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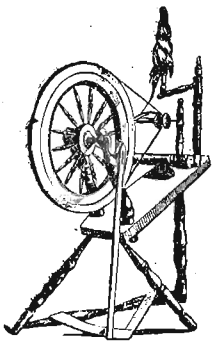
AGRICULTURE.



FLAX CULTURE.

H. T. FRENCH, Agriculturist.

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OREGON FLAX FIBER EXHIBITED BY PARRISH & MILLER
AT CENTENNIAL EXPOSITION 1876.

FLAX CULTURE.

H. T. FRENCH.

INTRODUCTION.

Flax culture might well be classified in this country among the lost arts. The time when flax was grown and manufactured into home-spun garments is fresh however in the memory of many who are living to-day. We may well ask ourselves the question, as to whether the natural conditions which made the growing of flax fiber possible, in those early days, have changed thus making it an unprofitable, and, in the minds of some, an impossible crop for the farmers of this country to raise at the present time.

Is it possible that within the boundries of this country where such a variety of soil, and climatic conditions exist, we have not the possibilities for growing flax for fiber?

With the knowledge which recent investigation has revealed upon the subject we are led to think, that possibly within our own state, there s hidden an immense resource which only awaits the touch of modern invention and enterprise to develop. We boast much of the delightful climate of Oregon, and of the inexhaustible fertility of her soil. Admitting these claims to be based upon actual fact, is it not important that such conditions should be made to contribute more to the needs of the people? Grain growing was in the past highly remunerative, but that time has gone by, possibly never to return, at least to the degree that it once enjoyed. The wide-awake agriculturist is looking about him for a new source of revenue. Some are converting their farms into fruit orchards while others are looking to the creamery for relief. These are wise moves, and when intelligently followed, will bring much relief and enjoyment to the tillers of the soil. If in addition to these industries we may add another, which will bring employment to manufacturer, as well as to producer, then we shall have increased the resouces of our state very materially.

The question of home production is a very important one, and has many advantages which are apparent to all; but we can

better understand its benefits when we have brought it about in our own midst.

In this report we shall present some information based upon facts which have been determined by actual experience, and experimentation in other states and countries. Only a very little has been done at the Oregon Experiment Station; but we expect to enter into an exhaustive line of experiments, touching the possibilities of the flax industry in this state.

FLAX FOR FIBER IN OREGON.

In entering upon any undertaking, it is well to know what has been done in the past along the special line which we propose following. The first question naturally presenting itself is, what are the possibilities indicated by past attainments?

Some twenty-five years ago there was a firm organized in the Willamette valley, for the purpose of manufacturing linen twine from flax produced on the farms of the valley. The factory was started, after overcoming great difficulities. due very largely to the lack of transportation facilities, and the results were highly satisfactory so far as quality of product was concerned. Misfortune overtook the firm in the way of fire, bad management and spiteful competition on the part of Eastern manufacturing interests, until the enterprise was abandoned. In those days labor was very dear and a large portion of the work that may now be done by machinery was done by hand. There were no transportation facilities for either the raw material or the finished product.

Mr. Chas. Miller, the surviving member of the firm of Parrish & Miller, has kindly given us permission to produce a cut of the medal which was awarded to them at the Centennial Exposition in 1876. It is an interesting, as well as an encouraging fact, that the exhibits of flax in its various stages of preparation, made by this firm, won first prizes over all competitors at this exhibition. The competing exhibits were from the flax growing countries of Europe, as well as from other states of the union.

The samples of straw and fiber from Oregon were given first place by all of the nine judges, each individual passing upon the samples separately, and without a knowledge of the action of the other judges. Several of the judges were from foreign countries

and all were experts in the handling of flax.

The accompanying half-tone cuts of the fiber, the award, the diploma, and the medal are presented as a matter of interest and pride in the success of the Oregon produc. at this early date, and under such conditions as then existed.

Dr. A. W. Thornton, of West Ferndale, Wash., has made some very exhaustive investigations in the culture of flax for the Department of Agriculture at Washington, D. C. Seed was furnished him by the Department from which he grew and prepared a ton of straw. This was forwarded to a firm at Liburn, Ireland, where it was prepared and manufactured into linen products. The results are briefly given below as recently furnished by Dr. Thornton for publication in the Oregonian.

"We congratulate you on the success of this experiment, which far exceeds our expectation. We believe there is a great future before flax growers in west of America. The flax is eminently adapted for thread-making and warp yarn spinning purposes. It is exceedingly strong, and works very well on the machines. If flax is grown and manipulated under proper conditions on Puget sound, we are convinced it will be of the greatest importance, and in a short time rival the great Belgian district of Corutrai. FRANK BARBOUR, (Liburn, Ireland)
General Manager.

"Commenting on the report, Dr. Thornton says: "The too thin seeding (two bushels per acre) was in accordance with specific instructions from the Department of Agriculture, and the over-ripeness arose from the six weeks in receiving the seed from Europe, which forced the crop into the drier summer months, causing an abnormal rapidity in ripening—both, it will be observed, preventable causes in the future. I have no hesitation in saying that had those adverse conditions not been present this flax would have reached a market value of $500 per ton. It is worthy of notice that the Belgian system of double retting possesses great superiority over the Irish system of single retting, not only in securing a larger yield of fiber, but also the higher quality and more favorable percentages. This report is very encouraging and highly satisfactory, and very specific in all its details, showing that great care and attention have been given to the experiment in all its stages, and, coming from so high an authority as Mr. Barbour, cannot be disputed or gainsaid." "

In 1892, three samples of flax were grown by the writer at the Oregon Experiment Station in cooperation with the Department of Agriculture at Washington, D. C. Mr. Dodge makes the

following statement in his report regarding the samples sent to the Department from this Station :

Oregon (Agricultural Experiment Station).—A careful report was also received from this state, with a lot of admirable samples, closely resembling the preceding. (those from Minnesota). These were of good length, some of the straw quite coarse. but well grown and cured. giving an abundance of clean silky fiber of superb strength. Well prepared it would make a superior fiber, fit for fine linen. This comes nearest to the Courtrai straw, in appearance, of any examined from the United States ; among the best and strongest received.

These samples were grown on soil without manure that had produced five crops of wheat previous to growing the flax. The soil was the grey, clay loam which is common throughout the Willamette valley. It was not, however, what is known as *white land*. Mr. Dodge states in his report that "the very best samples of straw received came from Oregon and California, where the experiments were conducted in heavy soils." A further discussion of soils will be found under its proper heading in this bulletin.

The success of the flax industry is controlled very largely by natural conditions. There are only a few localities in the world where the highest degree of success can be attained ; and some of these localities are losing their prestige on account of being no longer capable of producing the most desirable results.

The conditions of soil and climate, during the period of growth, and extending through the preparation of the fiber for manufacturing purposes, have a marked influence upon the quality of the product.

