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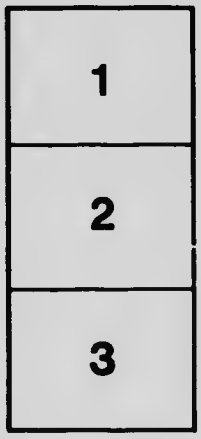

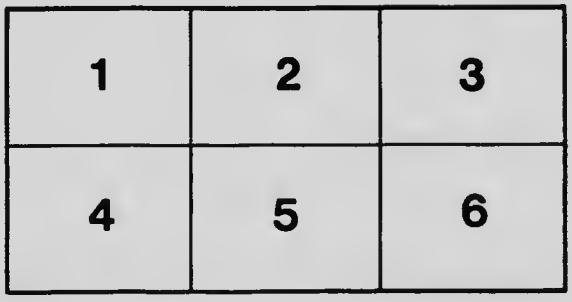

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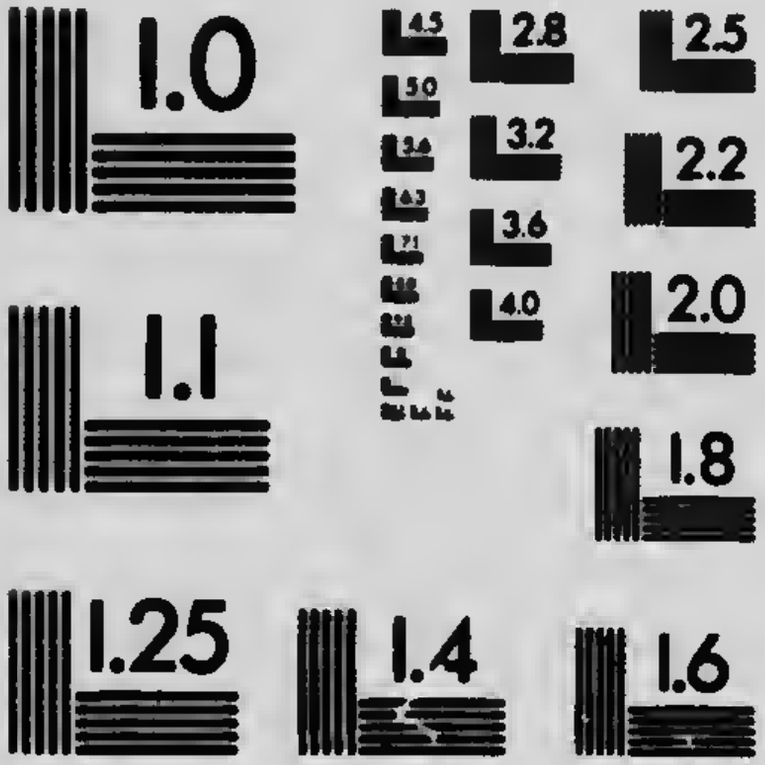

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DOMINION OF CANADA

DEPARTMENT OF AGRICULTURE

CENTRAL EXPERIMENTAL FARM

OTTAWA, CANADA

THE FLAX PLANT

ITS CULTIVATION FOR SEED AND FIBRE

BY

WM. SAUNDERS, C.M.G., LL.D., F.R.S.C.

Director of Experimental Farms

BULLETIN No. 59

APRIL, 1906

Published by direction of the Hon. SYDNEY A. FISHER, Minister of Agriculture, Ottawa, Ont.

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To the Honourable

The Minister of Agriculture.

SIR,—I have the honour to submit for your approval Bulletin No. 59 of the Experimental Farm series, prepared by myself. In this bulletin the subject of flax is discussed, its cultivation both for seed and fibre, and information given as to the preparation of the land and the general treatment of this crop.

In view of the growing importance of the flax crop in Canada it seems desirable that our farmers should be placed in possession of such facts as may be helpful to them in this branch of agricultural industry.

I have the honour to be,

Your obedient servant,

WM. SAUNDERS,

Director Experimental Farms.

OTTAWA, April 3, 1908.

FLAX.

By Wm. Saunders, C.M.G., LL.D., F.R.S.C., F.L.S.

Director of Experimental Farms.

