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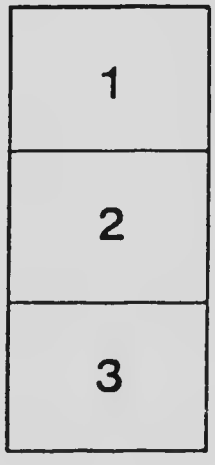

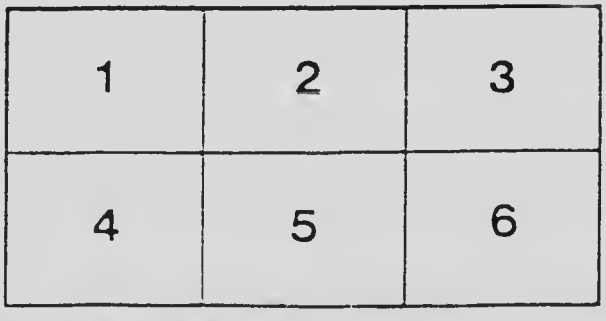

PREPARING LAND

FOR

GRAIN CROPS

ON THE

PRAIRIES

REPRINTED BY DIRECTION
HON. ARTHUR MEIGHEN, MINISTER.
W. W. CORY, C,M.G., DEPUTY MINISTER.
DEPARTMENT OF THE INTERIOR

ISSUED FROM
NATURAL RESOURCES INTELLIGENCE BRANCH
OTTAWA - - - - - CANADA.

Breaking land at Lacombe, Alberta.

Preparing Land for Grain Crops on the Prairies

COMPILED BY

J. H. GRISDALE, B. Agr.,

Director Dominion Experimental Farms.

Second Edition,---Incorporating Agricultural Maps and additional information relating to temperature, precipitation, seed, soils, fertilizers and loans to farmers.

REPRINTED BY DIRECTION

Hon. ARTHUR MEIGHEN, *Minister.*

W. W. CORY, C.M.G., *Deputy Minister.*

DEPARTMENT OF THE INTERIOR, OTTAWA, CANADA

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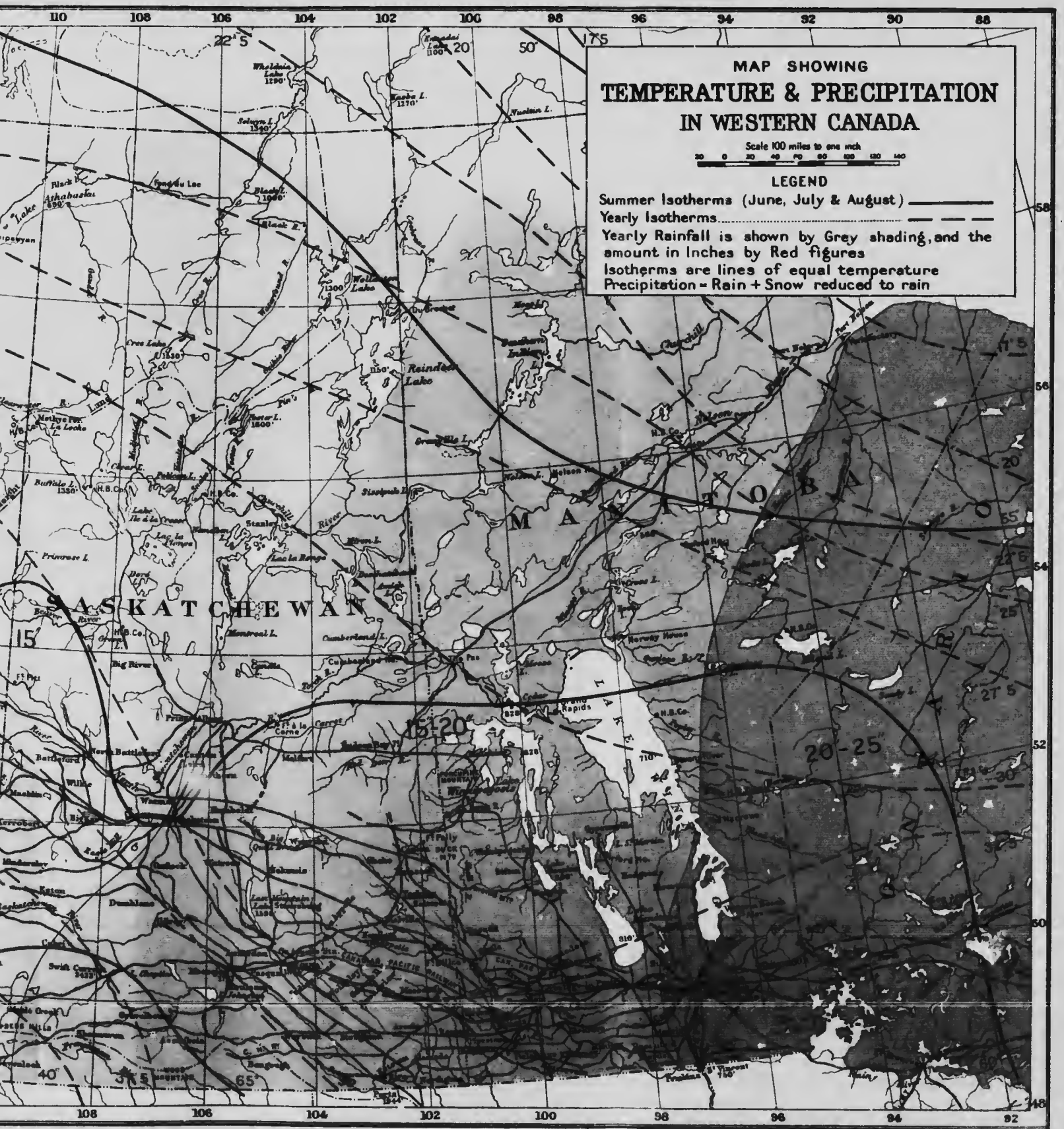

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Base map from plate of Geographer's Branch, Dept of the Interior

PREPARING LAND FOR GRAIN CROPS ON THE PRAIRIES.

SOUTHEASTERN SASKATCHEWAN.

Mr. Angus Mackay, for twenty-six years Superintendent of the Experimental Farm for Southeastern Saskatchewan at Indian Head, has said and written much on this subject of Prairie Breaking and Crop Production on the Prairies. After his many years spent on the prairies in a careful study of the various problems which confront the old as well as the new settler, he should be, and is, well fitted to outline the best cultured methods to follow to insure satisfactory crop returns.

The following information from his reports and pamphlets has been recently revised by him and may be said, therefore, to summarize the experience and work of a close observer and experimentalist, who has spent his whole life on the prairies.

For many years, commencing in 1888, the methods of conserving moisture by "Breaking and Backsetting" and by "Summer-fallowing," now called "Dry-farming" for a change, have been recommended and universally adopted by the older settlers, but to very many of the new settlers they are unknown. The latter, it is hoped, may be benefitted by the following explanation of the methods, which, for a great many years, have proven uniformly successful at the Experimental Farm at Indian Head, and may with confidence be recommended for almost every district in the province of Saskatchewan.

BREAKING PRAIRIE SOD.

The success or failure of a new settler often depends on the method employed in the preparation of the land for his first crop, and it is therefore of the utmost importance that the question of "Breaking" or "Breaking and Backsetting" be given the consideration it deserves.

For some years past the general practice throughout the country has been to continue breaking three or more inches deep so long as the teams can turn over the sod, then in the fall to disc the top-soil and grow grain in the spring following. From the breaking so done before the end of June, a good crop of wheat, oats or barley is usually obtained but no amount of cultivation will ensure even a fair crop on this land in the next succeeding year. After the first crop has been cut, the soil is usually in a perfectly dry state and remains so, in spite of any known method of cultivation, until the rains come in the spring following. If they are insufficient or late, as is frequently the case, failure of the crop must be the result.

BREAKING AND BACKSETTING.

Breaking and backsetting is the true way of laying the foundation for future success in the greater number of districts throughout the province, and while this method does not permit of as large an acreage being brought under cultivation in the year, it does permit of more thorough work and ensures better results in the long run.

The anxiety of nearly all settlers to sow every acre possible, regardless of how or when the work on the land has been accomplished, may be given as the reason for breaking and discing, to a large extent, superseding the older, better and safer plan.

Breaking and backsetting means the ploughing of the prairie sod as shallow as possible before the June or early July rains are over, and in August or September, when the sod will have become thoroughly rotted by the rains and hot sun, ploughing two or three inches deeper in the same direction and then harrowing to make a fine and firm seedbed. From land prepared in this way two good crops of wheat may be expected. The first crop will be heavy and the stubble, if cut high at harvest time, will retain sufficient snow to produce the moisture required, even in the driest spring, to germinate the seed for the next crop. The stubble-land can readily be burned on a day in the spring with a warm, steady wind and the seed may be sown with or without further cultivation. In the case where the grass roots have not been entirely killed by the backsetting, a shallow cultivation before seeding will be found advantageous but as a rule the harrowing of the land with a drag-harrow after seeding will be sufficient.

The principal objection to "breaking and backsetting" is urged with regard to the backsetting which, no doubt, is heavy for the teams, but if the discing required to reduce deep-breaking and then the ploughing or other cultivation that must be done in an effort to obtain a second crop, be taken into consideration it must be conceded that in the end "breaking and backsetting" is the cheaper and better method.

When the two crops have been taken from new land it should be summer-fallowed.

SUMMER-FALLOWS AND SUMMER-FALLOWING.

Among the many advantages to the credit of the practice of summer-fallowing may be mentioned: The conservation of moisture, the eradication of weeds, the preparation of the land for grain crops at a time when no other work is pressing, the availability of summer-fallowed land for seeding at the earliest possible date in the spring and the minor advantages of having suitable land for the growing of pure seed, potatoes, roots and vegetables at the least cost and with the greatest chance for success, and that of being able to secure two crops of grain with little or no further cultivation.

Summer fallowing has undoubtedly some disadvantages, but so long as the growing of grain, and more particularly wheat, remains the principal industry of the province, it will be necessary to store up moisture against a possible dry season, to restrain the weeds from over-running the land, and on account of the short seasons, to prepare at least a portion of the land to be cropped in the year previous to seeding and a well-made summer-fallow is the best means to this end. Among the disadvantages are: The liability of the soil to drift, the over-production of straw in a wet season, causing the late maturity and consequent danger of damage by frost, and it is claimed, the partial exhaustion of the soil. The two former may, to a great extent, be overcome by different methods of cultivation, and if the soil can be prevented from drifting, I am satisfied that one of the reasons for the latter contention will disappear.

Various methods are practised in the preparation of fallow and where the aim has been to take advantage of the June and July rains and to prevent the growth of weeds, success is almost assured. Where the object has been to spend as little time as possible on the work, failure is equally certain.

In my annual report for the year 1889, the following was submitted for the consideration of the settlers. Since then many experiments have been conducted on the Experimental Farm with different systems and again I submit what, on the whole, have been found to be the most successful methods for the cultivation of the soil in Saskatchewan:—

FROM REPORT OF 1889.

December 29.

"The year just passed has been one of extremes. Last winter was one of the mildest on record and March was so very fine that thousands of acres of grain were seeded from the 15th to the 31st, and at no time in the history of the country has the ground been in better condition for the reception of the seed. Immediately after seeding, however, exceptionally high winds set in, followed by extreme drought during the entire growing season. In many places the crops were injured by the winds and finally almost ruined by the succeeding dry weather. In some localities, however, where the farming has been done in accordance with the requirements of the country, the crops did fairly, and considering the excessively dry weather, remarkably well.

"The Experimental Farm suffered in company with every other farm in the country. Perhaps very few suffered as much from winds, but the dry weather, though reducing the yields, did not prove so disastrous as to many others. In this portion of the Territories at least, every settler knows the importance of properly preparing his land. For several years after the country became open for settlement every one imagined that grain would grow, no matter how put in, but now the man is devoid of reason who thinks he is sure of a crop without any exertion on his part. It is true that since 1882 we have had one year in which the land required little or no preparation for the production of an abundant crop but only too many realize the loss of the remaining years from poor cultivation.

"Our seasons point to only one method of cultivation by which we may in all years expect to reap something.

"It is quite within the bounds of possibilities that some other and perhaps more successful method may be found, but at present I submit that "fallowing" the land is the best preparation to ensure a crop. Fallowing land in this country is not required for the purpose of renovating it, as is the case with the worn-out lands in the East; and it is a question as yet unsettled how much or how little the fallows should be worked, but as we have only one wet season during the year, it has been proved beyond doubt that the land must be ploughed the first time before this wet season is over, if we expect to reap a crop in the following year. The wet season comes during June and July, at a time when every farmer has little or nothing else to do, and it is then that this work should be done. Usually seeding is over by the 1st of May and to secure the best results the land for fallow should be ploughed from 5 to 7 inches deep as soon after this date as possible. Land ploughed after July is of no use whatever unless the rains in August are much in excess of the average. A good harrowing should succeed the ploughing and all weeds or volunteer grain be kept down by successive cultivations. A good deal of uncertainty is felt with regard to a second ploughing, some holding that it is useless; others maintaining that it is an injury; while others again have found it to give from five to ten bushels per acre more than one ploughing. So far the experiments on the Indian Head Experimental Farm have shown that by far the best returns have been received from two ploughings; and more noticeably was this the case when the first ploughing had been completed in May or June. Without doubt, two ploughings cause a greater growth of straw and consequently in a wet year the grain is several days later in maturing, causing greater danger from frost; but taking the seasons so far past, 1884 excepted, two ploughings with as much surface cultivation as possible in between, may be safely recommended.

"Above all it is of the greatest importance that the first ploughing be as deep as possible, and that it be done in time to receive the June and July rains."

After seventeen years' further experience and observation, the following was written on this subject in the Annual Report of the Experimental Farms for 1906.

FROM REPORT OF 1906.

Methods of Preparing Soil for Grain Crops.

METHODS OF PREPARING NEW GROUND.

"In view of the fact that every year brings to the Northwest many new settlers who are unacquainted with the methods of breaking up and preparing new land for crop, a few suggestions with regard to this important work may not be amiss.

"In all sections where the sod is thick and tough, breaking and backsetting should be done; while in the districts where bluffs abound and the sod is thin, deep breaking is all that is necessary.

Tho former is generally applicable to the southern and western portions, and the latter to the northeastern part of Saskatchewan, where the land is more or less covered with bluffs.

BREAKING AND BACKSETTING.

"The sod should be turned over as thin as possible, and for this purpose a walking plough with a 12 or 14-inch share, is the best. When the breaking is completed (which should not be later than the second week in July), rolling will hasten the rotting process and permit backsetting to commence early in August.

"Backsetting is merely turning the sod back to its original place, and at the same time bringing up two or three inches of fresh soil to cover it. The ploughing should be done in the same direction as the breaking and the same width of furrow turned. Two inches below the breaking is considered deep enough.

"After backsetting, the soil cannot be made too fine, and the use of the disc harrow to cut up the unrotted sod, will complete the work.

DEEP BREAKING.

"Deep breaking, which in some sections of the country is the only practicable way of preparing new land, and which is, unfortunately, done in many instances where breaking and backsetting would give much more satisfactory results, consists in the turning over of the sod as deeply as possible, usually from four to five inches. When the sod has rotted the top soil should be worked and made as fine as possible. The use of harrow or disc will fill up all irregularities on the surface, and make a fine, even seed-bed.

"Whether the land is broken shallow or deep, it is necessary to have the work completed early, so as to take advantage of the rains which usually come in June and early July. These rains cause the sod to rot, and without them, or if the ploughing is done after they are over, the sod remains in the same condition as when turned, and no amount of work will make up for the loss."

SUMMER FALLOW.

