps SWCD employee, supervisor, cooperator, or newspaper reporter) who can assist in making observations. When conducting the survey, one person drives, another follows the route and marks data collection points on the soil survey map sheets, the third person records data, and the fourth person makes other desired field verifications (i.e. actually walking out into the field to verify residue cover, previous crop, etc.).

By getting a variety of people involved, the ability to assemble a full team for each day of surveying is greatly increased. Even if a SWCD supervisor or volunteer can only devote a half-day collecting data, it would increase their understanding of the process while making a valuable contribution to the survey.

Sample Route

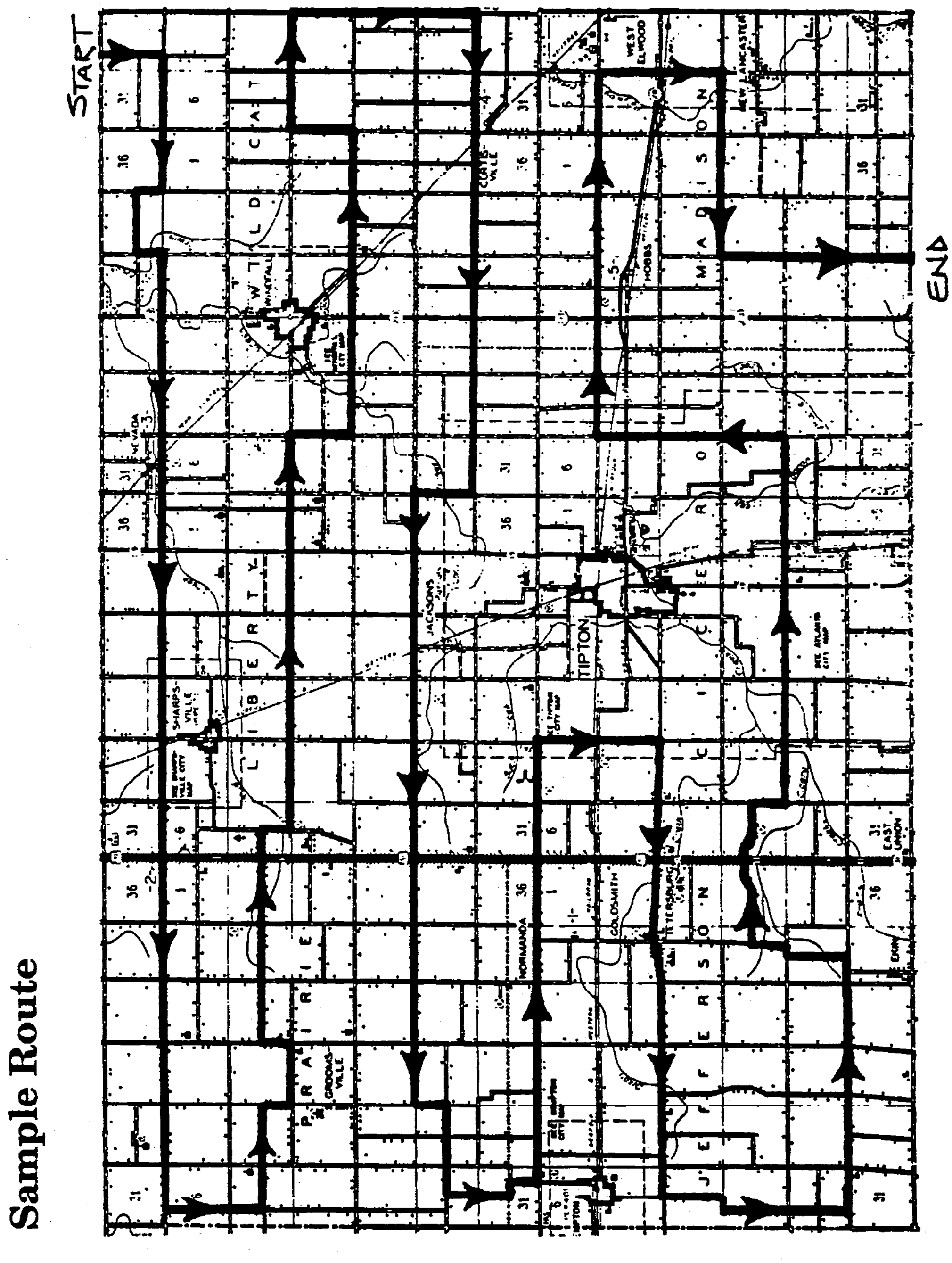


Figure 1. Sample county road transect route for Tipton County, Indiana. Note how the route bypasses towns (e.g. Tipton, Indiana located in the center of the county). This survey is applicable no matter the layout of the county ie. counties need not be square to provide accurate results with this method.

