

RESIDUE MANAGEMENT CHOICES

A Guide to Managing Crop Residues in Corn and Soybeans

**USDA Natural Resources Conservation Service and
University of Wisconsin - Extension**

in cooperation with: **Wisconsin Department of Natural Resources** **USDA Farm Service Agency**
Wisconsin County Land Conservation **Wisconsin Department of Agriculture,**
Departments and Committees **Trade & Consumer Protection**

Is less tillage better for your farm?

Thousands of Wisconsin farmers have found that changing tillage and planting operations to increase crop residues on the soil surface can pay off. Research shows that crop yields are generally equal to or only slightly lower than those produced by systems that leave little or no residue on the field after planting. However, more residue means fewer trips across the field, which translates to lower fuel bills, less soil compaction, and less wear and tear on equipment. These lower costs offset any slight reduction in yield.

Leaving residue on the soil surface after planting has benefits off the farm, too. The residue prevents the “mud splash” during a rain storm that starts erosion, and slows the runoff water from rainfall or melting snow. Preventing erosion and slowing runoff water keeps topsoil on your fields, and keeps soil, nutrients and chemicals out of our streams and lakes.

Farming with crop residues is different than planting in clean-tilled ground – not necessarily harder, just different. Learning to farm with crop residues takes time, and farmers new to crop residue management will make some mistakes. But overall, farmers find working with increased crop residues fairly easy.

If you’re just getting started with higher residue farming, this publication will help steer you in the right direction. It describes different residue management systems common in Wisconsin, and offers practical tips on common issues that you’ll face when farming with increased residue.



Crop residues not only minimize soil erosion, but result in fewer trips across the field, lower fuel bills and less wear and tear on equipment.

Which tillage system is right for you?

Three crop residue management systems are common in Wisconsin:

Mulch-till:
Uses chisel plows or disks to till the entire field.

Advantages
Adapted to poorly-drained to well-drained soils, depending on implements and number of passes; good to excellent incorporation.

Disadvantages
Moderate erosion control; moderate soil moisture loss; medium labor and fuel requirements depending on implements and number of passes.



Zone-till or strip-till:
Uses coulters to till a 5" to 7" strip for planting and/or injecting starter fertilizer in one operation.

Advantages
Excellent erosion control; conserves soil moisture; allows soil warming in the row; allows in-row incorporation; low fuel and labor costs.

Disadvantages
May increase dependence on herbicides; higher equipment costs.



No-till:
Leaves the soil and crop residue undisturbed except for the crop row where the seed is placed in the ground.

Advantages
Maximum erosion control; conserves soil moisture; lowest fuel and labor costs.

Disadvantages
No incorporation; may increase dependence on herbicides; slows soil warming in spring; limited use on poorly drained soils, particularly with heavy residue (corn).



Getting Started

Start small

When it comes to residue management, all the advice and volumes of information are no substitute for experience. The best way to get started with residue management is to select a field that is typical of your farm and experiment on a few acres.

For mulch till that may simply mean eliminating one or two tillage passes. Refer to the tillage/planting tables on the following pages for other options that fit with the equipment you have. Leasing or borrowing equipment might be another option for trying a system such as no till or strip till, where you might not have a no-till drill or the right finishing tool.

The residue left after a tillage pass depends on a number of factors:

- Corn produces higher amounts of residue than some other crops such as soybeans. Naturally, a good crop will leave more residue than a poor one.
- Tillage speed and depth affect residue levels. Slower speeds and shallower depth leave more residue, as will changing from twisted shanks to straight points or sweeps.
- Harvesting equipment and methods can affect the amount and distribution of residue. Spreader attachments on a combine distribute residue evenly over the field, while chopper attachments reduce residue levels by creating smaller residue pieces that decompose more easily.

Because these and other factors affect the residue left on your fields, it's always best to measure residue after each tillage pass to see what your equipment and management are leaving.



Start in fall

The goal of residue management is to leave a protective layer of crop residue on the field after planting. But residue management really starts at harvest. Remember that natural weathering during winter reduces the amount of residue left on the field in spring. Every tillage pass in fall and spring buries some residue and further reduces the protective cover on the field.

