Dry Land Farming

By Prof. Thomas Shaw.

SOIL MOISTURE—DRY FARMING.

Functions of Water in Soil

These include: (1) dissolving plant food in the soil; (2) carrying the food dissolved to the plant, and (3) maintaining proper growth in the plant. These functions can only be found at their best in soils of proper texture, well supplied with the elements of plant food, free from matter hurtful to plant growth and in proper condition as to tilth; water must also be present in sufficient quantities in the soil and subsoil.

Plants take their food from the soil through the roots. These cannot appropriate the food unless it is held in solution. The water which surrounds the soil grains in the form of a film dissolves the food so that the plants can feed upon it. When the plant food is thus liberated in excess of the needs of the plants or at a season when plants are not growing, it is carried down in solution in the gravity water. Should this gravity water reach the water table below, it is much liable to be carried away in the drainage water. Should it be absorbed in the lower soil along with the capillary water, it may be again carried to the area where the roots of plants feed in the upward movement of the capillary water, and it may also be reinforced by plant food liberated in the lower levels that have been reached by moisture.

The food solutions are carried to the plants through the root hairs which ramify through the pore spaces of the soil, hence the great benefit of plant growth by maintaining as far as this may be possible a suitable degree of tilth in soils. The rootlets cannot readily penetrate compact soils. The food thus absorbed is carried up from cell to cell in the plants to the leaves, where it is elaborated into food suitable for the plants. It is then distributed to those portions of the plants that are in need of it to enable them to make further growth.

It is evident, therefore, that if plants are to be maintained in vigorous growth, the food thus carried in solution must be present in sufficient supply. The growth made will be restricted, other things being equal, in proportion as the necessary food is lacking. If not supplied in sufficient degree to continue growth, the cells become impaired and the leaves wilt. When this happens, growth subsequently in many instances cannot be secured, and if secured it is never so vigorous again. Any period of stagnation in the growth of the plant hinders future development. In order to sustain good growth the food in the soil must first be held in solution by the capillary water in the same, hence the transcendent importance of a sufficiency of this element in dry areas.

How Soil Moisture May be Lost

It may be lost: (1) by evaporation at the surface; (2) by transpiration through plant growth, and (3) by leaching out through the subsoil. These influences may operate singly at different times, or they may all operate at one and the same time. The first is operative chiefly in the season of mild and warm weather and the second only during the growing period. The third may be operative at any time, but under some conditions in dry areas it is not operative at all at any time. The greatest loss, however, in much of the dry area, especially where the soil has not been tilled, occurs in the run off water that does not enter the soil at all.

Evaporation at the surface means the loss of moisture from the soil as it climbs up through the pore spaces in the same to the surface, where it becomes vaporized as it becomes incorporated with the air. To prevent loss from this source is of the utmost importance to the farmer in dry areas, hence the extent to which this question is dwelt upon below. Under the most favorable conditions the amount of moisture in the soil is less than could be utilized to the best advantage. If this should be lost or any large portion of it, the farmer is undone for that season. In dry farming the handling of the soil in a way that will cause the precipitation falling upon the soil to enter the same to the greatest extent possible is fundamental, and of no less importance are measures that will tend to prevent the escape of moisture to the greatest extent possible until it has been utilized in growing plants.

Loss of moisture by transpiration means the passing of moisture into the air through the leaves of the plant which has been taken from the soil by the roots. This process is continuous while growth lasts. It is a loss that cannot be lessened very much by those who till the soil. But the harm that may follow to succeeding crops may be minimized and in many instances entirely prevented by wisely regulating the rotation followed.

Loss of moisture by leaching is of course the loss of water that has passed down through the soil into the subsoil, whence it moves on and out as drainage water into streams. It seldom occurs in dry areas, because of the small quantity that enters the soil. In humid areas the water that passes down through the soil carries with it in solution much plant food that has been taken out of the soil. The richer the soil and the more abundant the precipitation the greater is the loss from this source. This explains, in part at least, why soils in areas of much rainfall frequently call for much fertilization, while crops are being grown upon them. The farmer in dry areas is usually spared loss from this source.