"The true worth of properly prepared fallows has been clearly demonstrated in past years in every district of Saskatchewan.

"The work of preparing land for crop by fallowing is carried on in so many ways in different parts of the country, that perhaps a few words on some of the methods employed may be of use.

"It has been observed in some parts of Saskatchewan that the land to be fallowed is not, as a rule, touched until the weeds are full grown and in many cases, bearing fully matured seeds. It is then ploughed.

"By this method, which, no doubt saves work at the time, the very object of a summer-fallow is defeated. In the first place, moisture is not conserved because the land has been pumped dry by the heavy growth of weeds; and, secondly, instead of

using the summer-fallow as a means of eradicating weeds, a foundation is laid for years labour and expense by the myriads of foul seeds turned under.

"The endless fields of yellow-flowered weeds, generally Bull Mustard (*Neslia paniculata*), testify to the indifferent work done in many districts, and, while no weed is more easily eradicated by a good system of fallows, there is no weed that is more easily propagated or takes greater advantage of poor work on fallows or in fall or spring cultivation.

"As has been pointed out in my previous reports, early and thorough work on fallows is absolutely necessary to success, and I here repeat the methods and results of tests carried on for some years past.

"*First Method.*—Ploughed deep (6 to 8 inches) before last of June; surface cultivated during the growing season, and just before or immediately after harvest ploughed 5 or 6 inches deep.

"Result—Too much late growth if season was at all wet; grain late in ripening, and a large crop of weeds if the grain was in any way injured by winds or spring frosts.

"*Second Method.*—Ploughed shallow (3 inches deep) before the last of June; surface cultivated during the growing season, and ploughed shallow (3 to 4 inches deep) in the autumn.

"Result—Poor crop in a dry year; medium or good crop in a wet year. Not sufficiently deep to enable soil to retain the moisture.

"*Third Method.*—Ploughed shallow (3 inches) before the last of June; surface cultivated during the growing season, and ploughed deep (7 to 8 inches) in the autumn.

"Result.—Soil too loose and does not retain moisture. Crop light and weedy in a dry year. Packing after ploughing greatly improves the crop.

"*Fourth Method.*—Ploughed deep (7 to 8 inches) before the last of June; surface cultivated during the growing season.

"Result.—Sufficient moisture conserved for a dry year, and not too much for a wet one. Few or no weeds, as all the seeds near the surface have germinated and been killed. Surface soil apt to blow more readily than when any of the other methods is followed. For the past fourteen years, the best, safest and cleanest grain has been grown on fallow worked in this way, and the method is therefore recommended.

"Fallows that have been ploughed for the first time after the first of July, and especially after July 15, have never given good results; and the plan too frequently followed of waiting till weeds are full grown, and often ripe, and ploughing-under with the idea of enriching the soil, is a method that cannot be too earnestly advised against.

"In the first place, after the rains are over in June or early in July, as they usually are, no amount of work, whether deep or shallow ploughing, or surface cultivation, can put moisture in the soil. The rain must fall on the first ploughing and be conserved by surface cultivation.

"Weeds, when allowed to attain their full growth, take from the soil all the moisture put there by the June rains, and ploughing-under weeds with their seeds ripe or nearly so, is adding a thousand-fold to the myriads already in the soil, and does not materially enrich the land."

During the past few years the term "dry farming" has been applied to what was formerly known in the West as "summer-fallowing."

With the exception of the addition of the use of a soil-packer, there is no change in the methods formerly employed, when the spring rains and frequent cultivation were depended upon for the packing of the soil.

Packers are without doubt most useful implements on the farm and where from any cause, the soil is loose, they should be used. They are, however, expensive implements and within the means of comparatively few of the new settlers. Fortunately, early ploughing and frequent shallow cultivation may be depended upon to produce equally satisfactory results.

CULTIVATION OF STUBBLE.

When farmers summer-fallow one-third of their cultivated land each year, as they should, one-half of each year's crop will be on stubble. For wheat, the best preparation of this land is to burn the stubble on the first warm, windy day in the spring, and either cultivate shallow before seeding or give one or two strokes of the harrow after seeding, the object being to form a mulch to conserve whatever moisture may be in the soil, until the commencement of the June rains.

The portion intended for oats or barley, should be ploughed four or five inches deep and harrowed immediately; then seeded and harrowed as fine as possible. Packing after seeding is advisable. In case time will not permit of ploughing, good returns may be expected from sowing the seed oats or barley on the burnt ground, and discing it in; then harrowing well.

FALL PLOUGHING.

With regard to fall ploughing it may be said that, as a rule, on account of short seasons and dry soil, very little work can possibly be done in the fall, but if the stubble-land is in a condition to plough and the stubble is not too long, that portion intended for oats and barley may be ploughed, if time permits. If possible burn stubble before ploughing.

It is, however, a mistake to turn over the soil in a lumpy or dry condition, as nine times out of ten it will remain in the same state until May or June, with sufficient moisture properly to germinate the seed, and the crop will very likely be overtaken by frost.

As to the quantity of seed to sow and the depth of sowing, long experience has shown that the best results are had in Saskatchewan by the sowing of one and a half bushels of wheat per acre or two bushels of barley or oats. Sowing about two inches deep has given the most satisfactory returns, and the seed should be got in as early as is practicable, wheat as soon after April 1 as frost is out of the soil 2 inches deep. Oats and barley from April 25 to May 10.

On heavy soil summer-fallowed previous year, 1¼ bushels wheat and 2½ bushels oats and barley per acre will ripen a few days earlier than the above quantities.

FLAX PRODUCTION.

Of late years a great deal of flax has been grown in many districts in the province, and as this is the only sure crop for new settlers to obtain returns from their land the first year, a few pointers may be of advantage to many.

New Breaking.—Prairie sod broken and sown up to May 25 will give good returns. The sod is best broken 3 inches deep and disced enough to afford good covering for seed. Sow 30 to 40 pounds seed per acre, the former quantity on light soil, and the latter on heavy. If the sod has been turned over roughly, roll or pack before discing, if not rough, roll or pack after seeding.

Sow seed from 15th to 25th of May. It can be sown before and after these dates, but late spring or early fall frosts may seriously injure the crop.

One-year-old Breaking.—Flax can also be grown on land broken at any time the previous year, but breaking done before the last of June gives much the best returns. Discing such land in the previous fall is advisable.

Summer-fallow.—In addition to growing flax on breaking, it does well on summer-fallowed land and fairly well on stubble land. Where fallows are sown, the land is

better packed twice after seeding, and, where the soil drifts, ploughing 4 to 5 inches deep, and packing after seed is sown, is necessary to stop drifting, and to retain moisture.

Stubble land.—If preceding crop was on fallowed land, the stubble should be burned, the land then cultivated shallow, and seed sown. If the stubble was from second or third crop, ploughing 4 to 5 inches deep is advisable. Harrow and pack as soon after ploughing as possible, but do not sow before May 15.

Harvesting.—Flax should be quite ripe before cutting and is not injured by remaining uncut after it has ripened.

Cutting.—For large areas, remove the knotter on grain binder and allow the flax to fall in loose bundles on the ground.

In wet seasons it is safer to remove the knotter entirely and permit flax to string out on the ground; this saves turning if the loose bundles get wet.

For small quantities, bind and stook the same as ordinary grain.

NORTHWESTERN SASKATCHEWAN.

The following note on the practice in vogue in northwestern Saskatchewan has been submitted by the Superintendent of the Experimental Station at Scott, Sask., Mr. R. E. Everest.

As will be noted, the excuse given by Mr. Everest for the practice of deep breaking commonly followed in his district, is scarcity of labour. No claim of superiority for deep breaking over breaking and backsetting is made.

"In this part of Saskatchewan deep breaking is the method usually followed in the preparation of prairie land for grain crops. This method is best suited to our conditions, namely: a scarcity of labour and a short season for the work.

Method.—Turn the sod over thoroughly before the last of June to a depth of four or five inches, follow closely with the packer, then disc. The packer puts the furrow in place and the disc cuts the comb from the furrow which fills up the interspaces and forms a light mulch for the absorption and retention of moisture. Subsequent work with disc, scrubber, and drag harrow will put the area in condition for seeding the following spring."

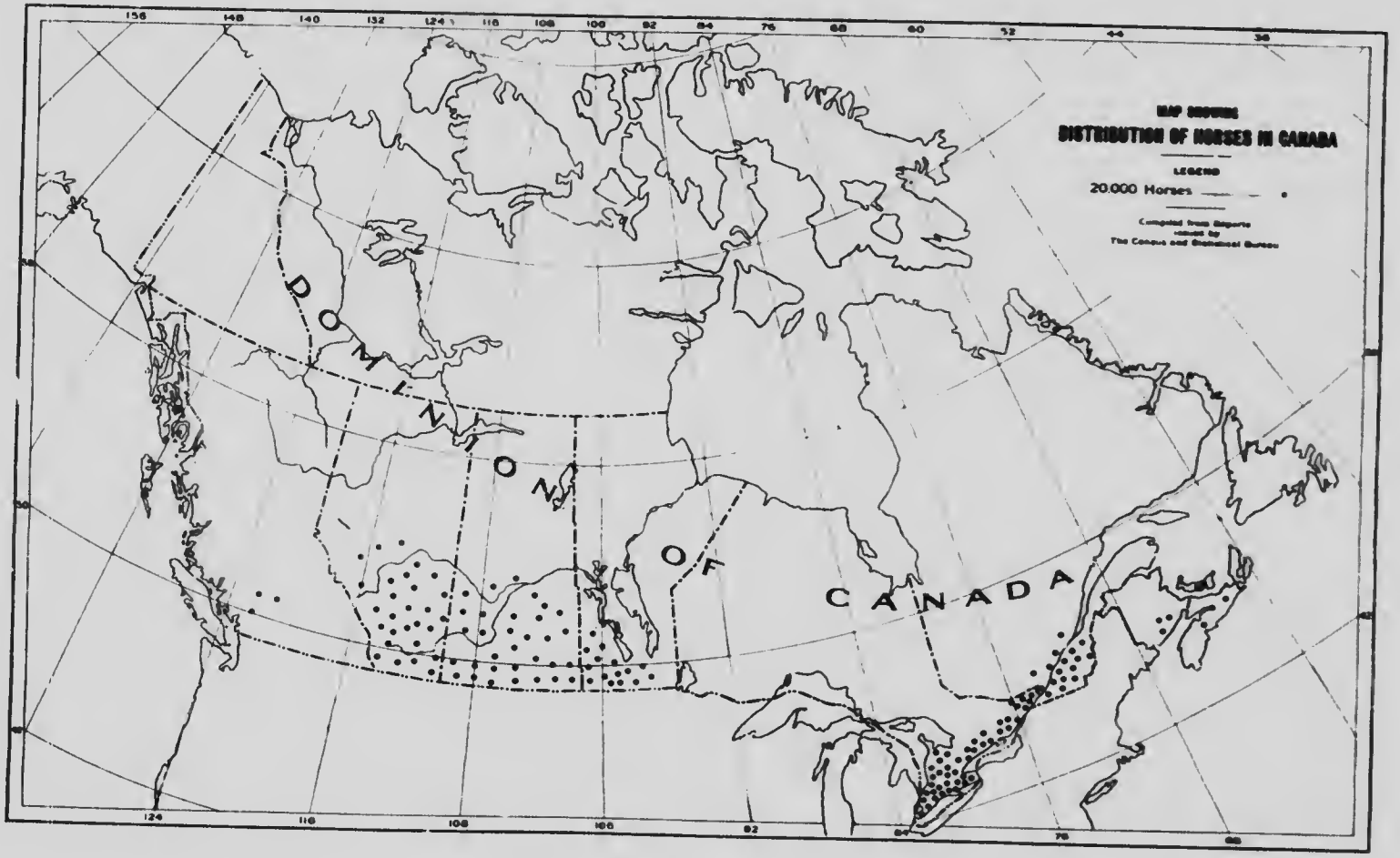
SASKATCHEWAN SOILS.†

In reviewing, for the purposes of this pamphlet, the soils of Saskatchewan examined during the past twenty years, a difficulty has been encountered in selecting only those which were truly representative of fairly large areas, owing to the fact that the second prairie steppe, comprising the larger part of this province, is not characterized by the uniformity noticed in the Red River valley. This fact precludes the possibility of presenting here examples of all types to be found, but it is worthy of remark that the larger number of the soils examined, and more particularly those in the noted wheat-growing districts, have been found to be abundantly supplied with humus-forming material and nitrogen.

No. 1. A rich, black loam from Moosomin, a point on the main line of the C.P.R., 220 miles west of Winnipeg. The elevation of this locality is in the neighbourhood of 1,800 feet, and this soil may be regarded as fairly representative of the southeastern part of the second prairie level. This true prairie soil possesses abundant stores of plant food, and is, judged by accepted standards, one of high fertility. It has not, however, looked at simply from the chemical point of view, a rank equal to that from the valley of the Red river (see p. 35).

No. 2. From the district of Tisdale, on the Canadian Northern Railway, about 160 miles due north of Indian Head. The district is one that in a large measure is comparable to the Dauphin country, described on page 38, being partly wooded with

† "Western Prairie Soils," by F. T. Shutt, M.A., F.I.C., Dominion Chemist.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DISTRIBUTION OF HORSES IN CANADA
LEGEND
20,000 Horses
Compiled from Reports issued by The Census and Statistical Bureau
DOMINION OF CANADA

scrub, poplar, etc., and therefore, unlike the true prairie, requiring clearance. It is a greyish-black loam of a decidedly clayey nature. The nitrogen, on the water-free soil, is almost half of one per cent, with notable amounts of potash and lime, and an average phosphoric acid content.

Nos. 3 and 4 are from Saltcoats and Yorkton, points on the northwestern branch of the C.P.R., 250 and 270 miles, respectively, west of Winnipeg, and approximately 75 miles northeast of Indian Head. Their similarity and comparative contiguity render unnecessary the separate consideration of these two soils. They are black, sandy loams of the true prairie type, rich in vegetable matter and nitrogen, with excellent percentages of phosphoric acid and potash.

Nos. 5 and 6 are black loams of a markedly sandy character, taken from areas that had been under grain (without manure) for a period of about fifteen years. Wolseley, the place of collection, is about 20 miles east of Indian Head on the C. P. R., a district which has produced large crops of very fine wheat. The data are of some interest since these soils have borne probably ten crops of grain, with a bare fallow every third summer. The evidence is that these soils are still of an exceedingly rich character, plentifully supplied with semi-decomposed vegetable matter and high in nitrogen; indeed, as regards these constituents, the data are not such as would differentiate them from virgin prairie soils. In "total" phosphoric acid they are decidedly above the average, but the amounts of this constituent immediately available are very small. This may be due to the taking up of the available phosphoric acid by the grain crop being more rapid than the conversion of the insoluble soil phosphates into assimilable forms.

Nos. 7 to 10 inclusive are from the Dominion Experimental Farm, Indian Head, and constitute a very instructive series, since they allow a comparison between the virgin prairie with the same soil after 22 years of cultivation without manure. The soil would be designated a heavy clay loam. A complete record of the cropping and fallowing since the prairie was broken in 1882 shows that the "cultivated" soil has borne six crops of wheat, four of barley, and three of oats, with a fallow between each crop since 1887—nine fallows in all. The virgin soil was taken from an adjacent area, the point of collection being about 150 feet distant from where the cultivated soil had been taken. The samples were of a composite character, and every precaution was taken to have them thoroughly representative. There is every reason to suppose that the soil, over the whole area examined, was originally of an extremely uniform nature; in other words, that, at the outset, the nitrogen content was practically the same for the soils now designated as virgin and cultivated, respectively. The tabulated data show the percentage of organic matter and plant food in the first four and the first eight inches of these soils, and make very clear that enormous losses of organic matter and nitrogen have followed upon the present method of continuously cropping with grain. The particulars respecting the nitrogen are given in the following arrangement, which allows a ready comparison of the two soils in this important matter.

