NATURAL RESOURCES CONSERVATION SERVICE

CONSTRUCTION SPECIFICATIONS

RESIDUE MANAGEMENT, SEASONAL

1. Scope

The work shall consist of managing crop residue in cultivated fields to conserve moisture, increase infiltration, reduce soil erosion, and to improve soil tilth. The specification will include residue management methods practiced during the part of the year from harvest until residue is either removed or buried by tillage for seedbed preparation.

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.

Seeding and tillage implements will be equipped to operate through plant residue and loose soil conditions without clogging, and to maintain residue on or near the soil surface.

Harvesting implements used for small grains will be equipped with devices that will distribute the crop residue over approximately 80 percent of the working width of the header, unless partial removal of the residue is intended.

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, Publication SCS-CRM-01, Crop Residue Management Guide (available at Natural Resources Conservation Service [NRCS] field offices); Publication SCS-CRM-02, Picture Your Residue (available at NRCS field offices), and National Agronomy Manual Part 502.

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. With this practice there will normally be less than 30 percent coverage of the soil surface required in accomplishing the sheet and rill erosion objectives, unless otherwise specified on the practice job sheet. The soil may be disturbed or residue removed prior to planting and generally more than half the soil surface will be disturbed using chisels, field cultivators, disks, sweeps, blades, or plows.

In wind erosion areas, the tillage and planting system shall maintain the amount of residue to accomplish soil erosion protection objectives as determined by the current approved wind erosion prediction method. Less than 1,000 pounds per acre of flat, small grain residue equivalent will normally be required on the soil surface throughout the critical wind erosion management period in accomplishing the wind erosion objectives unless otherwise specified on the practice job sheet. The soil may be disturbed or residue removed prior to planting and generally more than half the soil surface will be disturbed using tillage tools such as chisels, field cultivators, disks, sweeps blades, or plows.

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

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 portion of the year that is determined to be the most vulnerable to soil moisture losses.

To capture winter snowfall fall tillage operations should be limited to undercutting tools such as blades, sweeps or deep tillage implements such as rippers or subsoilers to maintain stubble in a standing condition.

Managing for pest reduction. Weed control shall be accomplished with herbicides, cultivation, cover crops, and crop rotations.

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.

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.

Tillage or chemical application operations will be timed with crop rotations to disrupt pest life cycles to prevent population growth beyond the economic thresholds.

Managing for soil organic matter content. Residue shall not be burned.

Crop rotations will consist of at least 50 percent non-fragile, high residue producing crops.

Conduct a periodic soil test to monitor levels of soil organic matter. Additional organic biomass in the form of livestock waste and/or increasing the intensity of the crop rotation and reduction of tillage operations may be needed to reduce the potential of further soil organic matter degradation.

Managing for wildlife food and cover. Residue height, amount, and time period shall be determined using and 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 may have little or no detrimental effects on available soil moisture, but is very beneficial to pheasant populations.

When managing for migratory waterfowl and/or sandhill cranes maintain residue cover during both the fall and spring migrations.

4. Other Requirements

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

Tillage systems often create restrictive or compaction layers that inhibit water infiltration and root penetration. Depth of these layers should be should be assessed to determine type of implement that will penetrate below the restrictive layer during a period when soil moisture is low so that the layer will be temporarily fractured. Attempting to treat a compaction layer when soils above the layer are moist or wet will normally increase the compaction problem.

The owner, operator, contractor, and other persons shall conduct all work and operations in accordance with proper safety code for the type of equipment and operations being performed with due regard to 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 in standing stubble:		
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 in flat residues:		
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
Duck foot 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
Duck foot 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:		
Spring tooth (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
Chisel Plows with:		
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
Combination Chisel Plows 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

Percentage of Cover	Alfalfa, Brome grass, 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