The fiber from which the fabric is finally wrought is a delicate vegetable organism which is easily ruined by bad management or unfavorable conditions. Like the growth of the sugar beet for the production of sugar, there is a certain amount of skill necessary to bring about the best results. If we have soil and climatic conditions well adapted to the industry, the skill required in handling the crop will soon be developed. It is not expected that the farmer will go farther than to raise the straw. From this stage the work can better be handled by the manufacturer, or in plants established or the purpose of preparing the fiber for manufacturing into linen fabrics. Invention and genius must step

in to assist, and they are ever willing wherever there is an open door and an inducement indicated by favorable natural conditions.

CLIMATIC CONDITIONS.

Our climatic conditions are very much the same as those which exist in the great flax growing districts of Europe. A cool, moist climate during the growing season is conceded to be the very best natural condition for the most rapid and healthy development of the flax plant. This description applies to Western Oregon and Washington. The elevation of the Willamette valley above the sea, compares very favorably with that of many foreign flax districts. In Ireland, where a large portion of the crop is grown, the elevation is 250 feet. The mean elevation of the Willamette valley will not vary much from these figures.

The absence of severe wind and rain storms throughout western Oregon and Washington, is of very great advantage; for the crop is often severely injured, and frequently destroyed in flax growing regions, by these climatic disturbances. Another advantage possessed by our climate, is the absence of rain during the harvesting season. The crop will be ready to harvest from August first to fifteenth. During this time there is no danger of injurious rain storms.

For the sake of comparison a table is here presented showing the mean temperature taken from the Weather Bureau reports of this state, and from similar records of flax growing countr es.

From records of the Weather Bureau compiled by the Dept. of Agriculture.

	Temperature.		Humidity.	
	Average* 3 months.	Average annual.	Average 3 months.	Average annual.
Foreign stations:	*Degrees.*	*Degrees.*	*Per cent.*	*Per cent.*
Belfast, Ireland.....	52.2	48.8	.....	.....
Brussels, Belgium.....	55.9	.....	77.4	83.4
Prague, Bohemia.....	54.6	48.1	66	74
Cologne, Germany...	55.7	50.6	67.1	74

*April, May, and June.

Willamette Valley:	*Mean Temperature.*
May	56.6°
June	58.8
July	64.3
Average for 3 months	59.9

Taking the corresponding months, April, May, and June the mean temperature is 54.4°, very nearly the same as that of the countries given above. The months of May, June, and July

are taken because we believe these are the months in which the crop will be grown in this locality.

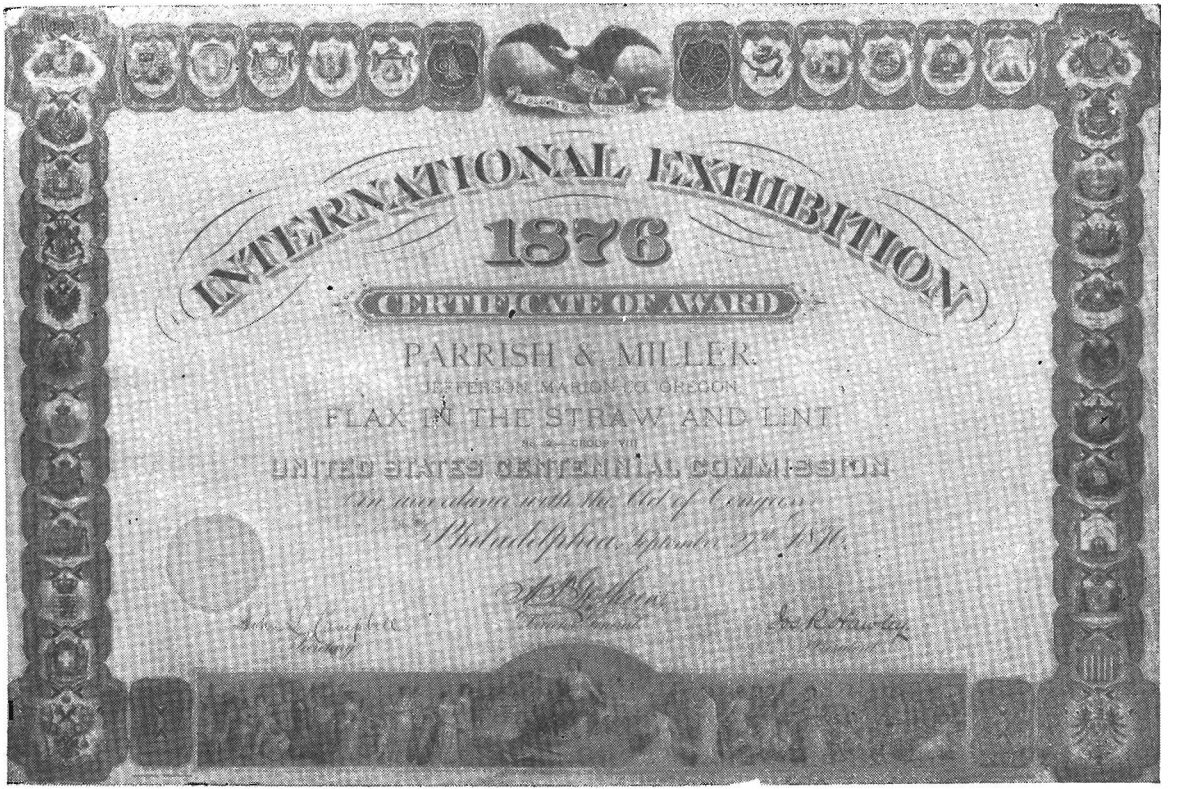
The mean relative humidity at Portland, Oregon, for May is 67.0 per cent; June, 66.9 per cent, and July 64.3 per cent, making an average of 66.1 per cent. This, it will be seen by referring to the table, compares very favorably with the same data from foreign countries.

From the foregoing data, and from all other information at our command, there seems to be no doubt as to the adaptability of the climatic conditions of Western Oregon, and Washington, to the growing of flax.

FLAX CULTURE.

Paper presented by Mrs. W. P. LORD at Farmers' Institutes held at Turner, Marion Co. Oregon, and Tangent, Linn Co., Oregon.

We are fortunate to live in a state of such boundless resources, that locations can be found that will suit any crop grown in the United States, except the purely tropical. And if we take the report of the Department of Agriculture, we have one specialty in the growing of flax for fine fiber, that no other state but Washington shares with us. We will see what Mr. Dodge says of it. To preface his remarks; In '91 an order was issued by the Government to every Agricultural College, that a test should be made of flax for fiber. The Department, of course, was aware that many of the states could not grow it with profit, but there was a wish to determine the most favorable localities. While many states sent in fairly good fiber at the season's close, it was the fiber from Oregon that received the special commendation of the department. Mr. Dodge said: "A careful report was received from this State, with a lot of admirable samples. These were of good length, some of the straw quite coarse but well grown and cured, giving an abundance of clean, silky fibre of superb strength. Well prepared, it would make a superior fiber fit for fine linen. This comes nearest to the Courtrai straw, of any examined from the United States. And then again, regarding the Pacific Coast samples; I can only say, judging from the straw submitted, in comparison with the samples grown east of the Rocky Mountains, that they are remarkably fine; and, if such flax straw can be produced economically, we need not be troubled concerning future supplies of fiber for the manufacture of fine linen in this country. The



HALF-TONE CUT OF CERTIFICATE OF AWARD.