The cultivation of flax and the manufacture of its fibre date back to a very remote period. The great value of this plant has been known and appreciated for probably five thousand years past. The fact that the Egyptian mummies were wrapped in linen, shows that the use of the fibre of flax is very ancient. It was an old and well established industry in Egypt at the dawn of the Christian era. Some 3000 years ago the Phœnicians devoted much attention to the cultivation of this plant, and subsequently the Greeks and Romans made the working of flax fibre a part of the household duties.

This fibre, next to cotton, is the most valuable and universally employed textile in the whole range of vegetable fibres, and the plant can be grown in nearly every part of the world where the climate is temperate. It is cultivated to a considerable extent in Great Britain, Ireland, Sweden, Denmark, Holland, Belgium, France, Russia, Germany, Austria, Spain and Portugal. It is also grown over a large area in North America, and to some extent in portions of South America, notably in Argentina, where it is cultivated chiefly for its seed. It is still grown in Egypt, also in Algeria and Natal. Japan has entered on flax cultivation commercially, so also have the Australian colonies, where there is said to be a wide range of soil and climate favourable to its growth. In India also there are large areas devoted to the cultivation of the flax plant, but in that country it is grown chiefly for its seed.

CULTIVATION OF FLAX IN AMERICA

Flax was brought to America by the early colonists, and the working of flax fibre was one of the earliest colonial industries, which was encouraged on every hand. Within the past hundred years it is said to have been a prevailing custom among farmers in the Eastern States to grow flax and to have it retted, scutched, hackled and spun by members of their household. A similar custom still prevails among some of the thrifty wives and daughters of the French-Canadian farmers in the rural districts of Quebec.

THE FLAX PLANT.

The flax plant of commerce received from the great botanist Linneus the name of *Linum usitatissimum*. From the generic name *Linum* the words linen, lint and linseed are derived, while the specific name *usitatissimum*, which means 'most useful,' was given to it in consideration of the service it has rendered the human family in supplying material for clothing.

Flax is an annual plant which grows from 20 to 40 inches in height or sometimes higher. The stem branches more or less, the number of branches depending largely on the quantity of seed sown and the relative closeness of the plants. The flower, when fully expanded, measures nearly an inch in diameter, and is usually of a purplish

blue colour, but varieties of the plant occur where the flowers are pink, flesh colour, or white. The plants bloom very freely, but the flowers are very fugitive, opening but once. Early in the morning when the flax is in flower the plot or field will be a mass of blue bloom, but before the day is far spent the flowers will have mostly withered and dropped. Each seed pod or boll has ten cells or divisions, each of which contains a single seed.

The seeds are flat, oval in form, of a dark brown colour, with a smooth polished surface. The outer portion of the seeds contain a mucilaginous material which dissolves freely in hot water, while the interior is very oily. When the seed is steeped for a time in hot water a mucilaginous beverage is made, known as flax seed tea, which is used as a soothing drink in some forms of inflammatory disease. The seed is said to contain about 15 per cent of mucilage and to yield from 22 to 27 per cent of oil, which is known in commerce as linseed oil and is largely used in the manufacture of paints. To obtain the oil the seed is ground and heated by steam and while hot is subjected to strong hydraulic pressure, when the oil flows freely from the pressed material. The cake left after the oil is extracted is known as oil cake, which when ground is much used as a food for cattle.

The fibre is that which gives to flax its greatest value. On cutting through a stem of this plant, the centre is found to be occupied by pith surrounding which is a layer of ordinary woody fibres, and outside of these is the inner bark which is formed of very long and remarkably tough fibres, the whole being covered by a skin or epidermis. The value of the plant depends on the abundance, length and quality of the fibre, and these characteristics can only be obtained where flax is grown in a suitable climate. The fibre of flax is very tough and is well adapted for spinning, and as compared with cotton, wool or silk is a good conductor of heat, linen clothing being proverbially cool.

GROWING FLAX FOR ITS FIBRE IN CANADA.

