DRY LAND FARMING

(Continued from Page Three.)

ing the efficiency of the dust mulch. It does so: (1) by tending to restore the pore connections between the dust mulch and the soil below, and (2) by the numerous cracks which follow in many soils from the rapid drying of a more or less impacted surface. It is greatly important that the soil mulch shall be renewed after rains, and especially after heavy rain in many of the soils of the west. The aim should be to make such renewal at the most propitious time, that is, when the soil has dried enough to prevent it from sticking to the harrow, but not enough to cause it to crumble into particles too fine. Of course in practise this cannot always be done when very large areas are to be harrowed.

The chief use of the mulch is to prevent the loss of soil moisture. This loss is far greater in the upper layer of the soil than in those layers that are lower, hence the great importance of maintaining the soil mulch on summer tilled lands. But it may also serve to aid in the increase of the moisture content of the soil, and in putting the soil in a condition that will favor the active working of the bacteria that inhabits the same. The first result follows from the added moisture through rain, which, because of the tillage, finds easy penetration into the soil. The amount of such accumulation will be proportionate to the amount of precipitation, and to the effectiveness of the measures for preventing its escape. All the moisture that enters the soil cannot be saved, but a very large proportion of it can, as much in some instances as 50 per cent. The second follows from the moisture thus maintained in the soil and the aeration given.

In some soils and under some conditions, the drying of the surface soil is so rapid and complete that this in itself forms a mulch, so to speak, through which moisture cannot pass up from below. This explains why moist soil may sometimes be found under soil that is quite dry on the surface. Such a condition may also be brought about where the temperature is high, the sunshine abundant and the relative humidity low.

The results that follow the judicious cultivation of growing crops are virtually the same in kind as those that follow the maintenance of the soil mulch on land that is fallow. The cultivation is given with the harrow when applied to cereals and with both the harrow and cultivator when applied to such crops as corn and potatoes. The cultivation also seeks the destruction of weeds, which will sap moisture from the soil more completely when they are allowed to grow numerously than any other agency. So valuable and so effective are these methods of maintaining soil moisture that in dry areas they are practised on crops by growing them in rows though not usually grown thus, as alfalfa for instance, in order to make such cultivation possible. When applied to small grains, however, the yields have not been found sufficient to justify the practise.

Shading the soil and thus protecting it from evaporation may be incidental or it may be designedly done. It is incidental when it is the result of crop growth, as when it is furnished by the cereals when too advanced in growth to admit of harrowing them longer, by corn and other cultivated crops when the plants have attained a considerable size, and by the high-cut stubbles of mature grain that has been harvested. It is done through design when the soil or the crop is strewn with straw, manure or some other substance. Such a method of preventing the escape of moisture has been found effective in a considerable degree when applied to orchard and other trees, and even to grass lands. The reduction of evaporation by a broad-leafed crop, as corn, when well grown, is very considerable.

Loss of soil Moisture by Transpiration

Soil moisture may be lost, as previously intimated, in three ways, viz: (1) by leaching; (2) by evaporation, and (3) by transpiration. The loss by leaching, as has been shown, seldom occurs in dry areas. The loss by evaporation, oftentimes serious, has just been discussed. The loss by transpiration through the leaves of plants is several times greater than the loss that usually occurs by evaporation.

Plants in the process of growth take up water from the soil by means of minute root hairs at the extremities of the rootlets. The water thus taken into the plant contains more or less of certain elements of plant food taken from the soil. It passes from cell to cell or up through tubes within the plant until it reaches the leaves, whence it passes off into the air. Through the medium of water, therefore, the elements concerned in promoting growth are distributed to all parts of the plant. As the water passes off ino the air, there is a demand for more water, to sustain the processes of growth, hence the demand upon the water supply in the soil continues until growth is complete.

Many things are yet to be learned about the transpiration of water through plants. It would seem safe to say, however, that it is influenced by the following conditions: It is increased: (1) by increased temperature; (2) by decreased humidity; (3) by increaes in the velocity of the wind; (4) by increase in the sunlight; (5) by increasing age in the plant up to the blossoming stage, and (6) by increase in the strength and the diffusion of the root system. It is very evident, therefore, that transpiration from plants is more rapid, other things being equal, in dry than in humid climates. It is decreased: (1) by increase in the soil water of the food elements which the plants require to properly sustain them, and (2) by adaptation in the plants to the requirements of growth under dry conditions. This last consideration is one of great moment, viewed from the standpoint of the future of dry farming.

The farmer can do but little directly to reduce transpiration in the crops. The greater the supply of plant food maintained in the soil, and the more available its condition, the less will be the relative amount of water taken from the soil. This emphasizes the wisdom on the part of the dry land farmer in maintaining a liberal supply of plant food in the soil in a readily available form. This in dry areas may be accomplished meanwhile by that high-class cultivation which will insure the abundant liberation of fertility.