Oregon samples are of such superb color. that, if river retted to preserve the color, the fiber would resemble the flax of Courtrai."

Every housewife delights in fine linen; to have a well filled closet of various grades for the table and bedroom, is her ambition. It is the oldest fabric known—the first to be spoken of in the Bible Look in the books of Genesis and Exodus to see how highly linen was thought of. and how God commanded the priests to wear it, in serving in the tabernacle. In one place wool for personal wear is condemmed and the command is given, "no wool shall be upon them." And right here we may say, that scientists. both of this country and of Europe, are of late years paying great attention to this matter of what shall be worn next to the skin. The feeling is growing rapidly that the wearing of woolen underwear is all a mistake. This woolen underwear fad has sprung into existence in the last forty or fifty years. Our pilgrim fathers and mothers wore linen from their own home-grown flax. spun by hand and woven on looms in their own houses. That we all know, and we all have traditions that they were a hardier race than the present. An eminent doctor of Boston makes the startling statement, that the continued use of wool as underwear will eventually wipe the nations from the face of the earth. Famous doctors of London are urging the returning to linen for underwear, as a matter of health. They have compiled in defense of their arguments some interesting statistics. In 1889, the latest date included in the Registrar General's report, 63,572 people died in England of bronchitis, 1,580 of pleurisy, and 33,206 of pneumonia—almost 100,000. Though the medical men of the present day so ably treat these diseases, and while their resources were so inadequate in the time when people wore linen yet comparatively far fewer persons died of these diseases in those earlier days. And yet the woolens now so universally worn are said to be a material protection against these diseases. If linen possessed the direful qualities ascribed to it by the advocates of woolens, either the whole population would have perished in those days, or have been reduced to a very small remnant, the detestation of woolen being for a very long time widespread and, as these London doctors think, well founded.

I hope you will pardon my digression as it is in the hope of

emphasizing the fact that the use of linen is on the increase, and the future demand for it is likely to be very great. The pioneer in this crusade against wool is a priest of Bavaria, who was in his youth, a weaver's apprentice. I have made the following extract from a foreign journal, that you may judge of the extent of this fad, or rather progressive education in the laws of health.

"The popularity of this Bavarian village priest, who, by the way began life as a weaver's apprentice, is really remarkable and we are told that his name has become a household word throughout Germany and Austria. Kneipp bread and Kneipp linens are advertised everywhere, and so great has been the crush of patients to Worishofen, that it has been filled month after month to overflowing, and establishments have been set up in various places to carry out Kneipp methods and treatment. His book, 'My Water Cure,' has run through 30 German editions and been published in English form with equal success. In the book is a forcible plea for the use and advantages of good linens, and so, particularly interesting from our point of view. No rubbing, no friction, says pastor Kneipp, but plenty of bathing and cold water, and then clothes for warmth, putting on linen first, without drying the skin, when the action of the coarse linen shirt upon the damp skin fulfills the second condition of opening the pores and restoring activity to the epidermis, having the advantage of keeping up a gentle friction night and day, without waste of time and trouble. The volume serves to remind us of an equal succcess in English literature, when John Wesley's Primitive Physic sold by the thousands. Both enjoin plain and simple living.

"Wesley would have those who cared for the preservation of their health, be as clean and sweet as possible, in their houses, clothes and furniture, and thought the fewer clothes one uses by day and night, the hardier will he be. It is certain he would have nothing to do with the indulgent, and enervating all-wool theory. Pastor Kneipp expressly condemns flannel or wool coming in direct contact with the skin. Wool, he says, only tends to absorb heat from our bodies, aggravating the poverty of blood of our weak and nerveless generation."

Many people, especially in the eastern states, are interested in the Kneipp laws of health, and are following them, and the manufacturer of Kneipp linens for underwear finds himself overcrowded with orders. A sample of the linen mesh came to us in the spring, and the thought at once occurred, if flax fiber should ever become a leading crop, here is an article for which there will be great demand, and of a simple weave, which could

easily be acquired by unskilled labor, while the intricacies of damask require a technical skill demanding years of study. I wrote to the New York office, 409—415 Pearl Street, calling the attention of the manufacturers to the possibility of procuring flax fiber in Oregon, and that, with the coming change in administrations, favoring protection to American industries, a manufacturer would find it to his interest to be located where he could procure raw material in unlimited quantity. Four months passed before the reply came, and I had abandoned all hope of hearing from the firm, when, to my surprise, came a letter from the head of the firm, saying he had just arrived at his New York office and had found my letter, which was of great importance. The growing demand for his goods made it extremely difficult to obtain the fiber necessary for his looms, and he was convinced that Oregon could grow the finest fiber "the world had ever seen," and now the question is: Will she do it? Here is the question for the farmers of Oregon to consider, and very promptly. Manufacturers are looking for locations; here is the opportunity we must improve. As a state we will never be prosperous until our manufacturing interests are developed: they must go hand in hand with the agricultural interests. Consider Belfast, originally a town of the size of Salem, now the home of 300,000, with 30,000 operatives in its linen mills. Aside from the fiber used in the mill grown by the Irish farmers, they require great quantities from other countries. On an average less than 100,000 acres are devoted to the flax culture in Ireland, for much of that country is a peat bog, not adapted to its growth. Ulster county raises the main part of the crop. I cull the following from Irish reports of 1888:

Acreage of Oats, 1,280,858 acres—value, £7,052,255—£5, 10 s. per acre. Flax, 113,613 acres—value, £1,318,280—£11, 12 s. per acre.

Land in Ulster county has been known to pay $160 per acre for a high grade of flax straw—that, of course, means what our city amateurs call intensified farming.

Our Canadian neighbors are alive to the possibilities in flax fiber. This last year they have had under cultivation, 80,000 acres in flax. Part of this is raised for linseed oil. There are 36 scutching mills, reducing the flax straw to fiber, the product

being shipped to Chicago : there it is made into twines and coarse crashes. (One scutch mill will use the prouct of from 500 to 600 acres yearly.) The grade of fiber is coarse; the climate is not suited to the finer grades, such as we can raise, but they find the crop quite profitable. They have been able to pay $1.50 a day for ordinary field labor, and 50 cts. a day for children. And right here it will be well to note the difference between the labor required for flax and for sugar beets. The flax crop is of quick growth, requiring only from 3 to 3½ months,—can be planted early in the spring (in ordinary seasons by the first of April) and harvested early in July. This is a season when it is a delight to be out of doors and at work in the fields, before the strong heat of summer. Beet fields require much longer attention, up to the fall months (if I am rightly informed). In connection with the flax industry many others spring into existence. The oil of the seed, while not equal to the product of flax, grown exclusively for the oil, can be made to pay ; and oil-cake will build up the dairy interest. Refuse and waste from the mills can be utilized in a tub, pail and flower pot factory. Nor is this all ; paper mills can utilize the waste.

