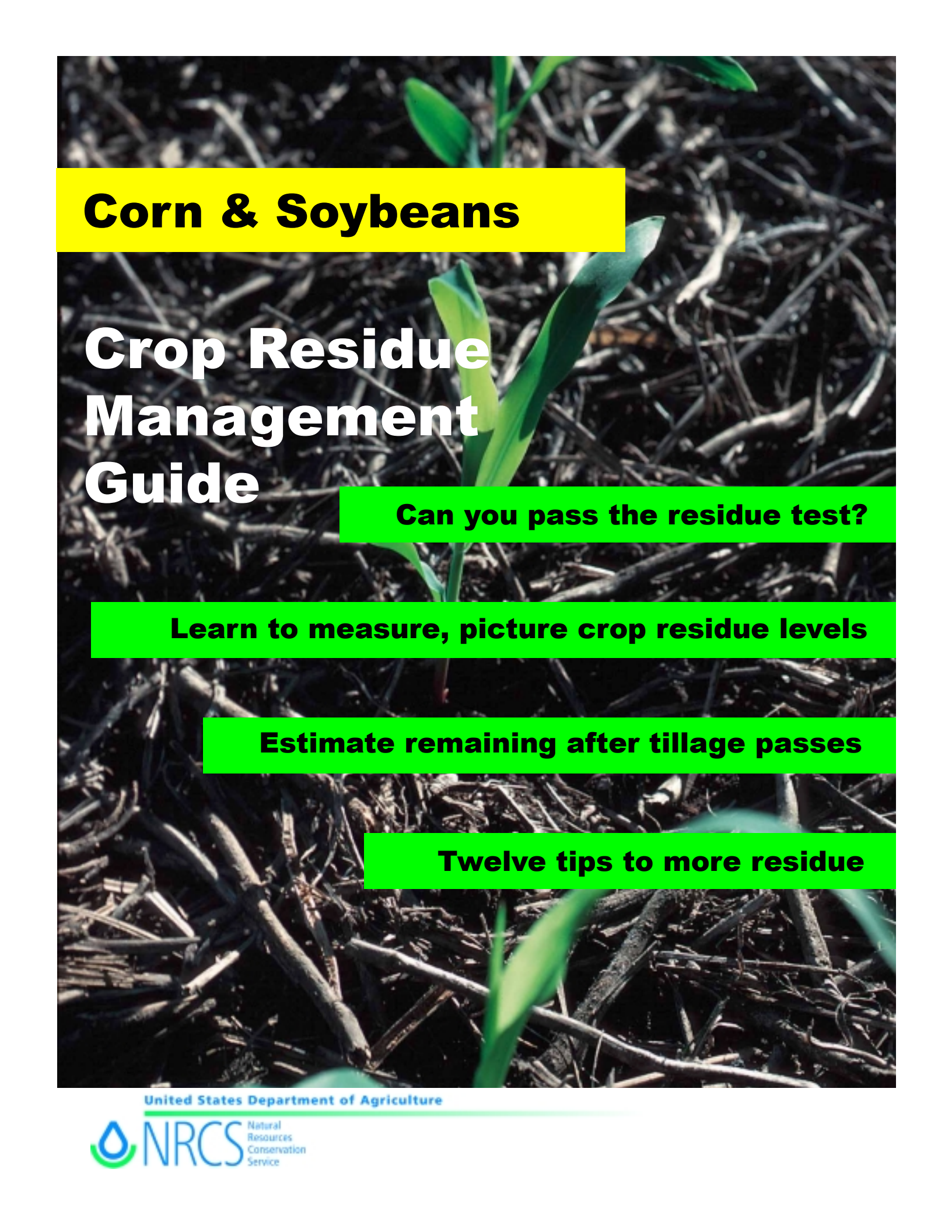




Corn & Soybeans

Crop Residue Management Guide

Can you pass the residue test?

Learn to measure, picture crop residue levels

Estimate remaining after tillage passes

Twelve tips to more residue

United States Department of Agriculture



Using this guide to reduce erosion with crop residues

Thousands of farmers have learned to save soil, time and money by farming successfully with crop residues. Their most important step, many say, was to become committed to the concept.

This guide gives direction on the soil-saving value of crops residues. Use it to:

- recognize crop residue levels;
- compare soil-saving abilities of various types of tillage equipment;
- measure crop residues;
- test yourself and your tillage system; and
- develop a tillage system for a “target” residue level.

There is a wealth of information available from farm suppliers on weed control, insect control, equipment needs, and other aspects of farming with crop residues. You can also find how to use other soil-saving practices with crop residues to build a complete conservation on your farm. Contact the Natural Resources Conservation Service (NRCS) office near you.