While not very much can be done to regulate the amount of water transpired by individual plants, the farmer can do much to regulate the amount of water taken from the soil in the aggregate, by regulating crop growth, and he can increase the amount of water available for transpiration. He may influence the amount of water that shall be taken from the soil: First, by deciding as to the crops that he will grow, some of which take more and some less moisture from the soil. Second, he may regulate the thickness or the thinness of the stand of the plants in a given crop. Third, when he finds that a crop that has been sown inopportunely is not going to prove remunerative, he should at once remove or bury it, and thus stop the drain on soil moisture to no purpose that is being made by the plants that compose the crop. The amount of water available for transpiration may, of course, be increased by that cultivation which will encourage the entrance of water into the soil and which will retard its escape when it has so entered. Experiment has shown that the amount of water called for to produce a pound of dry matter in various soils is much greater in those that are not well cultivated than in those which are. Experiments conducted in Utah have proved that the summer-fallow materially reduces the amount of water called for by plants as compared with land that has been continuously cropped.

As cultivation ext nds in dry areas and as it becomes more carefully conducted, the store of moisture in the soil will increase; as the crop area increases, transpiration through the grow'ng of crops will also increase. To such an extent will this increase prevail, that it should exercise a material influence by increasing the humidity in the air, and this in turn should tend to lessen the injury done by the hot winds that sometimes prevail in dry areas. This increase in transpiration has led to the hope that it will result in an increase in the precipitation, but the evidence based on the results does not sustain this view. The influence emanating from this increased transpiration does not appear to be enough to affect the precipitation, at least to any very appreciable extent.

Influences that Affect Evaporation.

Among the influences that affect evaporation in addition to those that have been dwelt upon are: (1) the influence resulting from latitude; (2) the influence resulting from altitude, and (3) that resulting from the store of humus in the soil. In the discussion of this question these influences cannot be ignored, because of the important bearing which they exercise upon evaporation.

Latitude influences evaporation because of the influence which it exerts upon temperature. Evaporation increases with increase in the temperature. This explains why evaporation is greatest when the summer heat is greatest, other things being equal, and why it is least in cool and cold weather. The loss of soil moisture, therefore, in northern latitudes, will be proportionately increased, other things being equal, with increase in the temperature which follows as the result of the lower latitude of the locality.

The influence of altitude is probably no less potent than that of latitude. With increase in the latitude comes decrease in the temperature, and with decrease in the temperature comes a lessened transpirat'on. Elevation alone may result in protecting a crop from the baneful influences of a temperature that will wither the same in lower altitudes, notwithstanding that these may be in the same latitude. Thus it is that betimes a crop will be withered in a low valley by hot winds which do not harm the same on a high altitude in proximity thereto, the latitude being the same. Because of the influence thus exerted by latitude and altitude on evaporation, it has been claimed by high authority that 15 inches of annual precipitation in Dakota or Montana will be as helpful in sustaining vegetation as 20 inches in southwestern Nebraska and northwestern Kansas.

The influence of humus in the soil is very potent on the transpiration that will result, not only because it lessens transpiration, but because it increases the moisture supply available for transpiration. A soil well stored with humus will sustain plant growth without languishing in a time of drought for a much longer period than a soil not thus prepared to resist the influences of drought. But the best methods of storing the soil with humus in dry areas have mut imperfectly been worked out. The crops that are best fitted to increase the humus supply and the best methods of growing them are as yet but imperfectly understood.

Importance of Subsoil Moisture.

The chief function of water in the subsoil in dry areas is to furnish a supply to the growing crops, when the supply from the surface soil is insufficient to meet the needs of the same. This is done by entering the root hairs that penetrate between the subsoil particles, and by furnishing additional water drawn from lower depths through capillary movement. Winter wheat and winter rye are frequently brought safely to maturity through water from this source. Crops of spring grain may grow vigorously for a time and then fail because of the shortage of water in the soil near the surface, whereas such failure would not have occurred had a sufficiency of moisture been present in the subsoil. But the fact should never be forgotten that the upward movement of subsoil moisture will carry it into the air when not taken up by growing plants, or when such escape is not prevented by the presence of a dust mulch on the surface.

Such water serves the further purpose of facilitating the passage of water downward to lower levels where it enters the soil. Water penetrates a moist soil more quickly than a dry one, hence the maintenance of a supply of water in the subsoil tends to deepen the area of such reserve supply. Experiment has shown that in well managed soils in dry areas the moisture in the soil in the spring is considerably more than it was in the autumn, but this result did not follow when the surface soil was hard. Subsoil moisture is an important regulator of crop growth, hence the great wisdom of trying to increase the supply of the same. Injury from water carried up from lower depths occurs only when substances hurtful to plant life, as alkali, are present in the subsoil water.

