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# The Culture and Manufacture of Flax for Fibre and Seed

With Special Reference to the Industry in Oregon

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Climatic Conditions and Advantages of Oregon

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Production, Demand, Freights, Markets,  
Prices, Profits, Expert Opinion, Conditions  
in Foreign Countries

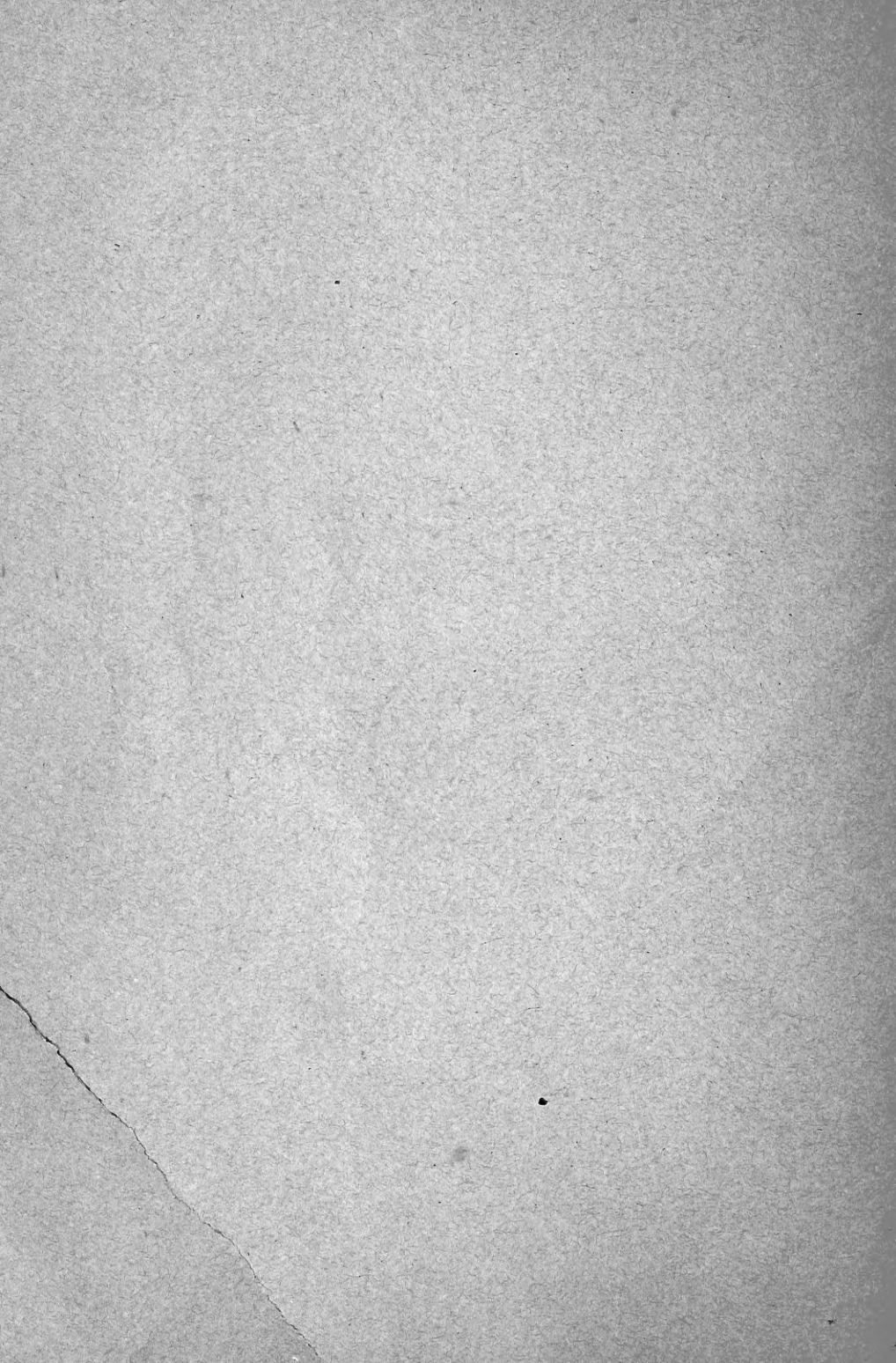


Issued by the

Department of Commercial and Industrial Service  
University of Oregon School of Commerce  
H. B. MILLER, Director

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Compiled by J. FREDERIC THORNE