At the present time experiments are being made in the line of fruit jars, that an inventive genius has already suggested, asserting that paper cans will supplant tin, the latter being unfit for the preservation of acid fruits. Glass, on account of its fragile nature, is seldom used by canners. But, note this, if the refuse flax can be utilized for cans, our fruit industry will receive an impetus. I assert what is known, that the refuse of beets will not pay for the hauling from the mill ; it would require too much time.

The field labor required, will be equal to that demanded for flax, but, when the crop is harvested, that labor will have no employment until the following season. A sugar mill requires but few men, but the linen mill will require 20 operatives to every farmer growing flax. This industry when established, would give profitable employment for our labor, and provide a home market for our farmers.

In what I have said about the flax industry, I do not wish to be understood that it will conflict with the wool industry. Wool has its place—and a large place—in the utilities of life,

which no other product can displace. Both can be made to flourish among our industries and increase the material wealth of our state. Both have uses which neither can supply alone, and therefore both may, and ought to, become leading industries in our state.

HISTORY OF THE PLANT.

The flax plant is known botanically by the name of *Linum usitatissimum*. From the word Linum comes our English words lint, linen and linseed. The specific name signifies great usefulness from the fact that the plant supplied human beings with many useful articles of clothing. The use of flax fiber is ancient, indicated by the records found in sacred writings, and by the linen wrapped about the Egyptian mummies. There are several wild species of the plant as well as domesticated varieties.

KIND OF SEED.

Regarding the varieties recommended for fiber the following remarks are taken from the Department report, Bulletin No. 27.

"Mr. J. R. Proctor, of Kentucky, writing upon this subject many years ago, advocated the white blossom Dutch as the best seed for American flax growers. Mr. Eugene Bosse. a practical flax grower, states that his preference, based upon several years' experience, is for (1) 'Riga seed, once sown in Belgium'—that is to say, imported seed grown on Belgian soil from seed procured in Riga; (2) seed imported direct from Riga, but it must be Riga and not Finland seed; (3) Dutch (Rotterdam) seed, and (4) American seed, which he reports "as good as Nos. 2 and 3 when well cultivated, though it will not stand the drought as well." Mr Bosse states that No. 1 will produce about 8 bushels of seed to the acre; No. 2, 10 bushels, and No. 3 between 8 and 10 bushels."

Experiments will be conducted during the present year to determine the best varieties for this locality. Until experiments demonstrate otherwise the foregoing remarks are fully indorsed. The value of the fiber produced is very largely governed by the kind and quality of the seed, hence much stress must be placed upon getting the seed from reliable sources. It will be safest probably, to use imported seed in the out-set; but we may be able to produce seed from the imported samples that will equal, and possibly surpass the foreign seed. Three varieties were grown in 1892 for the Department of Agriculture. They were

the Pure Riga or Russian, White Blossom Dutch,, and a variety called the Belgian. This last variety is produced from Riga seed grown on Belgian soil. The Pure Riga gave the best results in these experiments.

Fiber can be successfully grown only from seed which is adapted to the production of fiber. There is something in the *habit* of the plant, if we may use that term. The following statement is taken from the Department report.

"Imported seed gives the best results, but if this cannot be obtained, seed must be sown that has been produced from plants grown for their fiber, also from selected seed."

Whatever the source of seed great care must be taken in securing clean seed. Weed seeds would render the flax seed worthless. The supply must be fresh for old seed loses its vitality. Seed should be carefully tested before using so that the exact per cent of germination may be known. If only 60 per cent of the seed will grow then, evidently, more of it must be sown per acre. The higher the per cent of germination the better. Seed that, under favorable conditions, will germinate only 50 to 75 per cent would not be desirable.

Some apprehension has been expressed as to the danger of importing weeds with the flax seed ; but with proper precautions in procuring seed from reliable sources this danger will be largely obviated.

SOIL.

A retentive soil is best adapted to the growing of flax, other physical and chemical properties being favorable. Soils that will produce good crops of grain are usually good flax lands. The state of cultivation is more essential, however, in growing the flax plant than in growing a grain crop. The flax plant makes its growth very quickly, and during a time when there is no rain or frost to assist in pulverizing the soil, thereby rendering available the inert plant food. Wheat sown on a comparatively cloddy soil will often make a good growth ; for, during the long period of growth, the clods are broken up and washed down by the elements.

The composition of the best flax soil, as given by the chemist of the Minnesota Experiment Station, in Bulletin No. 47, is as follows : "The best flax soils are those that contain 25 per cent of medium sand, 20 to 25 per cent of fine and very fine

sand, 35 to 40 per cent of silt and 12 per cent of clay. A soil of this kind, known as a loam soil, is put together in such a way so as not to offer too great a resistance to the development o flax roots, and at the same time the soil is capable of holding and supplying the proper amount of water for the growing crop." The same report states that "flax soils should be well supplied with humus (decayed animal or vegetable matter). The best flax soils which have been analyzed usually show 0.2 of one per cent or more of nitrogen. This nitrogen must be in the most available forms, otherwise the flax crop will be unable to obtain its necessary supply."

Flax will not do well on lands where water stands within a few inches of the surface. The low white lands of the Willamette valley will hardly be expected to produce a profitable yield of flax until they are improved by tile drainage and careful cultivation.

It is safe to say that the best grain lands of the Willamette valley are well adapted to the growing of flax. The best evidence we have of this is in the fact that flax has been successfully grown on such soils. We learn from a report recently received that a field of flax, grown in Polk county the past season, made a remarkable growth. The report states that much of it was as high as a man's shoulders. This does not necessarily mean that this rank growth is desirable for fiber production, but it signifies that, that soil possessed the necessary conditions to produce a healthy growth, and from the descriptions given, we are well aware that there are vast areas of equally good soil in the valley. Mr. Charles Miller, of Jefferson, Oregon, who has had more experience than any other man in Oregon in growing flax for fiber, says, "that any of the soil of the valley which will produce good crops of grain will produce abundant crops of flax, provided the soil is properly prepared before the seed is sown."

Preparation of Soil.

All authorities on the subject of flax culture agree, that good culture is indispensable if success is to crown the efforts of the grower. As to the proper methods of cultivation, to produce the desired end, there is a difference of opinion largely due to the local conditions which surround the undertaking. One thing may be said however, that there is nothing connected with the

growing of flax which the ordinary farmer cannot understand, and carry on successfully. A few general observations will be made, and the details will be left to the intelligence of those who undertake the work.

When the fact that the flax plant reaches maturity in 60 to 100 days, and must take its supply of food from the soil in a much less time, is considered, the matter of thorough preparation of the soil has more significance. Prof. Snyder of Minnesota, found by experiment, that 75 to 90 per cent of the principal elements of plant food were taken from the soil during the first 45 to 50 days. The flax plant is not a strong rooted plant. It does not send out a large number of feeders compared with other plants. The root is the counterpart of the stem, hence it is straight and long sending out few branches.

Soil intended for flax growing should be plowed as deep as possible in fall or winter, and cross plowed again in the spring to a depth of 5 or 6 inches. If possible subsoiling should be practiced, for by this means better drainage will be secured, and a deeper soil will be provided for the flax roots. In case the plowing is delayed until spring it should be done as early as possible. If the work is performed late in the season there is danger of the soil getting too dry to break up loose and friable.

