Soil Moisture and its Uses.

From an address by Prof. A. M. Ten Eyck, Superintendent of the Fort Hays Branch Experiment Station, delivered before the Western Kansas Farmers' Conference, in June, 1910, we extract the following important facts :

USE OF WATER.

In the growth of plants, water is needed in the soil for the following reasons :

1. To dissolve the plant food.
2. To carry the food to the plants and through the plants.
3. It is food in itself to the plants.
4. A certain amount of water in the soil is necessary to give the proper texture favorable for the growth of the plant roots.
5. Water also acts as a regulator of the temperature of the soil, tending to raise the temperature of cold soil by reason of warm rains, and, by evaporation, to keep down the temperature of the soil during the hot summer weather.
6. The bacteria in the soil which assist in decay and in chemical changes by which the plant food in the soil is made available to the plant, thrive and multiply in the soil only with a favorable condition of soil, moisture, heat and air.

AMOUNT OF WATER REQUIRED BY CROPS.

Experiments which have been conducted show that in their growth plants require a large amount of water. Prof. F. H. King, at the Wisconsin Experiment Station, found that cultivated crops withdrew from the soil during their period of growth from 2.4 to 5.1 acre-inches of water, or 300 to 500 tons of water, for every ton of dry matter produced.

From his experiments he has determined that one acre-inch of water is required to produce three and one-third bus. of wheat, or that nine acre-inches of water are sufficient to produce a 30-bushel wheat crop, if this water could all be used by the growing wheat. In like manner, one acre-inch of water is equivalent to five bushels of barley, five bushels of oats, or six bushels of corn.

According to his figures, it would require only four and one-half acre-inches of water to produce a ton of clover hay, or a four-ton crop of clover hay could be produced by 18 acre-inches of water. Two acre-inches of water were equivalent to one ton of corn fodder, and a yield of six tons per acre would require only 12½ acre-inches of water.

Professor King's experiments were performed out of doors, but the crops were grown in cylinders and were not subject exactly to natural field conditions.

In experiments which the writer conducted at the North Dakota Experiment Station, 1898-99, it required, on an average, 15 acre-inches of water to produce a 30-bushel wheat crop, or one acre-inch of water was equivalent to two bushels of wheat. These results were secured in the field. The moisture content of the soil to a depth of six feet was determined at sowing time, and again at harvest time. The loss of water from the soil, plus the rainfall during the period of growth, was the amount of water which was charged to the crop.

At the Kansas Experiment Station a series of field experiments of this character have been conducted with different crops during the past three seasons. A summary of the data secured is given in the accompanying table.

WATER REQUIRED FOR DIFFERENT CROPS—SOIL-MOISTURE CONDITION AFTER DIFFERENT CROPS—AVERAGE FOR THREE YEARS, 1903-1905.

NAME OF CROP.	Average period of growth.	Average water used per day.	Total water used by crop.	Yield per acre.	Grain produced by one acre-inch of water.	Total dry matter produced per acre, including straw or stalks.	Pounds of dry matter produced per acre by one acre-inch of water.	Fall condition, † moisture in first six feet of soil after season's cropping.	Fall difference in moisture in first six feet of soil compared with corn plot.	Spring condition, moisture in first six feet of soil after previous season's cropping.	Spring difference in moisture in first six feet of soil compared with corn plot.
	Days.	Inches.	Inches.	Bush.	Bush.	Lbs.	Lbs.	Per ct.	Per ct.	Per ct.	Per ct.
Wheat (winter)	*170	0.131	22.22	18	0.81	2,399	108	23.81	+0.22	24.18	−0.29
Oats	106	0.190	20.15	32	1.58	3,530	175	23.91	+0.32	23.97	−0.50
Barley	102	0.178	18.20	18	0.99	1,918	105	23.79	+0.20	24.56	+0.09
Emmer	116	0.187	21.69	28	1.30	2,797	129	23.48	−0.11	24.20	−0.27
Flax	102	0.219	22.33	8	0.36	1,954	88	23.48	−0.11	24.36	−0.11
Millet	78	0.214	16.71	—	——	3,338	199	24.22	+0.63	24.97	+0.50
Sorghum (sowed)	110	0.166	18.21	—	——	10,749	509	23.09	−0.50	24.15	−0.32
Soy beans	105	0.152	15.91	14	0.88	1,853	116	24.40	+0.81	25.13	+0.66
Kaffir corn	116	0.146	16.98	50	2.92	6,811	401	23.03	−0.56	23.65	−0.82
Corn	137	0.194	26.64	40	1.50	4,424	163	23.59	——	24.47	00.0

*Three winter months deducted. †Average for two seasons only, 1904 and 1905.