The cultivation of flax mainly for its fibre has been carried on in some parts of western Ontario for many years, the yield of seed under such circumstances being a secondary consideration. To grow flax successfully for fibre, a moist climate is said to be necessary, and in seasons when the rainfall is deficient the fibre produced is smaller in quantity and inferior in quality. The quantity of seed used in western Ontario when sowing flax for fibre is said to be about 80 lbs. per acre, which is sufficient to produce a thick growth, with the plants sufficiently close to give long and straight straw, which generally yields fibre of good quality. The seed is usually sown in Ontario during the last week of April or early in May, commonly by a broadcast machine or otherwise by hand, and the seed is covered by a light harrowing. Where flax is grown for its fibre it is always pulled in harvesting, as a longer fibre and a larger quantity can be obtained by this method. In some localities men are employed in pulling, while in others the larger part of this work is done by women and children. The pulling is done before the seed capsules are quite ripe, when they are just beginning to change from a green to a pale brown colour. As the crop is pulled it is tied in bundles or small sheaves which are placed for a time in stooks in the field, and when dry it is drawn to the storehouses. It is threshed by the use of a special machine which separates the seed without injuring the fibre in the straw and the straw is subsequently retted and scutched and the fibre thus prepared for market.

RETTING.

In retting or rotting as usually practised the dried flax is placed in ponds or dams of soft water, the water being about four feet deep. The stalks are tied in bundles and packed roots downwards in the ponds or dams until they are quite full. Over the top of the upper layer is placed a covering of straw and on this sufficiently weighty

substances are laid to keep the flax submerged. Fermentation soon begins with the evolution of gases and the decay of the soft vegetable tissue sometimes proceeds quite rapidly. After a few days the fermentation subsides and usually in from ten to fourteen days the process is complete. The time required for this operation varies with the temperature, but when it is found that the fibre when handled separates readily from the softened woody tissue, the small bundles are removed from the water and spread evenly over a grassy meadow. After being so exposed for about a fortnight advantage is taken of the first fine dry weather to gather up the flax, which is now ready for the next operation.

Various modifications of this process of retting have been proposed and put in practice, some involving the heating of the water, others the addition of various chemicals, all looking to the hastening of the process without injuring the material.

SCUTCHING.

This is the process by which the fibre is freed from the woody material still adhering to it after retting, and thus rendering it fit for the market. Various machines have been devised for this purpose, driven either by water or by steam power. These scutching mills are made and run with the object of producing the largest proportion of long clean fibre with the smallest amount of waste.

In Bulletin II of the Census of 1906, covering the manufactures of Canada, the following particulars relating to the production of dressed flax in this country are given:—

Number of establishments in which dressed flax is prepared 23 (22 of these are in Ontario).

Value of land, buildings and plant	$105,750
Working capital	115,000
Total wages paid	144,396
Value of product	241,932

From these figures it will be seen that the production of dressed flax cannot be classed among the important industries in Canada.

THE GROWING OF FLAX FOR SEED.

The growing of flax for its seed is a larger industry in this country. In the Census of Canada for 1900 the area under the cultivation of flax and the yields of seed in the several provinces are given for 1890 and 1900 as follows:—

	1890.		1900.	
	Number of acres.	Number of bushels of seed.	Number of acres.	Number of bushels of seed.
Prince Edward Island	75	746	28	281
Nova Scotia	83	410	.....	58
New Brunswick	92	459	57	283
Quebec	2,878	29,476	1,881	19,309
Ontario	6,775	71,339	6,388	67,296
Manitoba	6,089	34,588	14,404	81,898
Saskatchewan and Alberta	153	1,462	327	3,113
British Columbia	91	364	1	4
Totals for Canada	16,236	138,844	23,086	172,242

These figures show that there was a decrease in the number of acres under flax during the ten years from 1890 to 1900 in all the eastern provinces and in British Columbia, whereas in Manitoba there was a considerable increase, and a slight increase in Saskatchewan and Alberta.

The recent census of the Northwest provinces in 1906 shows remarkable increases in the production of flax seed in 1905 and 1906, especially in Saskatchewan; considerable increases also are shown in Alberta. In 1905 there was a lessened acreage of flax in Manitoba, but owing to a heavier crop that year there was an increase in the total quantity of flax seed harvested. In 1906 Manitoba showed an increase both in area and yield, and in the Manitoba crop report issued December 14, 1907, a further advance is shown with this crop:—

—	Number of acres of Flax.	Number of bushels of seed.	Yield per acre.
			Bush. Lbs.
1905.			
Total yield for the Northwest Provinces	45,812	608,242	13 27
Divided as follows—			
Manitoba	9,205	110,041	11 95
Saskatchewan	35,664	486,578	13 64
Alberta	943	11,623	12 32
1906.			
Total yield for the Northwest Provinces	131,819	1,818,780	13 79
Divided as follows—			
Manitoba	16,501	227,796	13 80
Saskatchewan	108,834	1,504,814	13 82
Alberta	6,484	86,170	13 28
1907.			
From Manitoba Crop Report, Dec. 14, 1907—			
Manitoba	25,915	317,347	12 25
The final report on grain crops for 1907 published by the Government of the province of Saskatchewan, Feb. 20, 1908, gives the figures for 1907 as follows	125,029	1,364,716	10 91

The provincial report for Alberta is not yet received.