Step 3 - Collecting the Survey Data

In preparing to conduct the survey, plan to take both the county highway and soil survey maps. The highway map will aid navigation across the county, especially if there are detours or road changes that have occurred since publication of the soil survey. Also take at least 50 preprinted data collection scan sheets (see example, Figure 2.). Data will typically be collected for the following categories: present crop, previous crop, tillage system, residue cover, soil loss factors, and watershed location.

Usually, data will be collected at one-half mile intervals, as indicated by the vehicle odometer. To obtain a statistically reliable data set, approximately 460 cropland sites will need to be observed along the route. (For information on how the number of the data points is determined, see the Appendix.) For counties that have more than 300,000 cropland acres, a one-mile interval is recommended.

Beginning at the start of the route, travel exactly one-half mile and stop. Observe fields on both sides, and record the appropriate information on the first data sheet. The field on the left will be "1L" (one-left) and the field on the right will be "1R" (one-right). After the data are collected, mark "1L" and "1R" on the soil survey map sheet as close as possible to where the observations were taken. Repeat the procedure at half mile intervals until the route is completed.

Important:

(A) If no cropland field is encountered at the half mile interval on one side of the road, only record data for the side with cropland. Although no data are collected for the side with no cropland, note the landuse in the "comment" section of the data sheet.

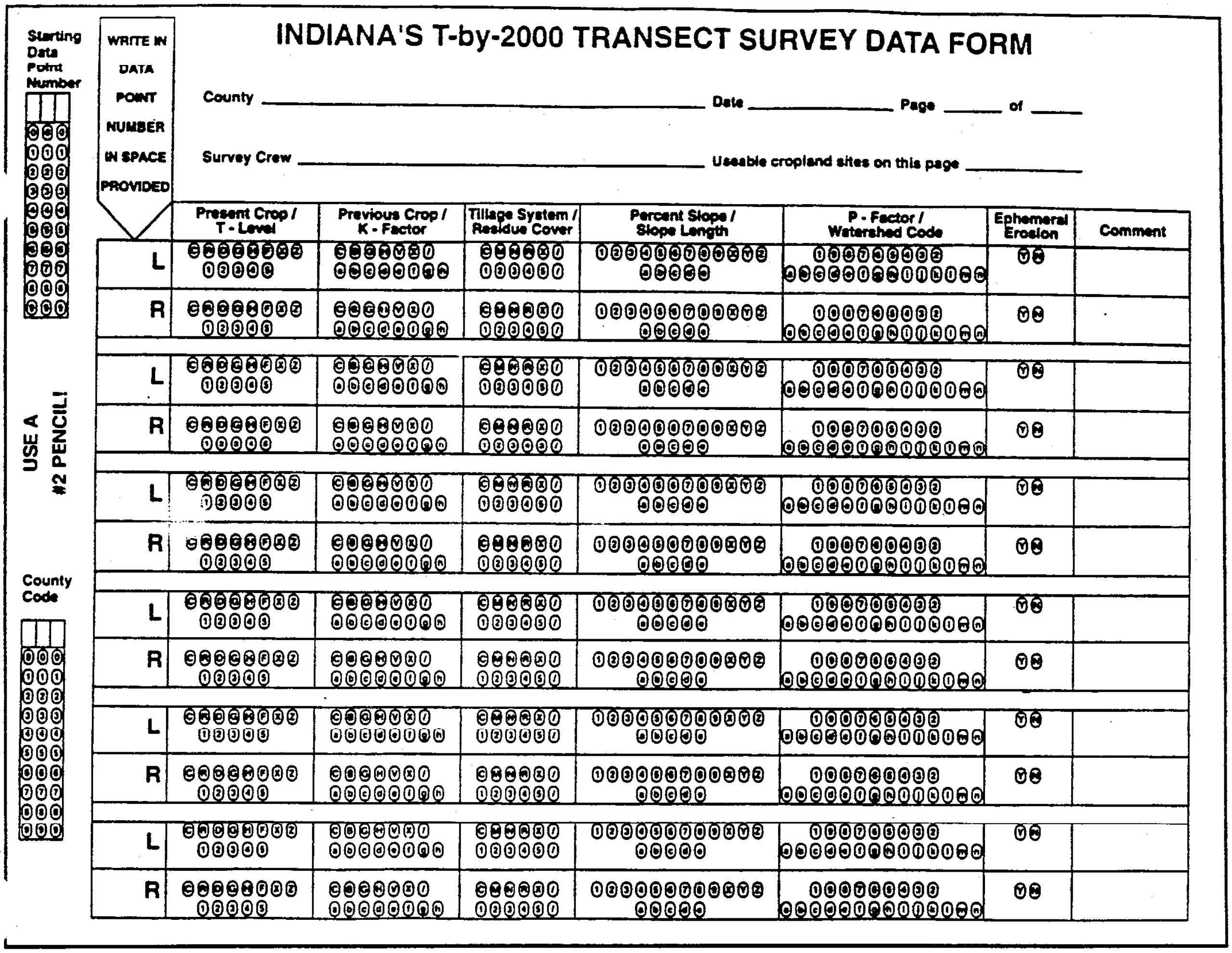
(B) If no cropland field is encountered at the half mile interval on either side of the road, continue driving until cropland is observed on at least one side of the road. Record data and then proceed at half mile intervals from that point.

