



Stubble Mulch Helps Prevent Dust Bowls

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This paper deals with a system of practices developed for improving the production of grain on semi-arid lands: lands devoted to the raising of grain where the factor limiting production is water. In most instances, this will include lands which have less than 14 inches of rainfall annually. These areas use a grain-fallow cropping plan to make use of two-years' moisture for one grain crop and are generally known as the dry farming areas.

The semi-arid lands in the low rainfall areas of the Pacific Northwest have been the subject of much long-range planning over the past years. Large areas are now, or in the near future will be, under irrigation and will no longer be classified as dry farming sections. It is with the areas that will not be irrigated in the foreseeable future that we are concerned here.

The use of stubble mulch has already done much toward re-establishing successful farming in areas that at one time were thought to have insufficient moisture for grain production. It has often been said that large sections of Adams, Grant, and Franklin counties in Washington should be sown back to grass and used only for livestock. The same has been said of the Horse-Heaven area. Parts of Sherman, Morrow, Gilliam, and Umatilla counties in Oregon, and numerous other areas of the Pacific Northwest are also included in this land class. When properly farmed, however, these areas produce good crops even in dry years.

Combating erosion in the semi-arid regions has always been a problem. In most cases settlers came from more humid regions and brought farming practices with them which were suitable only for the humid regions. The use of these practices usually resulted in the creation of dust bowls and ultimately in economic failure for the farmer.

Severe tillage and other bad practices lowered the organic content of the

surface layer and the soil suffered from both wind and water erosion. Eventually, the dust mulch was developed to aid in moisture conservation but it was found to be very susceptible to the ravages of the wind. Lumpy mulch next came into use because it resisted the wind. Weeds followed and made it increasingly difficult to maintain a lumpy mulch due to excessive tillage for weed control. Gradually, stubble mulch has come to the forefront of erosion control.

Stubble mulch results from a series of tillage practices which leave the residues of the previous crop on and near the surface of the fallowed ground. The prime purpose of stubble mulch is to protect the surface soil from wind and water erosion and it is able to do the job to the degree that it helps to maintain a more natural soil structure close to the surface and permits rapid moisture infiltration. Stubble on and near the surface is not enough in itself. If the land is worked in such a manner that the granular structure is destroyed, more moisture is likely to be lost and severe winds may cause soil drifting. This then brings us to the question: How are we to till the soil with the least damage to its natural structure?

Soils in their natural state are usually granular in structure near the surface. The basic mineral particle is surrounded by a colloidal substance which cements it to other particles until granules of odd shapes and sizes are formed. This granular condition is governed by the microorganisms in the soil and by the environment. In wind-deposited soils such as are predominant in the semi-arid Northwest, the colloidal material is usually organic and the particles are weakly cemented together. In the glaciated soils of the northern Great Plains, the colloidal material is usually inorganic and the particles are much more strongly cemented.

VIOLENT TILLAGE DESTROYS GRANULES

It is obvious that the more violent the tillage action the greater will be the destruction of the soil granules. In the same way that violent grinding action reduces granular sugar to powdered sugar, violent tillage breaks granular soil into powdered soil. The pounding action of raindrops is frequently sufficient to break down surface structure. Residue on the surface breaks the force of the rain and preserves the surface structure allowing more rapid infiltration. Powdered soil when wet is also likely to puddle, that is, to run together and form a layer on the surface that is nearly impervious to subsequent moisture. Moldboard plowing is an example of a violent form of soil tillage. In performing its function, the plow lifts the soil then completely turns it over

and lets it fall some distance to its place in the furrow. At low speeds and with adequate moisture this is much less harmful, but with low-moisture content and modern tractor speeds it is often very detrimental. The rolling disc type of implement has an even more destructive action on the soil structure but leaves enough residue on or near the surface to compensate somewhat for the additional damage done.

Plow and disc implements are the most commonly used initial tillage tools in the United States. However, we now have other initial tillage tools, developed for the dry farming areas, that are successful and the use of which will undoubtedly spread into the more humid regions. These tools are designed to give a vertical lift to the surface of soil, loosen it so that subsequent tillage is possible, let it fall nearly in place with a very minimum of destructive effect on the soil structure. These are the straight-blade and the sweep-type implements. The sweep-type plow should not be confused with the chisel-type plow or with the duckfoot cultivator. The chisel-type plow and the duckfoot cultivator have a different action on the soil structure than does the blade or the true sweep. The chisel-type plow and the duckfoot move a larger proportion of the soil horizontally than does the sweep. They also cover more of the residues. The true sweep moves the larger proportion vertically and only a minimum of the soil is moved horizontally. The difference is that in moving soil vertically there is less pressure exerted against the soil granules, hence, less structure is destroyed.

As an initial tillage tool for stubble mulch the straight blade has limitations in the softer soil areas. Where the operator wishes to do shallow work, there is not enough shear pressure to keep the blade free of plant roots. Where greater depth is allowed, however, or the soil is quite firm, the straight blade is successful. The true sweep is a still more versatile tillage implement. With this tool, the uncut surface roots will slide from the cutting edge allowing a very shallow operation in even the softest soils. In the firmer soils, the roots are cut and the operation is much like that of the blade.

The true sweep when used as the initial tillage tool leaves the entire residue of the previous crop on the surface of the ground. The crowns of the plants are still fastened to the surface soil and will not blow away. Tractor treads and wheel marks bring some of the residue into contact with the surface soil and decomposition begins to take place. With each subsequent weeding operation more of the residue is incorporated into the surface.

The rotary-rod weeder, the first successful undersurface tillage implement,