The ground should be permitted to lie idle long enough to allow the weeds to start before the final fitting for the seed. In this way a large portion of the weed seeds will germinate, and can be destroyed before the flax seed is sown. Weeds must not be permitted in the flax field. It is a common practice in flax growing districts to hand pull the weeds which appear in the flax fields. In the Northwest this must be avoided as far as possible on account of the higher wages which must be paid for labor.

The surface of the soil should be thoroughly pulverized before seeding. There are many useful harrows which can be used to bring the clods to the surface where they can be crushed with a clod-masher. If the soil is worked at the proper stage there will be few clods with which to contend. We find the spring-tooth harrow a very useful implement in bringing the clods to the surface.

Rolling the ground is often practiced after the flax seed is

HALF-TONE CUTS OF MEDAL AWARDED PARRISH & MILLER FOR BEST SAMPLES OF FLAX IN STRAW AND FIBER.

about to germinate. This will not do, however, if there is likely to be enough rain to pack the ground, and form a crust over the surface. It is only safe to roll late in the season, after the time is past when heavy rains might occur.

The conditions which prevail here are very favorable to a thorough preparation of the soil. The mild winter affords an opportunity to plow, and the early springs are favorable to cleaning, and preparing the surface of the soil for the seed.

ROTATION OF CROPS.

In growing flax the same facts will hold true regarding the advantages of a rotation of crops, as in growing any other crop, and in a more intensified way. Good fiber cannot well be produced from flax grown year after year on the same soil. As stated elsewhere in this report flax fiber is a delicate vegetable organism which can only be produced in its perfection by careful cultivation and attention. The plant is a delicate feeder, and must have its food ready prepared, as it were, and to do this in an economical way, rotation of crops must be considered. In European countries where flax is grown on the same soil for any length of time the supply of food is maintained by applying commercial fertilizers. This is expensive and of doubtful practical benefit under the conditions which exist in this western country.

In a majority of the flax growing districts of Europe flax is returned to the same soil after intervals of five to nine years, and in some cases fifteen to eighteen years elapse before flax is again grown on the same soil.

The following systems of rotation are taken from the Agricultural Department Report on flax culture for fiber. They represent those crops which are actually grown in flax districts.

1	2	3	4	5
Potatoes	Clover	Oats	Root crops	Barley
Wheat	Pasture	Turnips	Barley	Clover and
Clover	Oats	Wheat	Clover	grass
Pasture	Potatoes	Clover	Grass	Grazing
Oats	Wheat	Oats	Wheat	Wheat
Flax	Flax	Potatoes	Flax, half	Flax, half
		Flax	field	field

Clover is undoubtedly a very essential crop in the rotation. Some flax growers claim that it should precede the flax with no intervening crop; but from a majority of reports on the subject

we find that the clover crop occupies a midway place in the rotation.

The following rotation is presented by the writer as one which is believed to be best adapted to this locality:—(1) Wheat, (2) Oats and Barley, (3) Clover and Grasses, (4) Clover and Grasses, (5) Corn and Potatoes, (6) Flax.

The object of the cultivated crops in the rotation is to clean the ground of weeds. And by placing such crops just preceding the flax this object will be better obtained than when they occur earlier in the course.

The wild oat is one of the worst weeds with which the flax grower will have to contend. This will gradually disappear, however, under a uniform system of rotation, as we have proven by such a system on the Experiment Station farm.

Barley is a very good crop with which to seed to clover and grasses, if the seeding is done in the spring. And if the seeding is done in early fall, as we believe it can be successfully, then the oat and barley stubble will offer a good seed-bed for the grass seed. The stubble will act as a mulch for the clover and grass seed, and a good crop of hay may be harvested the following season.

This rotation would not necessarily cover the whole farm, for only a small area of flax can well be cared for by any individual. In fact the rotation of crops implies that the farm will be divided into small tracts or fields, which will in time be occupied by the various crops, provided the soil is adapted to the growing of the crops which are in the list.

In following potatoes and corn, or other hoed crops, with flax the old clover sod turned back to the surface will make a good seed-bed for the flax. As stated elsewhere in this Bulletin, it is necessary to have a good, rich surface soil for flax. A large portion of the nitrogen stored up in the soil will, by this plan, be near the surface.

If the growing of flax will induce the farmers of Oregon, to adopt a system of rotation of crops, which will do away with the naked summer fallow, there will be a great saving of the fertility of the soil. A long stride will be taken toward successful farming. The farmer says his land needs resting, when there is no such thing in nature, and especially during the growing season. Nature knows no rest. As soon as the farmer leaves the field

free from a crop, nature attempts to cover the ground with weeds and wild plants. Then there are unseen, but none the less potent, forces which are being exerted in the soil during the growing season. The soil is teeming with micro-organisms which are exerting a wonderful force in transforming the crude material of the soil into plant food. This matter of rotation of crops, with a view of doing away with the naked summer fallow, is a question which should demand the earnest thought of every tiller of the soil. He who does this, and thereby conserves the fertility of the soil, can confidently look forward to the time when coming generations will rise up and call him blessed.

MANURING FLAX.

Manure which is intended to benefit the flax crop should be applied to the crop preceding the flax, unless some commercial fertilizer is used, and in this case the manure should be thoroughly incorporated with the soil before the flax seed is sown. Commercial fertilizers are quite extensively used in the flax districts of the Old World; but the farms of Oregon are not in such a state of exhaustion as many of these older lands. Green manuring, and the plowing in of clover stubble, will be the most economical method of keeping up the fertility of flax land. If barnyard manure is used at all, it should be well rotted. The following extract is taken from Farmers' Bulletin No. 27 of the Department of Agriculture:

"Regarding the use of stable manure, it should be stated that well-rotted (composted) manure is preferable to the coarse barnyard manures, which are liable to make rank growth at the expense of fiber. Another reason for using well-rotted manures is to avoid fouling the crops with weeds, as the coarse manures are liable to be filled with the seeds of weeds which germinate and grow with the flax."

We are satisfied that successful crops of flax can be produced on the best grain lands of the Willamette valley, without the aid of artificial fertilizers.

EXHAUSTION OF SOIL.

It is a common belief that flax is a wonderfully exhaustive crop; but from recent investigations we are led to abandon some of the extravagant ideas which we once possessed regarding this matter. In a recent bulletin, No. 47 from the Minnesota Station,

giving the results of Prof. Snyder's investigations, is found the following statement:

"Flax belongs to the dainty or weak feeding crops. It does not take a great deal of fertility from the soil, but the small amount which it does take must be in the very best and most available forms. Mangels on the other hand belong to the gross feeding farm crops. Mangels, and in fact nearly all farm crops, are capable of taking their food in cruder forms, and with far less difficulty than flax. A heavy crop of mangels will remove five times more potash, twice as much phosphoric acid and nearly one and a half times more nitrogen than a crop of flax.