As the transect survey continues, the survey team should stop and check field conditions on a regular basis to insure correct estimates are being made for different crop, tillage, and residue conditions. Once the team has calibrated their visual estimates to match actual field conditions, stops can then be made less frequently. However, the team should plan to re-calibrate their visual estimates especially when entering a region of the county with different soil surface conditions due to changes in moisture, organic matter levels, stoniness, or crops grown.

Crop residue cover levels will be the most important data category to confirm with field measurements. Therefore, use the line-transect method (Eck et al., 1994 and Laflen et al., 1981) for confirming percent residue cover. Confirm visual estimates with field measurements in borderline cases. *But remember, never use end rows for field measurements*!

At the end of the route, count the number of cropland sites at which data were recorded. If less than 460, randomly extend the route and record data at half mile intervals until this number is met. *Do not count fields twice if a transect crosses over its previous route.* Be sure to mark the extended route on both the county highway map and the soil survey.

In counties that are highly urbanized, wooded, etc., collecting data on 460 cropland sites may not be feasible. In this case, collect as much data as possible.



INDIANA'S T-by-2000 TRANSECT SURVEY DATA FORM

Starting Data Point Number

WRITE IN DATA POINT NUMBER IN SPACE PROVIDED

County ______ Date ______ Page ____ of ____

Survey Crew ______ Useable cropland sites on this page ______

USE A #2 PENCIL!

County Code

	Present Crop / T - Level	Previous Crop / K - Factor	Tillage System / Residue Cover	Percent Slope / Slope Length	P - Factor / Watershed Code	Ephemeral Erosion	Comment
L							
R							
L							
R							
L							
R							
L							
R							
L							
R							
L							
R							

CODES FOR FILLING OUT TRANSECT SURVEY FORM:

Present Crop	Previous Crop	Tillage System	Percent Slope	P - Factor	Ephemeral Erosion
C = Corn	C = Corn	C = Conventional	1 = 1%	1 = 1.0	Y = Yes
R = Row Soybeans	B = Soybeans	M = Mulch-till (>30% cover)	2 = 2%	9 = 0.9	N = No
D = Drilled Soybeans	G = Small Grains	N = No-till	3 = 3%	8 = 0.8	
G = Small Grains	H = Hay	R = Ridge-till	4 = 4%	7 = 0.7	
H = Hay	V = Cover Crop	X = Other	5 = 5%	6 = 0.6	
F = Fallow (e.g., set-aside)	X = Other	/ = Doesn't Apply	6 = 6%	5 = 0.5	
X = Other	/ = Doesn't Apply		7 = 7%	4 = 0.4	
Z = CRP			8 = 8%	3 = 0.3	
			9 = 9%	2 = 0.2	
			X = 10%		
			Y = 11-15%		
			Z = 16-20%		