Corn stalk residue is relatively heavy and provides excellent over-winter cover if left with limited tillage in fall. (Many farmers chop stalks before fall chisel plowing. Chopping reduces plugging, but can significantly reduce residue levels.) Fragile soybean residues call for extra care. Small, fine pieces of soybean residue blow away easily and decompose rapidly. Experience shows that it's best not to disturb soybean residues at all after harvest.

Spreading residue evenly across a field is almost as important as the amount of residue left. Use a spreader on the combine that distributes residue evenly. Attachments are available that distribute the fine chaff that would otherwise fall in a narrow band and spread it across the width of the combine.



Measuring residue

The residue left on your fields will depend on the weather, crop yields, how deep and fast you operate equipment, and many other factors. So, the best way to know how much residue you're leaving is to measure the residue after planting.

A simple and accurate method for measuring residue uses a tape measure or any line divided

into either 50 or 100 equal parts. For example, take a 100-foot cord and mark it every one foot.

Take three to five measurements in different parts of the field and take the average percentage to get a good estimate of residue cover for the entire field.

1. Stretch the line

Place it diagonally across the crop rows.



2. Walk and count

As you walk along the line, look down directly from above and count the number of marks that have residue beneath them. Walk the entire length of the line.

3. Total the results

The total number of marks with residue under them is the percent cover for the field. If your line has only 50 marks, multiply the number by two.

How much residue am I leaving?

A great deal of research has been done on tillage and planting equipment and the amount of residue they leave on the surface after a single pass. The table at right summarizes this research, and is the basis for the tillage/planting estimates shown on the following pages.

Each of the examples shows a common sequence for tillage and planting, and also shows the average low and high residue to expect after harvesting, winter weathering, tillage and planting. For example, a common tillage sequence for corn is:

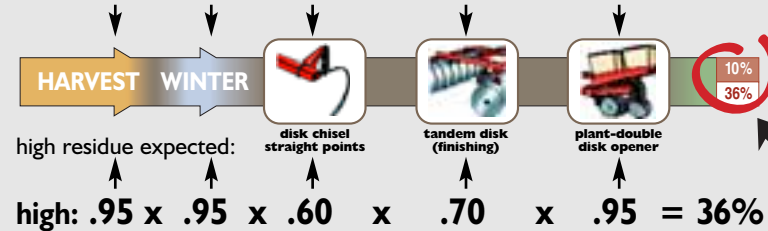


How we calculated residue levels

Using the numbers in the table on the right, we estimated the average high and low for residue left after planting. For example, in this corn sequence:

low residue expected:
(using numbers from the table)

$$\text{low: } .75 \times .80 \times .50 \times .40 \times .85 = 10\%$$



You needn't do the multiplication for the options shown on the following pages – the results are already calculated.

The following pages show estimated residues for typical tillage/planting sequences. If you don't find a sequence that exactly matches your tillage and planting operations, you can develop an estimate that does. Just look up the numbers for each operation you use, along with the "winter" and "harvest" numbers, and multiply them out as shown in the example above.

While these tables give a fair estimate of residue left after a year's typical tillage and planting operations, remember that measuring residue in your fields is the most accurate method.

Estimated residue left after harvest, winter, and different tillage/planting operations

