TECHNICAL NOTES

U.S. DEPARTMENT OF AGRICULTURE STATE OF COLORADO NATURAL RESOURCES CONSERVATION SERVICE

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To: All Offices

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Residue Cover as Affected by Tillage

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This Technical Note transmits "ESTIMATES OF RESIDUE COVER REMAINING AFTER SINGLE OPERATIONS OF SELECTED TILLAGE MACHINES." The Soil Conservation Service (SCS), Agricultural Research Service (ARS) and the Equipment Manufacturers Institute (EMI) developed this guide jointly.

The values in this list should not be used to estimate reductions in surface cover calculated and expressed as changes in mass (pounds of residue per acre).

The values contained in this guide should not be considered absolutes and should be used as a starting point when making judgments of residue burial from field operations.

Use the guidance presented in the footnote on the last page with judgment. Current data indicates that winter weathering in Colorado depends greatly on soil moisture and temperature at the time of first, persistent snow cover. Residue decomposition has been observed to be less when significant snow cover falls on cold, dry soils than when snow cover falls on warm, moist soils. Significant residue decomposition can occur throughout the period of snow cover given the right set of conditions. Research is continuing in these areas.

ESTIMATES OF RESIDUE COVER REMAINING AFTER SINGLE OPERATION OF SELECTED TILLAGE MACHINES

Developed jointly by the Soil Conservation Service, U.S.D.A. and the Equipment Manufacturers Institute

First Edition February, 1992

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The following information was developed from available research data, SCS Field Office Technical Guides and from farm equipment manufacturers. Each tillage or planting operation leaves a percent of the residue that was present just prior to that operation. The numbers in Table 2. represent these remaining percentages.

Crop residues have been generally classified as being either Non-Fragile or Fragile in Table 1. This is a subjective classification based in part on the ease in which crop residues are decomposed by the elements or buried by tillage operations. Plant characteristics such as composition and size of leaves and stems; density of the residue; and relative quantities produced were considered.

Many factors effect the amount of residue left after a pass with a tractor and tillage or planting machine. Residue levels are sensitive to depth and speed of equipment operation and to row spacing. When selecting values from the ranges in Table 2. for a specific machine, consider the following general rules of thumb. (1.) At shallower operating depths, greater amounts of residue are left on the surface, while at deeper operating depths, more residue is buried. (2.) Slower operating speeds tend to leave more residues on the surface while at faster speeds, more residue is buried. Under some conditions field cultivators and other finishing tools with field cultivator gangs and some planters and drills may return as much as 20% of the residue incorporated at shallow depths by recent previous operations. Excess wheel slippage caused by improper ballasting of tractor tires can destroy valuable residues in the wheel tracks.

Use the figures as a guide in selecting the types of equipment and types of blades, points or sweeps to be used in the tillage system. Measure the actual amount of residue being left by the operation and make adjustments accordingly.

Table 1. RESIDUE TYPES

NON-FRAGILE	FRAGILE
Alfalfa or legume hay	Canola/Rapeseed
Barley*	Dry Beans
Buckwheat	Dry Peas
Corn	Fall seeded cover crops
Cotton	Flower seed
Flaxseed	Grapes
Forage seed	Green peas
Forage Silage	Guar
Grass hay	Lentils
Millet	Mint
Oats*	Mustard
Pasture	Peanuts
Pineapple	Potatoes
Popcorn	Safflower
Rice	Soybeans
Rye*	Sugar Beets
Sorghum	Sunflowers
Speltz*	Sweet Potatoes
Sugarcane	Vegetables
Tobacco	
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 2.

