

**NATURAL RESOURCES CONSERVATION SERVICE
CONSTRUCTION SPECIFICATIONS**

RESIDUE MANAGEMENT, NO-TILL/STRIP TILL

1. Scope

The work shall consist of performing cultural operations to produce crops or hay in a manner that maintains acceptable yields and provides adequate residues on the soil surface from harvest until after planting the next crop. The crop residues will be distributed evenly across the production area and left undisturbed by full width tillage operations from harvest until planting of the next crop. Crops will be planted in narrow slots, tilled strips, or residue-free strips not previously tilled by full-width inversion implements. The intent of this practice is to provide surface cover to control soil erosion, conserve soil moisture, and reduce weed competition. Practice design and application will be documented on the Residue Management Job Sheet.

2. Materials

Chemicals used in performing this practice shall be federally, state, and locally registered and shall be applied strictly in accordance with authorized registered uses, directions on the label, and other federal, state, and local policies and requirements.

Chemical containers shall be properly stored and disposed of in a safe manner, according to state and local ordinances or procedures.

Planters or drills shall be equipped to plant directly through untilled residue or in a tilled seedbed prepared in a narrow strip (not exceeding one-third of the full row width) for each row through the use of planter attachments such as rotary hoes, sweeps, multiple coulters, or row cleaning devices.

Combines used to harvest small grains shall be equipped with devices that will chop and distribute the crop residues over approximately 80 percent of the working width of the header.

An estimation of the percent residue cover can be made by determining the residue quantity (Table 1) and type (Table 4) produced for the crop yield after harvest and multiplying by the appropriate values for each residue-disturbing operation (Table 2) that is conducted or planned. If the estimate is desired in percent cover, use Table 3 to convert pounds of residue to percent cover.

Procedures for estimating amounts of crop residue retained may be found in Kansas Agronomy Technical Note KS-1; National Agronomy Manual, Section 502; Publication SCS-CRM-01, Crop Residue Management Guide (available at Natural Resources Conservation Service [NRCS] field offices); and Publication SCS-CRM-02, Picture Your Residue (available at NRCS field offices).

3. Cultural Operations

Managing for soil erosion control. In rainfall erosion areas, the tillage and planting system shall provide enough surface cover to accomplish sheet and rill erosion objectives, as determined by the current approved sheet and rill erosion prediction method. At least 30 percent coverage of the soil surface with plant residues will be present after planting a crop, unless otherwise specified on the Residue Management Job Sheet. The soil shall be left undisturbed from harvest to planting, except for nutrient injection. Planting or drilling shall be accomplished in a narrow in-row seedbed or slot created by coulters, row cleaners, disk openers, in-row chisels, or rotary tillers. See Table 5 for crop tolerance with blowing soil.

In wind erosion areas, the tillage and planting system shall maintain the amount of residue needed to accomplish soil erosion protection objectives, as determined by the current approved wind erosion prediction method. At least 1,000 pounds per acre of flat, small grain residue equivalent will be on the

soil surface throughout the critical wind erosion management period, unless otherwise specified on the Residue Management Job Sheet. The soil shall be left undisturbed from harvest to planting except for nutrient injection. Planting or drilling shall be accomplished in a narrow seedbed or slot created by coulters, row cleaners, disk openers, in-row chisels, or rotary tillers.

Planting shall be performed as nearly as practical across the slope.

Planting shall be performed directly into old crop residues, annual cover crop, or chemically killed sods.

Follow fragile residue producing crops with non-fragile residue producing crops and follow low residue producing crops with high residue producing crops. Do not use fragile, low residue producing crops more than two consecutive years.

Managing for available soil moisture. In systems designed to maximize available soil moisture, crop stubble should be left standing during the winter period to increase the potential for snow catch. When shredding of stalks and stubble are included in the system, these practices should be conducted after primary snowfall periods to reduce evapo-transpiration at the soil surface. A minimum of 50 percent residue cover shall be maintained on the soil surface throughout the year.

Managing for pest reduction. Maintain a diverse crop rotation that will disrupt life cycles and not provide carry over diseases. Manage chemical diversity to reduce the potential of resistance to applied chemicals.

Spot treat perennial weed populations with chemical applications during the period when plant translocation to the root system is most advantageous for complete control. Early detection and immediate treatment will eliminate the need for more costly eradication or control.

