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THE SUMMERFALLOW

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Little more than a generation ago a large portion of the prairie land of Canada and the United States was spoken of as the "Great American Desert." The rainfall of this "Plains Region" was so small that the geographers considered it unsuitable for agricultural pursuits other than ranching. Yet today we are growing crops on this "desert" land.

Within the memory of men now living has grown up the science of "Dry Farming"—the science of making the best possible use of the moisture that falls in dry areas. In some parts of the world 12 feet of water reaches the earth in the form of rain yearly. In Central and Southwestern Saskatchewan we get from 13 to 18 inches per year on the average.

THE FUNCTIONS OF THE FALLOW.

Yet water in large quantities is absolutely essential to growing crops. The best "dry farmer" in the world cannot grow crops without rain. But he can grow crops in a limited rainfall if he understands and puts into practice the methods now understood of (1) storing the rainfall in the soil and (2) conserving it there for the use of crops. This is the first principle of "Dry Farming." In Saskatchewan we call it "Summerfallowing."

OUR RAINFALL INSUFFICIENT FOR A GOOD CROP EVERY YEAR.

Experiments and Experience—two good teachers—have shown that our low rainfall is not sufficient, at least under our present farming system, to grow good crops every year. So we do the next best thing and proceed to store as much as possible of one year's rainfall in the soil and keep it there for the next year's crop, thus in some years insuring that crop against failure from drought.

In farming practice it is not possible to store and retain in the soil all of the rain that falls in any year, but it is possible to store a large portion of it. In a foot of normal soil 2 to 3 or more inches of water can be stored and retained. At the end of the summer season the soil after a good fallow is moist to a depth of several feet, while adjoining cropped or prairie land is practically dry. (At the University in the dry year of 1914, fallowed land yielded $30\frac{1}{4}$ bushels of wheat; well cultivated fall plowing, 16 bushels 53 pounds, while spring breaking failed to produce a crop.)

PLANTS DRINK THEIR FOOD.

In addition to water, plants must get plant food—chemical elements—from the soil. These cannot be taken up in solid form as an animal gets its food. They must first be made soluble in water in which form they may be absorbed by the crop. The plant does not eat its food, it drinks it. If the “drink” or “soil soup” is thin, a large amount of water has to be taken up to get the necessary nourishment. If, on the other hand, the solution is concentrated or thick, a smaller amount of water will produce satisfactory growth. The “soil soup” is always thicker in fallowed land than on land not fallowed. This, together with the added moisture stored during the summer, explains why the fallow is an insurance against drought.

THE SCIENCE OF SUMMERFALLOWING.

Successful “Dry Farmers” have become very expert in handling the summerfallow. Their reasoning is something after this fashion:

OUR VITAL PROBLEM—THE STORAGE AND CONSERVATION OF MOISTURE.

“Ours is a ‘semi-arid’ climate, that is, it receives less than 20 inches of water from the clouds in an average year, or in other words less than half as much as falls in Ontario or the corn belt or Great Britain.

“Low yields in dry countries are caused by lack of water; then how can we make up that lack? Irrigation is not feasible with us, all we can do, therefore, is to make the best possible use of the moisture we get in the form of rain and snow—but principally the rain, because we cannot store nor retain the moisture from the melting snow as well. This rain water to be of use to the crop, must be gotten into the land—must be “stored” in the soil and retained there.

PREVENT THE “RUN OFF.”

“None of it may be allowed to run away. Unless we are careful some of it may ‘run off’ after the heavy downpours of early summer. In order to prevent this happening we shall plow and have the land in a receptive condition so that when the rains come they may go into the soil and not run off the surface where they can do no good to the crop. (In 1914 on the University Farm, a fallow plowed June 1st yielded 30 bushels 19 pounds of wheat, while one adjoining but plowed July 1st and otherwise similarly treated, yielded only 19 bushels 55 pounds. Oats under the same conditions produced 53 bushels 9 pounds, and 41 bushels 31 pounds respectively, while barley on the early fallow yielded 28 bushels 12 pounds and on the late fallow 16 bushels 44 pounds per acre).

“If the plowing is left until late, some form of surface cultivation should be given early, in order to prevent weeds and volunteer plants growing and to keep the soil from drying out.

PLOW EARLY AND DEEP.

"For the fallow we should plow deep and early on our lighter lands and on our older fields, but not quite so deep nor so early on our heavy and newer lands and on those fields in the Eastern and Northern part where the rainfall is greater, lest the crops grow heavy and lodge, or too late and get frosted.

MAINTAIN A SOIL MULCH TO LESSON EVAPORATION.