IMPLEMENT	PERCENT RESIDUE REMAINING NON-FRAGILE	FRAGILE
PLOWS:		
Moldboard plow	0-10	0- 5
Moldboard plow-uphill furrow (Pacific Northwest Region only)	30-40	-----
Disk plow	10-20	5-15
MACHINES WHICH FRACTURE SOIL:		
Paratill/Paraplow	80-90	75-85
"V" ripper/subsoiler 12-14" deep 20" spacing	70-90	60-80
Combination Tools:		
Subsoil-chisel	50-70	40-50
Disk-subsoiler	30-50	10-20
CHISEL PLOWS With:		
Sweeps	70-85	50-60
Straight chisel spike points	60-80	40-60
Twisted points or shovels	50-70	30-40
COMBINATION CHISEL PLOWS:		
Coulter Chisel plows with:		
Sweeps	60-80	40-50
Straight chisel spike points	50-70	30-40
Twisted points or shovels	40-60	20-30
Disk Chisel plows with:		
Sweeps	60-70	30-50
Straight chisel spike points	50-60	30-40
Twisted points or shovels	30-50	20-30
UNDERCUTTTERS:		
Stubble-mulch sweep or blade plows with:		
Sweep/"V"-Blade >30" wide	85-95	70-80
Sweeps 20"-30" wide	80-90	65-75
DISKS HARROWS:		
Offset		
Heavy plowing >10" spacing	25-50	10-25
Primary cutting >9" spacing	30-60	20-40
Finishing 7"-9" spacing	40-70	25-40
Tandem		
Heavy plowing >10" spacing	25-50	10-25
Primary cutting >9" spacing	30-60	20-40
Finishing 7"-9" spacing	40-70	25-40
Light tandem disk after harvest, before other tillage	70-80	40-50
One-way disk with:		
12"-16" blades	40-50	20-40
18"-30" blades	20-40	10-30
Single gang disk	50-70	40-60

IMPLEMENT	PERCENT RESIDUE REMAINING NON-FRAGILE	FRAGILE
FIELD CULTIVATORS:(Including leveling attachments)		
Used as the primary tillage operation:		
Sweeps 12-20"	60-80	55-75
Sweeps or shovels 6-12"	35-75	50-70
Duckfoot points	35-60	30-55
Field cultivators as secondary operation following chisel or disk:		
Sweeps 12-20"	80-90	60-75
Sweeps or shovels 6-12"	70-80	50-60
Duckfoot points	60-70	35-50
FINISHING TOOLS:		
Combination finishing tools with:		
Disks, shanks and leveling attachments	50-70	30-50
Spring teeth & rolling basket	70-90	50-70
Harrows:		
Springtooth (coil tine)	60-80	50-70
Spike tooth	70-90	60-80
Flex-tine tooth	75-90	70-85
Roller harrow (cultipacker)	60-80	50-70
Packer roller	90-95	90-95
Rotary Tiller:		
Secondary operation 3" deep	40-60	20-40
Primary operation 6" deep	15-35	5-15
RODWEEDERS:		
Plain rotary rod	80-90	50-60
Rotary rod with semi-chisels or shovels	70-80	60-70
STRIP TILLAGE MACHINES:		
Rotary tiller, 12" tilled on 40" rows	60-75	50-60
ROW CULTIVATORS:(30" and wider)		
Single sweep per row	75-90	55-70
Multiple sweeps per row	75-85	55-65
Finger wheel cultivator	65-75	50-60
Rolling disk cultivator	45-55	40-50
Ridge Till cultivator	20-40	5-25
UNCLASSIFIED MACHINES:		
Anhydrous applicator	75-85	45-70
Anhydrous applicator with closing disks	60-75	30-50
Subsurface manure applicator	60-80	40-60
Rotary Hoe	85-90	80-90
Bedders, listers & hippers	15-30	5-20
Furrow diker	85-95	75-85
Mulch Treader	70-85	60-75

IMPLEMENT	PERCENT RESIDUE REMAINING NON-FRAGILE	FRAGILE
DRILLS:		
Hoe opener drills	50-80	40-60
Semi-deep furrow drill or press drill [7"-12" spacing]	70-90	50-80
Deep furrow drill with >12" spacing	60-80	50-80
Single disk opener drills	85-100	75-85
Double disk opener drills (conventional)	80-100	60-80
No-till drills and drills with the following attachments <u>in standing stubble</u>:		
Smooth no-till coulters	85-95	70-85
Ripple or bubble coulters	80-85	65-85
Fluted coulters	75-80	60-80
No-till drills and drills with the following attachments <u>in flat residues</u>:		
Smooth no-till coulters	65-85	50-70
Ripple or bubble coulters	60-75	45-65
Fluted coulters	55-70	40-60
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	85-95	80-90
Staggered double disk openers	90-95	85-95
Double disk openers	85-95	75-85
No-till planters with:		
Smooth coulters	85-95	75-90
Ripple coulters	75-90	70-85
Fluted coulters	65-85	55-80
Strip till planters with:		
2 or 3 Fluted coulters	60-80	50-75
Row cleaning devices (8-14" wide bare strip using brushes, spikes,furrowing disks, or sweeps)	60-80	50-60
Ridge-till planter	40-60	20-40
CLIMATIC EFFECTS:		
Over winter weathering:**		
Following summer harvest	70-90	65-85
Following fall harvest	80-95	70-80

** 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.