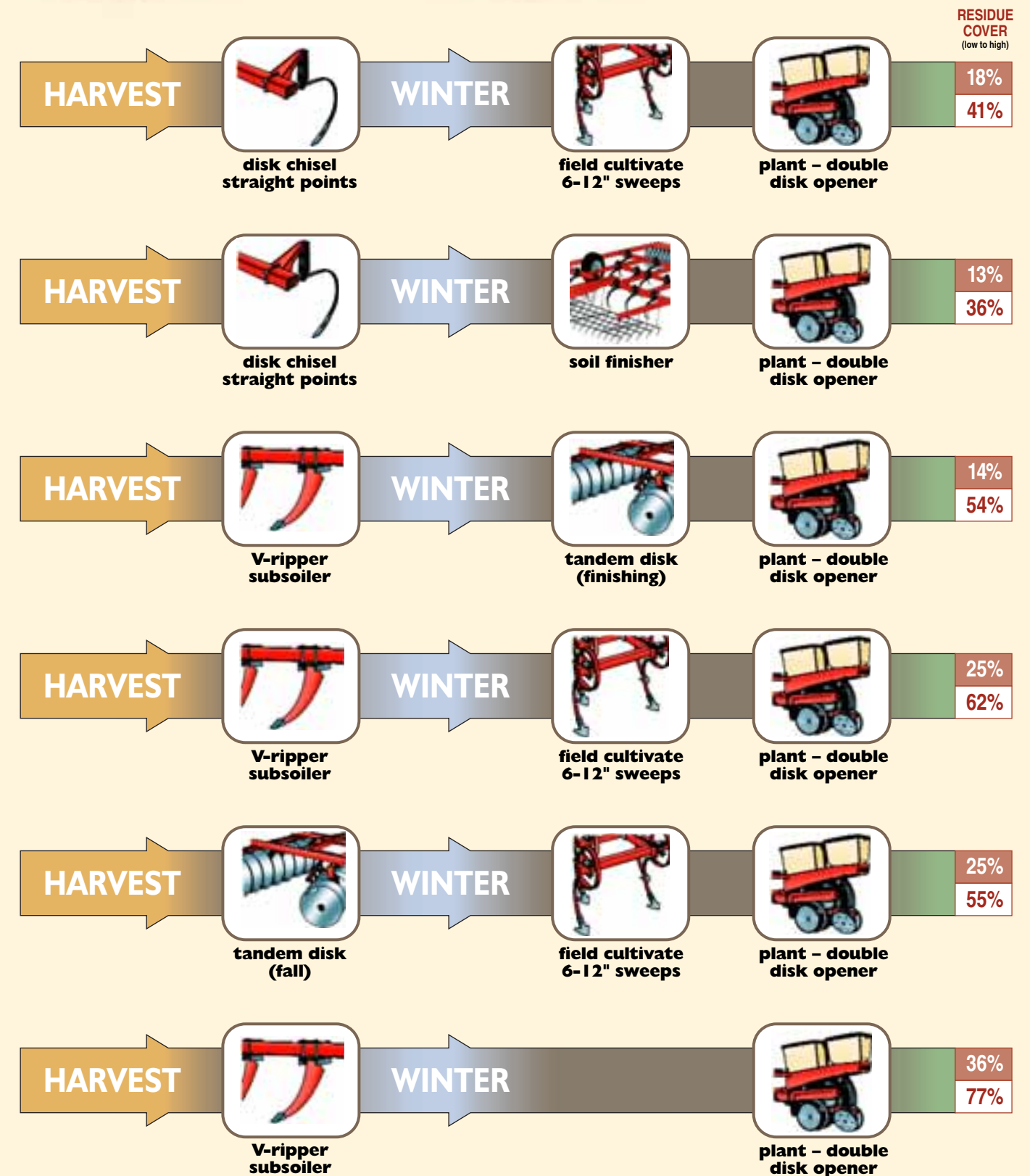
	% residue left	
	Corn/Small Grain	Soybeans
Harvest/Winter	low to high	low to high
After harvest	75-95%	65-90%
After winter weathering	80-95	70-80

Machine or operation		
Moldboard plow	0-10	0-5
Paraplow/paratill	80-90	75-85
V-ripper/subsoiler	70-90	60-70
Chisel plows with:		
Sweeps	70-85	50-60
Straight points	60-80	40-60
Twisted points	50-70	30-40
Coulter chisel plow with:		
Sweeps	60-80	40-50
Straight points	50-70	30-40
Twisted points	40-60	20-30
Disk chisel plows with:		
Sweeps	50-70	30-50
Straight points	50-60	30-40
Twisted points	30-50	20-30
Disks:		
Offset primary cutting	30-60	20-40
Offset heavy plowing	25-50	10-25
Tandem disk (primary cutting)	30-60	20-40
Tandem disk (fall)	70-80	40-50
Tandem disk finishing	40-70	25-40
Field cultivators as primary tillage:		
Duckfoot points	35-65	30-55
Sweeps or shovels 6-12"	35-75	50-70
Sweeps 12-20"	60-80	55-75
Field cultivators as secondary operation:		
Duckfoot points	60-70	35-50
Sweeps or shovels 6-12"	70-80	60-75
Sweeps 12-20"	80-90	65-80
Finishing tools:		
Soil finisher (disk, shank, leveler)	50-70	30-50
Seedbed conditioner (spring tooth and rolling basket)	70-90	50-70
Culti-packer	60-80	50-70
Harrow, spike tooth	70-90	60-80
Drills:		
Hoe openers	50-80	40-60
Disk Openers	80-100	60-80
No-till coulters	75-80	60-80
Planters:		
Double disk opener planters	85-95	75-85
Runner planters	85-95	80-90
Sweeps or double row cleaning disks	60-80	50-60
Ridge-till planter	40-60	20-40
No-till planters with:		
Smooth coulter	85-95	75-90
Ripple coulter	75-90	70-85
Fluted coulter	65-85	55-80
2 or 3 fluted coulters	60-80	50-75
Anhydrous applicator	75-85	45-70