Managing insect populations requires early detection and control to keep populations below an economic loss threshold. Monitor border areas for potential population expansions and control prior to infestations of the cropping area where feasible.

Weed control shall be accomplished primarily with herbicides, crop rotations, and cover crops.

Where cultivation is used for emergency weed control or spot tillage treatment is required for leveling ruts or similar operations, tillage shall be limited to the specific area of concern and to those operations which minimize burial of the crop residue.

Managing for wildlife food and cover. Residue height, amount, and time period shall be determined using an approved habitat evaluation procedure. Residues shall not be removed unless it is determined by the habitat evaluation procedure that removal would not adversely affect habitat values.

Determine the primary management purpose or objective when planning pest management activities. In a wheat-fallow cropping system, it has been determined that eliminating summer post harvest weed control applications have little or no detrimental effects on available soil moisture, but is very beneficial to pheasant populations.

4. Other Requirements

Residue shall not be burned.

Partial removal of residue by means of haying or grazing shall be limited to the amount needed to meet the desired objectives.

Any make of rotary harrow is considered full width tillage and is applicable to Conservation Practice Standards 329B, Residue Management, Mulch Till; or 344, Residue Management, Seasonal, only and will not be considered as a component of a no-till/strip till or direct seed system.

The owner, operator, contractor, or other persons shall conduct all work and operations, in accordance with proper safety codes for the type of equipment and operations being performed with due regard to the safety of all persons and property.

Planning and documentation requirements:

- Identified problem.
- Producers objectives.
- Location map – field numbers, map, or sketch of the area planned.
- Measured acres.
- Cropping sequence and planned residue, kind, amounts, percent surface cover required, and orientation.
- Critical time periods to maintain residue.
- Documentation of applied residue in pounds or percent by planning unit.

Table 1 – Residue Produced by Crops

Crop	Estimated Air Dry Residue Produced	Units
Corn	56	Lbs./bu. grain
Corn Silage Stubble	21	Lbs./in/10,000 plants/ac.
Grain Sorghum	56	Lbs./bu. grain
Soybeans	75	Lbs./bu. grain
Sunflowers	2.2	Lbs./bu. grain
Oats	64	Lbs./bu. grain
Winter Wheat	102	Lbs./bu. grain
Winter Wheat (fall growth)	175 to 400	Lbs./ac.
Spring Wheat	78	Lbs./bu. grain
Rye	84	Lbs./bu. grain
Rye (fall growth)	175 to 600	Lbs./ac.
Millet	80	Lbs./bu. grain
Dry Edible Beans	2.2	Lbs./lb. grain
Barley	72	Lbs./bu. grain
Safflower	1.5	Lbs./lb. grain
Potatoes	6	Lbs./cwt.
Sorghum Silage Stubble		
Plant Population: <58,000 plants/ac.	32	Lbs./in/10,000 plants/ac.
>58,000 plants/ac.	186	Lbs./in/10,000 plants/ac.
Rape Seed	2	Lbs./lb. grain
Buckwheat	1.5	Lbs./lb. grain
Field Peas (dry)	1.2	Lbs./lb. grain

Table 2 – Residue Reduction by Type of Activity

Implement	Percent Residue Remaining	
	Nonfragile Percent	Fragile Percent
Drills		
Hoe Opener drills	50 to 80	40 to 60
Semi-deep furrow drill or press drill (7 to 12 inch spacing)	70 to 90	50 to 80
Deep furrow drill with > 12-inch spacing	60 to 80	50 to 80
Single disk opener drills	85 to 100	75 to 85
Double disk opener drills (conventional)	80 to 100	60 to 80
No-till drills and drills with the following attachments <u>in standing stubble</u> :		
Smooth no-till coulters	85 to 95	70 to 85
Ripple or bubble coulters	80 to 85	65 to 85
Fluted coulters	75 to 80	60 to 80
No-till drills and drills with the following attachments <u>in flat residues</u> :		
Smooth no-till coulters	65 to 85	50 to 70
Ripple or bubble coulters	60 to 75	45 to 65
Fluted coulters	55 to 70	40 to 60
Air Seeders: Refer to appropriate field cultivator or chisel plow depending on the type of ground engaging device used. Air Drills: Refer to corresponding type of drill opener.		
Row Planters		
Conventional planters with:		
Runner openers	85 to 95	80 to 90
Staggered double disk openers	90 to 95	85 to 95
Double disk openers	85 to 95	75 to 85
No-till planters with:		
Smooth coulters	85 to 95	75 to 90
Ripple coulters	75 to 90	70 to 85
Fluted coulters	65 to 85	55 to 80
Strip-till planters with:		
2 or 3 fluted coulters	60 to 80	50 to 75
Row cleaning devices (8- to 14-inch-wide bare strip using brushes, spikes, furrowing disks, or sweeps)	60 to 80	50 to 60
Ridge till planter	40 to 60	20 to 40