Flax seed, as already stated, is chiefly used in the manufacture of linseed oil. There are three large linseed oil mills in Montreal, one at Baden, Ontario, and one at Winnipeg. The combined capacity of these mills is large and all the oil they manufacture finds a market in the Dominion. The demand indeed exceeds the supply, and the flax seed produced in Canada has to be supplemented by large importations, and considerable quantities of linseed oil are also brought in from other countries. The oil cake left after the oil is expressed, so highly esteemed as a nourishing food for cattle, is partly used in Canada and partly exported to Great Britain.

CAN THE FLAX STRAW PRODUCED IN THE NORTHWEST PROVINCES OF CANADA BE PROFITABLY WORKED FOR ITS FIBRE?

In 1896 experiments were conducted with flax at the several Dominion Experimental Farms for the purpose of ascertaining whether flax fibre could be profitably produced in the different climates of Canada where these experimental farms are located, also to gain further information as to the quantity of seed which should be sown per acre, and the best time for sowing.

A sufficient quantity of seed of the best sort obtainable—grown one year in this country after importation from Russia—was secured from J. Livingston, Esq., of Baden, Ontario, who was largely interested in the flax industry in Canada, being a manufacturer both of fibre and oil. Each experimental farm was supplied with seed from this source. Instructions were sent with the seed to select enough land in a

good condition of tilth and as uniform in character as possible, to provide for eight 1/10th acre plots. Two of these plots were to be sown early in the season at each farm, and two on the same day each week following for four sowings, thus making the sowing period cover three weeks. The quantity of seed to be used at each sowing was at the rate of 40 lbs. per acre for one of the plots, and 80 lbs. per acre for the other. Directions were also given that when the flax had reached that degree of maturity when about one-third of the seed was ripe, the flax on one half of each plot was to be pulled and tied in small bundles and when cured in the field the weight of the straw ascertained. On the other half of each plot the seed was to be allowed to ripen, and then harvested and threshed to find out the yield. Arrangements were also made for packing and forwarding a bale of 50 lbs. weight of the pulled flax from each plot to Messrs. J. & J. Livingston, of Baden, Ontario, to be retted and scutched and the quantity and quality of the fibre in each case ascertained. These experiments in cultivation were conducted at the Central Experimental Farm at Ottawa, and at the Branch Farms at Nappan, N.S., Brandon, Man., Indian Head, Sask., and at Agassiz, B.C.

The instructions given were carefully carried out, and the 400 lbs. of pulled and cured flax sent to Baden, Ont., from each farm. At the conclusion of the test the Messrs. Livingston reported that the flax grown at Nappan, Ottawa and Agassiz had produced a profitable proportion of fibre of good quality, but that the samples grown at Brandon and Indian Head had given but a small yield of fibre, which was of poor quality. Their opinion was that the fibre produced from the flax grown on these two latter farms was not sufficient to pay the cost of working.

PRODUCTION OF CURED FLAX FOR FIBRE AT OTTAWA.

The heaviest yield of pulled flax grown at Ottawa—7,878 lbs. per acre—was gathered from a plot which had 80 lbs. of seed per acre, sown on May 7. The second heaviest crop was also had from a plot sown with seed at the rate of 80 lbs. per acre, sown on May 14. The pulled flax in this instance weighed 6,657 lbs. per acre. The average weight of pulled straw from the four plots sown with 80 lbs. of seed per acre was at the rate of 6,379 lbs. per acre, while the four plots sown at the rate of 40 lbs. per acre gave an average of 5,616 lbs. of cured flax per acre.

AT NAPPAN, NOVA SCOTIA.

The heaviest yield of pulled flax grown at Nappan—8,200 lbs. per acre—was from a plot sown June 4, with 40 lbs. of seed per acre, and the second heaviest, 6,000 lbs. per acre, from one sown on May 28, with 80 lbs. per acre. The average weight of cured straw grown from the plots sown with 80 lbs. of seed per acre was 4,650 lbs. per acre, whereas the four sown with 40 lbs. per acre gave an average of 5,350 lbs. per acre.