Corn Residue



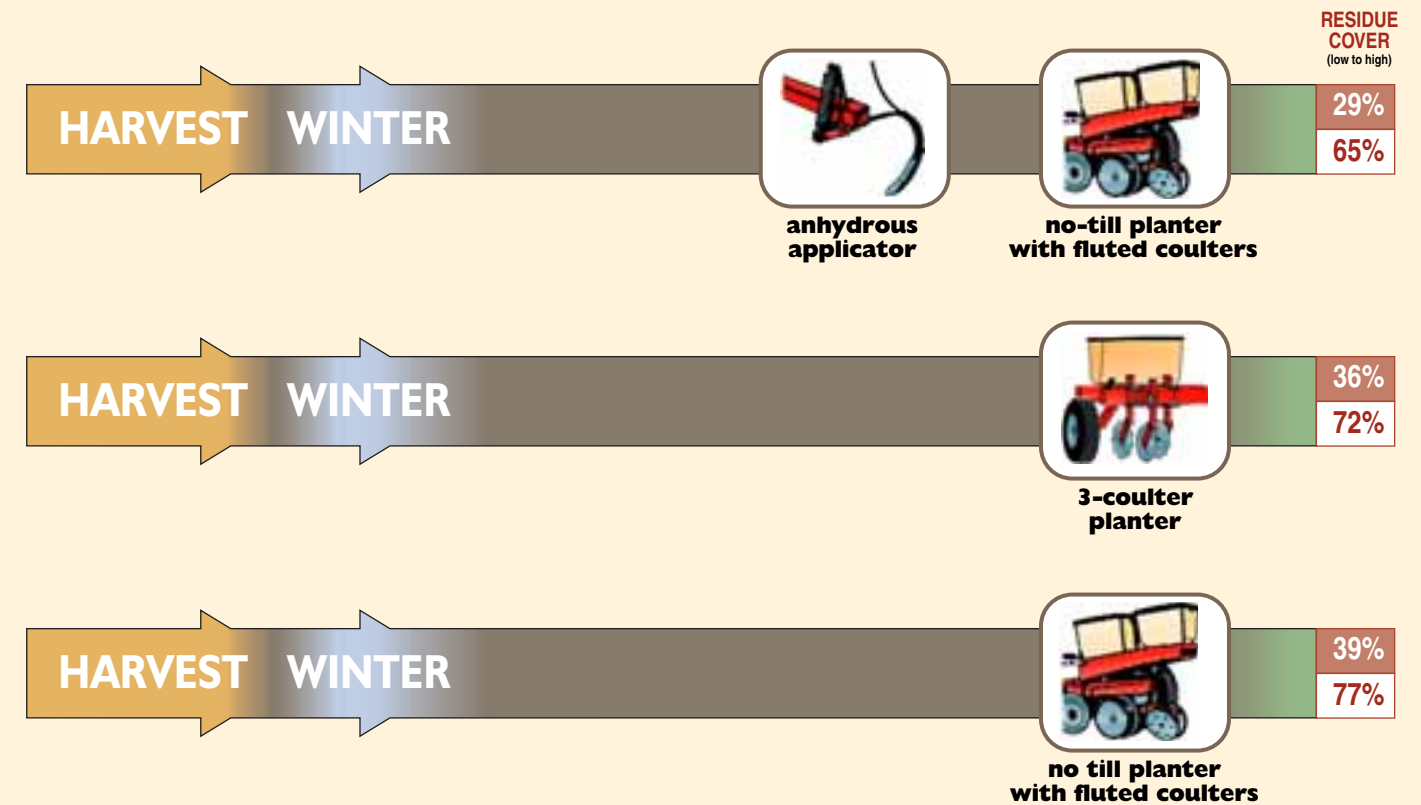