Depletion of the Nitrogen.

NITROGEN-CONTENT OF VIRGIN AND CULTIVATED SOILS, INDIAN HEAD, SASK.

	To a depth of 4 inches		To a depth of 8 inches.	
	Per cent.	Lbs. per acre.	Per cent.	Lbs. per acre.
Virgin soil	·409	3,824	·371	6,936
Cultivated soil	·259	2,421	·254	4,750
Difference or loss due to removal in crops and to cultural methods	·150	1,403	·117	2,186

Though the cultivated soil to-day, after nearly a quarter of a century's working, is still very rich, and possibly might yield as fine a crop as it did at the outset, yet, compared with the untouched prairie, it is seen to have lost practically one-third of its nitrogen.

An inquiry as to what proportion of this loss is due to removal by crops and what to cultural operations shows that the nitrogen contained in the various grain crops grown in the twenty-two years amounted to approximately 700 pounds per acre. If we subtract this amount from the total loss, calculated to a depth of eight inches of soil, we shall see that more than twice as much nitrogen has been dissipated by methods of cultivation as has been removed in the crops. The loss ordinarily in the grain growing districts of the Northwest would not, in all probability, be as great as that here recorded, because, as a rule, the land is fallowed every third year only. Nevertheless, the deterioration must be marked, and unless checked by the adoption of a system of rotation involving the formation of a sod and by the keeping of stock, will inevitably lead to that low degree of productiveness which now characterizes large areas in eastern North America. A study of these partially exhausted areas both in Canada and in the Northeastern States makes it clear that the deterioration has been, in a very large measure, due to the loss of humus and the dissipation of nitrogen consequent upon grain and potato growing, without any due return of organic matter.

A quite marked falling off in phosphoric acid is also to be noted, though what is perhaps of more significance is the reduction in the proportion of this element in the available condition. Since loss of phosphoric acid cannot be accounted for save in removal by crops, it would seem that in continuous grain growing the rate of abstraction exceeds that of conversion, a probability to which we have already referred.

In the "total" potash, the differences throughout the series are not large but, as in the case of phosphoric acid, we find that the percentage of "available" in the cultivated soil is considerably less than in that of the prairie.

No. 11 from the prairie in the neighbourhood of Vermilion Hills, 130 miles west of Indian Head and some 20 miles north of Lake Chaplin. It is a dark-brown, sandy loam. In organic matter and nitrogen it is fully the equal of the heavier (clay) loams of the prairie, but as regards phosphoric acid, potash and lime it is, as might be expected, somewhat inferior. Although the "total" stores of this mineral plant food may not be very large, it is significant that the "assimilable" proportions are not less than in those heavier loams which are considered wheat soils par excellence.

No. 12 is from an area in the eastern part of the third steppe, 281 miles west of Indian Head along the main line of the C. P. R., and not far from the boundary between Saskatchewan and Alberta.

The district from which this soil was taken enjoys, as a rule, but a very limited rainfall, and previous to the adoption of special methods for the conservation of moisture, gave but scanty yields. It was thought by some that the poor crops were due to a deficiency in some important fertilizing constituent, or to the presence of "alkali" or other matter deleterious to plant growth. From this analysis it will be seen that there is no lack of plant food, though the percentage of organic matter and nitrogen are only about one-half of those found in the richer prairie soils. Absence of "alkali" was established and the conclusion reached that the meagre yields were due to insufficient moisture rather than to any inherent fault in the soils.

SASKATCHEWAN SOILS.

RESULTS CALCULATED TO WATER-FREE BASIS.

No.	Locality.	Character of Soil.	Organic and Volatile Matter (Loss on ignition.)	Nitrogen.	Phosphoric Acid (P_2O_5.)	Potash (K_2O.)	Lime (Ca O.)	Available Constituents.		
								Phosphoric Acid (P_2O_5.)	Potash (K_2O.)	Lime Ca O.)
			%	%	%	%	%	%	%	%
1	Moosomin	Black loam	11·79	·479	·116	·306	·95			
2	Tisdale	Grayish-black loam	14·23	·480	·202	·622	1·11	·024	·041	·568
3	Saltcoats	Black, sandy loam	13·54	·572	·213	·340	2·89	018	·033	1·110
4	Yorkton	" "	14·01	·504	·211	·486	1·17	·025	·048	·531
5	Wolseley, N.E.¼, Sec. 27	Black loam (cultivated)	13·93	.514	·391	·555	·87	·005	·011	·306
6	" S.W.¼, Sec. 27	" "	10 98	·389	·369	·512	·76	·005	·018	·264
7	Indian Head	Black clay loam. Taken to a depth of 4 inches.	13·31	·409	·212	·863	1·26	·036	·070	1·187
8	"	Black clay loam. Taken to a depth of 8 inches.	12·83	·371	·234	.868	1·41	·032	·059	1·261
9	"	Black clay loam. Taken to a depth of 4 inches (cultivated.)	10·20	·259	·159	·839	3·44	·016	·039	1 384
10	"	Black clay loam. Taken to a depth of 8 inches (cultivated.)	10 70	254	·163	·898	3 51	·013	·038	1·336
11	Vermilion Hills, Tp. 21, R.5, W. 3rd.	Dark brown sandy loam	10·43	·354	·164	·164	50	·044	·050	·383
12	Maple Creek, sec.16, Tp. 11, R.26, W. 3rd	Heavy clay loam	5 54	·134	·064	·300	1·06			

Ploughing with Oxen.

VARIETIES OF GRAIN RECOMMENDED FOR USE IN SASKATCHEWAN.

Spring Wheat.—Marquis, Red Fife, Early Red Fife, Prelude and Pioneer should be considered. Marquis is the most productive and is the best variety for many districts, especially on summer-fallowed land. If Marquis proves too short in the straw, Red Fife or Early Red Fife should be grown. Where Marquis grows too rank and is too late in ripening Prelude will be found very valuable. Pioneer is a new variety introduced by the Dominion Cerealist for dry districts where early ripening varieties are necessary. It is not recommended for test where the rainfall is good.

Oats.—Banner and Ligowo are among the best. Ligowo is slightly earlier than Banner, but does not usually produce quite so large a crop. Victory is a new and promising sort. It is also called Conqueror and Seger. Daubeney may be used if it is essential to have a very early ripening variety. The commercial sorts Orloff and Sixty Day are still earlier, but they yield less.

Barley.—Manchurian and Ontario Agricultural College No. 21 are recommended. If a two-row type is desired for any special purpose, Duckbill or Early Chevalier should be tried.

Peas.—Arthur, Chancellor and Golden Vine are among the best yellow sorts. Arthur has the advantage of usually ripening in advance of the others. English Grey and Prussian Blue are among the best coloured varieties.

CLIMATIC CONDITIONS IN SASKATCHEWAN.

Saskatchewan has a mean temperature of 36 degrees Fahrenheit for the year with a growing season temperature of about 55 degrees Fahrenheit, a mean annual precipitation of only about 16·75 inches. Her sunshine average is nearly nine hours a day in the growing months. Her precipitation, though light, is practically all rain, and comes as a rule when most needed—May, June, and July. This fall of 16·75 is too low for sure crop production, with average careless methods of soil cultivation; hence dry farming methods have to be practised.

The following table* gives the temperature, precipitation, hail and frost at representative points in Saskatchewan for January, April, May, June, July, August and September in 1916:—

* Compiled from information furnished by the Meteorological Service of Canada.

Temperature, Precipitation, Hail and Frost.

	—	Saskatoon	Prince Albert.	Battleford.	Swift Current.	Regina.	Kamsack.
	Elevation in feet	1,571.	1,414.	1,622	2,432.	1,885	1,445.
JANUARY.	Temperature in degrees Fahr:—						
	Highest	17	17°	20°	27°	13°	27°
	Lowest	−15°	−58°	−61°	−49	−53	−56°
	Mean	−16	−15	−16°	−12°	−15°	−23°
	Difference from average	−18°	−12°	−14°	−21°	−11°	—
	Precipitation in inches						
	Total	0.55	0.96	0.76	2.70	1.15.	0.20.
	Difference from average	+0 06	+0.09	+0.30	+2.04	+0 78	
	Sunshine in hours—						
	Total number	71°		71°	56°		
	Difference from average			− 34°			
	Possible number	256°		254			
	Number of days of hail	0	0°	0	0°	0	0°
	Number of days below 32°	31°	31°	31	31°	31°	31°
APRIL.	Temperature in degrees Fahr						
	Highest	74°	75°	76°	80°	72°	71°
	Lowest	14°	2°	15°	18	2°	−1°
	Mean	38°	38°	40	41°	36°	35°
	Difference from average	+1°	+1°	+2°	+0°	−1°	
	Precipitation in inches—						
	Total	0·64	1·21	0·73	0·62	0·56	0·15
	Difference from average	+0 27.	+0·38	+0·32	−0·13	−0 17	
	Sunshine in hours—						
	Total number	204°			197°		
	Difference from average						
	Possible number	417°		418	413°		
	Number of days of hail	0°	1°	0	0°	0°	0°
	Number of days below 32	19°	19°	18°	23°	29°	21°
MAY.	Temperature in degrees Fahr —						
	Highest	78°	78	77°	79°	77°	75°
	Lowest	19°	20°	21°	23°	20°	24°
	Mean	47°	48°	48	48.	48°	47°
	Difference from average	−3	−1°	−4	−3°	−2°	
	Precipitation in inches—						
	Total	2·45	4·38	2·77	1·59	1·89	2·21
	Difference from average	+0·86	+2·84	1·08	−0 53	−0·09	
	Sunshine in hours						
	Total number	198°			210°		
	Difference from average						
	Possible number	486°		488	478°		
	Number of days of hail	0·	0·	0·	0·	0·	0·
	Number of days below 32°	7·	3·	8·	9·	8·	9·

Temperature, Precipitation, Hail and Frost—*Continued.*

		Saskatoon	Prince Albert.	Battleford.	Swift Current.	Regina.	Kamsack.
JUNE.	Temperature in degrees Fahr.—						
	Highest	78·	77·	78·	79·	79·	77·
	Lowest	32·	30·	32·	28·	35·	28·
	Mean	56·	56·	57·	56·	55·	54·
	Difference from average	− 2·	− 1·	− 2·	− 4·	− 4·	.....
	Precipitation in inches						
	Total	1·68	2·60	3·66	4·05	4·28	2·29
	Difference from average	− 0·83	− 0·03	+ 0·19	+ 1·00	+ 1·11	.....
	Sunshine in hours—						
	Total number	250·	.....	.....	230·	.....	.....
	Difference from average	.....	.....	.....	.....	.....	.....
	Possible number	498·	.....	561·	488·	.....	.....
	Number of days of hail	0·	0·	0·	1·	0·	0·
	Number of days below 32°.	1·	1·	1·	1·	0·	2·
JULY.	Temperature in degrees Fahr.—						
	Highest	90·	86·	89·	91·	89·	87·
	Lowest	48·	46·	47·	44·	42·	38·
	Mean	66·	66·	66·	67·	68·	67·
	Difference from average	+ 3·	+ 4·	+ 2·	+ 1·	+ 4·	.....
	Precipitation in inches—						
	Total	4·79	3·88	2·11	5·29	5·02	1·13
	Difference from average	+ 2·25	+ 1·46	0·00	+ 2·78	+ 2·53	.....
	Sunshine in hours—						
	Total number	304·	.....	.....	335·	.....	.....
	Difference from average	.....	.....	.....	.....	.....	.....
	Possible number	502·	.....	503·	491·	.....	.....
	Number of days of hail	0·	0·	0·	0·	0·	0·
	Number of days below 32°	0·	0·	0·	0·	0·	0·
AUGUST.	Temperature in degrees Fahr.—						
	Highest	83·	85·	84·	88·	87·	95·
	Lowest	37·	30·	34·	32·	34·	24·
	Mean	59·	60·	60	61·	61·	59·
	Difference from average	− 1·	+ 1·	− 2·	− 3·	0·	.....
	Precipitation in inches—						
	Total	1·99	1·66	4·79	2·54	0·69	0·58
	Difference from average	− 0·18	− 0·87	+ 2·72	+ 0·65	− 1·17	.....
	Sunshine in hours—						
	Total number	288·	.....	.....	302·	.....	.....
	Difference from average	.....	.....	.....	.....	.....	.....
	Possible number	452·	.....	452·	446·	.....	.....
	Number of days of hail	1·	1·	0·	1·	0·	0·
	Number of days below 32°	0·	1·	0·	1·	0·	4·

Temperature, Precipitation, Hail and Frost—*Concluded.*

		Saskatoon	Prince Albert.	Battleford.	Swift Current.	Regina.	Kamsack.
SEPTEMBER.	Temperature in degrees Fahr.						
	Highest	78·	80·	81·	81·	80·	80·
	Lowest	21·	26·	23·	25·	26·	19·
	Mean	49·	51·	52·	53·	50·	47·
	Difference from average	− 1·	+ 2·	0·	0·	− 1·	.....
	Precipitation in inches						
	Total	1·38	1·00	1·05	1·46	4·14	3·21
	Difference from average	− 0·08	− 0·44	− 0·21	+ 0·13	+ 2·95	.....
	Sunshine in hours						
	Total number	178·	.....	.....	165·	.....	.....
	Difference from average	.....	.....	.....	.....	.....	.....
	Possible number	378·	.....	378·	377·	.....	.....
	Number of days of hail	0·	0·	0·	1·	0·	0·
	Number of days below 32	11·	7·	3·	1·	8·	12·

AGRICULTURAL LOAN ACTS IN SASKATCHEWAN.

1. *Farm Loans Act.*—Under the administration of a Board of three appointed by the Lieutenant-Governor-in-Council this act makes provision for the lending to agriculturalists of money on first mortgages for the purpose of improvement of properties, the payment of liabilities; the acquisition of land or for any other purposes approved by the Board. The loan is limited to fifty per cent of the value of the land. All loans are for thirty years re-payable in equal annual instalments with interest sufficient to realize a sum equal to the interest on the money raised by the Board to provide the loan together with the expenses of management.

2. *An Act respecting the purchase and sale of live stock by the Provincial Department of Agriculture.*

This act provides for an appropriation of $500,000 by the Provincial Legislature for the purpose of purchasing live stock to be sold to agriculturalists for cash or partly cash and partly credit in which latter case a lien is taken on the animals till they are paid for.

3. *Co-operative Farm Mortgage Association Act.*—This act makes provision whereby a society of at least twenty-five agriculturalists may be formed by petition to a Board of three commissioners appointed by the Provincial Government. Each member of the society must be an applicant for a loan and must give security for fifty per cent of the loan which is made on a first mortgage only, and which is limited to forty per cent of the value of the farm property.

SOUTHERN ALBERTA.

Mr. W. H. Fairfield, Superintendent of the Experimental Station at Lethbridge, Alta., finds that the methods advocated for Saskatchewan by Mr. Mackay are entirely applicable to Southern Alberta. He emphasizes the value of harrowing immediately after ploughing.

"What Mr. Mackay says is applicable in every detail to Southern Alberta. If every homesteader settling here could have the importance of the advice given so impressed on him that he would follow it implicitly, the annual production of grain in this part of the province would be increased by many thousands of bushels. I cannot see that there are any conditions peculiar to this part of the Province of Alberta that demand treatment other than such as Mr. Mackay has outlined for Saskatchewan, with the possible exception of the following details:—

"Prairie sod in Southern Alberta should be broken shallow and backset later on the same season as recommended, but, if for any reason the land is to be broken deep, care must be exercised to see that the furrow slice or sod is not so thick as to prevent it being turned completely over and lying flat. For, if it is allowed to lap on the previous furrow, an air space will be left under part of each furrow slice, with the result that it will dry out rapidly and the process of rotting will be stopped. It is a help to roll or flatten down all breaking as fast as it is done.