Table 2 – Residue Reduction by Type of Activity (Continued)

Implement	Percent Residue Remaining	
	Nonfragile Percent	Fragile Percent
Climatic Effects		
Over Winter weathering: *		
Following summer harvest	70 to 90	65 to 85
Following fall harvest	80 to 95	70 to 80
Field Cultivators (Including leveling attachments)		
Used as the primary tillage operation:		
Sweeps 12 to 20 inches	60 to 80	55 to 75
Sweeps or shovels 6 to 12 inches	35 to 75	50 to 70
Duckfoot points	35 to 60	30 to 55
Field cultivators as secondary operation following chisel or disk:		
Sweeps 12 to 20 inches	80 to 90	60 to 75
Sweeps or shovels 6 to 12 inches	70 to 80	50 to 65
Duckfoot points	60 to 70	35 to 50
Finishing Tools		
Combination finishing tools with:		
Disks, shanks, and leveling attachments	50 to 70	30 to 50
Spring teeth and rolling basket	70 to 90	50 to 70
Harrows:		
Springtooth (coil line)	60 to 80	50 to 70
Spike tooth	70 to 90	60 to 80
Flex-tine tooth	75 to 90	70 to 85
Roller harrow (cultipacker)	60 to 80	50 to 70
Packer roller	90 to 95	90 to 95
Rotary tiller:		
Secondary operation 3 inches deep	40 to 60	20 to 40
Primary operation 6 inches deep	15 to 35	5 to 15
Rodweeders		
Plain rotary rod	80 to 90	50 to 60
Rotary rod with semi-chisels or shovels	70 to 80	60 to 70
Strip Tillage Machines		
Rotary tiller, 12-inch tilled on 40-inch rows	60 to 75	50 to 60

*In northern climates with long periods of snow cover and frozen conditions, weathering may reduce residue levels only slightly while, in warmer climates, weathering losses may reduce residue levels significantly.

Table 2 – Residue Reduction by Type of Activity (Continued)

Implement	Percent Residue Remaining	
	Nonfragile Percent	Fragile Percent
Row Cultivators (30 inches and wider)		
Single sweep per row	75 to 90	55 to 70
Multiple sweeps per row	75 to 85	55 to 65
Finger wheel cultivator	65 to 75	50 to 60
Rolling disk cultivator	45 to 55	40 to 50
Ridge till cultivator	20 to 40	5 to 25
Unclassified Machines		
Anhydrous applicator	75 to 85	45 to 70
Anhydrous applicator with closing disks	60 to 75	30 to 50
Subsurface manure applicator	60 to 80	40 to 60
Rotary hoe	85 to 90	80 to 90
Bedders, listers, and hippers	15 to 30	5 to 20
Furrow diker	85 to 95	75 to 85
Mulch treader	70 to 85	60 to 75
Plows		
Moldboard plow	0 to 10	0 to 5
Moldboard plow-uphill furrow (Pacific Northwest Region only)	30 to 40	---
Disk plow	10 to 20	5 to 15
Machines Which Fracture Soil		
Paratill/paraplow "V" ripper/subsoiler	80 to 90	75 to 85
12 to 14 inches deep, 20-inch spacing	70 to 90	60 to 80
Combination tools:		
Subsoil-chisel	50 to 70	40 to 50
Disk-subsoiler	30 to 50	10 to 20
<u>Chisel Plows with:</u>		
Sweeps	70 to 85	50 to 60
Straight chisel spike points	40 to 80	30 to 60
Twisted points or shovels	35 to 70	20 to 40
<u>Combination Chisel Plows</u> Coulter chisel plows with:		
Sweeps	60 to 80	40 to 50
Straight chisel spike points	30 to 60	25 to 40
Twisted points or shovel	25 to 60	10 to 30
Disk chisel plows with:		
Sweeps	60 to 70	30 to 50
Straight chisel spike points	30 to 60	25 to 40
Twisted points or shovels	20 to 50	10 to 30