"We shall then work the surface of that land so that the moisture will not be lost by evaporating into the air, nor by the growth of weeds, or other plants, because it is only in these two ways (except on very light soils where leaching occurs) that the moisture can get out of the land. We shall keep down the loss from evaporation by putting on the land a 'mulch'—a loose granular layer of soil that will effectively lessen the amount of water that evaporates. This we shall accomplish principally by using the drag harrows immediately after plowing and as soon as the soil is in condition after rains. The drag harrows we shall use as much as possible because they cover so much ground and at such low cost. But we shall use the disc or the spring tooth or 'duckfoot' cultivator if harrowing causes the soil to drift or if weeds get so well established that the harrows do not kill them.

"In the fall when the stubble interferes with the harrows we shall either plow shallow or use the disc in order (1) to lessen the evaporation and thus save the moisture in the soil for the next crop (2) to give weed seeds the conditions necessary for germination and (3) to make the plowing of the next fallow easier. (Discing in early spring before the fallow increased the yield of wheat $1\frac{1}{2}$ bushels per acre—discing early after harvest in the fall would probably have done better still).

CONTROL WEED GROWTH AND SAVE MOISTURE.

"We shall keep down all plant growth on the land because weeds or domestic plants use from 300 to 1,000 pounds of water for every pound of dry matter they produce, and once used, the water is not available for the next year's crop. (A thin pasture crop of oats and clover on the 1913 fallow decreased the yield in 1914 from 30 bushels 15 pounds of wheat to 18 bushels 55 pounds, a loss of 11 bushels 20 pounds; and a short crop of rape on the fallow the same year decreased the yield of wheat from 30 bushels 15 pounds to 22 bushels 15 pounds, a loss of 8 bushels. Corn planted in wide rows and intertilled reduces the yield less than any other crop. Pasturing the fallow is a good practice on heavy soils in the more humid parts of the province, and on soils inclined to drift, but not on 'the very dry lands' in the southwest).

"In any case, with our short growing season, we haven't sufficient time in the fall after crops are removed, and in the spring before seeding time, to prepare all our land for a crop. And even if we had, we should carry a greater risk of complete failure in occasional

seasons. We should also have little for our horses and our men to do in midsummer and these would be an added charge upon the cost of growing the crops. For economic reasons we find the fallow almost a necessity.

"The fallow, then, in addition to having an increased supply of moisture, and a larger amount of available plant food, will be ready for early seeding in the spring and we shall have done our part toward producing a good crop."

HONEST DOUBTS.

1. But someone says, "I did that and my crop did not ripen—it got touched with the frost because it was late in maturing."

2. Another, "I don't believe in letting one-third of my land worth \$30 an acre lie idle, it isn't good business."

3. Another one says, "The fallow is wasteful of fertility—nitrogen and organic matter—and should be discontinued."

4. Another, "Will not hay crops or hoed crops accomplish all these things claimed for the fallow?"

5. And another, "I did all these people say and in the spring after the seed was sown and just as the crop was coming up, the wind rose and the surface soil, because it was so fine, 'drifted' away and the resulting crop was 'patchy,' uneven and unsatisfactory."

6. And another, "I can't get the weed seeds germinated before the first of June in dry seasons and object to plowing them under because they will live and grow when plowed up again."

7. And yet another, "I did that and my crop was so heavy and rank that it 'lodged,' was poor in quality as a consequence and cost me double what it should have to harvest it."

8. And still another, "I plowed my fallow early in June and it kept my teams busy all summer cultivating it to keep down the weeds; I prefer to do it later because the weeds don't grow so much and it takes less horse power and time to keep it black—I reduce the cost of fallowing by doing it later."

LIGHT IN DARK PLACES.

And all these objections may be quite legitimate under certain conditions, but the successful dry farmer answers—

1. "If frost cuts down the yield or quality of the crop, the cause of the low yield is not the shortage of water but the shortage of heat, in which case the practices of "northern farming," those that promote early maturity, should be given first consideration, and not the practices of dry farming which are primarily concerned with controlling the moisture supply. Among the practices of northern farming may be mentioned: the use of early classes of grain, early maturing varieties within the class, early seeding, thicker seeding, packing the land, less frequent fallowing, later and shallower plowing of the fallow, and the use of frost resistant crops."

2. "If it isn't 'good business' to let the fallow field be 'idle' then don't let it be idle. But first, be sure it isn't good business. It isn't on the heavy, moist lands in the more moist parts of the prov-

ince nor on soils that blow, but it is good business on the dry lands of southwestern and west central Saskatchewan that are not subject to early fall frosts."

3. "If the fallow dissipates organic matter and nitrogen—and we regret that it does to a very serious degree—then we shall dissipate organic matter and nitrogen until we find a better way because we must have water in the soil and the fallow is the best way to get it there. But we shall set our experiment station men to work to find out if possible a better way. If they can find out a better method of procedure we shall embrace it. If they can't we shall ask them to find out how best we can maintain or restore this organic matter and this nitrogen; and as soon as these, and not water, commence to limit the yield of crops, we shall then restore them to the soil. We recognize this serious objection to fallowing, but before dispensing with the fallow we want to be shown a better way."