T-Level	K-Factor	Residue Cover	Slope Length (feet)	Watershed Code
1 = 1 t/a	a = .43	1 = 0 - 15%	a = 75 (50-100)	See individual county codes for letters a - n.
2 = 2 t/a	b = .37	2 = 16 - 30%	b = 125 (100-150)	
3 = 3 t/a	c = .32	3 = 31 - 50%	c = 175 (150-200)	
4 = 4 t/a	d = .28	4 = 51 - 75%	d = 250 (200-300)	
5 = 5 t/a	e = .24	5 = 76 - 100%	e = 400 (300-500)	
	f = .20	/ = Doesn't Apply		
	g = .17			
	h = .15			

Figure 2. Sample data collection scan sheet and corresponding codes (Indiana, 1997).

Step 4 - Compiling and Analyzing the Data

After completion of the survey, the survey team should review the data entry sheets to correct entry mistakes, fill in missing data, etc. before having the data scanned for analysis. The data can be analyzed manually (as in Examples 1 and 2) or by using the Transect computer program, which converts scanned data to an easily compiled format (this assumes that the data sheets can be scanned with the data outputted to a suitable file format).

Manual Analysis

The following examples illustrate how the data can be compiled manually.

Example 1: "How many acres of mulch-till soybeans (with at least 30% residue cover) are in my county?"

Given: 100,000 acres are estimated to be in soybeans (FSA, NASS, or Ag-Census information).

Transect Results: 110 sites were planted to soybeans (found by adding the number of locations or stops marked for soybeans in the "present crop" section). Twenty-five of those sites were in mulch-till with greater than 30 percent residue cover.

Solution: The percentage of sites of mulch-till soybeans with greater than 30 percent residue over is 25 divided by 110 which equals 0.23 or 23 percent. This number multiplied by 100,000 acres yields 23,000 acres of mulch-till soybeans.

Example 2: "How many acres of ridge-till corn are in my county?"

Given: 50,000 acres are estimated to be in corn (FSA, NASS, or Ag-Census information).

Transect Results: No sites (0) planted to ridge-till corn were recorded on the survey sheets.

Fact: The survey team members know that Farmer Brown has planted 500 acres in ridge-till corn that has greater than 30% residue cover.

Solution: Given the 10 percent error range of the transect survey when data on 460 fields are included, it is reasonable to expect survey routes to miss areas of small acreages of certain cropping systems. This is particularly true when these systems make up less than 10 percent of the total acreage. Therefore, instead of recording zero acres for ridge-till corn, use the knowledge of the survey team and add the 500 acres to your estimates of ridge-till corn. Remember, however, to reduce the total acreage figure of 50,000 by subtracting 500 (total ridge-till acres) to obtain a new base of 49,500 acres for calculating the other conservation tillage systems. This is necessary since ridge-till information was not included in the data.

Computer Analysis

Collecting the transect data on scannable forms allows for efficient processing and subsequent analyses of the data (as compared to analyzing the data manually). After the forms are scanned, the data is then converted for use by the Transect computer program. The program allows for several types of summaries using any data category included on the scannable forms. For example, a tabular report showing the percentage of the "present crops" (corn soybeans, wheat, etc.) that are planted by the different tillage systems can be generated.

County summaries can also be generated to assist completion of the annual CTIC survey data form. This summary only includes the major crops such as corn, soybeans, and wheat. Other crops are omitted since acreage is small and may not be included in the actual survey. *Remember, however, CTIC requires that no-till systems have 30% residue cover or greater — this is not a requirement when collecting data during cropland transect surveys* (see CTIC definitions in Figure 3).

Tillage Systems Definitions

As featured in the National Crop Residue Management Survey

The following set of definitions was established by CTIC and is recognized as a standard. They are used nationwide by government agencies and private industry.

