

# TECHNICAL NOTES

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The following material is adapted to California conditions from information presented at a recent Idaho State Conference of Work Unit Conservationists, by Verle G. Kaiser, Conservation Agronomist.

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## TILLAGE AS A PART OF CONSERVATION CROPPING SYSTEMS

Conservation cropping systems, by definition, include many things: Crop rotation, crop residue use, fertilization, tillage, and all other soil culture or management practices. Proper tillage is one of the very important components. It is also one of the least understood or more poorly applied on many farms.

This may be true for many reasons such as less available research information than for other aspects of agriculture. Proper tillage is receiving more attention by technicians and by farmers, and will undoubtedly continue to do so in the future.

## STEPS IMPORTANT IN HELPING FARMERS PRACTICE PROPER TILLAGE:

1. Review and be sure the farmer understands basic principles or basic objective of proper tillage.
2. Help him adjust or set and operate tillage equipment properly in accordance with the basic principles or basic objectives involved in proper tillage.

Helping farmers understand the basic principles involved in proper tillage must be the first step. It is necessary with every farmer we work with, regardless of how recently he may have graduated from a College of Agriculture. It must be related to the kind of soil he has, and the cropping system he uses.

A good approach to this is to ask the question, "Why do we cultivate soil?" Usually the following items will come up and be understood by the farmer as this question is considered:

1. To kill weeds.
2. To prepare desirable seedbeds for the crop.
  - a. Facilitate planting the crop.
  - b. Facilitate cultivation of the crop.
  - c. Facilitate irrigation of the crop.
  - d. Facilitate root development of the crop.
  - e. Facilitate the harvest of the crop.
3. To conserve moisture.
  - a. Water intake.
  - b. Moisture penetration.
4. To release plant food nutrients.
5. To condition the land surface.
  - a. Level up or smooth rough surfaces.
  - b. Roughen up smooth surfaces.
6. Because of habit or local custom.

In addition to the above, which may be readily understood by farmers, the following things should be considered and understood (they usually are less well understood by the average farmer):

1. Tillage affects soil aeration.
2. Tillage may hinder or help capillary movement of soil moisture.
3. All tillage tends to "break down" soil organic matter.
4. Tillage may promote or destroy desirable soil physical condition or tilth.
5. Tillage affects soil aggregation.
6. Tillage causes compaction, often to a serious degree.
7. Tillage affects the condition or decomposition of plant residues from the preceding crop.
8. All tillage costs money.

It should also be understood that the results of tillage in terms of weed control, moisture conservation, crop yields, erosion, and soil tilth, will largely be governed on a given soil in a given cropping system by these things:

1. Depth of tillage.
2. Frequency or number of operations.
3. Speed of operation.
4. Kind of implement and type of tractor used.
5. Moisture content of soil in tillage zone at time of tillage.
6. Soil texture.
7. Condition of crop residues and weeds.

The extent to which technicians will have to assist farmers in attaining proper operation of equipment will depend on the farmer. Some farmers will need little or no on-site assistance. After they understand basic principles or objectives, they, themselves, will work out proper tillage methods, using the equipment they now have or can get. Other farmers may need considerable help in selecting the best equipment and in operating that equipment properly for the soil they have and the cropping system they use.

#### References to Recent Results of Tillage Research

1. Soil Science Society of America, Jan.-Feb. 1958, "Soil compaction Zones as Affected by Conservation Cropping Systems," Elder. Two items of importance are pointed out:
  - a. Cropping with continuous cash crops forms soil compaction zones faster than rotation cropping.
  - b. During the period of row cropping after a sod crop, a single improperly carried out tillage operation can destroy up to 80% of the benefits or improvement which the sod crop has imparted to the physical condition of the soil.
2. Three issues of Soil Conservation Magazine: Dec. 1957, April 1958, "Soil Compaction by Farm Machinery," Nichols. These reports point out that two things are involved in formation of soil compaction layers:
  - a. Soil Compression.
  - b. Soil "smear".

The September 1961 issue of the same magazine has a good article: "Cutting down on Cropland Soil Compaction," by Cooper.

3. USDA - Research Review, 1959: "Deep Tillage - When and How."
4. "Results of Cloddy Tillage," Pendleton, Oregon Experiment Station. By T. R. Horning.
5. Recorded observations made by the SCS technician as a part of his everyday follow-up and application work with farmers.

Much of the factual information needed in the tillage practice specifications for Technical Guides and illustrated practice job sheets will come from this procedure.

For example, in one Work Unit in the dry farming area of the Northwest, by making observations of different tillage practices used by farmers in the Unit, and recording the results in terms of erosion, crop yields, etc., it has been determined that the following facts must be observed by farmers to practice proper tillage:

- a. The practice of chiseling is properly performed on fine to medium textured soils having 15% to 20% clay in the surface when it is done at a time when the moisture content is about 50% or less of normal field capacity.

Chiseling on coarse textured or light soils should be done when the moisture content is above 60% of normal field capacity.

- b. Rod weeding in summer fallow on the prairie or chernozem soils with 15% + clay content in the surface should be carried out when the moisture content of the tillage layer is between 50% and 70% of normal field capacity.

On brown and sierozem soils, moisture in the tillage layer should be between 50% and 90% of normal field capacity.

#### Tillage Practices Used in California

Several tillage practices now used in the State are defined in the National Catalog. Several others have been added to the list of reportable items. The excellence or completeness of the technical program of soil and water conservation should not be limited or controlled by the records and reports system. Improper tillage can cancel out the benefits of good practices.