Scientific Soil Tillage

By Professor George Severance
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(In Washington Agriculturist.)

WITHOUT question it would be possible to double the total production of grain in the Inland Empire if proper methods of tillage were followed. We must till for at least three distinct purposes: to keep the soil clean, to put the soil into proper physical condition for the necessary chemical changes to take place in the soil for the liberation of plant food, and to conserve moisture.

Under dry conditions the first two purposes are accomplished when we till properly to conserve moisture. The handling of the soil may then be considered from the standpoint of proper conservation of moisture. Since our precipitation occurs largely in the dormant period our soil must be in condition first of all to absorb and retain this rainfall as completely as possible. To keep the soil in an absorbent condition a good supply of humus should be maintained in the soil. This makes the soil looser, more absorptive and retentive of moisture, more friable, with a less tendency to puddle in winter and bake and crack in spring. An abundant supply is also necessary for the rapid formation of available mineral plant food in the soil.

Under our present system of wheat farming in which we remove the larger part of the straw and burn the surplus and even the stubble, the supply of humus in the soil is becoming gradually depleted. The evidence of this de- of the hill sides, the greater difficulty ficiency is seen in the greater washing with which the soil is brought into a mellow condition, and the lighter color and the more spindling growth of the grain. Manure spots are showing in our grain fields more conspicuouly every year. Without doubt we shall ultimately be obliged to grow certain crops for the primary purpose of renewing this humus in the soil. Alfalfa and clover will probably play an important part in this rejuvination of our soil.

This depletion, however, can be very appreciably checks by working in all the straw and stubble from each crop that we can. Where the plowing under of considerable straw or stubble has resulted in burning of the crop, the fault has been in the method followed. Where loose straw or stubble is plowed under with no previous treatment, and the furrow is left untouched the straw will act like a ventilator in a potato pit, drying out the soil completely. To overcome this difficulty surplus straw should be scattered thinly over spots most in need of it, and the straw and stubble should be chopped into the soil as much as possible by the use of some form of sharp disc, performing this operation before the setting in of winter. The winter rains will beat down the loose soil and broken straw starting it to decay in the early spring, so that when finally plowed under and the furrow properly worked down it soon becomes incorporated with the soil and helps to form humus.

Added reasons for discing our stubble land in the fall are: First, to cover seeds of weeds and volunteer grain so that they may germinate and be destroyed when the land is plowed instead of being turned under to be gradually brought to the surface to cause trouble in succeeding years. Second, to loosen the surface of the soil so that the winter precipitation may be absorbed as completely as possible. The difference between the amount of water taken into the soil through a loosened surface and the amount absorbed through a firm surface is sometimes very marked, instances being noted on the college farm where the loosened surface has permitted the absorption of three times the moisture taken in through a firm surface with slope of surface and character of soil almost identical. If our soil absorbs a high percentage of the winter precipitation it is equally important that it be retained. With the opening of spring evaporation of soil moisture from the surface is very rapid, the moisture pumping up from below as oil pumps up in a lamp wick to feed the flame. It has been found that the rise of the soil moisture is very largely checked when it reaches a loose dry layer. Therefore the best agricluturists make a practice of developing a mulch of three or four inches depth of loose soil on the surface. Since the rise and escape of moisture is very rapid in the early spring where the surface is firm, it is necessary to work up this mulch as soon as the soil is fit to work. This leads to the practice of discing in early spring all lands that are to be late spring or summer plowed.

In handling a large tract of summer fallow much is gained in the end by discing the entire tract to hold the moisture before touching it with a plow. Summer fallow land is disked in early spring will plow up moist and mellow late in the summer. It takes less horse flesh to do the plowing and the soil may be gotten into better condition with much less work. In disking to develop a mulch it must be borne in mind that to form an effective mulch the surface must be broken up completely. A common disc harrow set nearly straight, cutting little grooves in the firm surface, leaving two-thirds of the surface unbroken, is of little benefit. Some form of disc hung on wheels so that the disc may be set to cut shallow, and the discs at the same time set at sufficient angle to cut the surface over completely is desirable. If the soil disks up somewhat chunky, a smoothing harrow should follow the disc. In the case of fall plowing land for late spring crops, the same principle should be observed by working up a loose mulch in early spring with a smoothing harrow.