"In the district of the Chinook winds special emphasis should be laid on the importance of harrowing land as fast as it is ploughed, in fact, of the advisability of attaching a section of the harrow to the plough. Special attention should also be called to the mistake so often made of ploughing in the fall when the soil is in a lumpy, dry condition. In regard to the depth of seeding, it is well for a farmer to force the seed down till it is in contact with the moisture, even if it is over two inches below the surface."

NORTHERN ALBERTA.

Mr. G. H. Hutton, Superintendent of the Experimental Station at Lacombe, Alta., gives some valuable points as to the breaking and later treatment of brush land.

"Generally speaking, the Experimental Station at Lacombe covers conditions in all territory north of Township 24 west of the 5th Meridian, and all territory north of Township 30. In those districts in Central Alberta which are strictly prairie country, the general recommendation outlined elsewhere in this bulletin will apply. In those districts which are not strictly prairie, but which are commonly designated as brush country, *i.e.*, country in which there is a fair proportion of prairie and also patches of willow brush or timber, slightly different recommendations may be made.

"*Brush Country Methods.*—In brush country deep breaking is the only practical method. By breaking to a depth of five or six inches, the breaking plough gets under the roots and it is not so easily thrown from the ground. When plenty of power is used, as a five or six-horse team, or a heavy four-ox team, a furrow eighteen to twenty inches wide and five or six inches deep may be turned. Such an outfit, where the coulter is kept in condition, will pass through remarkably heavy brush, cutting the roots clean and turning the furrow over flat. The ploughs most favoured by the writer for breaking brush land are the 'Van Slyke' and the 'John Deere Wisconsin Grubber." With good power, one man can break and prepare for crop one hundred acres of heavy brush land in one season. After being broken, the land should be packed or, if a packer is not available, it should be given a discing. The packing or discing firms the freshly turned furrow and hastens the rotting of the sod. A second crop without backsetting is advised where land has been heavily covered with brush and the job of breaking has been well done. Thorough discing will prepare such land for a second crop.

"Summer fallow is not advised for the brush country, the objection being that the first crop after summer-fallow grows too rank, almost invariably lodging and fails to fill as well or ripen as early as a crop on land not summer-fallowed. Stubble land not seeded down should be fall-ploughed five or six inches deep and packed or harrowed as it is turned. If fall ploughing is not possible, then the same depth of ploughing in the spring followed immediately by the packer or harrow will give good results.

"*Mixed Farming.*—In all that territory included in the general term 'brush country,' climatic and soil conditions are such as to make it most desirable as a mixed farming country. For this district some such rotation as the following, modified or expanded to suit particular cases, is suggested:—

1st yr.—Hay.
2nd yr.—Pasture—Manure in autumn 12 tons per acre.
3rd yr.—Pasture—Break and disc July or August
4th yr.—Wheat or oats.
5th yr.—Oats.
6th yr.—Barley—seeded down:—
Timothy, 4 pounds.
Alsike clover, 4 pounds.
Red clover, 4 pounds."

ALBERTAN SOILS.*

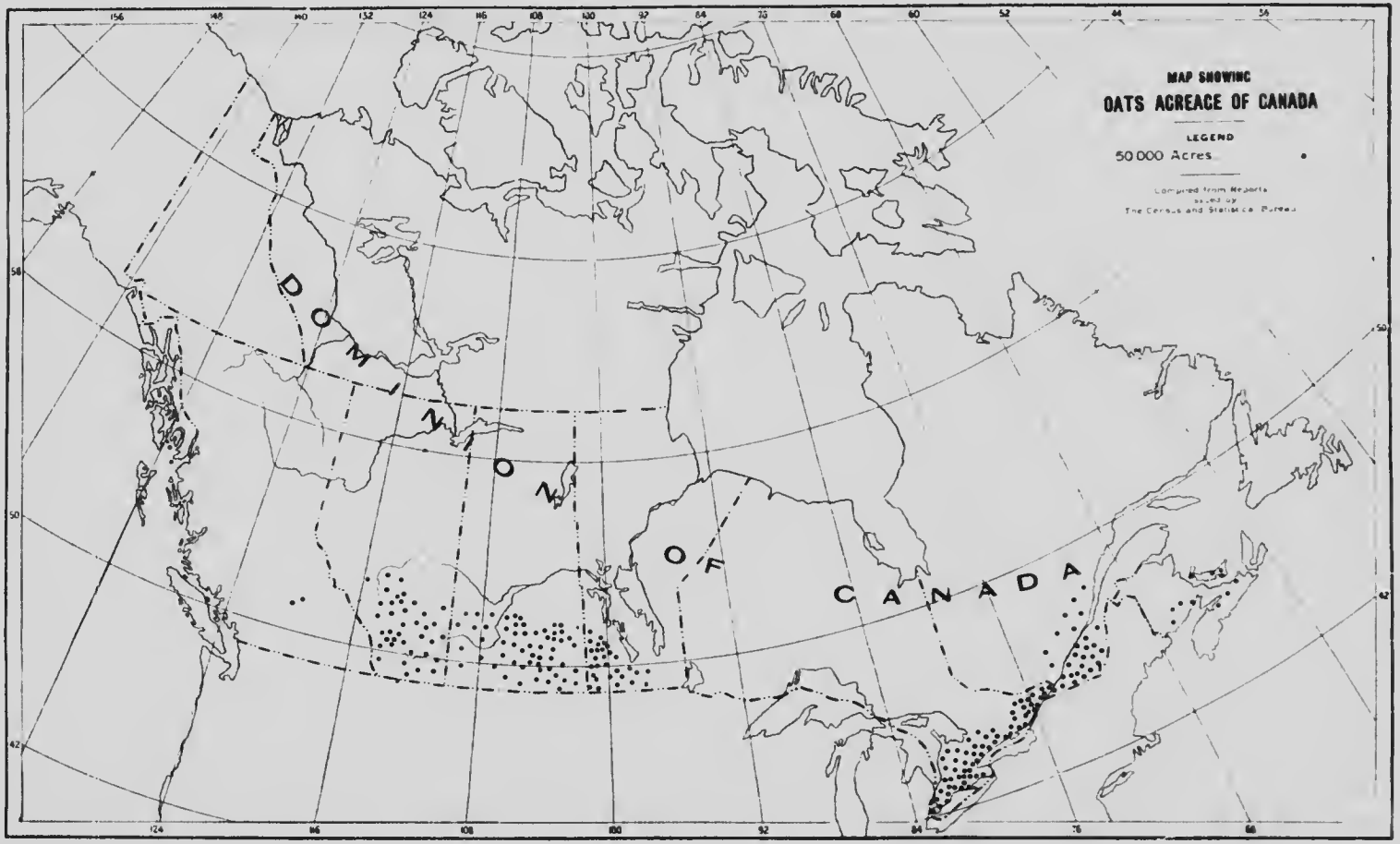
No. 1. This soil, a black sandy loam, was collected in the neighbourhood of Tilley, a point on the main line of the Canadian Pacific Railway about 50 miles west of Medicine Hat, and a district that, owing to sparse rainfall, has hitherto been considered better adapted to ranching than to grain growing. As in the case of certain Saskatchewan soils (see page 16), this soil was supposed to be deficient in some particular, or to contain alkali. The data, however, show that there is an abundance of plant food present and an entire absence of alkali. It has been demonstrated in recent years in this and similar districts, through improved methods of culture (resulting in the better conservation of soil-moisture) that the poor yields were not due to the poverty of the soil, but rather to insufficient water supply for the needs of the crop.

No. 2, from the Dominion Experimental Farm at Lethbridge, an important centre in Southern Alberta, a true prairie region, and where, until recently, ranching has been the chief branch of agriculture followed. It is a district in which, speaking broadly, irrigation is desirable, if not indeed necessary; but in which, in many seasons, fairly good yields can be obtained by the adoption of proper cultural methods for the conservation of soil moisture. The soil appears to be extremely uniform in character and very productive, provided there is a sufficiency of moisture.

The sample, which in this case was taken to a depth of 12 inches, is a dark gray, inclining to black, sandy, loam, light and friable, free from stones and containing an abundance of root fibres. Though not as rich in organic matter and nitrogen as the majority of the prairie soils hitherto considered, the results are quite satisfactory, especially when the greater depth to which this sample was taken is considered. In mineral constituents it seems to be fairly well supplied, the amounts being such as are possessed by many soils of high productiveness.

No. 3 was collected from an uncultivated area on a bench in the valley of the Elbow River, some few miles from Calgary. The soil of the district is stated to be one "well fitted for either cultivation or grazing." It might be classed as a light to medium, black, prairie loam, especially rich in organic matter. It is practically neutral, and examination of the analytical data gives evidence that it is well supplied with all the essentials of plant growth, a very fair proportion of which appears to be in a condition immediately available.

* "Western Prairie Soils," by F. T. Shutt, M.A., F.I.C., Dominion Chemist.


MAP SHOWING
OATS ACREAGE OF CANADA
LEGEND
50 000 Acres
Compiled from Reports
issued by
The Census and Statistics Bureau
DOMINION OF CANADA

Soils 4 and 5 were taken at no very great distance from the location of No. 3, and are in appearance very similar to it. They were examined to learn what effect irrigation might have on the stores of fertility. No. 4 is from a non-irrigated area, while No. 5 is from irrigated land, collected 50 feet from the lower side of an irrigation ditch, and 100 feet from No. 4.

Undoubtedly the feature of greatest interest in the comparison of the data is the decidedly higher percentages of soluble (available) mineral constituents in the soil that had been irrigated, and it is important to note in considering this fact, that, while the non-irrigated land is neutral, that of the irrigated area is slightly alkaline. These features are not uncommon to irrigated soils, and two possible causes therefore may be advanced. The first is the deposition of mineral salts from the irrigation water, and the second-probably the chief cause—is the bringing up of these compounds from the lower strata by increased capillarity induced by greater surface evaporation consequent upon irrigation.

It may be said that as Southern Alberta is of the true prairie character, so Northern Alberta is largely wooded, enjoying a more liberal rainfall and is naturally a country better adapted to mixed farming. The soils of Northern Alberta are, for the most part, characterized by high percentages of organic matter and nitrogen, and in this respect are somewhat superior to those in the southern part of the province. We have in this a certain confirmation of the view that a relationship exists between rainfall and the organic content of the soil.

The samples so far considered from this province have been representative of areas in Southern Alberta, the remaining examples are from points north of Calgary.

No. 6 is from Innisfail, an excellent district for dairying and mixed farming, some 80 miles north of Calgary on the Edmonton branch of the Canadian Pacific Railway. This sample had been collected to a depth of 12 inches. As received, in the air-dried condition, it was a loose, friable, grayish-black, sandy loam, full of fibre and evidently rich in organic matter.

No. 7 is fairly representative of the soil on the Dominion Experimental Farm at Lacombe, a point some 40 miles north of Innisfail. The country and soil in this neighbourhood are similar in character to those of the Innisfail district just described, and indeed may be considered typical of a very large part of this northern portion of the province.

Nos. 8 and 9 are clay loams from Lac la Nonne, a district lying some 40 miles northwest of Edmonton. These loams are very similar, containing a large proportion of clay and well furnished with humus-forming material. They are of a grayish-black colour when air-dried. The chemical data will bear out the opinion formed from their inspection, and show that they are very rich in organic matter and nitrogen. The analysis also demonstrates that in potash and lime they are above the average and fairly well supplied in phosphoric acid. Under proper cultural operations and favourable climatic conditions, they should prove to be highly productive soils.

ALBERTAN SOILS.

RESULTS CALCULATED TO WATER-FREE BASIS.

Number.	Locality.	Character of Soil.	Organic and Volatile Matter (Loss on ignition).	Nitrogen	Phosphoric Acid. (P_2O_5)	Potash (K_2O)	Lime (Ca O)	Available Constituents.		
								Phosphoric Acid. (P_2O_5)	Potash (K_2O)	Lime (Ca O)
			%	%	%	%	%	%	%	%
1	Tilly, Tp. 16, R. 13, W. 4th	Sandy loam	11·12	·398	·174	·266	·37			
2	Lethbridge (1st foot)	Dark gray, or black sandy loam	5·89	·215	·123	·462	1·04	·008	029	959
3	Calgary, N.W. ¼, Sec. 21, Tp. 23, R. 1, W. 5th.	Black granular, sandy loam	[illegible]·69	·530	·210	·520	·71	009	635	·498
4	Calgary, S.W. ¼, Sec. 15, Tp. 23, R. 1. W. 5th.	Black granular, sandy loam, non irrigated.	16·12	·549	·240	·380	90	004	028	440
5	Calgary, S W. ¼. Sec. 15, Tp. 23, R. 1, W. 5th.	Black granular, sandy loam, irrigated.	15·30	·574	·180	380	1·28	012	035	·508
6	Innisfail. (1st foot)	Black, sandy loam	12·09	·403	155	384	·68	016	015	·392
7	Lacombe (first 8 inches)	" "	8·78	326	136	250	63	·023	·024	·385
8	Lac la Nonne	" "	17·63	·673	·190	611	1·00	037	022	584
9	Lac la Nonne	" "	14·34	·514	·197	·673	1·24	050	·035	·799

Fall ploughing at Olds, Alberta.

VARIETIES OF GRAIN RECOMMENDED FOR USE IN ALBERTA.

Winter Wheat.—Kharkov and Turkey red. These two sorts are essentially the same in most respects, but Kharkov has shown productiveness in some tests. In districts where winter wheat has not been fully tested, farmers are advised to sow only very small areas of it at first.

Spring Wheat.—Red Fife is perhaps the best sort for some of the dry areas towards the south, but wherever there is sufficient rainfall, Marquis should be tried. If early maturing varieties with longer straw than Marquis are essential, Huron and Early Red Fife are suggested for test.

Pioneer, a new variety recently introduced by the Dominion cerealist ripens earlier than any of the above mentioned sorts and has given good results under dry conditions. It is bearded and produces straw which is usually of fair length. It is not adapted to moist districts.

For all localities where the tendency is towards the production of excessively long straw and where a very early-ripening wheat is required, Prelude is unquestionably the best variety known.

Oats.—Banner and Ligowo are recommended where rather long straw is required. Ligowo is rather early in ripening, but generally yields a little less than Banner.

The new variety called Victory, Seger or Conqueror is also good.

Daubeney should be tried wherever extreme earliness is required. It produces rather short straw. Orloff and Sixty Day are still earlier, and produce less straw and less grain. The name Sixty Day is very misleading.

Barley.—Manchurian and Ontario Agricultural College No. 21 are recommended six-row sorts.

If two-row varieties are desired, Duckbill and Early Chevalier may be tested.

Peas.—If it is desired to secure ripe grain, Arthur is probably the best sort on account of its early-ripening habit.

For growing with oats, to be cut green, Prussian Blue, Golden Vine Chancellor, English Grey and Arthur are advised.

CLIMATIC CONDITIONS IN ALBERTA.

Alberta has a mean temperature somewhat higher than either Saskatchewan or Manitoba, 38·8 degrees Fahrenheit, but a lower annual rainfall of 16·1 inches. Her sunshine record is high for the growing season, about 10 hours a day on the average, April to September inclusive. Dry farming methods are essential as may be surmised from the low rainfall. The precipitation is practically all rain. Her growing season mean temperature is about 60 degrees Fahrenheit.

The following table* gives the temperature, precipitation, hail and frost at representative points in Alberta for January, April, May, June, July, August and September in 1916:—

* Compiled from information furnished by the Meteorological Service of Canada.

Temperature, Precipitation, Hail and Frost.