4. "If crops require 300 to 1,000 pounds of water per pound of dry matter produced, and if the function of the fallow is to store and conserve water, then neither grass not even hoed crops will replace the fallow, even though crops be 'rotated'; but both, and particularly the hoed crops, will lessen the frequency of the fallow. (The yield of wheat on corn ground at the University in 1914 was within 1 bushel of the yield on fallow, but there was a fallow immediately preceding the corn, and the corn was a light crop)."

5. "If drifting soil interferes with the development of the crop, then the drifting soil needs greater attention than the fallow. Let excessive harrowing cease and cause 'organic matter,' 'humus,' 'root fibre,' the thing that was in the land when it didn't blow, to be put back. To accomplish this it may be found advisable to grow a thin cover crop or pasture crop on the fallow, or to seed the land down to hay, or in extreme cases to plow under a green crop. But after any or all of these it will still be necessary to practice bare fallowing or a modification of it occasionally on our drier soils.

6. "The plowing under of ungerminated weed seeds should never be practiced. Early fall discing or shallow plowing will help to start germination, but if in very dry seasons the seeds do not start, it would be wise to delay plowing the fallow a short time in order to give them opportunity to do so. But every effort should be made to cause the early germination of weed seeds. If on account of the presence of ungerminated seeds the plowing of the fallow be delayed, it should either be disced or plowed shallow early, and then plowed deeper at a later time."

7. "If the crop on fallow grows too rank and 'lodges' or too late and suffers from frost, then consider whether you have to fallow so often, or plow so deep, or so early in June, or whether the pastured fallow is not best for you. The practices recommended are for extremely dry conditions. Perhaps yours is not the 'driest' district. Perhaps you can dispense with one or two or more of these dry farming practices."

8. "If weeds grow more luxuriantly on an early fallow and the cost of keeping them down is thereby increased—it is but nature's evidence that such a fallow is achieving its only legitimate function

—the storage and conservation of soil moisture. The cost of the added cultivation is, of course, an extra charge against the fallow. In soils where the moisture supply limits the yield of crops it has yet to be demonstrated that early fallowing, even at a greater cost, does not pay."

GENERAL CONCLUSIONS.

In conclusion, then, the dry lands of earlier days are producing crops because men have found out how to get moisture into the land and keep it there. They "store" it by letting the soil lie idle one year in two or three or four or five, as necessary, and by putting it, early in the rainy season, in such a condition that it will absorb the rains that fall and not let them "run off" the surface. They do this by plowing deep, early in June. They "conserve" it after it has been "stored" by controlling "evaporation" and weed growth, the two things which dissipate moisture from our soils. They control "evaporation" by tilling the land in such a way as to form a "mulch"—a loose shallow layer of dry soil—on the surface of the field. And they control weed growth also by timely and suitable tillage with harrows, discs and cultivators.

To be most effective a fallow should be surface cultivated the fall before, plowed early in June, not 3 or 4 inches deep, but 6 or 7 inches or more, particularly on old land; should be harrowed immediately after plowing, surface cultivated as necessary to maintain an efficient mulch, to control weed growth and to have the soil firm to within about three inches of the surface. In regions where the rainfall is greater and where fall frosts are likely to do damage, such extreme dry farm practices as result in later maturity of crops should be modified in order to meet the more humid and colder conditions found.

The frequency of the fallow may be lessened by the use of inter-tilled crops, the practice of suitable rotations, the maintenance of the humus content of soils and by a more intensive agriculture; but these will not replace it or a modification of it in the drier parts of this province as long as grain growing is our principal occupation.

At present the fallow is absolutely essential in the southwest; it is less essential but advisable in southeastern and in central Saskatchewan; it is to be desired occasionally in the northwest; but it need be less frequent in the east and northeast than in the other parts. Indeed, on some of the richer soils in the northeast it may under good management be practically dispensed with. But northeastern Saskatchewan is not the "great American desert" of earlier days.

The fact that the fallow dissipates the two most valuable constituents of fertile soil, viz., organic matter and nitrogen, is a matter of national concern. If it is a fact that the fallow dissipates 100 lbs. of nitrogen per acre per year and that the nitrogen is lost for purposes of crop production, it is also a fact that the loss of potential wealth to the state from every acre of summerfallow every year is about equal to the present price of the land. The present generation of land owners will not feel the loss of this source of wealth but later generations must. Yet even if this teaching were accepted and

believed by the present occupiers of the land they know no alternative method that pays.

Nor does the individual care much about the future. He will soon pass out. But the state never dies. It should have consideration for its own future. It should give attention to the conservation of its only resource—its only source of present and future wealth—the soil. It is the business of the state and not the business of the farmer to find a better method and not only a better method, but a method *that will pay*, otherwise it will not be practiced regardless of its value to future generations. This and other problems are being investigated by the state but none too quickly and in none too thorough a fashion.