To get water down into the subsoil is one of the first considerations that should engage the attention of the farmer, and to increase the shortage of the same should be an object of constant solicitude. The following are chief among the methods by which it may be accomplished: (1) by obening up the soil deeply when breaking it; (2) by keeping it fallow the first season; (3) by maintaining the surface soil in that condition which will admit of easy access of water when it falls; (4) by growing alfalfa in the rotation every few years; (5) by not cropping too freeely with small grains; (6) by preventing water from running away over the surface.

Opening up the soil deeply at the first is one of the most effective methods of getting water down into the subsoil. Usually this is not easily done and it is costly. The more deeply the soil is stirred when breaking it or by subsoiling, the more deeply will water penetrate in the average season. But if the farmer crops the land the first season, the crop takes from it in its growth moisture that would otherwise have gone down into the subsoil. Those who can afford it, therefore, should allow breaking to lie fallow the first season, whether the land is plawed in the autumn or in the spring. The surface soil is kept in condition for the easy access of water when it is subjected to the summer-fallowing process, or when a cultivated crop is grown upon it. The use of the disc on stubble land after harvest aids materially in the storage of water in the soil. When land is being fallowed or a cultivated crop is being grown upon it, the forming of a crust a few inches below the surface should be guarded against. If present it should be broken up by deep cultivation. When alfalfa comes frequently in the rotation the spaces occupied by the decayed roots form ready channels for the easy descent of water into the subsoil. If the farmer persists in growing small grains on the land year after year where the precipitation is light, the soil moisture will be drawn upon to such an extent that none will be left to enter the subsoil. The run off waters may be partially held until they enter the soil, but loss from this source may not be wholly prevented in all instances. Loss from this source only occurs when moisture accumulates within short periods of time, as when rain comes in downpours or snow melts suddenly. The plowing, discing and harrowing of sloping land along the slope will lessen the loss. Keeping surfaces from baking will do the same. Stubbles also are helpful. It is not possible under any conditions to save all the water that enters the soil, but much of it may be saved. When the subsoil is moistened to low depths, the roots will feed deeply save where there is an excess of water in the lower soil.

In humid areas the question is not usually how to retain subsoil moisture, but how to get rid of the excess. In dry areas the former will always be a burning question. The subsoil moisture, like the soil moisture, is drawn upon from two sources. One is the needs of the crops that are grown. The other is the influences concerned in evaporation. Draughts from the first source can only be partially prevented while grain crops occupy the soil. But it may be regulated by regulating the number of the crops to be grown and also the kind of the crops. Those from the second source may be greatly lessened but not entirely prevented by the maintenance of the soil mulch even as persistently as this may be practicable. Under no circumstances can it be maintained so continuously as to entirely prevent loss from evaporation. Even on the carefully managed summer-fallow there will be loss. When rain falls, water is taken fr m and nea the surface before the mulch can be renewed by using the harrow. Small showers and frequent, aid in such escape. Vapor comes up from below in hot weather and cracks are formed through which moisture escapes. There are periods when a dust mulch cannot be maintained, as when grain crops are in the advanced stages of growth. When the land is plowed in the autumn some moisture is lost from a damp surface and the same is true in the early spring. From all these causes moisture will escape, hence in many soils it has been thought that not more than half the precipitation that falls is retained. But it is very evident that the loss of moisure will decrease as the dust mulch is maintained. The more, therefore, that the processes of cultivation are followed that will admit of maintenance of the dust mulch, the less will be the loss of moisture from the soil and subsoil.

Utilization of Subsoil Moisture.

The stored water in the soil and subsoil is much more valuable than an equal amount of rain water falling during the period of crop growth. It contains nitrates formed the previous season. These are not washed out as in humid regions. It also increases the supply of potash and phosphoric acid in the soil. It is in a considerable degree secure from evaporation, and it enables the roots to penetrate more deeply than would otherwise be possible. But beneficial as subsoil moisture is to growing crops, there are limitations as to the extent to which it should be drawn upon. The idea has prevailed that the large yields in the Canadian west are the outcome of moisture liberated gradually in the subsoil by the melting of the frost of winter as summer advances. It would be claiming too much to say that no advantage results to the crop from this source, but it is correct to say that the chief advantage to the crop comes from the moisture that has been stored in the soil and subsoil the previous summer, and as the outcome of the nitrates which the subsoil moisture contained.