		Fort Vermilion.	Grande Prairie.	Athabaska Ldg.	Edmonton.	Calgary.
	Elevation in feet	900·	1350·	1650·	2158·	3428·
JANUARY.	Temperature in degrees Fahrenheit—					
	Highest	22·	26·	32·	29·	36·
	Lowest	−60·	−48·	−58·	−45·	−41·
	Mean	−20·	−15·	−17·	−13·	− 8·
	Difference from average	− 9·		−13·	−21·	−21·
	Precipitation in inches—					
	Total	0·40	1·26	1·08	1·09	0·79
	Difference from average	−0·07		+0·41	+0·38	+0·33
	Sunshine in hours—					
	Total number	84·			91·	
	Difference from average				+12·	
	Possible number	218·			250·	
	Number of days of hail	0	0	0	0	0
	Number of days below 32°	31·	31·	31·	31·	31·
APRIL.	Temperature in degrees Fahrenheit—					
	Highest	62·	62·	69·	70·	76·
	Lowest	2·	21·	5·	17·	22·
	Mean	36·	40·	39·	42·	43·
	Difference from average	+4·		+1·	+1·	+3·
	Precipitation in inches—					
	Total	0·09·	1·31·	0·54·	1·17·	0·85·
	Difference from average			−0·30·	−0·61·	+0·22·
	Sunshine in hours—					
	Total number	247·			219·	
	Difference from average				+7·	
	Possible number	431·			419·	
	Number of days of hail	0·	0·	0·	0·	0·
	Number of days below 32	28·	20·	19·	21·	23·
MAY.	Temperature in degrees Fahrenheit					
	Highest	80·	73·	77·	75·	74·
	Lowest	25·	26·	24·	24·	23·
	Mean	48·	48·	46·	49·	46·
	Difference from average	0·		−4·	−2·	−3·
	Precipitation in inches					
	Total	0·60·	0·22·	1·16·	1·77·	3·10·
	Difference from average	0·21·		−0·51·	+0·01·	+0·62·
	Sunshine in hours—					
	Total number	275·			230·	
	Difference from average				+8·	
	Possible number	519·			492·	
	Number of days of hail	2·	0	0	3·	0·
	Number of days below 32	17·	8·	14·	9·	8·

Temperature, Precipitation, Hail and Frost—*Continued.*

	—	Fort Vermilion.	Grande Prairie.	Athabaska Ldg.	Edmonton	Calgary.
JUNE.	Temperature in degrees Fahrenheit—					
	Highest	87·	82·	79·	77·	82·
	Lowest	30·	25·	28·	29·	34·
	Mean	59·	57·	54·	56·	56·
	Difference from average	+2·		−2·	−1·	+1·
	Precipitation in inches					
	Total	·05·	0·41·	0·85·	2·62·	1·46·
	Difference from average	−0·38·		−2·71·	−0·79·	−1·81·
	Sunshine in hours—					
	Total number	368·			264·	
	Difference from average				+24·	
	Possible number	543·			506·	
	Number of days of hail	0·	0·	0·	1·	0·
	Number of days below 32	3·	1·	5·	1·	0·
JULY.	Temperature in degrees Fahrenheit—					
	Highest	88·	97·		80·	87·
	Lowest	33·	34·		38·	38·
	Mean	58·	56·		60·	62·
	Difference from average	−2·			−1·	+2·
	Precipitation in inches—					
	Total	4·04·	3·98·		3·31·	1·49
	Difference from average	+2·44·			−0·44	−1·11·
	Sunshine in hours—					
	Total number	270·			248·	
	Difference from average				−25·	
	Possible number	540·			508·	
	Number of days of hail	0·	0·		1·	1·
	Number of days below 32	0	0·		0·	0·
AUGUST.	Temperature in degrees Fahrenheit—					
	Highest	83·	84·	84·	81·	85·
	Lowest	24·	27·	27·	32·	39·
	Mean	54·	56·	58·	58·	60·
	Difference from average	−4·		+2·	−1·	+1·
	Precipitation in inches—					
	Total number	0·42·	0·47·	0·69·	3·70·	2·03·
	Difference from average	1·15·		−1·15·	+1·65·	−0·49·
	Sunshine in hours—					
	Total number	318·			237·	
	Difference from average				−19·	
	Possible number	473·			455·	
	Number of days of hail	0·	0·	0·	0·	0·
	Number of days below 32°	6·	2·	2·	1·	0·

Temperature, Precipitation, Hail and Frost—*Concluded.*

		Fort Vermilion.	Grande Prairie.	Athabaska Ldg.	Edmonton,	Calgary.
SEPTEMBER.	Temperature in degrees Fahrenheit—					
	Highest	78·	78·	79·	79·	80·
	Lowest	23·	27·	21·	29·	23·
	Mean	46·	49·	49·	51·	52·
	Difference from average	0·	.....	+2·	+1·	+1·
	Precipitation in inches—					
	Total number	1·56	0·52·	2·51·	2·80	0·84·
	Difference from average	+0·15·	.....	+1·37·	+1·33·	−0·40·
	Sunshine in hours—					
	Total number	196·	.....	.....	175·	.....
	Difference from average	.....	.....	.....	−9·	.....
	Possible number	382·	.....	.....	379·	.....
	Number of days of hail	0·	0·	0·	1·	·
	Number of days below 32	15·	5·	11·	3·	2·

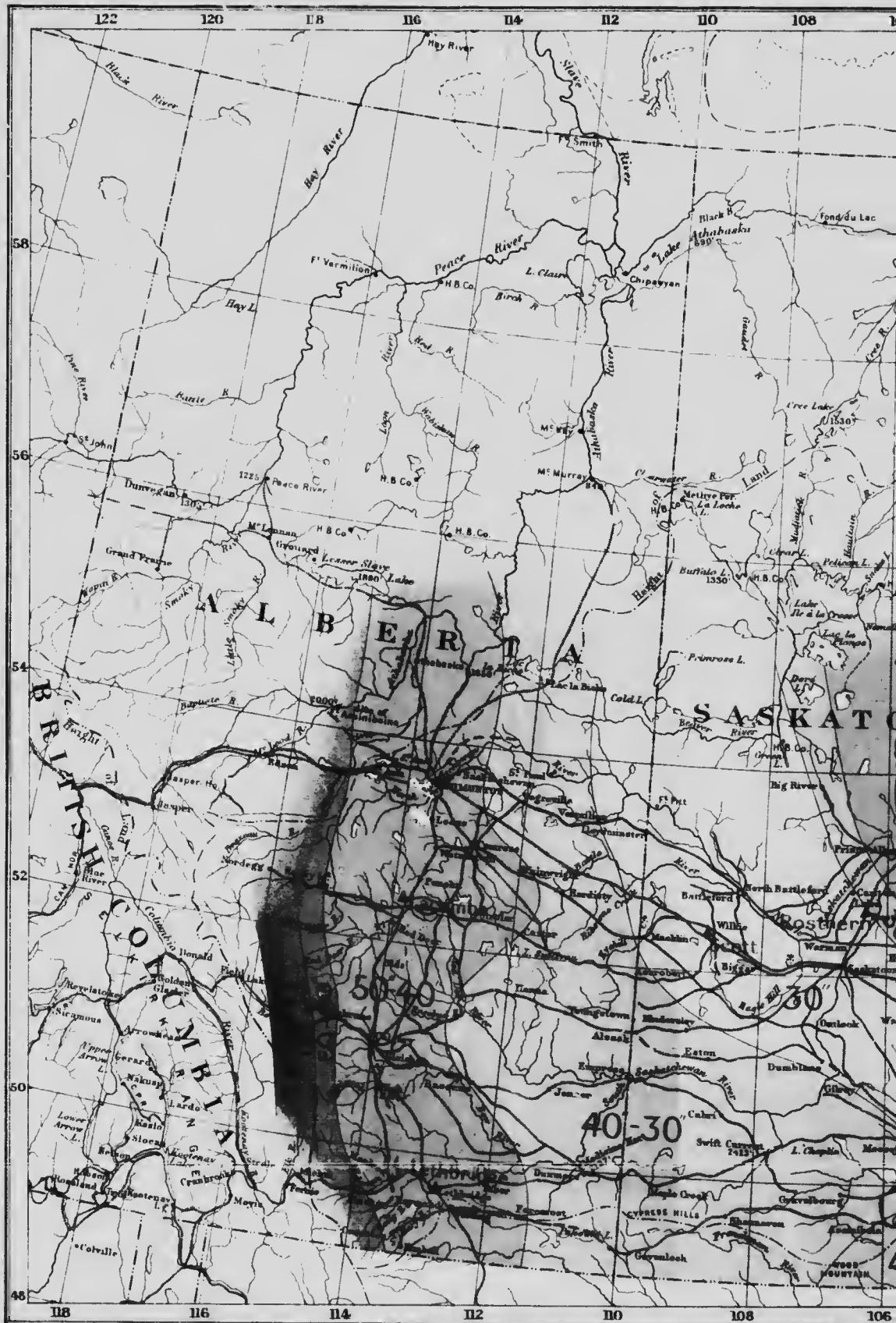
AGRICULTURAL LOAN ACTS IN ALBERTA.

1. *Alberta Farm Loan Act.*—This Act provides for the lending of money on first mortgages on farm lands up to 40 per cent of their appraised value. The loan is limited to $5,000 to any one person. The rate of interest charged is sufficient to pay interest on bonds issued to provide funds for loan purposes together with office expenses. The mortgage is for 30 years repayable in equal annual instalments. The loan business is administered by a Farm Loan Board, the general management of which is in the hands of a Commissioner of Farm Loans appointed by the Lieutenant-Governor in Council.

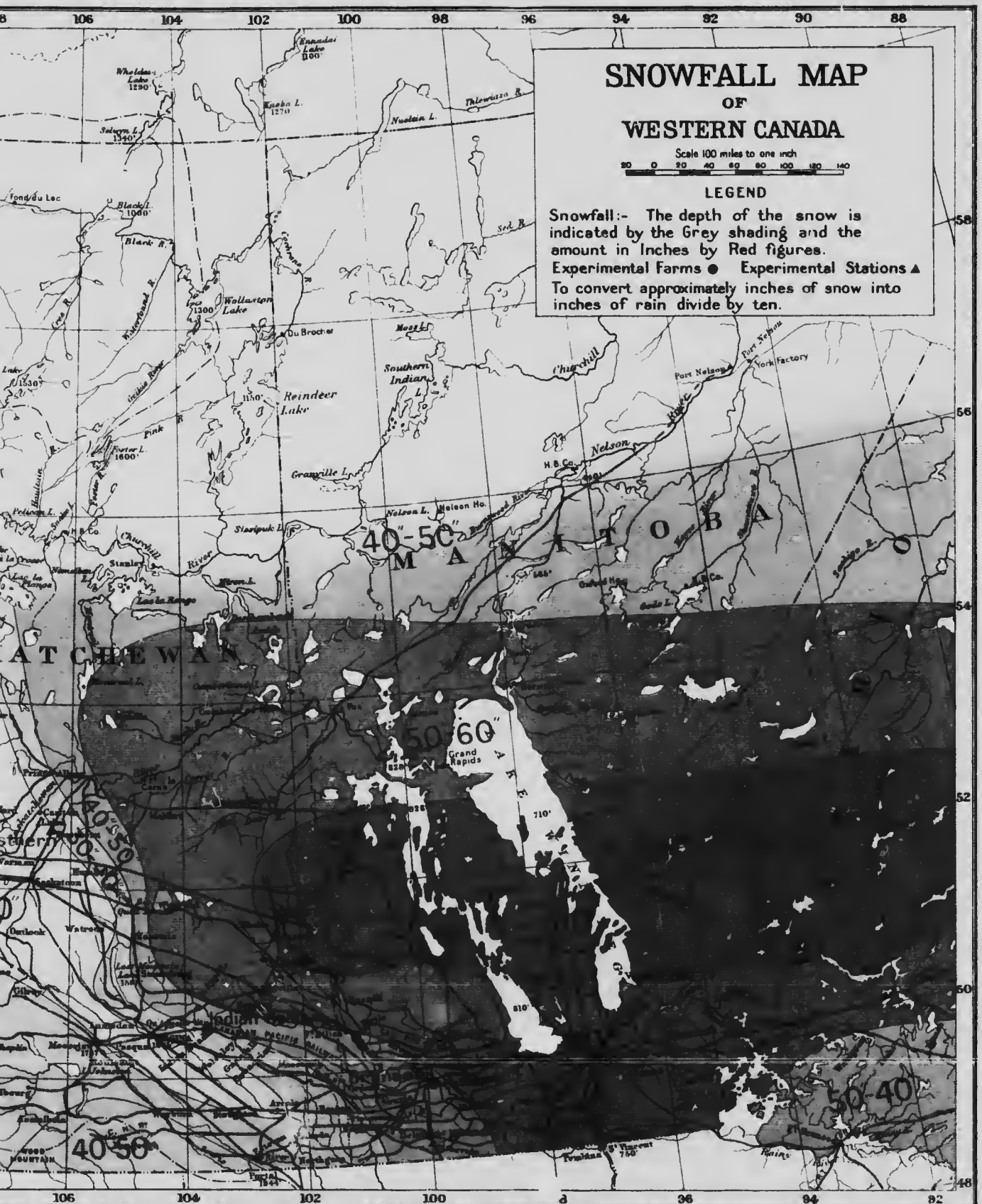
2. *Alberta Co-Operative Credit Act.*—This Act makes provision whereby a society of at least thirty agriculturalists may be formed by petition to the provincial treasurer. Each must subscribe $100 and pay $20 on account in cash. Certificate of registration is then granted by the Government; officers are elected and arrangements made with the banks to loan money on notes endorsed by the society. Loans are only made for the purpose of buying feed, seed, live stock and implements or for paying for season's operations. The loan must be repaid in one year. The rate of interest charged is agreed upon between the society and lender. Until the loan is repaid the society holds a lien on the animals or machinery purchased. The profits are applied to expenses, dividend and reserve.

3. *Live Stock Encouragement Act.*—Any five or more agriculturists may form an association and may jointly apply to the Live Stock Commissioner for a loan not to exceed $500 each for the purchase of cows and heifers. The Commissioner notifies the lender as to the amount of the guarantee he will make and how much each member of the association is to receive; 10 per cent of the joint loan may be used by one or more members for the joint purpose of a pure bred bull. The lender then takes the joint and several notes from the members of the association. The loan is repayable within five years with interest at not more than 6 per cent payable yearly. The lender also collects from each purchaser in the association $1 expense money for each $100 of his portion of the loan to be borrowed. The Provincial Treasurer guarantees the loan to the lender, who then deposits the money to the joint credit of the borrowers and the Live Stock Commissioner. The live stock purchased are branded and no attachment can issue against them. The purchaser cannot dispose of these cattle until the note is paid off.

Discing and Harrowing by Mules.



Natural Resources Intelligence Branch



Compiled from figures supplied by the Meteorological Service, Toronto.
Base map from plate of Geographer's Branch, Dept of the Interior

Discing and Harrowing by Mules.

MANITOBA.

Mr. W. C. McKillican, Superintendent of the Experimental Farm at Brandon, Man., calls attention to some differences in the conditions prevailing in Manitoba, as contrasted with Saskatchewan conditions and to the consequent variations in the procedure which should be followed with new land in the former province.

MODIFICATIONS FOR MANITOBA.

"The methods advocated by Mr. Mackay for Saskatchewan are largely applicable to Manitoba, particularly to new land in the southwestern part of the province where conditions are similar to Saskatchewan. The method of handling prairie sod by breaking shallow early in the season and backsetting deeper at a later date is quite the best here as well as in Saskatchewan. The practice of putting crop on newly broken prairie sod cannot be too strongly condemned; the latter should always have a season in which to rot."