AT BRANDON, MANITOBA.

The heaviest yield of pulled flax grown at Brandon—1,900 lbs. per acre—was from a plot sown on May 23, with 40 lbs. of seed per acre. The second heaviest, 1,270 lbs. per acre, was had from one sown June 6, with 80 lbs. of seed per acre. The average weight pulled and cured from the plots sown with 80 lbs. of seed per acre was 1,237 lbs. per acre, while the four plots sown with 40 lbs. of seed per acre gave an average crop of 1,327 lbs. per acre.

AT INDIAN HEAD, SASKATCHEWAN.

The heaviest weight of pulled flax, cured, grown at Indian Head—4,240 lbs. per acre—was obtained from a plot sown on May 23, with 80 lbs. of seed per acre. The second heaviest, 4,120 lbs. per acre, was from a plot sown May 30, with 80 lbs. of seed per acre. The average weight of pulled flax cured from the plots sown with 80 lbs. of seed per acre was 4,030 lbs. per acre, while the four plots sown with 40 lbs. per acre produced an average crop of 3,380 lbs. of cured flax per acre.

AT AGASSIZ, BRITISH COLUMBIA.

The heaviest weight of pulled flax cured grown at Agassiz—3,400 lbs. per acre—was produced by a plot sown on May 15, with 80 lbs. of seed per acre, the second heaviest, 3,280 lbs. per acre, was from a plot sown May 22, also with 80 lbs. of seed per acre. The average weight of the pulled flax cured from the four plots sown with 80 lbs. of seed per acre was 2,740 lbs., whereas the average weight of crop obtained from the four plots sown with 40 lbs. of seed per acre was 2,490 lbs.

These figures show that at Ottawa, Indian Head and Agassiz the plots sown with 80 lbs. of seed per acre gave the larger average weight of pulled flax per acre, while at Nappan and Brandon the advantage in weight was in favour of the plots sown with 40 lbs. of seed per acre.

FURTHER EXPERIMENTS IN GROWING FLAX FOR SEED.

As the evidence obtained in 1896 as to the small quantity and poor quality of the fibre obtainable from flax grown in the Northwest provinces of Canada was in harmony with the general opinion of experts who had worked with similar material in like climates in the Western States, it was regarded as conclusive and it was not thought necessary to continue the experiments further. These were continued, however, in growing flax for its seed for several years, using 40 and 80 lbs. of seed per acre with each of the four sowings made one week apart. In all the subsequent trials the straw was allowed to ripen then cut and threshed.

RESULTS OF EXPERIMENTS WITH FLAX GROWN FOR SEED.

—	Largest crop.	Seed sown per acre.	Date of sowing.	Second largest crop.	Seed sown per acre.	Date of sowing.	Average yield from 40 lbs. seed per acre.	Average yield from 80 lbs. seed per acre.
For four years at Ottawa, Ont.	Bush. lbs.	lbs.		Bush. lbs.	lbs.		Bush. lbs.	Bush. lbs.
1896	17 8	40	May 14	15 15	80	May 14	13 31	12 11
1897	10 30	40	May 26	9 26	40	May 19	9 23	7 35
1898	13 42	80	April 25	13 12	40	April 25	9 33	12 51
1902	9 20	80	April 30	8 40	40	April 30	8 10	7 30
For two years at Nappan, N.S.								
1896	34 20	40	June 4	32 40	80	May 21	24 43	25 43
1899	21 30	80	May 18	21 30	80	June 1	16 53	19 53
For four years at Brandon, Man.								
1896	17 26	80	June 6	17 8	80	May 16	14 14	16 45
1897	14 16	80	June 2	12 48	80	Jnne 9	10 52	12 38
1898	28 32	40	May 28	25 00	80	May 28	22 15	19 29
1900*	7 8	40	May 12	6 44	80	May 12	6 19	6 24
For four years at Indian Head								
1896	13 12	80	May 23	12 48	80	May 16	10 25	12 13
1897	13 30	40	May 25	13 10	80	May 18	10 27	12 24
1898	22 00	80	May 28	16 00	80	May 21	11 22	17 10
1899	21 10	80	June 9	21 00	80	May 26	18 26	19 21
For three years at Agassiz, B. C.								
1896	12 8	80	May 22	12 8	80	May 15	7 28	8 52
1899	18 32	40	May 19	17 48	40	May 12	16 4	15 20
1900	11 4	80	April 24	9 16	80	May 1	7 28	8 54

*The season of 1900 was a very unfavonrable one in Manitoba, owing to severe spring frosts and a very unnsual drought.