Crop Residue Management (CRM)

A year-round system beginning with the selection of crops that produce sufficient quantities of residue and may include the use of cover crops after low residue producing crops. CRM includes all field operations that affect residue amounts, orientation and distribution throughout the period requiring protection. Site-specific residue cover amounts needed are usually expressed in percentage but may also be in pounds. **CRM is an "umbrella" term encompassing several tillage systems including no-till, ridge-till, mulch-till, and reduced-till.**

Conservation Tillage Types

(30 percent or more crop residue left, after planting. Conservation tillage systems include no-till, ridge-till and mulch-till)

Any tillage and planting system that covers 30 percent or more of the soil surface with crop residue, after planting, to reduce soil erosion by water. Where soil erosion by wind is the primary concern, any system that maintains at least 1,000 pounds per acre of flat, small grain residue-equivalent on the surface throughout the critical wind erosion period.

No-till - The soil is left undisturbed from harvest to planting except for nutrient injection. Planting or drilling is accomplished in a narrow seedbed or slot created by coulters, row cleaners, disk openers, in-row chisels or roto-tillers. Weed control is accomplished primarily with herbicides. Cultivation may be used for emergency weed control.

Ridge-till - The soil is left undisturbed from harvest to planting except for nutrient injection. Planting is completed in a seedbed prepared on ridges with sweeps, disk openers, coulters, or row cleaners. Residue is left on the surface between ridges. Weed control is accomplished with herbicides and/or cultivation. Ridges are rebuilt during cultivation.

Mulch-till - The soil is disturbed prior to planting. Tillage tools such as chisels, field cultivators, disks, sweeps or blades are used. Weed control is accomplished with herbicides and/or cultivation.

*(**Zone-till & Strip-till** -* Although these are popular terms in some areas, they are not official survey categories because they are considered modifications of no-till, mulch-till or other tillage types, depending on the amount of crop residue left on the soil surface after planting.*)*

Other Tillage Types:

(less than 30 percent crop residue left after planting)

Tillage and planting systems that may meet erosion control goals with or without other supporting conservation practices (i.e. strip cropping, contouring, terracing, etc.).

Reduced-till - Tillage types that leave 15-30 percent residue cover after planting or 500 to 1,000 pounds per acre of small grain residue equivalent throughout the critical wind erosion period.

Conventional-till - Tillage types that leave less than 15 percent residue cover after planting, or less than 500 pounds per acre of small grain residue equivalent throughout the critical wind erosion period. Generally involves plowing or intensive tillage.

Figure 3. CTIC tillage definitions (1996) used for conducting their annual national survey of crop residue management practices.

APPENDIX

Background on Surveys

Begun in 1988, Indiana's T-by-2000 program seeks to significantly reduce soil erosion and sedimentation throughout the state by the year 2000. A major component of the program is educational assistance provided through a statewide coordinator and five regional specialists. The coordinator and specialists work primarily with the state's 92 Soil and Water Conservation Districts (SWCDs) to increase farmer adoption of conservation tillage systems, particularly on highly erodible cropland. As T-by-2000 educational efforts progressed, it became apparent that a survey method was needed to assess their impact on producers and consequently the rate of adoption of conservation tillage systems.

Cropland surveys designed to estimate the amount of conservation tillage being used on the land are a relatively new concept. The Conservation Technology Information Center (CTIC) initiated the annual National Crop Residue Management Survey in 1982. The data gathered for this national survey usually involves a meeting of minds and data. NRCS field office personnel (usually district conservationists) in each county are annually urged to utilize area ag statistical data and meet with others who may have information to arrive at "best estimates" for the national survey. NRCS district conservationists are often assisted by soil and water conservation district personnel, county extension agents, agribusiness, local farm organizations, and other interested parties to complete a survey form that denotes these best estimates which are generally based on personal knowledge.

Another survey conducted on a national basis is the five-year NRCS National Resources Inventory (NRI). These data are collected on some 22 parameters, including physical characteristics of the land and the effects of agronomic practices on soil erosion. The NRI is a "point" survey method, where points correspond to random locations within a field. The first NRI in 1977 contained limited data on conservation tillage systems, as did subsequent surveys in 1982, 1987, and 1992.

Use of the NRI to estimate accurate acreage of conservation tillage or to document annual cropland trends is greatly limited by its survey interval of five years. The NRI has proven valuable, however, in development of national resource policies.