"A corn crop removes a half more nitrogen, twice as much potash, and about the same amount of phosphoric acid, while a good oat crop removes practically the same amount of nitrogen and phosphoric acid and about three quarters more potash than the flax crop. Compared with wheat, flax removes less phosphoric acid and potash per acre, and about a half more nitrogen. Potatoes remove about the some amount of phosphoric acid, about one-third less nitrogen, and nearly three times more potash per acre than an average crop of flax." It is further stated, "that in flax growing the heaviest draft falls upon the nitrogen, but when clover is grown this loss of nitrogen is not a serious matter, because one fair crop of clover will more than return all the nitrogen removed in two crops of flax."

From all the sources of information at our command it is safe to conclude that the flax crop has been charged with a greater power of exhausting the soil than it really possesses. On the other hand, on account of its delicate feeding propensities, it should not be compelled to search for its food where only a scanty supply is found.

AMOUNT OF SEED TO THE ACRE.

The amount of seed sown to the acre will depend somewhat on the germinating qualities of the seed, and the condition of the soil. The stronger the soil the more seed will be required. A recent report received from Belfast, Ireland, states that 1¾ bushels of seed, 95 per cent growing, will seed an English acre well, whereas 2¼ bushels, germinating only 70 to 75 per cent, will scarcely be enough. If the seeding is too thin the plants will branch, making them unfit for fiber. As little branching as possible is necessary for the production of fiber. A straight slender stem 18 to 30 inches high, with a ball of seed at the top, is an ideal stalk for fiber. When flax is grown for seed alone, ¾

of a bushel of seed per acre is sufficient.

In our experiments in 1892, in growing flax for fiber, 2 bushels of seed per acre were sown. The results were very satisfactory, and are mentioned in the first pages of this Bulletin. The straw was a little coarse which condition would have been obviated by sowing more seed.

From the latest information at our command we would conclude, that not less than two bushels per acre should be sown, and we are inclined to think that on the best grain lands of the Willamette valley, 2½ bushels will give better results than less.

Experiments will be carried on at the Station this season in growing flax from various amounts of seed per acre.

MANNER OF SOWING.

Broad-cast seeding is generally recommended. This may be done by hand or by using some kind of broad-cast seeder. The Thompson wheel-barrow seeder was used at the Station in 1892. The seed is usually sown by hand in the flax districts of Europe. Men go from farm to farm sowing flax seed during the planting season. In this country, where considerable grain is sown by hand, there would be little difficulty in procuring experts for the sowing of flax.

It is difficult to grow a uniform sample of flax for fiber, when the seed is sown in drills. Some of the stems will branch more or less on the sides of the drills. Weeds will grow more readily between the drills.

A light smoothing harrow is sufficient to cover the seed; but if the ground is not thoroughly pulverized a second harrowing may be applied. It is better, however, to fit the ground before seeding. This may be followed by the roller, if the season is well advanced so there will be no danger of heavy rain storms. The roller firms the earth about the seed, and thus hastens its germination. It is important that the plants should come up as evenly as possible; for, if they do not the crop will make an uneven growth, and thus the plants will not all mature at the same time.

TIME TO SOW.

The conditions of the season will largely govern the time of sowing. In the experiments of 1892, the seed was sown May 18th. This is about the time to plant corn in this locality. When the

ground is warm enough to germinate corn quickly, flax seed will germinate, and the young plants will make a rapid growth. Care must be taken in not sowing too late, and yet late enough to enable the farmer to thoroughly prepare the ground. It is better to wait a little later than to sow the seed on poorly prepared ground. By properly preparing the ground more moisture will be saved for the use of the plant, than if the ground is left in a cloddy condition. Seed sown in this climate on well prepared ground will reach maturity, making a good growth, without any rain-fall. This has been demonstrated by actual experiments. The moisture in the air will furnish a large supply to the growing plant, if the soil is in a condition so that it can be penetrated by the air. Under average climatic conditions we do not believe that it is safe to sow flax seed, throughout the Williamette valley, before the first of May.

HARVESTING THE CROP.

Flax should be pulled when the lower leaves turn yellow and the lower part of the stem begins to turn. Much valuable flax is ruined by letting it get too ripe. The yield of seed will not be quite so large, but the increase in value of fiber product, will more than make up for this loss.

There are machines for pulling flax, but the writer is not familiar with the results thus far attained. Some good authorities claim that the machines are a success. This is an important consideration where labor is dear.

The following extract is taken from Farmers' Bulletin No. 27, Department of Agriculture:

"As to the special mode of harvesting the crop, nearly every experimenter states that the straw was pulled. This is not the usual practice of the Western flax grower, who cultivates for seed, however, and it has been urged that it is absolutely essential, where the object is to produce both fiber and seed, or, to state it more precisely, when the object is to produce a common grade of fiber and at the same time save the seed. If the land surface is made very smooth so that the knives of the reaper may be set low, cutting by machine (rather than pulling) may answer. Several inches of the best portion of the stem will be lost and the square ends of the fiber will not work into the "sliver" as smoothly as pulled flax when the fiber is being manipulated in the first stages of manufacture. A flax-pulling machine is a desideratum, and for the past two or three years inventors have

attempted to work out the problem. The Department has knowledge of four inventions in this direction, one of which, the Lamar device, controlled by the Minnesota Flax Company, has already shown good results."

"After all has been said, pulling is essential to the production of fine fiber. If pulled by manual labor, the course is to draw the handful of straw out of the ground, and by striking the roots against the boot the earth is dislodged. The straw is then laid in handfuls, crossing each other, so as to be readily made into bundles. In Belgium the flax is pulled with great care, the ends being kept very even, and the straw laid in handfuls upon the ground, a line of straw being first laid down, which serves to bind these handfuls when a sufficient quantity has been pulled to tie. When put into stooks to dry, the seed ends being tied together, the bottom ends are opened out, giving to the stook the appearance of an A tent. After drying in the stook the handfuls of straw are then tied into small bunches, or "beets," and piled something as cord wood is piled in this country, two poles being first laid upon the ground to prevent injury to the bottom layer by dampness, and two poles driven at each end of the pile to keep the "hedges" in form."

The matter of handling the crop after it is grown is very important. A mistake in this work will change the outcome, very materially as far as quality of fiber is concerned. The following extracts are taken from a report made by Mr. Henry Wallace to the Department of Agriculture covering the flax industry of Ireland and Belgium. While these suggestions may not apply to the industry here, and undoubtedly many of them will not, they will serve as "guide posts" to those who start out in the work in an experimental way.

"A flax crop in Ireland is grown mostly at an elevation of from 250 feet above down to sea level, and the best flax is grown at an elevation but little above the level of the sea. The climate is moist, but a few days at most intervening between showers. The soil is by no means rich; in fact, is much inferior to most soil of the Northern and Western States. Few of the soils on which flax is grown so successfully will grow red clover, except as a rotation crop, and only at intervals of six or seven years. It is, besides, polluted with weeds to an extent that an American can scarcely comprehend, the weeds being mostly deep-rooted, and growing from detached pieces, which the moistness of the climate prevents being killed by cultivation by any kind of machine. The only known method of destroying these weeds is by careful hand pulling. Given a soil somewhat clayey and retentive of moisture, the absence of winter freezing and a moist climate, with frequent showers during the growing season, and we have the conditions which the flax grower must meet by the method of culture described below.