Another opportunitw for great improvement is in working the furrow down close after the plow in all spring and summer plowing. The furrow should be brought firmly down upon the unbroken soil beneath, shutting out the large air spaces, packing the soil firmly around the straw and stubble, establishing capillary connection with the soil moisture reservoir below and preventing the drying out of the seed bed. This result may best be brought about with some form of subsurface packer. This is particularly important in the drier part of the wheat belt. Where the soil is heavier and the rainfall greater the use of some form of harrow following close after the plow will give very successful results. Whatever tool may be used, the essential point is to work down the furrow at once.

A further opportunity for vast improvement is in the subsequent care of the fallow. A heavy crop of weeds will use up just as much moisture and plant food as a heavy crop of any other kind, and if the moisture and fertility of the soil are to be conserved for our valuable crops the soil must be kept absolutely clean. Where there is danger of making the soil too fine, causing it to run together in winter and wash and bake badly in the spring, if a smoothing harrow is used enough to keep the soil clean, the difficulty may be quite largely overcome by the use of some form of knife weeder. With this type of tool the weeds may be destroyed completely with the least amount of horse flesh and the least amount of pulverization of the surface soil. The knives will cut under the surface, allowing no weeds to escape, but causing the soil to slide over the top of the knife with the minimum of pulverizing, leaving it perfectly loose and forming an ideal mulch.

Tu summarize: First, keep up the supply of soil humus by working in as much straw and stubble as possible. Second, disk the stubble land between harvest and winter to work in stubble and encourage the germination of weed seeds, and to loosen the surface of the soil for better absorption of moisture. Third, prepare a mulch of loose soil as early as possible in the spring on all land to be late spring or summer plowed, or on all fall plowed land for late spring seeding. Fourth, work the furrow down close after the plow in all spring and summer plowing. Fifth, keep the land perfectly free and clean of weeds, whether in fallow or in cultivated crop. Where there is danger of puddling and washing some form of knife weeder is preferable.

The County Agriculturist

Byron Hunter, State Leader.

WITHIN the last half century there have been several great movements in the United States for the betterment of agriculture. Among these may be mentioned the establishment of the State Agricultural Colleges, the State Experiment Stations, the United States Department of Agriculture, and the County Agricultural Agent Movement. The latest of these movements comes more closely into touch with the farmer than any of the others. In fact it is the connecting link between the farm and scientific agricultural investigation. It is the belief of those who stand behind this movement that within a few brief years a competent, experienced and scientifically trained agriculturist will be employed by practically every agricultural county in the United States. Although the movement is yet in its infancy, more than 250 counties in the eastern, northern, and western states have taken up this work.

The State of Washington is not lagging behind in this movement. At the last session of the legislature a law was passed authorizing the commissioners of any county to provide and appropriate funds for the salary and expenses of a county agriculturist. The law creates "A Bureau of Farm Development," of which the director of the State Experiment Station is director. The law also provides for cooperation with the Office of Farm Management of the United States Department of Agriculture. The Office of Farm Management and the State College of Washington have perfected arrangements for jointly employing a State Leader, who will have the supervision of all of the county men within the state. Eight counties, namely, Wahkiakum, Benton, Lincoln, Spokane, Walla Walla, Adams, Douglas, and Okanogan, now have county agriculturists at work. Several other counties are also considering the employment of county men.

The Kind of Men Selected.

Where it is possible to do so, men are selected for these positions who were raised upon a farm, who have finished a four-year college course in agriculture and who have had several years of practical experience in farming or along investigational lines after leaving college. It is very desirable that men of mature judgment be selected, for a county position is a most difficult place to fill. So far such men have been found for the positions now being filled in this state.