In some instances, nevertheless, soils may be excessively wet, as when for instance, seepage waters flow into depressions from a subterranean source. If these are possessed of much clay, they usually become hard when the water evaporates sufficiently to admit of tilling them. When plowed they turn up cloddy, and much labor is involved in pulverizing them. If plowed when wet they bake. Moreover, they are much liable to contain substances that are injurious to vegetation, as an excess of salts. These soils are undesirable as has already been shown.

Loss of Moisture by Evaporation

The chief influences that lead to the loss of soil moisture by evaporation are: (1) sunshine; (2) dry and warm air, and (3) wind. The sun shining down on moist soil turns the moisture near the surface into vapor, which rises and mingles with the air. The rapidity of the process is proportionate to the heat of the sunshine and the degree of moisture in the soil. The influence of sunshine as a factor in removing moisture by evaporation is readily seen by comparing the quick drying of the surface soil after rain when exposed to bright sunshine with the slow drying of soil in a similar condition on a cloudy day. Sunshine is the most powerful factor in thus removing moisture. In dry areas such removal should be specially guarded against, because of the great abundance of the sunshine.

Air penetrates the soil to a greater or lesser depth, according to its density or porosity. It more readily penetrates between the soil grains in a newly cultivated soil. As it passes between these, more or less of the moisture which adheres to the soil grains becomes incorporated with the air thus diffused in the soil, and escapes with it into the atmosphere as a result of constant movement of air. The degree of the soil moisture thus removed is increased with increase in the dryness and warmth of the air. Warm air will hold several times more vapor than cold air. As the air is usually more dry in dry areas than in humid ones, the loss from this source will be much more in the former, and, because of the increased heat of summer, it will be much greater at that season than in winter.

Wind is a strong factor in removing moisture from soils, especially moisture on or near the surface. The influence of wind in thus taking up moisture may be clearly seen in the rapidity with which water is removed from the highway by strong wind blowing, after rain. Winds are usually more prevalent in dry than in humid areas, because of the comparatively treeless condition of the former, hence the relative loss of the moisture from this source is greater. These influences frequently act in conjunction, and when they do the loss of moisture from the soil will be very rapid in the absence of measures to prevent it.

The extent to which soil moisture is lost through evaporation will be proportionate: (1) to the extent to which the agencies of air and wind are operative in removing it; (2) to the extent to which other influences are present that facilitate such loss, and (3) to the extent to which soil conditions are absent that would tend to lessen and prevent the same.

From what has been said, it will be apparent that evaporation will be much greater in southern than in northern areas of the dry belt. In the former the sunshine is hotter, and the humidity of the air is less. The winds may not be any stronger but they are warmer. The annual average evaporation of surface water in dry areas is usually several times greater than the annual precipitation. In the Panhandle of Texas, the annual evaporation has been placed at about 54 inches, whereas along the Canadian boundary in North Dakota and Montana it is not more than half that amount. It is even more imperative, therefore, that measures shall be taken promptly and persistently to prevent the escape of soil moisture in areas far south than in those far north.

Prominent among the other influences that aid the escape of soil moisture in the absence of preventive measures are showers, especially those that fall frequently and in small quantities. Water climbs upward in the soil by capillary attraction. The more thin the film of water that surrounds the soil grains the more slowly does it move upward. Should the soil be dry, the upward movement ceases. Should rain fall and moisten the soil down to where soil moisture is still present the upward movement begins again. Water moves up to the surface and unchecked mingles with the air. If this movement is not checked by stirring thes urface soil, much moisture will soon escape. Such stirring of the soil is much more liable to be neglected after light than after heavy rains, hence the hazard that light showers will bring to dry farming in this way.

Subsurface packing of the soil may also facilitate the escape of soil moisture from below, since it facilitates the ascent of the same by making it possible for it to climb more readily toward the surface than would be possible in the absence of such packing. Any influence that will facilitate the ascent of soil moisture will facilitate the escape of the same in the absence of hindering influences.

Weeds also pump water out of the soil in the process of growth, hence the loss of moisture from this source will be proportionate to the extent to which weeds are allowed to grow. The rame is true of useful plants in their growth, but with the former there is no compensation as with the latter.