A third type of survey which has been used by the NRCS in Iowa (Iowa NRCS, 1989) and by the Ohio Department of Natural Resources (Kush and Crawford, 1987) is the county road or transect survey. Random road routes are selected so that data collected will represent all of the agricultural practices found within a county.

In Iowa, routes traverse at least six miles in every township, and tillage systems data (corresponding to CTIC survey needs) are collected on every field adjacent to the roads. Miles traveled for each survey corresponds directly to the number of townships. For example, if a county has 16 townships, then the transect route will be at least 96 miles long (16 x 6 mi.). In most cases, surveys are completed in one day with over 1,000 fields included in the data.

Ohio DNR's survey method is similar but more refined in that the survey sample size is based on statistical sampling techniques. Designed for surveying an 11-county watershed, data are collected on approximately 500 fields in each county. This number of fields yields a 90 percent accuracy level (± 5 percent) for any averages obtained from the data. Data are collected for several parameters, including present and previous crops grown, tillage systems, and residue cover. Consequently, one to two days are usually required to complete the survey. Typical county routes traverse every township and are approximately 110 miles long.

Cropland Transect Surveys

For Indiana, the Ohio road transect survey method was modified to allow more extensive surveying of cropland within a county. The purpose of the transect is three-fold: (1) to evaluate progress achieved in reaching statewide T-by-2000 goals when transects are repeated every three to five years, (2) to provide information that can be used by individual SWCDs in establishing priorities for soil conservation educational programs, and (3) to provide accurate data on tillage systems and crop residue cover that would supplement the CTIC survey.

In 1989, pilot transects were performed in 11 counties to test methodology and to make refinements in the procedures. All 92 counties were then surveyed in 1990 and again in 1993. Most transect surveys were completed in two days with assistance from personnel of NRCS, SWCDs, Indiana Department of Natural Resources, Farm Service Agency (FSA), and Purdue University Cooperative Extension Service. Data were summarized by the TRANSECT microcomputer program (Hess, 1990), which increased the efficiency of data processing significantly. An interval of three years was established for subsequent transect surveys.

In 1994, Illinois' NRCS and Department of Agriculture contracted with Indiana's T-by-2000 education program to conduct transect surveys statewide. They further modified the data collection form to include data categories that would allow the calculation of soil loss estimates for every field included in the survey. The Transect computer program was subsequently modified to generate soil loss estimates using the Universal Soil Loss Equation.

Survey Cost Estimates

The following estimates may vary depending on the complexity of the surveys conducted by states. They're designed to give you some idea of how affordable it is to use the cropland roadside survey method (transect). Some states may opt for surveys using pre-existing data gathering sheets like the one found on page 5 (Figure 2) which would be more economical.

1) **Scannable forms**
   To print forms such as the one featured on page 5.
   - 100 counties..$435.00
   - 50 counties..$535.00

2) **Scanning fee**
   To convert the survey data recorded on paper forms to an electronic format so it can eventually be used on computer.
   - 100 counties..$100.00
   - 50 counties..$ 75.00

3) **Programming fee** (<u>one time charge only</u>, assuming no changes in data categories from one survey to the next survey)
   To customize TRANSECT software for number of counties, R-factors, C-factors and other variables for your specific state. These charges apply only to first-year tillage and soil loss surveys. Forms customized to gather additional data (for ex. watershed survey) will face additional programming fees.
   ....$1,000

4) **Data management fee**
   Combining electronic data with computer software, includes processing data, proof reading, correcting for errors, generating summaries, etc.
   ....$10-$20 per county

Example: Let's say the state of Nebraska conducts a survey in all 93 counties. The costs would total approximately (forms + scanning + programming + processing) $3,500 or just over $37 per county ($1,000 less for subsequent surveys since no programming fee will be needed as long as survey data categories are unchanged). The rest is labor and your own local initiative.

Considering the value of the data and its use for making management decisions, developing educational programming, identifying areas of need etc., this is a very affordable investment. Find out for yourself. Compare this cost to surveys of similar scope and size.

Survey Sample Size

The reliability of the survey to provide representative and accurate data largely depends on two factors: route layout and sample size. Layout of the route was discussed under STEP 1 of the "Survey Method" section. Determination of sample size, however, requires some understanding of how the data are distributed and collected.