The Work of the County Agriculturist.

Upon taking up his work the county agriculturist will acquaint himself, as rapidly as possible, with the several agricultural conditions of his county, study the various types of soils and the crops and types of farming that have been most successful on each type of soil.

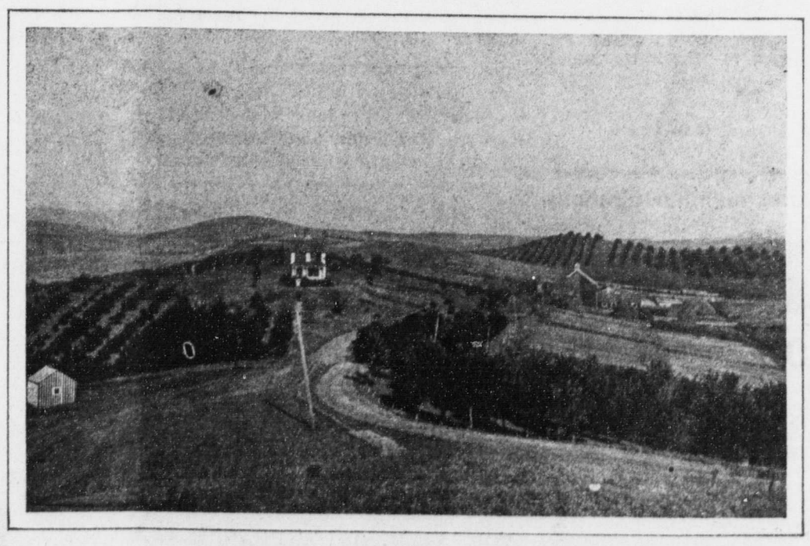
He will search out the most successful and reliable farmers in the county, who follow the various types of farming, visit them on their farms, study their methods and practices in detail, and learn their viewpoint of the agricultural problems of the county. He will study carefully the methods of the farmers in preparing their land for seeding, methods of cultivation, kinds of seed used, how it is selected and kept, and how the crops are harvested and disposed of. He will study the live stock kept on the various farms and the methods of feeding and handling the same.

He will study every phase of all the farms he visits so that he may know what crops and cropping systems are best adapted to his county or the various localities of the county. He will ascertain the field operation that each crop or farm enterprise requires, the approximate dates when these operations should or must be done, the amount of work that a man with a given sized team can do in a day. This information will enable the county agriculturist to guard against laying out more work for the farmer than he can get done with his equipment. It will also enable him to select crops and other farm enterprises that will not seriously compete with each other for labor, and will give comparatively steady employment to the farmer and his equipment during most of the year.

Such a study also permits him to see a farm from a farmer's viewpoint, while his training enables him to view farm problems and farm methods from the scientific aspect. Practically every individual farm has problems peculiar to itself. These and the financial ability of the farmer as well as his viewpoint and attitude must be taken into consideration in giving advice. As the county agriculturist goes from farm to farm he passes the good practices and methods that he learns on the best farms on to those that are less successful. He gives the farmers the benefit of the results of scientific investigation conducted by the various state experiment stations and the United State Department of Agriculture. In this way he becomes an indispensable advisor to the farmers of his county. The study of so many farms under so many conditions, as well as learning the viewpoints of so many men, enables him to understand better than any one else the lines along which the agriculture of the county should be directed.

After becoming thoroughly convinced that the growing of some particular crop, the introduction or extension of some tillage practice, the selection of seed wheat, corn or potatoes, and adoption of some rotation or cropping system or a change in the common methods of feeding live stock would be most profitable, the county agriculturist arranges with reliable farmers here and there throughout the county to take up these lines of work under specific instructions. This phase of the work is called "Farm Demonstrations". It differs materially from "Demonstration Farms".

This movement should give the farmer a much higher appreciation of the value of the agricultural colleges and the state experiment stations. It should likewise point out to these institutions more clearly than they have heretofore seen the problems of the individual farmer.



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