"In Ireland the seed of flax is rarely or never saved, and hence all the seed sown is imported from Riga, Russia, or from Holland, generally from Rotterdam. We find many farmers sowing Riga seed, while preference is generally given to the product of Riga seed sown one or two years in Hol-

land. This is called Dutch seed. By personal inquiry in Holland we find that the seed sown there is constantly renewed from Riga, few farmers venturing to sow their own seed longer than one year, so that Riga may be regarded as the source of all the seed sown in the linen-producing countries.

"As the object in Ireland is to produce fiber and not seed, flax is sown very thickly, averaging about 2 bushels per statute acre. By this thick sowing, the plant is pushed upward in a straight stem, with but one or two top branches, and attains a height of from 3 feet to 3 feet 9 inches. As the branch scutches off into tow and the universal practice of pulling the fraying off of the root end, this gives a length and staple of from 27 to 36 inches, an exceedingly important consideration in producing valuable fiber. To what extent the practice of sowing flax thinly to produce a seed crop tends to develop and transmit by the law of heredity the habit of low branching we have been unable to determine, as no flax is grown for seed in Ireland. In Holland it is grown for both seed and fiber, while it is grown mostly for seed in Russia, and it would therefore seem that the tendency to branch is governed by the same law that prevails among trees, thin planting developing a tendency to branch while thick planting compels an upright growth. Our observation among the flax growers of Belgium and Holland shows that when the climate and conditions are favorable it is possible to secure a moderate crop of fairly good seed, and at the same time a crop of good fiber. The finest fiber in the world is grown in Belgium, where the seed is also saved, although it must be stated that the seed grown in Belgium is quite inferior in quality, everything being sacrificed to the production of the choicest fiber.

"From observations continued over two months during the growing period, we are inclined to the belief that the most important of all the operations connected with flax growing is that of seeding. Weeds are especially pernicious to flax; they not only occupy space that should be occupied by the plant, but they interfere very seriously with pulling, causing more or less loss of staple in separating the flax from the weeds, and, we have reason to believe, not merely exhausting the fertility of the soil, but absolutely poison it.

* * * * We did not see in either Ireland, Holland or Belgium a single good flax crop where weeding had been neglected, nor did we see a poor one where the flax had been kept scrupulously clean and free from weeds. In growing flax, America will for many years have a great advantage over these countries in this, that the weeds that trouble the Western farmer are mostly annuals, which can be destroyed for the most part in a dry, hot climate by cultivation of the ground previous to sowing, while the soils of the Old World are polluted with many varieties of weeds which cannot be killed by a brief exposure to the low temperature of these climates."

Mr. Wallace's report contains the following remarks on flax growing in Belgium:

"The soil and the general principles of this district bear a striking resemblance to the prairie States of the West. The whole region is under the most complete and thorough system of cultivation, fences being used only to inclose permanent pastures and the tillable land being under a most complete system of rotation. Belgian soil gives an opportunity for a more varied rotation than in Ireland, growing, as it does, wheat, rye, oats, barley, sugar beets, clover, chickory, turnips, rape, and smaller crops. The principles followed in adopting a rotation for any particular farm are the same as those adopted by the Irish farmer, few farmers caring to sow flax on the same land oftener than once in eight years, and the greatest success being obtained when the crop is not more frequent than once in from fifteen to twenty years. The following is one of the favorite rotations: wheat, barley,

INTERNATIONAL EXHIBITION.

PHILADELPHIA, 1876.

The United States Centennial Commission has examined the report of the Judges, and accepted the following reasons, and decreed an award in conformity therewith.

Philadelphia, Dec 19th 1876.

REPORT ON AWARDS.

Product. Flax in Straw & Fibre

Name and address of Exhibitor. Parrish & Miller

Jefferson Marion Co Oregon

The undersigned, having examined the product herein described, respectfully recommends the same to the United States Centennial Commission for Award, for the following reasons, viz:

Extraordinary length, good in strength, superior gloss and silky softness

M Miller

Signature of the Judge.

APPROVAL OF GROUP JUDGES.

Charles Hazlehurst Jr.
B.B. Britton
J. Fritz
Coleman Sellers
Spencer F. Baird
Edward Cooley
James P. Kirkwood
H.K. Oliver
Henry H. Smith

A true Copy of the record. Francis A. Walker

Chief of the Bureau of Awards.

Given by authority of the United States Centennial Commission.

A. T. GOSHORN,
Director-General.

J. L. CAMPBELL,
Secretary.

J. R. HAWLEY,
President.

FACSIMILIE OF REPORT OF AWARD SHOWING REPORT OF JUDGES.

potatoes (with manure), wheat, clover, sugar beets, chickory, flax, in which rotation the flax comes but once in eight years. Others bring in flax after mangolds or sugar beets. Belgian farmers adopt practically the same policy adopted by the Irish farmer in regard to manure. They avoid the application of coarse rank manures, which would produce an uneven fiber, preferring land that has been kept in a higher state of fertility and not exhausted by previous crops, and when manure is applied it is done a month or more previous to sowing, in the shape of colza cake or liquid manure, which can be applied evenly and with due regard to each portion of the field.

"No pains are spared in the preparation of the soil. The Belgian farmer is practically a gardener, who wastes nothing and leaves no spot with its resources undeveloped; and to this end he uses whatever kind and amount of labor is necessary to attain the desired end. The greatest care is used in the selection of the seed, adopting practically the same methods as the Irish farmer.

* * * The rate of seed sown is about 7 bushels per hectare or 2½ bushels per acre. This is heavier than the Irish practice, but the Belgian farmer corrects any excess by removing the surplus plants at the first weeding.

"The weeding is regarded as one of the most important operations of the flax grower. When the flax is about 2 inches high it is gone over by the weeders, mostly women, often from ten to thirty in a field, their elbows touching each other, who remove with the greatest care every weed, however small. Two or three weeks afterwards the operation is repeated and at the end of this weeding the fields are absolutely clean. The wages paid weeders are from 14 to 25 cents per day.

"In this district flax is grown for both seed and fiber, and hence the plant is allowed to maintain greater maturity than in Ireland (where the pulling commences when the leaves begin to fall from the lower part of the stem), but is not allowed to attain that degree of maturity that fits the seed for sowing. Belgian seed is always a synonym for poor seed.

"The pulling is done with extreme care, the root ends being kept even, and the straw is cured by stooking the handfuls. After this it is tied up in "beets" or small bundles and then placed in what are called "hedges" or ricks of bundles with plenty of air spaces between, and finally stacked preparatory to retting in the river Lys, the sacred river of the Belgian flax grower. * * * *

"The yield of fiber in Belgium seldom exceeds 500 pounds per statute acre. This is not greatly different from the yield in Ireland when allowance is made for the wasting of fiber by the practice of retting in running water. In Holland, where both systems are followed, we found that retting in water with the slightest possible current led to a decrease in the quantity of fiber of about 15 per cent, while increasing the quality in about the same ratio."