Table 2 – Residue Reduction by Type of Activity (Continued)

Implement	Percent Residue Remaining	
	Nonfragile Percent	Fragile Percent
Undercutters Stubble-mulch sweep or blade plows with:		
Sweep/"V" blade >30 inches wide	75 to 95	60 to 80
Sweeps 20 to 30 inches wide	70 to 90	50 to 75
Disk Harrows		
Offset:		
Heavy plowing >10-inch spacing	25 to 50	10 to 25
Primary cutting >9-inch spacing	30 to 60	20 to 40
Finishing 7- to 9-inch spacing	40 to 70	25 to 40
Tandem:		
Heavy plowing >10-inch spacing	25 to 50	10 to 25
Primary cutting >9-inch spacing	30 to 60	20 to 40
Finishing 7- to 9-inch spacing	40 to 70	25 to 40
Light tandem disk after harvest, before other tillage	70 to 80	40 to 50
One-way disk with:		
12- to 16-inch blades	40 to 50	20 to 40
18- to 30-inch blades	20 to 40	10 to 30
Single gang disk	50 to 70	40 to 60

Table 3 – Relationship of Residue Weight to Percent Residue Cover

% Cover	Alfalfa, Bromegrass, Rye	Wheat, Oats, Soybeans	Corn	Sorghum	Sunflower
	-----Lbs./Ac. * -----				
5	95	85	135	145	215
10	190	180	275	295	440
15	295	275	430	450	675
20	405	380	585	620	930
25	525	490	755	800	1200
30	650	605	940	990	1485
35	785	730	1135	1195	1795
40	930	865	1345	1420	2130
45	1085	1015	1575	1660	2490
50	1260	1175	1825	1925	2890
55	1450	1355	2100	2220	3325
60	1665	1555	2410	2545	3820
65	1910	1780	2765	2915	4375
70	2190	2040	3170	3345	5015
75	2520	2350	3650	3850	5775
80	2925	2730	4235	4470	6705
85	3450	3215	4990	5270	7905
90	4185	3905	6060	6395	9595

* Values listed for 30, 60, and 90 percent cover vary slightly from those listed in the RUSLE database due to rounding.

Table 4 – Residue Types

Nonfragile	Fragile
Alfalfa or legume hay	Canola/Rapeseed
Barley *	Dry beans
Buckwheat	Dry peas
Corn	Fall seeded cover crops
Flaxseed	Lentils
Forage Silage	Mustard
Grass Hay	Potatoes
Millet	Safflower
Oats *	Soybeans
Pasture	Sugar Beets
Popcorn	Sunflowers
Rye *	Vegetables
Sorghum	
Triticale *	
Wheat *	

* If a combine is used with a straw chopper or otherwise cuts straw into small pieces in harvesting small grain, then the residue should be considered as being fragile.

Table 5 – Crop Tolerance to Blowing Soil

Tolerant T	Moderate tolerance 2 ton/ac	Low tolerance 1 ton/ac	Very low tolerance 0 to 0.5 ton/ac
Barley	Alfalfa (mature)	Broccoli	Alfalfa seedlings
Buckwheat	Corn	Cabbage	Asparagus
Flax	Onions (>30 days)	Cotton	Cantaloupe
Grain sorghum	Orchard crops	Cucumbers	Carrots
Millet	Soybeans	Garlic	Celery
Oats	Sunflowers	Green/snap beans	Eggplant
Rye	Sweet corn	Lima beans	Flowers
Wheat		Peanuts	Kiwi fruit
		Peas	Lettuce
		Potatoes	Muskmelons
		Sweet potatoes	Onion seedlings (<30 days)
		Tobacco	Peppers
			Spinach
			Squash
			Strawberries
			Sugar beets
			Table beets
			Tomatoes
			Watermelons