These results seem to indicate that when flax is sown for its seed only, the sowing of 40 lbs. of seed per acre does not always produce as heavy a crop as where 80 lbs. is sown. The yields of seed obtained from the four years tests at Brandon show an average difference of 23 lbs. per acre in favour of the 80 lbs. of seed, while at Indian Head the heavier sowing has increased the crop to the extent of 2½ bushels per acre. These experiments, however, were conducted on land which had been under crop for several years, and this may have made some difference in the results. On new breaking the general opinion drawn from experience is that 40 lbs. of seed per acre is sufficient. With regard to the best time for sowing in the Northwest provinces, from the middle to the end of May is usually recommended. The seed selected for sowing should be plump, well developed, of good colour and free from the seeds of weeds. Where large fields are sown the seeding is usually done with the drill.

Some further trials have been made in the growing of flax seed at the Indian Head and Brandon farms, using the following proportions of seed:—

Seed sown per acre.	Indian Head. — Years sown.	Average crop.	Brandon. — Years sown.	Average crop.
lbs.		Bush. lbs.		Bush. lbs.
20	4 yrs. 1901-4-5-6	15 27	1 yr. 1901	11 14
30	4 yrs. 1901-4-5-6	17 28	1 yr. 1901	11 14
40	5 yrs. 1901-2-4-5-6	21 13	2 yrs. 1901-3	17 48
50	2 yrs. 1904-5	14 1	1 yr. 1903	18 32
60	1 yr. 1902	16 16	1 yr. 1903	22 28
70			1 yr. 1903	21 4
80			1 yr. 1903	20 20
90			1 yr. 1903	19 36
100			1 yr. 1903	17 48

Judging from the crops produced and the quality of the seed grown it is evident that the conditions in the Northwest provinces of Canada are favourable for the production of flax seed. As in the United States, the greatest development of this industry is in the Northwest. In that country, with its annual product varying from twenty-five to nearly thirty million bushels, North Dakota produces about one-half of the entire crop, while if the product of South Dakota and Minnesota be added these three states contribute more than three-fourths of the total production.

In the United States the average yield of flax seed per acre for the five years ending 1907 was 9·6 bushels.

The production of flax seed in Canada has not yet been sufficient to meet the demands of the oil mills. Hence large quantities are imported from the United States and from Argentina. The quantity brought into Canada during 1906 was about 500,000 bushels. Besides this a large quantity of linseed oil is imported which could be profitably made here if the crop of home grown seed were sufficiently large. The Canadian government has, in the interest of Canadian agriculture, imposed a duty of ten cents per bushel on flax seed, and as long as the demand so largely exceeds the supply there is a great inducement to farmers to take up the sowing of flax on a larger scale.

SOIL AND TREATMENT.

A deep and well tilled soil in a good condition of fertility, but at the same time not too heavy, is well suited for flax. Indeed soil which is in fit condition to produce a good crop of grain may be successfully used for growing flax. In most flax growing countries this crop is grown as one in a regular rotation, the crops forming the rotation being so arranged as to meet the conditions of the farmer and to bring the flax into the regular series of crops once in four or five years. A common rotation

in the flax growing countries is said to be oats, rye, wheat, clover and flax. Clover is regarded as one of the best crops to precede flax as its roots penetrate deeply into the soil and bring up stores of fertility from below which many other plants do not reach. Clover also assimilates and stores up nitrogen from the air, and when ploughed under furnishes much of this important element for the crop that is to follow. Flax can also be grown on the prairie soils of the Northwest on new breaking, but usually produces a heavier crop on backsetting, or on a clean fallow. To make this clear to those who are unacquainted with the methods of prairie farming it may be said that the first breaking of prairie sod is generally made by turning over a wide and shallow furrow about two inches thick, when this is done in the spring the land is ready for backsetting early in the autumn, by which is meant a second ploughing the furrows running across the breaking to a depth of about four inches. This cuts the decayed sod, turns it over and covers it with about two inches of fresh soil from below. In many parts of the Northwest provinces backsetting is the usual preparation for a wheat crop. After turning the sod over where flax is to be sown it should be lightly worked with a disc harrow setting the harrow so as to cut the earth fairly well but not so as to tear up the sod. The seed is then sown and the land rolled so as to press the sod firmly in its place. Many farmers break the land deeper, from three to four inches, then disc harrow, sow and roll. Where flax is sown on new breaking a seed bed comparatively free from weeds is provided, which is a great advantage for a flax crop. The farmer also derives some revenue from this part of his land the first year and the crop effectually rots the sod so as to admit of ploughing to the ordinary depth in the autumn.