Picture your residue levels

Use the photographs in this guide to get a good picture in your mind of what the various percentages of residue look like. You may want to take the guide with you to your fields after planting, to compare your levels of residue with these pictures.

Percent ground cover is dependent on both the amount of crop residues and its distribution. Residues spread evenly across the rows produce the highest percentages of ground cover.

It's easy to over-estimate residue levels by looking out across a field. Residues appear to cover most of the ground from that perspective. For a true picture,

look straight down at the field, as was done with the pictures in this guide. Ask yourself what percent of the ground is covered with residues

You'll develop confidence in your ability to visually estimate residue levels by using these photographs and measuring residues a number of times.

Caution: The tillage systems, described under the photos on the next pages, produced levels noted. Crop varieties, weather, timing of tillage operations, and other variables may change the actual amount of ground cover left after planting.

Look down, not out across the field, for an accurate estimate of ground cover

corn residue





**10% corn
residue**

This level of residue might be expected from a fall chisel with twisted points, a deep spring disking, a field cultivation, and planting.



**20% corn
residue**

This level of residue might be expected from a fall chisel with twisted points, one spring shallow disking, a field cultivation, and planting.



**30% corn
residue**

This level of residue might be expected from one fall chiseling with straight points, a shallow disking in the spring, a field cultivation, and planting.



**40% corn
residue**

This level of residue might be expected from a fall shallow disking, one spring field cultivation, and planting. Paraplowing in the fall followed by a spring field cultivation and planting are similar.



50% corn residue

This level of residue will be difficult to reach without using a no-till system. One tillage system that could produce 50% ground cover after planting is to field cultivate twice in the spring and plant.



60% corn residue

This level of residue might be expected from a no-till system where you plant directly into the existing residue. Another system is to field cultivate once in the spring and plant.

soybean residue





**10% soybean
residue**

This level of residue might be expected from a fall deep disking, spring field cultivation, and planting.



**20% soybean
residue**

This level of residue will be difficult to achieve with any fall tillage. This level could be achieved with an anhydrous application, a spring field cultivation, and planting.



**30% soybean
residue**

This level of residue might be expected from a spring field cultivation and planting.



**40% soybean
residue**

This level of residue might be expected from a well managed continuous no-till system.

How to measure residue

USE any line that is equally divided into 100 parts. Fifty foot cable transect lines are available for this purpose. Another tool is a 50-foot nylon rope with 100 knots or marks, six inches apart. A 50-foot tape measure using the 6-inch and foot marks also works well.

STRETCH the line diagonally across the crop rows. Walk back along the line, looking for residue underneath the marks. Count the number of marks (tabs or knots) that have residue under the leading edge when sighting from directly above the mark. It is important to use the same point on each mark for accuracy. Don't count residue smaller than 1/8 inch in diameter.

WALK the entire length of the rope or wire. The total number of marks with residue under them is the percent cover for the field. If your rope or tape has only 50 marks, multiply by 2; for 25 marks, multiply by 4.

REPEAT the procedure at least 3 times in different areas of the field and average the findings. Avoid measuring areas not representative of the whole field, such as end rows.

Measure residue before and after any field operation to find out how much residue is buried with a single pass of that piece of equipment.

For purposes of crop residue values for soil conservation systems, the residue cover is measured after planting.

A dozen ways to leave more residue

- 1 Follow a crop rotation sequence with high residue producing crops. Soybeans don't provide the same kind of protection as corn, for example. Also, high yields give more residues.
- 2 Wait until spring for tillage operations. This is most important on low residue producing crops such as soybeans. Fall tilled soybean ground is very vulnerable to wind erosion in late winter and early spring.
- 3 Reduce the number of tillage passes. In most cases, this is as important as the type of tillage performed.
- 4 Plant rye or wheat as winter cover crops. this is a good option when you are growing low-residue crops such as soybeans or corn silage.
- 5 Set chisels and disks to work shallower. Tilling deeper buries more residue.
- 6 Stop using the moldboard plow.
- 7 Drive slower on tillage operations. Driving faster throws more soil and covers more residue.
- 8 Use straight points and sweeps on chisel plows instead of twisted points. Twisted points may bury 20% more residue.
- 9 No-till drill soybeans instead of planting them in a prepared seedbed. No-till drilling keeps more residue on the soil surface, and generally produces a quicker canopy.
- 10 Convert to a no-till system. No-till disturbs residue only in the row.
- 11 A straighter alignment of disk blades buries less residue.
- 12 Strive for even distribution of residue from a combine at harvest. Also, leave residue size as large as possible. Smaller residue particles, such as chopped soybean residue will decompose more quickly and be buried more easily.