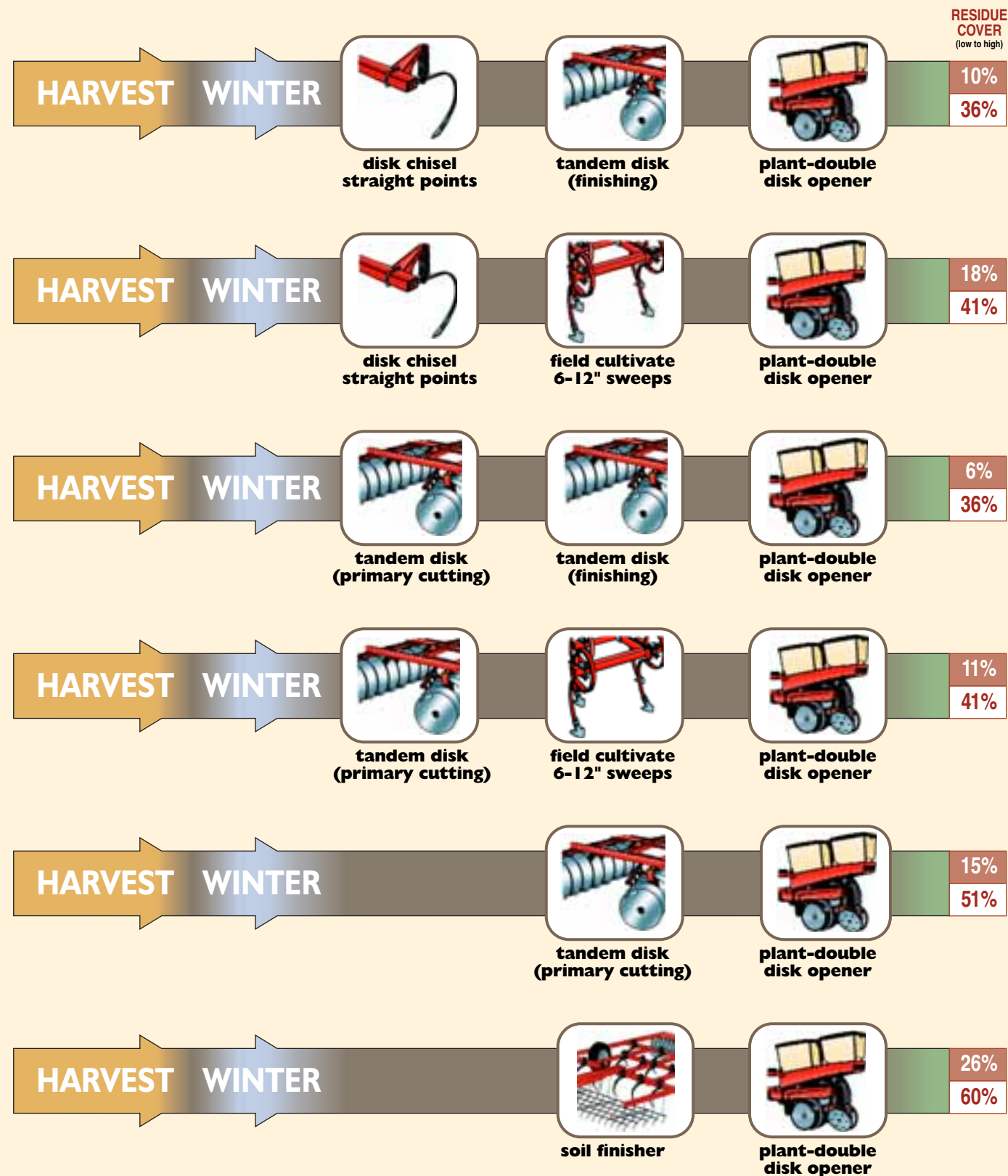
• • • Fall Tillage