"*Summer-fallowing.*—The method of summer fallowing called "Fourth Method" by Mr. Mackay, gives the best results in Manitoba. Ploughing early is quite as important in Manitoba as it is in Saskatchewan.

"There are, however, large districts in Manitoba where the need or advisability of summer-fallowing is not very great. Generally speaking, the portions of the province north of range 16, that bordering on Lakes Winnipeg and Manitoba and that east of the Red River, are not suited to summer-fallowing. There may be drier localities within this territory where fallowing is permissible; but, in the greater part of it, the result of summer fallowing is too great a conservation of moisture, giving a heavy growth of straw that falls down and fails to mature the grain. For this territory, barley or green oats may be used as a cleaning crop. These should be sown late and cut before any weeds can ripen. Grass and clover crops can also be used to good advantage in the place of summer-fallow in a rotation."

"*Stubble burning.*—Stubble burning is not advisable in Manitoba, whether it be in Saskatchewan or not. It is waste of valuable vegetable matter that is very seldom justifiable. Unless the soil is unusually dry the stubble should be ploughed under and thoroughly packed down with the soil packer. Fall ploughing is not as impracticable in Manitoba as Mr. Mackay says it is in Saskatchewan. There is often sufficient moisture for fall ploughing, and when this is the case better results are obtained in most districts than could be secured from spring ploughing."

"*Crop rotation.*—In the older parts of Manitoba, the system of grain and summer fallow can no longer be considered as a complete or wholly satisfactory system. The spread of weeds and the increasing difficulty with soil blowing show the necessity of a scientific rotation of crops. Such a rotation should include grasses to renew the vegetable fibre in the land, clover or alfalfa to restore fertility and, if possible, potatoes, roots or corn should be used as a cleaning crop instead of summer fallow."

The following mixed-farming rotation covering a six year experimental test at Brandon has proved the most successful.

Six years rotation—

First year.—Wheat.
Second year.—Wheat.
Third year.—Oats and barley. Seeded with grass and clover.
Fourth year.—Clover hay.
Fifth year.—Pasture.
Sixth year.—Corn or roots. Manured preceding fall.

The wheat of the first year is sown among the stubble of the corn of the sixth year without ploughing. The trash from the corn is raked off and burned, and the land harrowed. After the first crop of wheat is harvested, the land is fall ploughed for the second crop. After the second crop, it is again fall ploughed. The third crop is oats or barley, and with it is sown a mixture of 5 pounds of timothy and 8 pounds of red clover per acre. The fourth year, there is a crop of hay, mostly clover. As soon as it is removed, the aftermath is used for pasture. The fifth year is pasture, up till about the middle of July or first of August, when the aftermath of the hay-field is ready to carry the stock. The pasture is then manured and ploughed under. There having been only two years of grass, the sod is not very hard to plough, and does not need to be backset. The sixth year is corn or roots. These are thoroughly cultivated, so that the land is left as clean as a good summer-fallow, and is ready for wheat again, without ploughing.

The following rotations give good results but are not so successful as the six year rotation mentioned above.

Five years rotation—

First year.—Wheat.
Second year.—Wheat.
Third year.—Corn or roots.—Manured preceding fall.
Fourth year.—Oats or barley. Seeded with grass and clover.
Fifth year.—Clover hay.

Four years rotation—

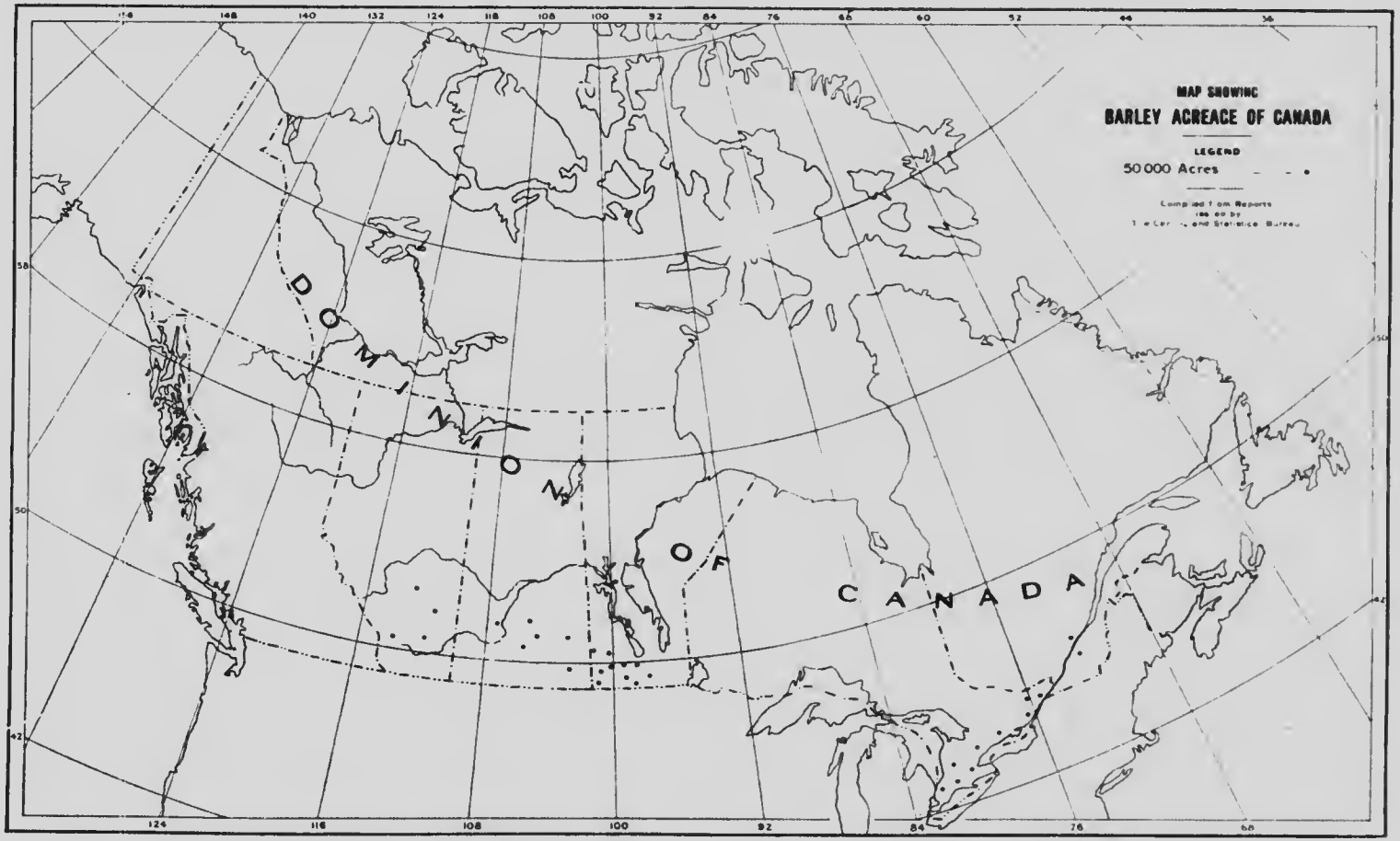
First year.—Wheat.
Second year.—Wheat.
Third year.—Oats.
Fourth year.—Summer-fallow.

MANITOBAN SOILS.*

As illustrative of the soils of the first steppe—the prairie of the Red River valley—the results have been tabulated from a few typical examples, restricting the data to the more important constituents. The plateau south of the Winnipeg group of lakes is of remarkable uniformity, and the data of soil No. 1 are representative of a very large area of the immediate valley of the Red River, though perhaps not typical in all details of the whole plateau. It is a deep, black clay loam, of a fine and peculiarly characteristic granular order. In the air-dried condition, it reduces easily to a greyish-brown or greyish-black powder. Though there is present a considerable amount of undecomposed root fibre, the soil proper presents a remarkable homogeneity in appearance, indicating a process of physical refining in its formation and uniformity in chemical composition. The very large amount of organic matter present is undoubtedly intimately incorporated with the clay and sand which constitute the basis of the soil.

Though containing a large amount of clay, laboratory experiments show that this soil does not readily "puddle" on moistening, nor on subsequent drying does it form into a hard mass, but granulates on moderate pressure. The large amount of organic matter present has already been remarked; it exceeds 25 per cent of the water-free soil. The nitrogen, calculated on the same basis, is found to be practically one per cent, from which it may be estimated that there is contained in an acre of soil to the depth of one foot from 20,000 to 25,000 pounds at least of this element. Since ordinary fertile soils to a like depth contain from 3,500 to 10,000 pounds, the vast reserve of this valuable constituent in this prairie soil is apparent.

* "Western Prairie Soils" by F. T. Shutt, M.A., F.I.C., Dominion Chemist.


MAP SHOWING
BARLEY ACREAGE OF CANADA
LEGEND
50 000 Acres
DOMINION OF CANADA

The soil is also very rich in potash, containing an amount (1·033 per cent) far in excess of that ordinarily met with in the fertile soils of Eastern Canada. Data have indicated that good agricultural soils possess usually between 0·25 and 0·5 per cent of potash.

Of phosphoric acid, it contains 0·29 per cent. This is slightly above the average, most of our good soils showing between 0·15 and 0·25 per cent of this element.

The fairly large percentage of lime is worthy of note, since it indicates not only a fair supply for crop use but also a condition of the soil that should be particularly favourable to nitrification.

We may safely conclude, that, in these data, there is ample proof of abundant stores of plant food, and that this prairie land, as regards the elements of fertility, ranks with the richest of known soils.

The late Dr. Geo. M. Dawson, the eminent geologist and Canadian explorer, wrote some years ago as follows regarding the prairie soil of the Red River valley: "Of the alluvial prairie of the Red River much has already been said, and the uniform fertility of its soil cannot be exaggerated. The surface, for a depth of two to four feet, is a dark mould, composed of the same material as the subsoil, but mingled with much vegetable matter. Its dark colour is no doubt due in part to the general accumulation of the charred grasses left by the prairie fires. The soil may be said to be ready for the plough, and, in turning the tough, thick prairie sod, the first year a crop of potatoes may be put in, though it is not efficiently broken up till it has been subjected to a winter's frost. When the sod has rotted, the soil appears as a light, friable mould, easily worked and most favourable for agriculture. The marly alluvium underlying the vegetable mould would, in most countries, be considered a soil of the best quality, and the fertility of the ground may, therefore, be considered as practically inexhaustible."

"The area of this lowest prairie has been approximately stated as 6,900 square miles, but the whole is not at present suitable for agriculture. Small swamps are scattered pretty uniformly over its surface. The greater part of these swamps are, however, so situated as to be easily drained, either into the Red River or some of its tributaries, which are usually depressed 30 or 40 feet below the level of the surface."

Soils Nos. 2 and 3 are from Portage la Prairie, a district lying some 50 miles directly west of Winnipeg. It is one of the earliest settled localities in the Northwest and has long enjoyed a reputation for producing wheat of the very highest quality. In No. 2 we have an example of the virgin prairie—uncropped and unmanured; in No. 3, the same soil after twenty-five years of cultivation, in which grain-growing was interspersed with fallowing to clean the land. The virgin soil shows more root fibre than the cropped soil, and is somewhat darker in colour. Both might be described as black, friable loams, containing a considerable proportion of sand. The analytical data afford evidence of their richness in the elements of plant food, though they are not quite equal to the soil from the Red River valley either in "total" or "available" constituents.

A comparison may be made of Nos. 2 and 3, since it is of more than passing interest to learn what effect grain-growing carried on for a number of years may have had on the composition of the soil. In the first place, it will be noticed, there has been a considerable reduction in the percentages of organic matter and nitrogen, consequent upon cultivation. This loss as will be shown later when discussing certain Saskatchewan soils, has in a very large measure been due to fallowing—a system of immense value for the conservation of moisture and the freeing of the land from weeds, but one particularly wasteful as regards organic matter and nitrogen.

In the mineral constituents, no great differences are to be observed—the losses so far as they may be gauged by chemical analysis, have not been at all excessive. This is not to be wondered at, as the wheat crop does not remove large amounts of plant food—it is not exhaustive according to the usual acceptation of the term—and in such a period as twenty-five years representing, say, sixteen crops, the effect upon the mineral stores of such rich soils would not be very noticeable.

Nos. 4 and 5 are composite samples from the Experimental Farm, Brandon, about 130 miles west of Winnipeg. They resulted from monthly collections (May to November) from plots under different cultural treatments in connection with moisture conservation experiments. In so far as physical character is concerned these two samples are practically identical, the soil being a mellow, black loam of a somewhat sandy type.

The tabulated data bear out their similarity in composition, and we may undoubtedly regard them as typical and illustrative of the true prairie soil. We have only to remark the abundance of vegetable matter, the high nitrogen content and the liberal supply of the mineral elements, and more particularly of potash and lime.

No. 6 is a soil from the district immediately west of lake Dauphin and northwest of lake Manitoba. The area is one that, in parts, is covered with willow and other "scrub," necessituting clearance before cultivation. This soil is probably to be regarded as representative of those lands immediately surrounding the lakes, and subject to more or less flooding during the early part of the season, and for which drainage is, of course, necessary. It is a sandy loam, rich in organic matter, but with a sufficiency of clay to render it somewhat refractory on drying.

The data indicate it to be a soil of more than average fertility, and experience has borne out the conclusion drawn from the figures that it would, on drainage, prove suitable for wheat growing, excellent returns having been obtained in favourable seasons.

Nos. 7 and 8, the remaining two samples, are black, sandy loams from the Valley river, Dauphin district. They were collected in 1906 in an investigation to learn the influence of environment on the composition of wheat—a matter still under study in the Farm laboratories. The significance of the soil data in the solution of the problem referred to need not now be discussed, but the richness of these loams in organic matter and their high nitrogen-content is worthy of remark.

In potash, they are decidedly poorer than the stronger or more clayey soils of the Northwest—indeed in this constituent they are somewhat below the average found for Canadian soils of medium fertility. The percentages of "available" potash are similarly low, though not reaching the limit set by Dyer as indicating the need of a potassic fertilizer.

With respect to phosphoric acid, we find considerably lower percentages than in the prairie soils of the Red River valley; the amounts, however, being about equal to those generally present in soils of average fertility. The large proportion of lime in these soils would undoubtedly favour rapid nitrification, and also serve to render effective the somewhat sparse supply of phosphoric acid.

In the examples discussed, two distinct types of Manitoban soils are represented, the heavy clay loam covering the true prairie region in the southern part of the province, and undoubtedly one of the finest wheat soils in the world, and the other representative of the sandy loams of the northwestern and more humid area, more or less covered with small trees and shrubs, a district regarding which we know less as to suitability for wheat growing, but nevertheless, one which has produced profitable crops. Considered as a whole, the quality of the wheat of this northwestern section has not been equal to that of the southern and more distinctly prairie portion of the province, but there is evidence to support the view that the grain will improve in character with drainage and further cultivation of the soil.

MANITOBAN SOILS.

Results Calculated to Water-Free Basis.

No.	Locality.	Character of Soil.	Organic and Volatile Matter (Loss on ignition.)	Nitrogen.	Phosphoric Acid (P_2O_5)	Potash (K_2O)	Lime (CaO)	Available Constituents.		
								Phosphoric Acid (P_2O_5)	Potash (K_2O)	Lime (CaO)
			%	%	%	%	%	%	%	%
1	Red River valley, near Morris....	Virgin prairie soil-black, heavy clay loam....	26·29	1·005	·288	1·033	1·89	·054	·076	·581
2	Portage la Prairie.....	Virgin prairie soil black, sandy loam	19·43	·[illegible]1	178	·658	1·05	·038	·056	·529
3	" "	Prairie soil, cropped for 25 years ..	14·79	·[illegible]	·170	·588	1·61	·033	·048	·776
4	Brandon..	" " black loam, rather sandy	11·27	·[illegible]6	·123	·819	1·14	·029	·057	·572
5	"	" " " " " " ..	12·05	·451	·136	·841	1·02	·027	·076	·462
6	Dauphin, Dauphin District.... ..	Black sandy loam....	11·44	·363	·215	·687	1·89	·023	·018	1·121
7	Valley River, Dauphin District ..	" " "	21·54	·662	·155	·144	10·57	·007	·017	1·346
8	" " " " ..	" " "	13·11	·379	133	·194	3·54	·007	·067	949

Discing and Harrowing by Steam.