Points for higher residue levels

The point of a tillage implement can make a big difference in crop residue levels remaining on the surface after a tillage operation. For example, a shallow chisel plowing with sweeps could be expected to leave as much as 85 percent corn residue, while a deep dish-chiseling with a 4-inch twisted points could be expected to leave as little as 30 percent residue.

The percentages on these pages are based on tests under similar conditions. Use them as a guide to farming with heavier residues.

Your best guide will come from measuring residues levels before and after a tillage pass.



Sweeps

Sweeps can be operated shallow or as deep as 10 inches. Sweeps with low crowns fracture and loosen the soil but do very little turning of the soil. In corn residue, chisel plows with sweeps could be expected to leave 65 to 86% of the residue that existed before the tillage pass.



Straight points

Straight points, often called spikes, have been used for years on chisel plows. A two-inch wide point leaves more residue than wider points. Straight points do less turning and mixing of the soil than twisted points. In corn residue, expect to leave 55 to 75% of the residue that existed before a pass with a chisel with these points. The amount is less if stalks were disked.



Winged straight points

Winged straight points are a combination of sweeps and straight points. The sweep-like wing helps undercut and fracture more soil than a straight point. The wing extends a 2-inch wide point to a width of 7 inches. Expect residue levels similar to those of a straight point.



Twisted points

Twisted points work like a mini-moldboard plow bottom, turning and throwing soil. Twisted points, especially 4-inch wide twisted points, bury significantly more residue than straight points or sweeps. Expect to leave 40-60% of the corn residue that existed before a chisel pass with these points. Cover will be less if stalks are disked before chiseling.



Helical points

Helical points work much like twisted points, turning or throwing soil. Expect them to leave residue levels similar to those of twisted points.

Estimates of residue cover after machinery operations

Most tillage operations bury some crop residues. How much residue is buried depends primarily on the type of machine used, how it's used, and the type of residue it's used on.

The chart on the following page has been developed from research data. For each machine listed, the numbers to the right are the ranges of crop residue that you could expect to leave after one pass with that piece of equipment. The actual residue level can vary widely.

Type of machine

Machinery listed is that commonly used with corn and soybeans. Machines that are designed to turn the soil over, throw soil, and till the entire machine width tend to bury the most residue.

Tillage techniques

The person on the tractor seat can use a tillage tool to full advantage to leave crop residues on the soil surface. It's best to set equipment to work shallower, drive slower, and use tillage points that fracture the soil rather than turn to throw it.

Crop residue type

Fragile crop residues such as soybean stubble are more easily buried than larger, coarse residues such as corn stalks. Fragile residues decompose more quickly, and may be blown away. Fragile residues are produced from most vegetables, peanuts, grapes, and small grains harvested with a rotary combine.

Examples of non-fragile residue are sorghum, tobacco, sunflowers, popcorn, wheat, oats, and cotton.

Using the tillage chart

Use the chart on the following page to compare tillage implements for their ability to leave residues on the soil surface and to get a rough estimate of the percent residue you could expect to leave after planting from a specific tillage system. Multiply each of the machinery operations numbers together. Chose from within the range listed.

Include the overwintering factor. As a general rule, use the higher number in northern states and the lower number in the South. Residue decomposes more quickly in warmer temperatures.

Here's an example of how to estimate ground cover after planting:
 $.95$ (% cover after harvest) $\times$ $.90$ (10% overwinter loss) $\times$ $.60$ (40% spring chisel - straight points loss) $\times$ $.80$ (20% field cultivate with sweeps loss) $\times$ $.90$ (10% planting loss) = $.37$ (times 100 equals 37% ground cover after planting).

The attached table (in the back) will convert percent ground cover to pounds per acre weight.