Corn Residue



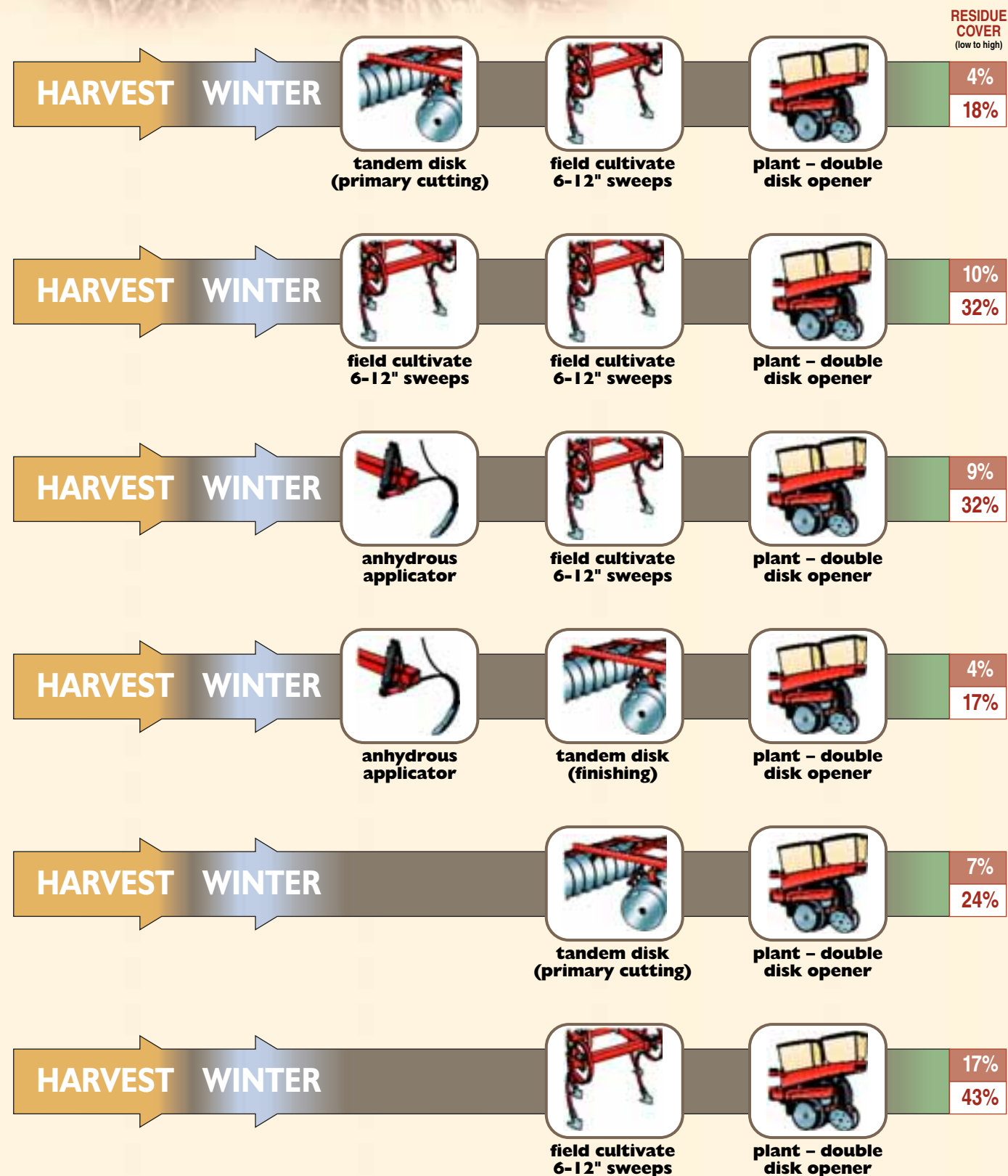
• • • No Fall Tillage



Note: Drills leave residue similar to no-till planters.

