Utilization of Plant Residues as Mulches in the Production of Corn and Oats

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The practice of tilling soil in such a way that a considerable proportion of the crop residue from preceding crops is retained on the surface of the soil during the preparation for and growth of succeeding crops has been called stubble mulch, subsurface tillage, and mulch farming.

Experiments started at Clemson, S. C., in 1939 proved conclusively that plant residues applied to the surface of Piedmont soils were enormously more effective in reducing runoff and erosion than equal quantities of plant residues incorporated with the soil.

In 1942, large-scale field experiments to develop and test practical methods of mulch farming with corn and oats were started cooperatively by the Soil Conservation Service and the Agricultural Engineering Department of the South Carolina Experiment Station. The investigation included (1) the development and testing of machinery and cultural techniques suitable for mulch farming in this area, and (2) determining the effects of mulch farming methods on crop yields, runoff, erosion, soil structure, and the accumulation of organic matter and nitrogen in the soil as compared with conventional clean tillage practices.

It is the purpose of this paper to present some of the results of the second phase of the mulch farming investigations outlined above. A separate paper reporting the machinery development and testing work is being prepared for publication in the near future.

TILLAGE METHODS

The three tillage methods used in the tests with row crops were the mulch disk method, the mulch balk method, and the conventional method of plowing and clean cultivation.

1. Mulch disk method.—The growth of winter cover crops or the dead residue from preceding summer cover crops is disked with a disk harrow having scalloped disks with the disk harrow heavily weighted and pulled slowly to avoid covering any more plant material than necessary. With heavy residue on hard, dry, clay soil the disks can be operated at full angle and moderate speed without incorporating an excessive amount of plant residue. On sandy soils the disk harrow should be pulled more slowly and the disks set at about two-thirds of full angle. The object of the disk operation is to loosen the soil to a depth of 2 to 4 inches, cut the residue on the soil surface, and kill any plant growth.

The second operation consists of ripping the soil at 5-foot intervals, using middlebuster shares with moldboards removed, preceded by rolling coulters and followed by reversed disk hillers set to push the plant litter out of the furrows without pushing any more soil into the areas between the furrows than necessary. The disk hillers are set to run very shallow. The two middlebuster shares used on a two-row tractor for this operation are mounted on the front tool bar with gage wheels attached to the tool bar to insure operation at the proper depth. This unit is shown in Fig. 1 and its operation in vetch and rye residue is shown in Fig. 2. The object of this operation is to prepare a loose, clean seedbed in a moderately deep furrow for planting corn.

2. Mulch balk method. Planting furrows are prepared with the middlebuster unit as the initial operation leaving an undisturbed balk about 20 inches wide between the rows as shown in Fig. 3. The balk is then plowed using the middlebuster unit as the initial operation leaving an undisturbed balk about 20 inches wide between the rows as shown in Fig. 3. The balk is then plowed with a 26-inch sweep of the type shown in Fig. 4 and the corn is planted about 2 weeks later, using a standard two-row tractor planter.

Cultivation of the corn is done with conventional tractor equipment, using small conventional sweeps set to run rather flat.

3. Conventional method. Plowing and clean cultivation are done as described for corn. Conventional tractor equipment is used for cultivating the corn.