VARIETIES OF GRAIN RECOMMENDED FOR USE IN MANITOBA.

Spring Wheat.—Red Fife and Marquis for most localities. Marquis is especially desirable in districts where early frosts are feared; but its rather short straw is a disadvantage in dry districts. In such localities it should only be sown on summer-fallowed land. Prelude is worthy of a trial wherever Marquis produces rather too long straw and ripens too late.

Oats.—Banner and Ligowo are among the best. Daubeney may be used if it is essential to have a very early ripening sort. Orloff and Sixty Day are earlier than Daubeney, but usually much less profitable.

Barley.—Manchurian and Ontario Agricultural College No. 21 are recommended. If a two-row type is desired for any special purpose, Duckbill or Early Chevalier should be tried.

Peas.—Arthur, Chancellor and Golden Vine are among the best yellow sorts. English Grey and Prussian Blue are among the best coloured varieties.

CLIMATIC CONDITIONS IN MANITOBA.

Manitoba has a mean temperature of 36 degrees Fahrenheit with a growing season temperature of 56 degrees Fahrenheit on the average, a precipitation of about 20 inches annually, chiefly rain, and a daily average sunshine record of 8 to 9 hours during the growing season.

Twenty inches precipitation per annum means on the edge of water scarcity and dry farming methods are necessary.

The following table* gives the temperature, precipitation, hail and frost at representative points in Manitoba for January, April, May, June, July, August and September in 1916:—

* Compiled from information furnished by the Meteorological Service of Canada.

Temperature, Precipitation, Hail and Frost—*Continued.*

Month.	—	Brandon.	Winnipeg	Dauphin.	Grand Rapids.	Le Pas.
	Elevation in feet	1265·	760·	957·	810·	860·
JANUARY.	Temperature in degrees Fahrenheit—					
	Highest	18·	22·	25·	18·	21·
	Lowest	−51·	−41·	−40·	−41·	−51·
	Mean	−13·	− 7·	− 6·	−11·	−16·
	Difference from average	−11·	− 4·	− 2·	.....	.....
	Precipitation in inches—					
	Total	2·70	3·36	1·	1·15	·23
	Difference from average	+ 1·87	+ 2·39	.....	.....	.....
	Sunshine in hours—					
	Total number	99·	90·	.....	.....	77·
	Difference from average	−11·	−20·	.....	.....	.....
	Possible number	267·	266·	.....	.....	250·
	Number of days of hail	0·	0·	0·	0·	0·
	Number of days below 32	31·	31·	31·	31·	31·
APRIL.	Temperature in degrees Fahrenheit—					
	Highest	65·	66·	72·	69·	69·
	Lowest	− 1·	28·	7·	− 9·	−12·
	Mean	35·	37·	41·	33·	33·
	Difference from average	− 3·	0·	+ 3·	.....	.....
	Precipitation in inches—					
	Total	·92	·30	.....	·54	·20
	Difference from average	+ ·17	− 1·18	.....	.....	
	Sunshine in hours—					
	Total number	175·	213·	.....	.....	238·
	Difference from average	−16·	+ 6·	.....	.....	.....
	Possible number	412·	412·	.....	.....	420·
	Number of days of hail	0·	0·	0·	0·	0·
	Number of days below 32	23·	16·	15·	25·	22·
MAY.	Temperature in degrees Fahrenheit					
	Highest	78·	75·	80·	63·	66·
	Lowest	20·	7·	21·	20·	17·
	Mean	49·	50·	50·	41·	44·
	Difference from average	0·	− 1·	− 2·	.....	.....
	Precipitation in inches—					
	Total	1·59	2·47	2·10	5·68	5·40
	Difference from average	+ 0·29	+ 0·46	− 0·23	.....	.....
	Sunshine in hours—					
	Total number	187·	220·	.....	.....	184·
	Difference from average	−41·	−31·	.....	.....	.....
	Possible number	476·	476·	.....	.....	493·
	Number of days of hail	0·	0·	0·	0·	0·
	Number of days below 32	9·	7·	5·	20·	7·

Temperature, Precipitation, Hail and Frost—*Continued.*

Month.	—	Brandon.	Winnipeg.	Dauphin.	Grand Rapids.	Le Pas.
JUNE.	Temperature in degrees Fahrenheit—					
	Highest	80·	80·	80·	83·	78·
	Lowest	30·	34·	33·	28·	32·
	Mean	56·	58·	57·	54·	56·
	Difference from average	−5·	−4·	−4·	...	...
	Precipitation in inches—					
	Total	4·33	4·12	5·38	4·83	1·96
	Difference from average	+1·30	+0·68	+2·99	...	...
	Sunshine in hours—					
	Total number	190·	232·	...	...	249·
	Difference from average	−30·	−18·	...	...	...
	Possible number	486·	486·	...	...	509·
	Number of days of hail	0·	1·	0·	0·	0·
	Number of days below 32°	1·	0·	0·	1·	1·
JULY.	Temperature in degrees Fahrenheit—					
	Highest	92·	95·	88·	89·	87·
	Lowest	37·	48·	45·	45·	52·
	Mean	69·	70·	70·	68·	69·
	Difference from average	+7·	+6·	+6·	...	...
	Precipitation in inches—					
	Total	2·63	2·84	1·64	1·99	1·39
	Difference from average	+0·30	+0·17	−1·69	...	...
	Sunshine in hours—					
	Total number	259·	311·	...	...	322·
	Difference from average	−18·	+21·	...	...	...
	Possible number	488·	488·	...	...	509·
	Number of days of hail	0·	0·	0·	0·	0·
	Number of days below 32°	0·	0·	0·	0·	0·
AUGUST.	Temperature in degrees Fahrenheit—					
	Highest	97·	93·	96·	88·	86·
	Lowest	34·	38·	34·	35·	38·
	Mean	62·	65·	64·	62·	62·
	Difference from average	0·	+2·	+2·	...	...
	Precipitation in inches—					
	Total	2·22	2·35	1·03	1·62	3·20
	Difference from average	+0·33	−0·09	−1·42	...	...
	Sunshine in hours—					
	Total number	261·	278·	...	...	306·
	Difference from average	+11·	+21·	...	...	...
	Possible number	445·	444·	...	...	455·
	Number of days of hail	0·	0·	0·	1·	2·
	Number of days below 32°	0·	0·	0·	0·	0·

Temperature, Precipitation, Hail and Frost—*Concluded.*

Month.	——	Brandon.	Winnipeg.	Dauphin.	Grand Rapids.	Le Pas.
SEPTEMBER.	Temperature in degrees Fahrenheit—					
	Highest	82·	79·	75·	76·	72·
	Lowest	22·	27·	26·	28·	20·
	Mean	52·	54·	52·	50·	50·
	Difference from average	−2·	0·	−1·	.....	.....
	Precipitation in inches—					
	Total	2·39	2·03	1·68	5·08	2·02
	Difference from average	+1·17	+0·11	−0·78	.....	.....
	Sunshine in hours—					
	Total number	177·	172·	.....	.....	162·
	Difference from average	−5·	−8·	.....	.....	.....
	Possible number	377·	377·	.....	.....	379·
	Number of days of hail	1·	0·	1·	0·	0·
	Number of days below 32°	7·	5·	5·	7·	4·

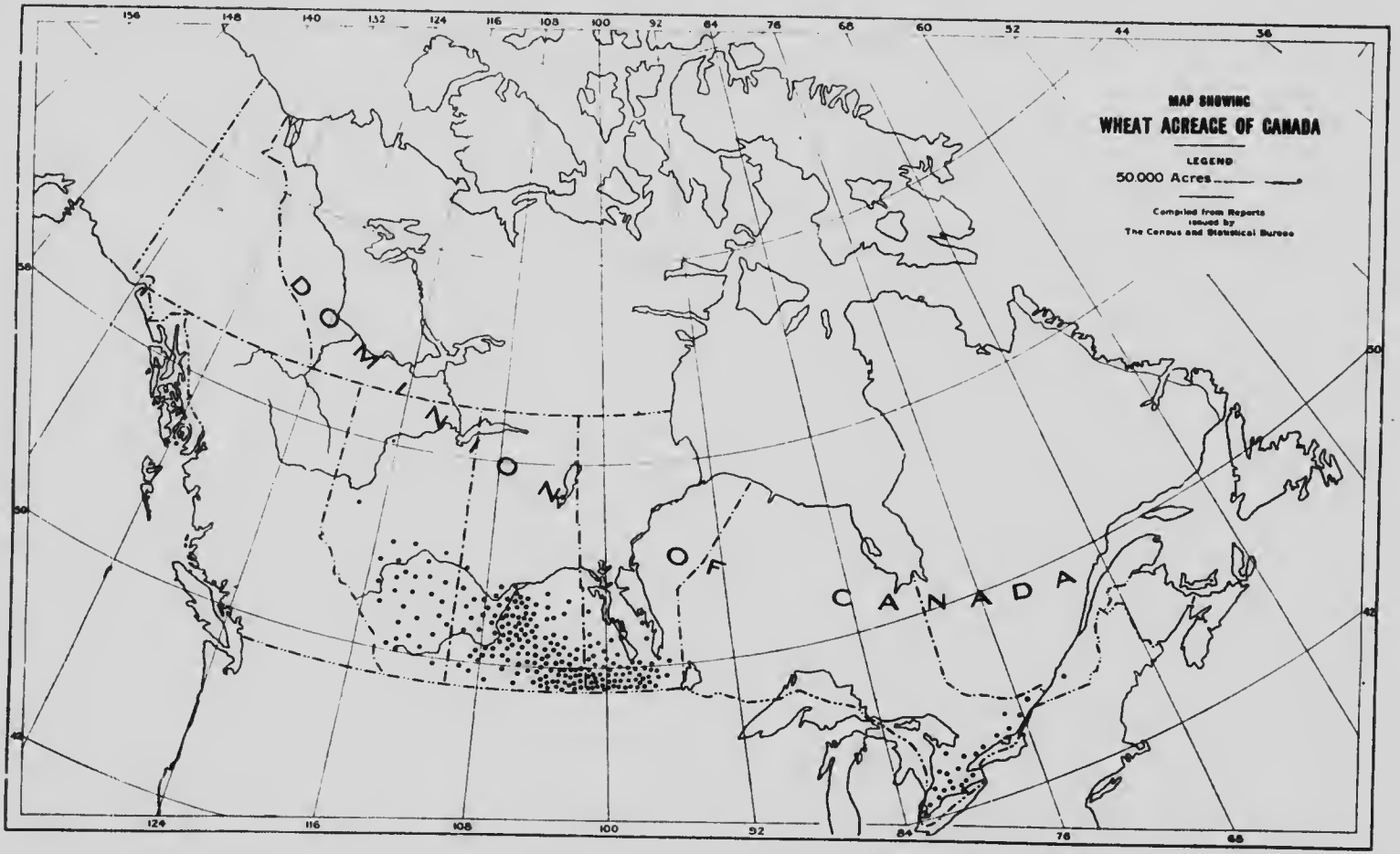
AGRICULTURAL LOAN ACTS IN MANITOBA.

1. *The Manitoba Farm Loans Act (March 9, 1917).*

This Act provides that persons residing or intending to reside on land within the province may obtain through the Manitoba Farm Loans Association, on first mortgage security, loans up to fifty per cent (50 per cent) of the appraised value of the property offered, extending over a period of thirty years at a rate of interest not exceeding six per cent (6 per cent) per annum, repayment being made on an amortization basis by equal annual payments composed of principal and interest. The loan must be made to make improvements, to increase productiveness or to pay off prior encumbrances on the land. It also makes provision for each borrower to become a shareholder in the Association by investment in its capital stock of an amount equal to five per cent (5 per cent) of the sum borrowed, and none other but borrowers and the province of Manitoba can hold such shares.

2. *An Act respecting Rural Credits.*

A rural credit society may be initiated by a petition, addressed to the Lieutenant-Governor-in-Council and sent to the Provincial Secretary, signed by not less than fifteen farmers. The society cannot commence business until at least fifty have subscribed $5,000 and ten per cent paid in. The management of the business of the society is vested in a board of directors composed of nine members. Loans are made only for the purchase of feed, seed, implements, live stock and farming operations. Loans must be repaid within the calendar year at a date agreed upon. The rate of interest charged is not greater than seven per cent per annum, of which one-seventh goes to the society. A lien is taken on all machinery, goods or personal property purchased with the loan made. In the event of a borrower's defaulting, the society pays the lender and then seeks to recover the amount so paid from the borrower by any means authorized by any statutes applicable thereto.


MAP SHOWING
WHEAT ACREAGE OF CANADA
LEGEND
50.000 Acres
Compiled from Reports
issued by
The Census and Statistical Bureau
DOMINION OF CANADA
156
148
140
132
124
116
108
100
92
84
76
68
60
52
44
36
58
50
48
42
124
116
108
100
92
84
76
68

QUANTITIES OF SEED TO SOW.

WHEAT.

The quantity of wheat to sow to the acre, while an important matter, is one that must be decided at the time of seeding and according to the season and the condition of the land.

Thick heavy seeding usually matures more quickly than thin or light seeding.

Light, poor land will not carry satisfactorily as heavy a seeding as strong, rich soil.

A safe rule is to sow from 1¼ to 1½ bushels of wheat to the acre on a good, strong summer-fallow; the lighter seeding if put in early, a considerably heavier seeding, if it is late in the season before seeding is done.

On stubble land a considerably lighter seeding should be given. If the land is rather dry, possibly three pecks per acre would give the best results.

OATS AND BARLEY.

Oats and barley should be sown as soon as possible after wheat is in. The same general directions as to relative quantities of seed apply as in the case of wheat. Sow 1½ to 2½ bushels seed to the acre according to the fall preparation and the character of the soil.

FLAX.

Flax should be sown on summer-fallow or new land at from 30 to 40 pounds to the acre, the lighter seeding on lighter soil and heavy seeding on strong, rich soil. Do not sow too early. May 15 is quite sufficiently early. On stubble lands a lighter seeding should be given, say 25 to 30 pounds to the acre.

ESSENTIALS TO SUCCESSFUL WHEAT PRODUCTION.

1. Prepare the ground thoroughly as directed.

2. When the seed grain is cleaned, graded, and bagged, treat it for smut. The cost is low; it takes little time and results in larger yields. Always treat wheat and oats in the following manner:—

Blue-stone solution—5 pounds commercial blue-stone to 50 imperial gallons of water.

Formalin solution—1 pound formaldehyde (normal strength) to 40 imperial gallons of water.

Steeping method—In blue-stone solution, immerse grain not less than 2 minutes —not more than 3 minutes. In formaldehyde solution not less than 4 minutes and not more than 5 minutes.

Sprinkling method—Heap the grain on a clean floor. Sprinkle either solution over it with a broom or can; mix well; 40 gallons will treat 40 to 50 bushels of grain. When using blue-stone, spread out to dry at once after mixing; form the grain into a pile when using formaldehyde, and cover for three hours with bags, then spread out and dry.

Note.—For detailed information on the subject, ask for Exhibition Circular 24, or Experimental Farm Bulletin 73, Publications Branch, Ottawa, Ontario.

3. Get the seed in early.

If the above directions are fulfilled, success is assured nineteen times out of twenty.

MANURES.