The seasons of 1903 and 1904 were very wet. Excessive rains fell, and a considerable part of the water must have been lost by surface drainage. None of the crops lacked for water. From these results, it would appear that barley and oats require less water than the other grain crops, while emmer, which is classed as a drouth-resistant crop, used more water per acre than any other small-grain crop, except flax.

Corn used more water per acre than any other crop. This was due, in part, to its longer growing period. The relatively small amounts of water required to produce the crops of sorghum and Kaffir corn may be due, in part, to the fact that the crops were planted several weeks later than the corn, and had less rainfall charged to them than was charged to the corn. The fact remains, however, that the amount of dry matter produced was greater with the Kaffir corn and sorghum than with the corn, and that an acre-inch of water produced more pounds of dry Kaffir corn or sorghum than of corn.

MOISTURE IN SOIL AFTER CROPPING.

The moisture determination made in the field after the crops were harvested showed the following results: Comparing the soil in each plot to a depth of six feet, the Kaffir-corn plot contained 0.69 per cent. less water than the corn plot, while the sorghum plot contained 0.41 per cent. less water than the corn plot. Thus, the drouth-resistant crops actually left the soil drier in the fall than did the corn.

The results of this experiment indicate that the drouth-resistant crops may use a large amount of water, and tend to exhaust the supply of moisture stored in the soil to a greater degree than crops which are not classed as drouth-resistant. Dry-land farming is therefore as much a question of soil culture or of conserving the soil moisture as of growing drouth-resistant crops.

The presence of a large amount of humus in the soil increases its moisture capacity and its power to retain water, and is an important requisite to insure against the injurious effects of drouth. It is true of the soil in a large part of the (American) West that it is lacking in humus, and for this reason its water-holding power is not so great as it might be, resulting often in low yields and crop failures in an unfavorable season.

Saving Distance on Hay-fork Haul

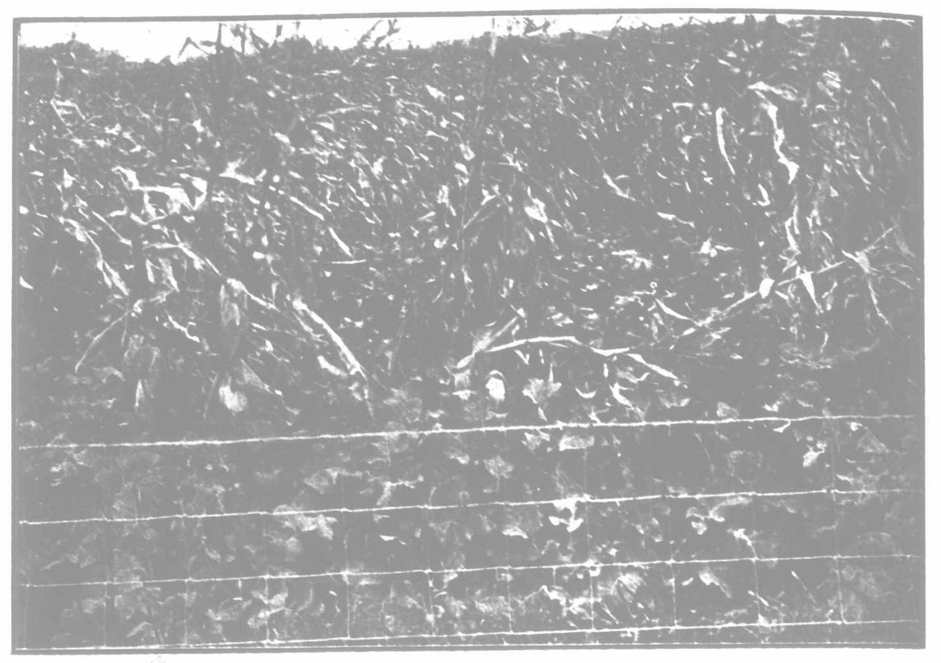
Editor "The Farmer's Advocate" :