Machine or operation	Percent Residue Left	
	Corn/Small Grain	Soybean
Over winter weathering	80-95	70-80
Moldboard plow	0-10	0-5
Paraplow/Paratill	80-90	65-75
V ripper/subsoiler	70-90	60-70
Chisel plows with:		
Sweeps	65-85	35-55
Straight chisel points	55-80	30-50
Twisted points	40-60	15-35
Coulter chisel plows with:		
Sweeps	60-80	30-60
Straight chisel points	50-70	25-45
Twisted points	35-55	10-30
Disk chisel plows:		
Sweeps	55-75	25-45
Straight Chisel Points	45-65	20-40
Twisted points	30-50	10-25
Disks: Offset light duty	45-55	30-40
Offset heavy duty	35-45	25-35
Tandem disk (as a secondary operation)	40-60	35-45
Tandem disk after harvest, before other tillage	80-90	50-60
Field cultivators as primary tillage operation:		
Duckfoot points	---	30-55
Sweeps or shovels 6-12"	---	50-70
Sweeps 12-20"	---	55-75
Field cultivators as secondary operation:		
Duckfoot points	60-80	50-70
Sweeps or shovels 6-12"	75-85	60-75
Sweeps 12-20"	80-90	65-80
Finishing tools:		
Soil finisher	45-65	30-50
Seedbed conditioner	75-95	50-70
Culti-mulcher	70-90	60-70
Harrows	70-90	65-85
Drills: Hoe openers	50-80	40-60
Disk openers	80-90	60-80
No-till coulters	75-85	70-80
Cross slot openers	90-95	90-95
Planters: Runner planters	85-95	80-90
Double disk opener planters	80-90	70-80
Sweeps or double row cleaning kisks	60-80	40-60
Ridge-till planter	60-70	30-50
No-till planters with:		
Offset double disk openers	90-95	85-95
Smooth coulters	90-95	85-95
Ripple coulters	85-90	80-90
Fluted coulters	80-85	70-80
2 or 3 fluted coulters	75-85	65-75
Anhydrous applicator	75-85	45-70
Knife-type fertilizer applicator	60-80	40-60
After Harvest*	75-95	65-90

* Begin calculations with residue remaining after harvest.

Can you pass the residue test?

Do you know how much crop residue is called for in your conservation plan?

Does your tillage system allow for leaving that amount of residue?

Did you measure that percent ground cover after planting?

If you answered "yes" to these questions YOU PASS!

Percent Residue Cover to Residue Weight for Various Crops¹

% Cover	Small Grains, Soybeans, Peanuts, and everything else	Corn, Tobacco, & Sorghum	Cotton, Sesame, & Sunflowers	% Cover	Small Grains, Soybeans, Peanuts, and everything else	Corn, Tobacco, & Sorghum	Cotton, Sesame, & Sunflowers
	Residue lbs/ac	Residue lbs/ac	Residue lbs/ac		Residue lbs/ac	Residue lbs/ac	Residue lbs/ac
1	15	18	40	51	1244	2064	3048
2	30	36	80	52	1288	2128	3146
3	45	54	120	53	1332	2192	3244
4	60	72	160	54	1376	2256	3342
5	75	90	200	55	1420	2320	3440
6	90	112	250	56	1466	2386	3542
7	105	134	300	57	1512	2452	3644
8	120	156	350	58	1558	2518	3746
9	135	178	400	59	1604	2584	3848
10	150	200	450	60	1650	2650	3950
11	168	240	502	61	1698	2734	4078
12	186	280	554	62	1746	2818	4406
13	204	320	606	63	1794	2902	4734
14	222	360	658	64	1842	2986	5062
15	240	400	710	65	1890	3070	4590
16	258	440	764	66	1942	3156	4722
17	276	480	818	67	1994	3242	4854
18	294	520	872	68	2046	3328	4986
19	312	560	926	69	2098	3414	5118
20	330	600	980	70	2150	3500	5250
21	350	640	1036	71	2212	3618	5433
22	370	680	1092	72	2274	3736	5616
23	390	720	1148	73	2336	3854	5799
24	410	760	1204	74	2398	3972	5982
25	430	800	1260	75	2460	4090	6165
26	450	840	1318	76	2528	4212	6352
27	470	880	1376	77	2596	4334	6539
28	490	920	1434	78	2664	4456	6726
29	510	960	1492	79	2732	4578	6913
30	530	1000	1550	80	2800	4700	7100
31	556	1044	1614	81	2918	4898	7280
32	582	1088	1672	82	3036	5096	7460
33	608	1132	1730	83	3154	5294	7640
34	634	1176	1788	84	3272	5492	7820
35	660	1220	1870	85	3390	5690	8000
36	688	1266	1936	86	3512	5892	>8000
37	716	1312	2002	87	3634	6094	>8000
38	744	1358	2068	88	3756	6296	>8000
39	772	1404	2134	89	3878	6498	>8000
40	800	1450	2200	90	4000	6700	>8000
41	838	1504	2274	91	4200	6960	>8000
42	876	1558	2478	92	4400	7220	>8000
43	914	1612	2682	93	4600	7480	>8000
44	952	1666	2886	94	4800	7740	>8000
45	990	1720	2570	95	5000	8000	>8000
46	1032	1776	2646	96	5450	>8000	>8000
47	1074	1832	2722	97	5900	>8000	>8000
48	1116	1888	2798	98	6350	>8000	>8000
49	1158	1944	2874	99	6800	>8000	>8000
50	1200	2000	2950	100	7250	>8000	>8000

¹Note: Small grain, Corn, and Cotton table values are from figure 5-4 RUSLE Ag. Handbook 703, pg. 179. Green shaded values match 703 table values, non-shaded values are interpolated