Farmyard manures are the most effective fertilizers that can be applied to the soil.

Comparatively small applications at short intervals are more effective than larger dressings applied less frequently; to put in concrete form, five tons of manure per acre every third year will give a better return than ten tons every sixth year, simply because there will be less loss of organic matter.

It is a more profitable practice to keep the manure comparatively near the surface. The larger number of the feeding roots of most of our crops lie fairly close to the surface; at least, that is in humid districts.

A result which is remarkable but nevertheless which must be true since experiment has verified it over and over again is that, weight by weight, fresh manure has given yields almost equal to those obtained from rotted manure.

On the ordinary Canadian farm where the manure is not at once utilized by being put into the soil or on to the soil, the farmer is losing one-third of the initial value of that manure. In the various methods of rotting manure the losses are least where the manure is kept compact and protected from rain.

If manure can be put on to the fields while still fresh there may be returned to the soil seven-tenths of the plant food taken from the soil by the growth of the crop.

It has been found utterly impossible to save all the plant food contained in manure no matter what system of rotting is followed. The sooner, therefore, that it is put on to the soil, the better.

It is important to bear in mind that the growth of clover in a rotation is practically equal to a good dressing of manure of say ten tons per acre of ordinary farmyard manure.

The table below gives the approximate average composition of manure (fresh) from various animals:—

APPROXIMATE AVERAGE COMPOSITION OF MANURE (FRESH) FROM VARIOUS ANIMALS.

Kind of Animal.	Relative proportions of solid excrement, liquid excrement and bedding in manure.	Lbs. per ton.	Nitrogen.		Phosphoric Acid.		Potash.	
			Per cent.	Lbs. per ton.	Per cent.	Lbs. per Ton.	Per cent.	Lbs. per Ton.
Horse	Solid excrement	1,200	0·55	6·60	0·30	3·60	0·40	4·80
	Liquid excrement (urine)	300	1·35	4·65	trace	trace	1·25	3·75
	Bedding material	500	0·50	2·50	0·15	0·75	0·60	3·00
	Total mixture	2,000	0·60	13·15	0·22	4·35	0·58	11·55
Cow	Solid excrement	1,260	0·40	5·04	0·20	2·52	0·10	1·26
	Liquid excrement (urine)	540	1·00	5·40	trace	trace	1·35	7·29
	Bedding material	200	0·50	1·00	0·15	0·30	0·60	1·20
	Total mixture	2,000	0·57	11·44	0·14	2·82	0·48	9·75
Pig	Solid excrement	990	0·55	5·44	0·50	4·95	0·40	3·96
	Liquid excrement (urine)	660	0·40	2·64	0·10	0·66	0·45	2·97
	Bedding material	350	0·50	1·75	0·15	0·42	0·60	2·10
	Total mixture	2,000	0·49	9·83	0·30	6·03	0·45	9·03
Sheep	Solid excrement	1,206	0·75	9·04	0·50	6·03	0·45	5·43
	Liquid excrement (urine)	594	1·35	8·02	0·05	0·30	2·10	12·47
	Bedding material	200	0·50	1·00	0·15	0·30	0·60	1·20
	Total mixture	2,000	0·90	18·06	0·33	6·63	0·95	19·10
Poultry	Solid and liquid excrement	1,900	1·00	19·00	0·80	15·20	0·40	7·60
	Bedding material	100	0·50	0·50	0·15	0·15	0·60	0·60
	Total mixture	2,000	0·97	19·50	0·77	15·35	0·41	8·20

FERTILIZERS

Fertilizers can be used only as supplemental to and not as a substitute for manure. There are three constituents, nitrogen, phosphoric acid and potash which may be present in compounded fertilizers; when all three elements are presented the material is termed a complete fertilizer. Experiment has lead to the conclusion that in the larger number of instances where a profit has been obtained it has resulted from the application of a complete fertilizer.

Domestic sources of potash other than manure:—

"Wood ashes are essentially a potassic fertilizer, ashes of good quality, that is, dry, unmixed with sand, etc., and unleached, containing between 4 per cent and 6½ per cent potash, the average potash content being about 5½ per cent. This potash is in a soluble form and hence immediately available for crop use.

"In addition to their potash they contain some 2 per cent phosphoric acid and from 20 to 30 per cent carbonate of lime, enhancing their fertilizing value and making them, in a sense, an all-round fertilizer for supplying the mineral elements required by crops. And, further, they correct acidity, a condition detrimental to the thrift of most farm crops.

"From 25 to 50 bushels of wood ashes per acre will furnish from 60 to 120 pounds of potash, the latter an ample dressing for even very light soils. They are not needed on heavy clay loams; indeed their use on such may destroy good tilth and do more harm than good. Their application is best deferred to spring, broad-casting preferably on a quiet damp day on the ploughed land, and incorporating in with a thorough harrowing.

"For clover, corn and mangels, they will be found very valuable. Especially are they beneficial for orchards and for grapes on sandy loams. For turnips, mixed with one-third to one-half their weight of bone meal, superphosphate or base slag, they have similarly proved advantageous. But indeed there are few crops on light and gravelly soils, as also on vegetable loams inclined to be sour, for which wood ashes cannot be employed with profit."

ALKALI SOILS.*

Alkali soils occur in arid or semi-arid districts only, and these in Canada may be said to be restricted to certain areas in British Columbia, southwestern Alberta and in a limited degree Saskatchewan and Manitoba.

Two classes of alkali are generally recognized "white" and "black."

White alkali consists chiefly of the sulphate and chloride of sodium (Glauber's salt and common salt).

Black alkali is characterized by the presence of sodium carbonate (washing soda), which through its solvent action on decayed vegetable matter gives a black incrustation to the soil.

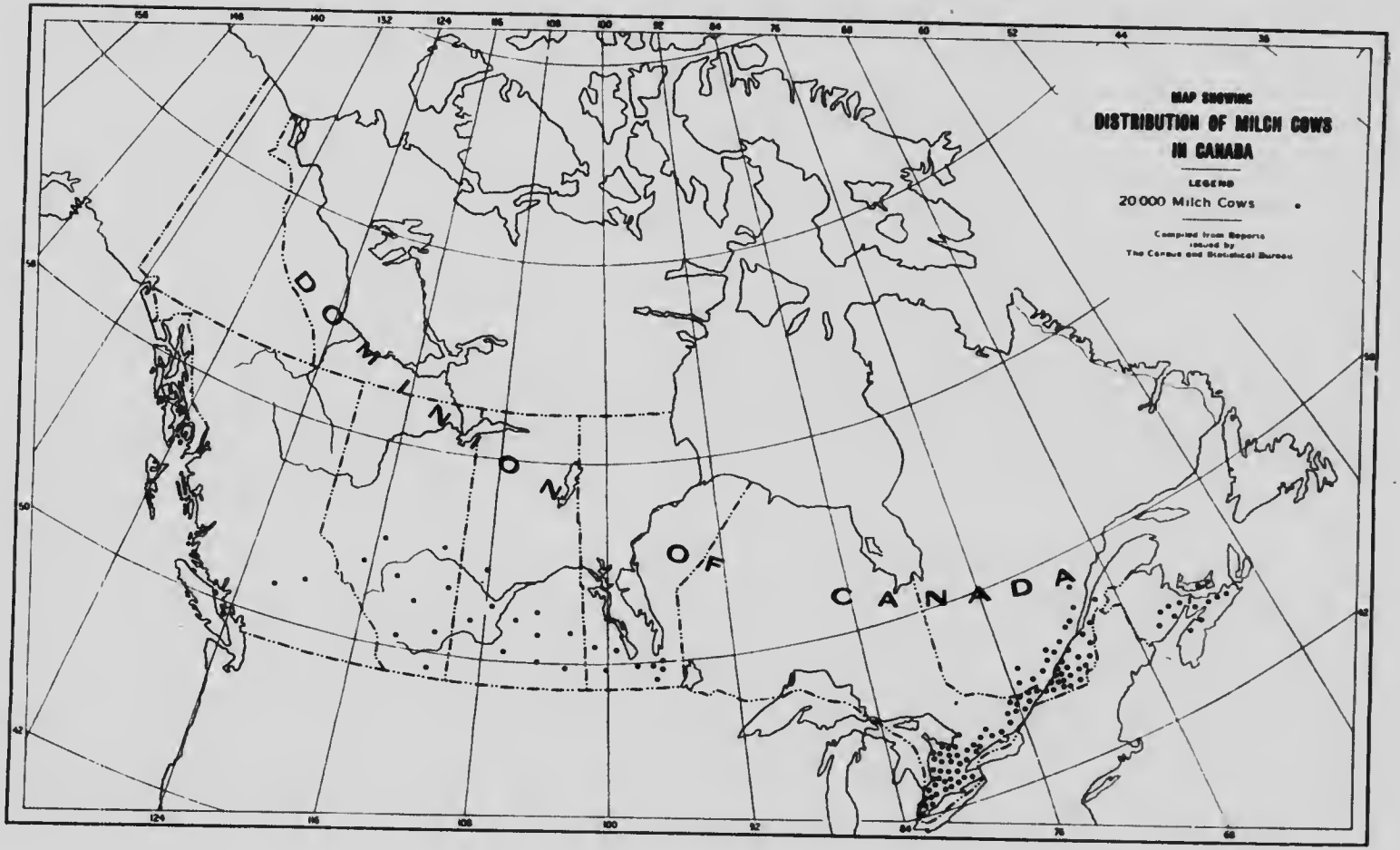
Soils impregnated with alkali are injurious to vegetation, but the greater number of alkali soils when freed from excess of alkali are exceedingly fertile.

Black alkali is more injurious than white alkali.

Alkali soils can be reclaimed by thoroughly washing out and carrying away the alkali. If the natural drainage of the soil is not good, flooding by irrigation should be preceded by the construction of an adequate system of under-drainage.

The black alkali in soils can be converted by the application of land plaster (ground gypsum) into white alkali, which, as already stated, is a milder form as regards vegetable life. In this way large tracts of useless soil in the United States have been effectively and cheaply reclaimed. If the black alkali is only present in

* "Alkali Soils," by F. T. Shutt, M.A., F.I.C., Dominion Chemist.


MAP SHOWING
DISTRIBUTION OF MILCH COWS
IN CANADA
LEGEND
20000 Milch Cows
Compiled from Reports
issued by
The Census and Statistical Bureau
DOMINION OF CANADA

small amounts the land may be rendered cultivable simply by a dressing of land plaster, but in most cases it will be necessary to wash away the resulting white alkali before the soil is fit for bearing crops.

CROPS FOR ALKALI SOILS.

Sugar beets, where the alkali is not severe may so far improve the soil as to make it suitable for grain, grasses, etc. At first the beets may be too bitter for stock. Mangels have proved very satisfactory in removing injurious salts from the soil.

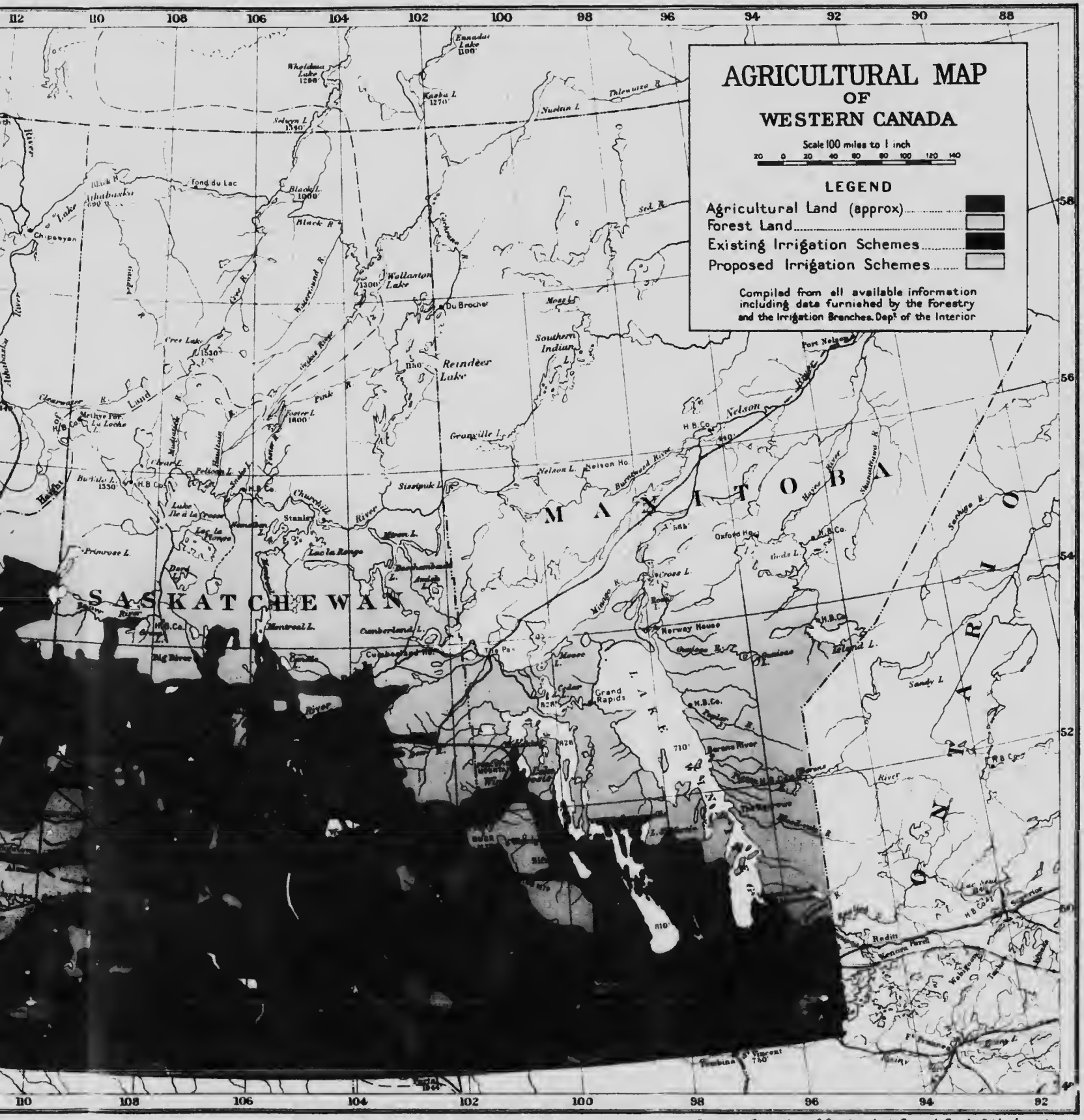
As for cereals wheat is less resistant to injury from alkali than oats or barley.

Among the good grasses that can be grown on alkali lands are Timothy, Awnless, Brome Grass, Red Top and Perennial Rye Grass.

Legumes, with the exception of Alfalfa and Sweet Clover, are particularly sensitive to alkali.

Very few vegetables except beets, mangels and asparagus can be grown successfully on alkali soil. Potatoes are an alkali resistant crop, but the tubers are usually poor in quality and do not keep well.

Natural Resources Intelligence Branch


AGRICULTURAL MAP
OF
WESTERN CANADA
Scale 100 miles to 1 inch
20 0 20 40 60 80 100 120 140
LEGEND
Agricultural Land (approx)
Forest Land
Existing Irrigation Schemes
Proposed Irrigation Schemes
Compiled from all available information including data furnished by the Forestry and the Irrigation Branches, Dept of the Interior
SASKATCHEWAN
MANITOBA
ONTARIO
Reindeer Lake
Southern Indian L.
Nelson
Churchill
Stanley
Cumberland L.
Norway House
Grand Rapids
Lake Winnipeg
Port Nelson
Oxford House
Sandy L.
Reditt
Wabigoon
Base map from plate of Geographer's Branch, Dept of the Interior