A DISEASE IN FLAX.

A disease known as 'flax wilt' has attracted considerable attention in the Northwestern States. This disease is said to be due to a fungoid growth. It manifests its presence by the wilting of the young plants as if caused by drought or intense heat. It occurs in spots in the fields, which at first are limited to three or four feet in diameter, but if the disease is unchecked these gradually increase in size until finally the whole crop may be affected. Flax wilt occurs most commonly where flax has been grown in successive crops on the same land, when the land is said to become flax sick. This shows the importance of paying attention to the rotation of this crop with others. No reports of the occurrence of 'flax wilt' in the Canadian Northwest provinces have yet been reported to us, but it is not likely we shall long escape this malady unless it can be avoided by strict attention to a proper rotation.

IS FLAX A SPECIALLY EXHAUSTING CROP?

This question is usually answered in the affirmative, but this opinion does not appear to be warranted by the chemical analyses which have been made of this crop, showing the principal elements of fertility taken from the soil during the period of its growth. The results which have been obtained by chemical examination have furnished the following figures, which represent approximately the plant food removed from the soil by flax, wheat and oats:—

An acre of flax producing 15 bushels of seed and 2,000 lbs. of straw, takes from the soil—

	Nitrogen.	Phosphoric Acid.	Potash.
	Lbs.	Lbs.	Lbs.
For the seed, 840 lbs	26	14·86	9·28
" straw, 2,000 lbs.	20	9·00	28·00
Total	46	23·86	37·28

If we compare this with a crop of wheat yielding 25 bushels of grain per acre and 2,200 lbs. of straw, we find that the wheat takes from the soil—

——	Nitrogen.	Phosphoric Acid.	Potash.
	Lbs.	Lbs.	Lbs.
For the grain, 1,500 lbs.	28·50	12·68	8·54
" straw, 2,200 lbs.	12·03	4·96	20·57
Total	40·53	17·64	29·11

If we compare the figures given of the analyses of flax with those of a crop of oats of 50 bushels to the acre with 2,200 lbs. of straw, we find that there is taken from the soil by the oat crop—

——	Nitrogen.	Phosphoric Acid.	Potash.
	Lbs.	Lbs.	Lbs.
For the grain, 1,700 lbs.	32·13	10·48	8·05
" straw, 2,200 lbs.	13·90	4·74	24·83
Total	46·03	15·22	32·88

The larger part of the straw of all these crops grown in the Northwest is usually burnt, when the mineral ingredients taken from the land are returned to it in the form of ashes. In the east, where the straw is utilized chiefly for bedding animals, the mineral constituents taken up are returned to the soil with the manure, hence the seed only need be considered. It will be seen that the grain, in the case of the wheat crop, takes up a little more nitrogen and somewhat less of phosphoric acid and potash than is taken by the flax seed; while the oat crop takes for the grain a larger proportion of nitrogen, nearly one-third less of phosphoric acid and about one-eighth less of potash. The difference, however, in exhaustive effect of these several crops on a rich soil would scarcely be perceptible, and would not justify the opinion that flax is a very exhausting crop. In some experiments tried at the Experimental Farm at Brandon, Man., during the year 1895, in sowing wheat, oats and barley after flax, the results obtained point to the same conclusion.

THE IMPROVEMENT OF FLAX BY SELECTION.

At the Central Experimental Farm the tests of different varieties of flax have been found unsatisfactory owing to the mixed character of the different kinds. The Cerealist is now engaged in propagating a number of selected strains so as to obtain varieties which shall be really distinct and homogeneous. Some of the new selections will, it is expected, be an improvement on the original mixtures from which they were obtained.

OTTAWA, March, 1908.