The concept of a "multinomial population" is the statistical foundation of the transect survey method. A multinomial population is said to exist when an element is assigned to one and only one of two or more categories. (For example, an estimate of residue cover is an "element" and can fall into one of five categories.) The number of categories within the primary population of interest greatly determines how large a sample needs to be in order to have a high level of confidence in reaching conclusions.

For transect surveys, crop residue cover is the most important data collected. Therefore, as we determine the sample size in the following discussion, the number of categories will be six (0-15%, 15-30%, 30-50%, 50-75%,75-100% residue cover, and "/" or doesn't apply). If present crop is the primary population of interest, then the number of categories is seven (Figure 2). *Remember, the primary goal in the design of the survey method is to achieve the highest level of confidence with a reasonable sample size.*

Tortora (1978) gives the following equation to determine the sample size assuming a multinomial distribution:

$$n = X^2_{(1,\ 1\text{-}a/k)}\ q\,(1\text{-}q)\,/\,d^2$$

where:

- n = survey sample size.
- $X^2_{(1,\ 1\text{-}a/k)}$ = Chi-square value for one degree of freedom and the value (1-a/k) substituted for (1-a).
- a = *alpha* = (1-p)
- p = confidence level or degree of confidence we want in the proportions arrived at for each category.
- k = number of categories.
- q = *a priori* estimate (estimate from prior knowledge of the proportions of the category). The proportion closest to 50 percent is used. If no a priori estimate is available, use 50 percent (0.50) since this yields the largest value for n.
- d = allowable error in the proportions (e.g. plus or minus 5 percent) expressed as a decimal.

For example, if a goal of 90 percent confidence with an allowable error of five percent is desired, then p = 0.90, a = (1 - p) = 0.10, k = 5, (1-a/k) = 0.98, and d = 0.05. It is known from prior CTIC surveys that at least 70 percent of the fields are expected to fall in the 0-15% cover category. Of the five categories, it is determined that 70% is the closest to 50%; therefore, we select q = 0.70 and (1 - q) = 0.30. A Chi-square table (found in any statistical methods book; e.g. Steel and Torrie, 1980) lists a value of approximately 5.50 (interpolated) for X. Solving the equation for n yields a value of 460. Consequently, a minimum of 460 fields would have to be included in the data set. If no prior knowledge had existed, then q and (1 - q) would equal 0.50. These values would give the largest sample size of 550.

NOTE:

The number of cropland acres within a county and the interval between data points have no effect on sample size; thus they are not included in the equation. Whether a county has 300,000 cropland acres or 5,000, or whether the survey interval is 0.2 or 2.0 miles, statistical accuracy of the survey is always based on the type of data being collected and the desired level of accuracy. For example, Krieger (1986) found little difference in data accuracy between 0.2, 0.4 and 0.6 mile intervals. It was discussed, however, that for smaller geographic areas, shorter intervals would be needed to obtain the desired number of data points. *In counties with small cropland acreage (approximately 50,000 acres or less), choosing shorter intervals might be more efficient than driving additional miles. Similarly, in large counties with cropland acreage greater than 300,000 acres, choosing longer intervals will prevent collecting an excessive number of data points.*

Once the survey is completed, new *a priori* figures are available for determining the sample size of the next survey. Depending on these figures, more or fewer samples (fields) will be needed to achieve the same reliability. *Remember, the percentage of fields for the category that is closest to 50 percent or 0.50 is used in the equation for determining sample size.* For example, suppose a county was surveyed for the first time in 1990. With prior knowledge similar to that of the above example, a sample size of 460 was used. After conducting the survey, the following results were obtained:

Residue Cover (%) Category	Percentage of Fields
0 - 15	65
15 - 30	13
30 - 50	2
50 - 75	8
75 - 100	12
/, doesn't apply	0

Sixty-five percent of the fields fell into the 0 - 15% category. Compared to the other percentages, 65 is closest to 50 and is used in determining the sample size for the next survey. Substituting 0.65 into the equation yields n = 500. Therefore, the sample size is larger for 1991! Had the percentage of fields been equal to 80 (which is still the closest estimate to 50), the sample size would have decreased to 352.

Although the use of *a priori* estimates can refine future sample size, increasing survey accuracy can always be improved by increasing sample sizes.

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