I am enclosing you herewith plan of a scheme for saving time and labor during the rush of haying and harvest. Some of your readers, no doubt, already practice the following method of shortening the haul for the horse on the hay-fork rope; but, for the benefit of those who do not, I wish to give my plan. Instead of having simply one pulley attached to the side of the barn door, and a straight-away pull for the horse the full length of the rope, the rope, after passing through the pulley at the door, is then run through a pulley attached to the whiffletree, and back to the opposite side of the barn door, where it is fastened by means of a ring or other attachment. In this way the length of the haul is considerably shortened, and the hay elevated to the top of the barn in nearly half of the time taken by the old way. The draft is slightly heavier, but not enough to be at all noticeable. In returning, pulley is detached from whiffletrees, and comes back of itself when the fork is pulled down.

Glengarry Co., Ont. J. E. McINTOSH.

Sowing Rape in the Corn.

Under favorable conditions of weather, rape may profitably be sown in the corn field just before the last cultivation to provide pasture for sheep and lambs in the autumn months. The seed may be sown broadcast from the saddle on a horse's back, or by simply walking between the rows with a hand-seeder, sowing at the rate of about four or five pounds to the acre. The last cultivation



Rape in a Minnesota Corn-field. Sown at Last Cultivation of Corn.

should be shallow, to avoid cutting off the fibrous roots of the corn and too deep covering of the rape seed. The sheep will eat the lower leaves of the corn without injuring the ears or stalks, and after the corn is harvested, in an average season of rainfall, the rape will grow rapidly and make fine pasturage for sheep or lambs through the late fall months. It is well to take advantage of weather conditions by sowing and covering the rape seed as soon after a rain as the land is fit for cultivation. There is no pasturage equal to rape for fattening sheep or lambs, and the seed is so cheap that there is very little expense involved in a trial of this suggestion.

The Longevity of Seeds.

In the course of an elaborate article, officially published, on the longevity of seeds, by Dr. Alfred J. Ewart, Government Botanist and Professor of Botany in the University of Melbourne, the stories of mummy wheat and other grains coming to life and productivity are relegated to the region of exploded myths or frauds. The author has made an exhaustive inquiry into existing data on the subject, and by coming into possession of a packet of over 600 different sorts of seeds, dated over 50 years ago, was able to make valuable first-hand research and trial himself. The early complete records of de Candolle disclosed that out of 368 seeds, kept dry in air for 14 years, only 17 retained a feeble germinative power. Becquerel found that 18 out of 90 leguminous seeds, those of two species of Nelumbium, of one Labiate, and one Malvaceæ, remained germinable for 25 to 80 years. The oldest germinable seeds obtained by the latter were three species of Leguminosæ 80 years old. The records of seeds supposed to have lain dormant in the soil are regarded as quite worthless, not more than two or three per cent. being confirmed by the two experts quoted and Prof. Ewart himself. The tabulated records given by him go to show that vitality decreases, as a rule, in proportion as age increases, and from 20 to 50 years, or over, the record stands "nil," "nil," "nil." In the case of oats ten years old, cases are cited, 93 and 84 per cent. germinating. Several cases of mustard (Nigra Koch) are cited, 2 years old, germinating 10 to 80 per cent.; carrots, 12 and 13 years old, nil ; sunflowers, 1 year old, 96 and 97 per cent., 15, 50 and 51 years, nil ; barley, fresh, 100 per cent.; 2 to 7 years old, 10 to 95 per cent.; 8 to 10 years, 20 per cent.; and others, varying from 6 to 18 years, nil. Linseed, very variable, even with fresh seed the highest record being 98 per cent. [illegible]ne lot, 12 years old, germinated 14 per ce[illegible]ut others of that age and over are record[illegible]." Lucerne (alfalfa) showed very varying results, from nil to 84 per cent., in one case of seed 16 years old. Fresh peas varied from 80 per cent. to nil, and in one case two-year-old peas germinated 100 per cent.; three years old, 88 per cent. Cultivated sow thistle, 5 years old, germinated 50 per cent. Rye, fresh, 100 per cent. germinated in one case recorded ; 2 years old, 87 per cent., but