The measures that may be adopted to prevent or at least to lessen the escape of soil moisture include the following: (1) the maintenance of a dust mulch on land that is being fallowed; (2) the stirring or cultivating of the soil that has been sown or planted, and (3) the artificial shading of the soil.

A dust or soil mulch is a dry layer of earth covering the surface of the soil. It is formed by pulverizing the surface after the land has been plowed. It may also be formed by discing stubble land in the autumn or spring, and by stirring fall-plowed land in the early spring, that has settled upon itself. The implement chiefly used in making it is the spike-tooth harrow, but on cloddy soils the aid of the planker or roller may be called in. On hard surfaces the disc should precede the harrow. The process is frequently spoken of as summer tillage. The depth of the mulch is from 2 to 3 inches. The fineness of the same is dependent to some extent on the character of the soil. On some soils, especially those that are granular, it does not readily become too fine. On others, as fine clays, the excessive use of the harrow may make the soil so fine that it is not readily penetrated by rain. In clay soils covered with a dust mulch, the loss by evaporation is greater than in those covered by a mulch of coarse particles, as coarse sand, for the reason that water climbs more readily in fine than in coarse soil particles.

Rain is the chief agent in destroy-

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NOTICE FOR PUBLICATION.

Department of the Interior, U. S. Land Office at The Dalles, Oregon, October 21st, 1912.

Notice is hereby given that Ralph A. Dunn of Bend, Oregon, who on June 29th, 1906, made Desert Land Entry No. 641, Serial No. 0447, for E½NE¼, section 25, township 18 south, range 13 east, Willamette Meridian, has filed notice of intention to make final desert proof, to establish claim to the land above described before H. C. Ellis, U. S. Commissioner, at his office at Bend, Oregon, on the 30th day of November, 1912.

Claimant names as witnesses: Milo W. Wilson, Henry Starr, George E. Lowell and Kenneth R. Dunn, all of Bend, Oregon.

C. W. MOORE, Register.

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NOTICE FOR PUBLICATION

Department of the Interior, U. S. Land Office at The Dalles, Oregon, October 16th, 1912.

Notice is hereby given that Elmer A. Antes, of Bend, Oregon, who, on September 13th, 1911, made homestead entry No. 09482, for NE¼, Section 25, Township 20 South, Range 16 East, Willamette Meridian, has filed notice of intention to make final commutation proof, to establish claim to the land above described, before H. C. Ellis, U. S. Commissioner, at his office at Bend, Oregon, on the 30th day of November, 1912.

Claimant names as witnesses: Orlea O. King, Peter Jordan, O. C. Henkle and W. C. McCuiston all of Bend, Oregon.

C. W. MOORE, Register.

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NOTICE FOR PUBLICATION.

Department of the Interior, U. S. Land Office at The Dalles, Oregon, October 17th, 1912.

Notice is hereby given that Albert Harryman, of Bend, Oregon, who, on February 6th, 1909, made homestead entry No. 02460, for N½ NE¼, Section 7, Township 17 South, Range 12 East, Willamette Meridian, has filed notice of intention to make final three year proof, to establish claim to the land above described, before H. C. Ellis, U. S. Commissioner, at his office, at Bend, Oregon, on the 3rd day of December, 1912.

Claimant names as witnesses: John F. Young, Earl B. Houston, George Bates of Bend, Oregon, and George W. Horner of Laidlaw, Oregon.

C. W. MOORE, Register.

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NOTICE FOR PUBLICATION

Department of the Interior, U. S. Land Office at The Dalles, Oregon, October 16th, 1912.

Notice is hereby given that C. S. Benson, guardian of Jesse L. Poush, of Bend, Oregon, who, on June 19th, 1907, made homestead entry No. 15542, Serial No. 04113, for NW¼, Section 8, Township 18 South, Range 16 East Willamette Meridian, has filed notice of intention to make final five year proof, to establish claim to the land above described, before H. C. Ellis, U. S. Commissioner, at his office at Bend, Oregon, on the 26th day of November, 1912.

Claimant names as witnesses: C. H. Erickson, Oliver Erickson of Bend, Oregon, George T. Kitching and Ralph E. Gates, of Roberts, Oregon.

C. W. MOORE, Register.

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