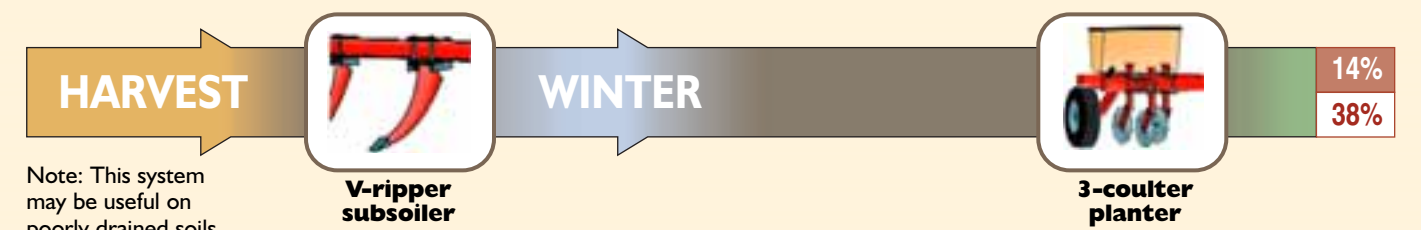
Soybean Residue

• • • No Fall Tillage



Note: Drills leave residue similar to no-till planters.

• • • Fall Strip Till



Note: This system may be useful on poorly drained soils.

Ready to Start?

Farming with higher residue levels means less time spent on the tractor, but more time spent on management tasks. Here are some general tips for getting started successfully.

Consider your nutrient and pest management

Increased residue, cooler soils and higher soil moisture affect the availability of nutrients. These factors also affect weed and insect populations. Careful nutrient and pest management strategies are critical to working successfully with increased residues.

Prepare and test the soil.

If the soil is compacted, subsoil before switching to higher-residue farming. Adjust P and K levels and soil pH based on six-to-eight-inch deep soil samples. Broadcast and incorporate fertilizer and lime before starting to farm with increased residues. Surface pH may decrease in established high-residue fields and should be monitored over time, especially in the top two inches of soil.

Manage fertilizer.

Once increased residue levels are established, nitrogen fertilizer should be placed below the residue to avoid losses through volatilization or runoff. As a rule, the greater the residue, the more likely you are to see a response to banded starter fertilizer (see graph).

On fields where residue levels are 50% or more, apply an additional 30lbs/acre N for the first two years. This will offset the N that may be immobilized in surface residues and unavailable to crops, as well as the lower annual amount of N mineralized from soil organic matter.



Manage manure.

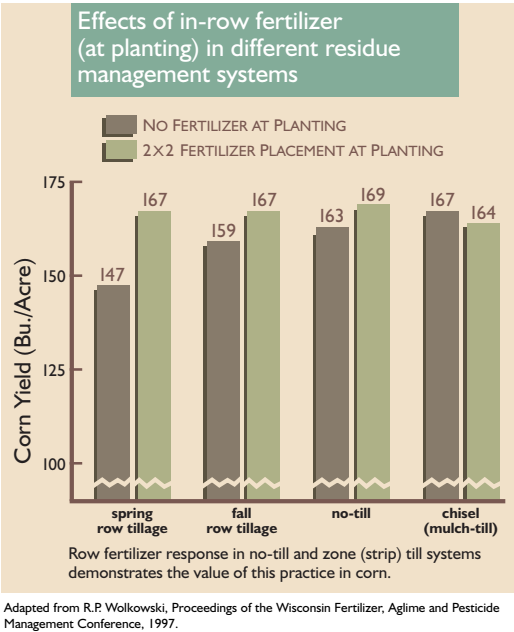
Manure applications to no-till fields are not recommended because excess phosphorus can be washed off. Manure can also cause production problems by increasing soil moisture and decreasing soil temperature. Consider using mulch till, which uses light disking to incorporate the manure into the top two inches of soil. This reduces the manure runoff problem while retaining residue for erosion control.

Prepare for weed control.

If weeds are a problem with the current system they will continue to be a problem. A full herbicide program the first few years can help manage weeds. Generally, increase use of pre- and post-emergence herbicides that do not require incorporation. Row cultivators are also available that work well in high-residue systems.

Prepare for insect and disease control.