Under some conditions, from 50 to 90 per cent fo the precipitation that falls may be stored in the soil and subsoil. The larger percentage, of course, goes to the surface soil. Much of the water stored in the surface is drawn upon by the crop in the early stages of growth. The question naturally arises, how much of the moisture stored in the subsoil should be drawn upon in the growing of crops and how much should be left because of the influence which it exerts on the accumulation of subsoil moisture. The larger the quantity of water in the soil in the autumn, the more quickly will the winter and spring precipitation go down, and the greater will be the store of the accumulation. It is very evident, therefore, that it would be unwise to follow a system of tillage that would at any time exhaust the soil of its supply of subsoil moisture. Experiment has shown that when moisture is maintained in the subsoil, the tendency is to increase in such moisture. More especially is this true in areas where much of the precipitation falls in the winter. Subsoil moisture is sometimes drawn upon to no good purpose.

Moisture from the subsoil is drawn upon to no good purpose when the supply is sufficient to properly mature a crop. This result is almost certain to follow when grain crops are grown every year in the semiarid country. The amount of moisture in the soil and also in the subsoil are not enough to properly mature a grain crop in a dry year, and the outcome is that the crop fails. The moisture that has been used in growing it is therefore lost. Under such conditions subsoil moisture is drawn upon to no good purpose.

A reserve of moisture in the subsoil is so 'mportant that its presence or absence may make the difference between success and failure in the growing of crops. In areas with an average rainfall of less than 15 inches, experiment has shown that enough of reserve moisture cannot be maintained in the soil to produce good crops when small grains are grown upon the soil every year. In a dry year they may promise well for a time, but before they reach full maturity they fail. Experiments conducted by the Montana experiment station extending over a period of five years have shown that more grain can be obtained in a series of years by alternate cropping and alternate summer-fallowing of the land than by growing on it annual crops of small grains. Such a process of tillage maintains a reserve of moisture in the soil and this reserve carries a crop through safely in a time of drought that but for its presence might absolutely fail.

In order to maintain this reserve of soil moisture, therefore, the bare-fallow must be occasionally introduced where such 'ntroduction is practicable. It may not be practicable in all instances, as where, for instance, soils are so tight as to drift with the wind. In lieu of the summer-fallow a cultivated crop may answer the purpose, but not quite so well, as the cultivated crop makes drafts upon the soil moisture in the process of its growth. The timeliness of the cultivation and the depth of the same to effect these ends is greatly significant. Experiments conducted in Utah have tended to emphasize the great importance of stirring the soil at the earliest moment practicable in order to conserve soil moisture after rainfall. Nearly one-half the entire loss from the unstirred surface soil of fallow land was lost during the first three days subsequent to the rainfall. The depth to which the soil should be cultivated in order to conserve moisture is still and unsettled question. Of course it is influenced by soils. For the retention of soil moisture only, it will probably be found that deep cultivation is to be preferred to shallow, but when a cultivated crop is being grown, cultivation should not be practised deep enough to seriously interfere with the growth of the plants. The objections to the summer fallow are: (1) the loss of a crop for a single season; (2) the depletion of organic matter in the soil, and (3) the blowing of the soil in certain areas. The first objection may be obv'ated by growing a cultivated crop, which, in addition to furnishing the crop, will serve almost the same purpose as the summer-fallow. In both instances, however, the depletion of the organic matter is about the same, but in the case of the cultivated crop some benefit has resulted to the crop grown. It has been stated that the blowing of soil may be prevented entirely by stirring it at the opportune time after rain, so that it may form granules rather than soil particles. This is only partially true.

Turkeys.

Phone orders to F. A. Shonquest for young spring turkeys.—Advertisement. 24tf

SUMMONS.

In the Circuit Court of the State of Oregon, for the County of Crook.

Central Oregon Irrigation Company, a corporation, plaintiff, vs. Willard M. Houston, defendant.

To Willard M. Houston:

In the name of the State of Oregon: You are hereby required to appear and answer the complaint filed against you in the above entitled suit within six weeks from the day of the first publication of this summons and if you fail to so appear and answer, for want thereof, the plaintiff will apply to the Court for the relief prayed for in the complaint, to-wit: for the cancellation and setting aside of a certain contract, dated September 12, 1908, made between you and The Deschutes Irrigation and Power Company and assigned to said plaintiff, relating to the settlement of certain lands, and the purchase of water rights appurtenant thereto, situate in Crook County, Oregon, and for such other and further relief as may seem to the Court just and equitable.

This summons is served upon you by publication by authority of an order of the Hon. W. L. Bradshaw, Judge of the Circuit Court of the State of Oregon for the County of Crook, and said order is dated the 25th day of October, 1912, and is duly recorded and entered in said Court and suit.

Date of first publication, October 30, 1912.

Date of last publication, December 11, 1912.

Jesse Stearns & Jacob Kanzler,
Attorneys for the plaintiff.