While it will be impracticable to follow the methods practiced in Belgium in all the details, the general principles of careful, pains-taking work will apply here as elsewhere. In the matter of applying machinery, to many of the operations now performed by hand in the flax districts of Europe, the American will make long strides. The American laborer is loath to use his hands in any occupation where mechanical appliances can be made to perform the same kind of work, and many times in a more satisfactory manner. The machine for pulling flax referred to in another place in this Bulletin is an American invention, and

from the latest reports promises to become a complete success. Our implements for cultivating the soil and destroying weeds are far superior to those used in the Old World. On this account there will be less danger of the product being injured by weeds. We have not the cheap labor, which it is to be hoped we never will have, but the loss may be made good by other conditions equally remunerative.

YIELD PER ACRE.

From experiments in this state and elsewhere it is safe to place the yield of straw at 3 to 3½ tons per acre.

RETTING.

Retting is the process by which the woody portion of the stalk is separated from the fiber. This is done by inducing a certain stage of decomposition or fermentation. By this means the gum, which holds the fiber closely bound together with the woody portion of the stalk, is dissolved away and the fiber will separate freely from the worthless portion of the stem.

Dew retting is followed most generally in this country and and in Canada; but pond or river retting is the most common practice in the European flax districts. While the dew retting is slow and in it there is little danger of over retting, the majority of evidence is in favor of pond retting or a still more modern method, tank retting. By this latter method the operator may have a more complete control of temperature and other conditions of water, used in the retting process. Mr. Dodge in his reports on flax for fiber states that "rain, dew, sun and wind influence the rind in a high degree, and cause a loss of weight, fineness, and strength, and the result is a reduced quality and quantity of flax and an increased quantity of loss. The loss of weight from dew retting amounts to 30 or 40 per cent, while water retting causes a loss of 20 to 30 per cent."

Soft water is desirable for retting purposes. It should not contain any considerable amount of lime or iron and should be free from vegetable matter. From observations made in Oregon, west of the Cascade mountains, we are led to think that many of the mountain streams, which flow into the Willamette river, would furnish an excellent supply of water for retting purposes. The water taken from the Willamette river at this place is comparatively free from lime, and would not be called hard water.

The matter of double retting is becoming a very important consideration in flax countries. In a recent publication received from Mr. William M'Causland, Belfast, Ireland, this process is spoken of as follows :

"Having been informed by several gentlemen, conversant with Continental methods, that flax straw was often steeped two or three times in order to procure finer quality, in the year 1892, along with the new flax of that year, I resteeped a few beets of flax that had been watered in the customary way in 1891. Having had this small lot dried and scutched separately, I showed it to several competent judges, and they were astonished at its quality and fineness, no Irish flax equal to it having been seen for many years. This experiment confirmed my opinion that Irish flax, by rewatering could be improved in quality, and the extra trouble made to pay."

Undoubtedly the practice is based on sound principles. One thought suggested to the writer by Dr. Thornton is, that the flax fiber, when the straw remains in the water until completely retted, is injured and discolored by decomposition or fermentation, and by sunning and drying, the fiber is relieved from this danger. When again placed in the retting pools, the woody portion of the stem is attacked first by the fermentation, and is completely broken up before the fiber can be injured ; and in this way the fiber comes out of the steep without any discoloration or injury whatever. It is not our purpose to go into the details of retting flax or any of the operations which follow the harvesting of the straw. We believe it is the intention of those who contemplate entering into the industry to buy the straw direct from the farmer as per contract. The preparation of the straw for fiber will be carried on by the company that purchases the straw. We agree fully with Mr. Dodge in this particular and herewith give his views as published in Farmers' Bulletin No. 27 :

"While I have given above full instructions for retting the crop, this operation is not strictly the work of the farmer, for in this country the industry must be developed on the lines of a practice that will be essentially American. In this age everything is reduced to specialties so far as possible, cost of production being reduced by coöperation.

"This brings us to an important consideration which may be called one of the most urgent needs of the flax fiber industry in the United States. Something more is required to set the industry on its feet than for a body to undertake to grow the plant for fiber. There is a necessity for a class of skilled workers who will come between the farmer and manufacturer in carrying on the operations of retting and scutching. It is futile to expect the farmer to ret and scutch his flax. It is not done on the farm in foreign countries, nor in Canada, save, to a very limited extent, and it cannot be done here. It is done largely in Russia, and low-grade fiber requiring most careful sorting by the buyers is the result.

"As the case stands, the farmer is hardly in position to grow flax, save in an experimental way, until he is sure of a market, and the manufacturer, that is, the spinner, is not in a position to make offers of purchase or to

name a price, because he is not sure that the farmer can grow flax of the proper standard, or that he can afford to purchase at any price, for his particular manufacture, such flax as the farmer may produce.

"Does this mean a deadlock between grower and manufacturer, an insurmountable obstacle that will doom forever the American flax fiber industry? Not at all. It simply means that what isolated farmers can not accomplish alone must be accomplished by the establishment of little local industries. To borrow a foreign term, the future flax industry of the United States must be communial; that is to say, capital must establish scutch mills in localities where flax may be profitably grown, farmers of the neighborhood agreeing to produce 5, 10, or 20 acres of straw each, under the direction, if need be, of the managers of the mills, the growth of a quality of straw that will give the proper standard of fiber. This relieves the farmers from any responsibility in the matter further than to produce a proper crop of straw. The scutch mills or tow mills attend to the retting and cleaning of the fiber, which in turn is sold to the spinner.

* * * * The scutcher has a money interest in the matter of the production of properly grown straw by the farmer, and is in position to aid him by many hints and suggestions. In Canada and in Northern Michigan (in the neighborhood of Yale, where there are scutch mills) the practice is to sell the seed to the farmers, at the mills, at a fixed price per bushel, the farmers agreeing to sow a certain number of acres to flax, the straw of which the managers of the scutch mills agree to take at a fixed price per ton, in some cases $10 being named. And in no other way can an American flax fiber industry be established."

As a matter of information to those who are not familiar with the terms applied to the various processes through which the straw passes before it reaches the fiber stage the following explanations are given:

The seed is first removed by a process called "rippling." The seed bolls are combed off or the seed is thrashed out of the straw by passing it between rollers. This is now done by machinery.

"Breaking" and "scutching" refer to the process by which the fiber is separated from the woody portion of the stalk or "shive."

The plan as outlined by those who are interested in the development of the flax industry in this state is to establish a company whose object will be to contract with the farmers to grow the flax, and sell the straw direct to the company. This company will furnish capital sufficient to establish the scutching mills, and to supply seed to farmers who will not be required to pay for the same until the straw is delivered at the mill.

It is the plan of the Experiment Station to assist as far as possible in determining the possibilities of the industry by experiments in testing varieties of seed and various methods of culture.

I wish to acknowledge my appreciation of assistance rendered in furnishing information on this subject from the various sources mentioned in the text. Great credit is also due Prof. E. F. Pernot in the skill displayed in making the cuts which appear in the Bulletin considering the difficult objects from which the cuts were made.