The potential for insect problems is slightly greater in reduced tillage systems. Diseases favored by cool, moist conditions may be more troublesome than those favored by dry, warm conditions in plowed fields. Field scouting and a pest management plan are critical in reduced tillage systems. County Extension offices and Land Conservation Departments, NRCS field offices and private consultants can help develop an effective management program for your situation.



Making the change to higher-residue farming

Higher-residue farming doesn't mean changing overnight from the moldboard plow and clean tillage to no-till. You can make the change to higher residue gradually. From the moldboard, you might progress to a chisel plow with twisted shanks. To leave even more residue, you might then change to a chisel plow with sweeps, and eventually to strip-till or no-till.

If you're already farming with crop residue, keep these tips in mind to maximize residue levels:

- Reduce the number of tillage passes. Two passes are usually the limit for leaving 30 percent residue.
- Drive slower, which will turn less soil and leave more residue.
- Use straight points or sweeps instead of twisted points.
- Align disk blades straighter to bury less residue.
- Set chisels and disks shallower.
- Spread residue from the combine evenly – don't windrow residue.

Consider your tillage equipment

The points or shanks of a tillage implement largely determine how much residue remains after each tillage pass. One pass with a shallow chisel with sweeps could leave as much as 85 percent corn

residue, while a deep disk chiseling with 4-inch twisted points could leave as little as 30 percent. Below are some general relationships between points and residue.

Getting to the point



Sweeps

Sweeps with low crowns loosen the soil but do very little turning. Chisel plows with sweeps typically leave 70 to 85 percent corn residue with each pass.



Straight points

Straight points, or spikes, bury less residue than twisted points, typically leaving 60 to 80 percent corn residue with each pass. A 2-inch wide point leaves more residue than wider points.



Twisted points

Twisted points work like mini-moldboard plows, turning and throwing soil. Wider (4-inch) points bury significantly more residue than straight points or sweeps. Twisted points typically leave 50 to 70 percent corn residue with each pass.

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Summing up...
the benefits of farming
with higher residue

Farming with more residue will require
a change in management, especially at
the beginning. But in return, the
changes can bring about long-term
benefits, both on and off the farm.

Save time and money

On a 500-acre farm, annual time
savings can be as much as 225 hours,
or almost four 60-hour weeks.

Fewer trips can save up to \$5 per acre
on machinery wear and maintenance,
and 3.5 gallons of fuel per acre over
conventional tillage.

Improve your soil

Depending on the amount of residue,
soil erosion can be reduced up to 90
percent compared to intensively tilled
fields. On a demonstration plot in
central Wisconsin, for example, a corn
plot with 0 percent residue lost 8,623
lbs. of soil after a rain storm, a plot
with 14 percent residue lost 239 lbs.,
and a plot with 54 percent residue lost
only 20 lbs.

Field traffic required by intensive
tillage compacts the soil over time. Less
tillage, particularly no-till, increases
aggregation of soil particles, which
allows water to infiltrate and allows
plants to establish strong root systems.

Crop residues reduce water
evaporation from the top few inches of
soil, making more water available for
plants in late summer. This is
especially important in dry summers
and on sandy soils.



Help the environment

Crop residues slow runoff and allow
water to soak into the soil and recharge
groundwater. Reducing field runoff also
keeps sediment and the chemicals
attached to soil particles out of streams
and lakes.

Crop residues can provide critical
shelter and food for wildlife such as
game birds and small animals.

Finally, crop residues contribute to
cleaner air by reducing wind-blown soil
and dust. Fewer trips across the field
also reduce fossil fuel emissions.

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A Final Word

Because farming with crop residues is different
than farming in clean-tilled ground, the key is
to develop a residue management system that fits
into your total operation.

This booklet helps you get started by pointing out
some common tillage systems and answering some
questions you'll have when getting started. But this
booklet is only an introduction. Learning to farm
with crop residues takes time, and mistakes should
be expected.

That's where neighbors experienced with reduced
tillage, crop consultants and staff with your local
NRCS office, USDA Service Center, county Land
Conservation Department, or county Extension
office can help with more specific information and
assistance. Talk with them when you start to
develop a residue management plan for your farm.





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