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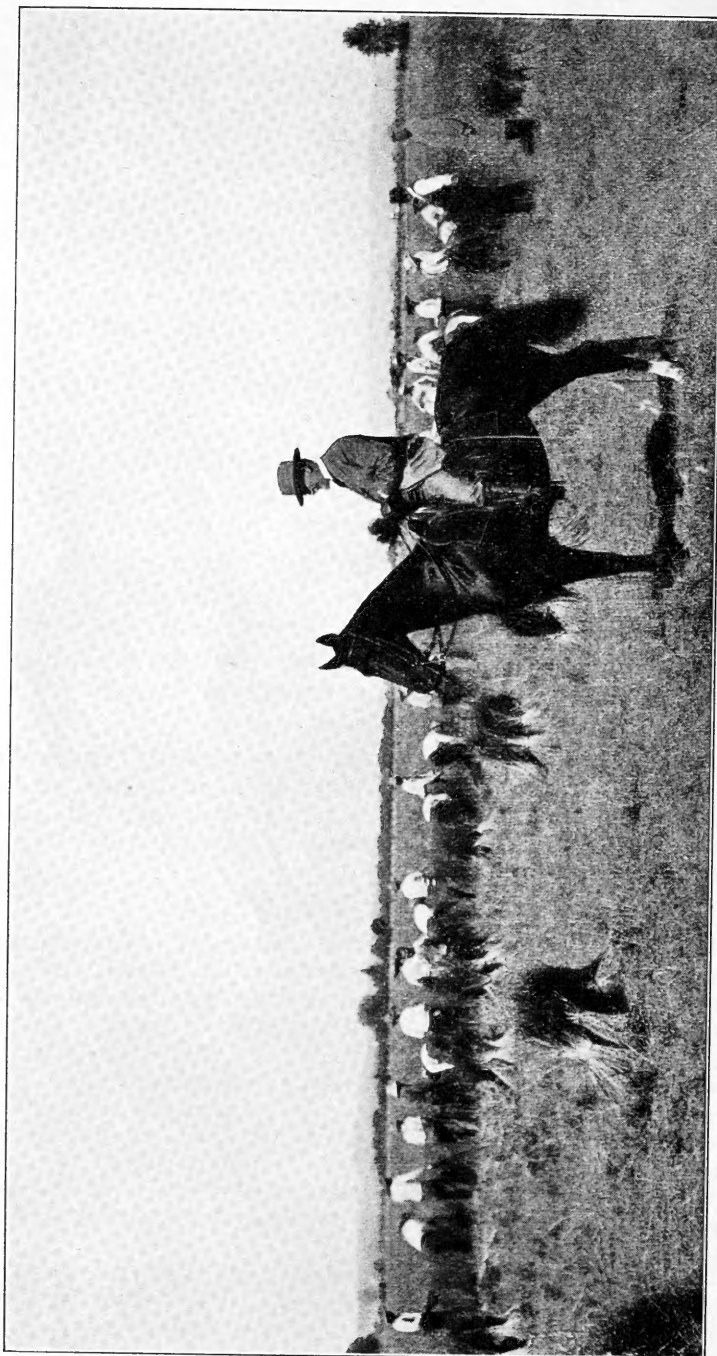
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HONORABLE JAMES D. WITCOMBE, GOVERNOR OF OREGON, INSPECTING FLAX FIELD NEAR SALEM, OREGON,  
STATE FLAX PROJECT

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JUL 13 1916

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The following world survey of and report on the culture and manufacture of flax with special reference to the establishment of the industry in Oregon, was made by the Department of Commercial and Industrial Service, School of Commerce, University of Oregon, at the special request and under the auspices of the flax committee of the Portland Chamber of Commerce and is published by the University of Oregon at the committee's request.

This committee consists of Dr. E. A. Pierce, chairman; William McMurray, passenger agent of the O.-W. R. & N. Ry.; William Lipman of Lipman, Wolfe & Company; and H. B. Miller, director of the School of Commerce, University of Oregon.

Acknowledgment is due and appreciation expressed to the United States Departments of State and of Commerce for the great and invaluable assistance rendered in collecting the material upon which a large part of this report is based.

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Copies of bulletins issued by the United States Department of Agriculture giving details of planting, growing and care of flax will be sent to those who are interested and who make application to the School of Commerce, University of Oregon.

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### EXPERIMENT BULLETINS

The School of Commerce of the University of Oregon has copies of the bulletins of the Department of Agriculture and Technical Instruction for Ireland, giving detailed reports of the experiments of the following varieties of seeds: Dutch, Riga, Dutch Child from Canada, Riga Child from France, Yorkshire seed, Pernau Crown, Rega Child from Ireland, Pernau Child from Michigan, United States, a strain seed, which though originally improved by selection for seed production purposes is thought would, owing to its remarkable evenness of growth, yield a satisfactory return of fibre. Small plots of Japanese, Siberian, Canadian Common, and Argentine seed were also experimented with.

Copies of experiments with fertilizers in different kinds of soil and the different varieties of seed by the Department of Agriculture of Ireland will also be provided on request.

### OREGON ADVANTAGES

Investigation demonstrates and the opinions of experts confirm the fact that Western Oregon, and especially the Willamette Valley, possesses natural advantages for growing and manufacturing flax equal to those of any other section of the world, even rivalling the famous Courtrai district of Belgium for flax culture, and having climatic conditions for manufacture as good as those of Ireland.

The three elements that comprise these advantages are soil, water and climate—not singly but in combination.

**Soil**—The Department of Agriculture says: "The soils on which fibre flax are to be planted should be of such nature that good drainage is afforded, as the plants will not endure severe inundation. At the same time the soil should have good water-retaining capacity. A gently sloping field having a loam soil with clay subsoil is suitable, provided it is in a good state of fertility and is free from weeds."

Western Oregon has thousands of acres of such soil and much of it has been passed upon by experts and declared to be as good as any in Belgium or other flax producing countries.

**Water**—The second element is water of the kind proper for the necessary retting of the flax. Eugene Bosse, the Belgian expert says: "Belgium has one river, the Lys, especially suitable for flax retting, while in Western Oregon every river is, practically, the equal of the Lys." Water for retting needs to be soft and free from mineralization.

**Climate**—The Department of Agriculture says: "Fibre flax can best be grown in regions where moderately cool, damp weather prevails during the summer. Sufficient moisture is needed to enable the plants to continue, without interruption, their growth during the period of elongation of the stems. And it is desirable that there should be little or no rainfall during the ripening period and harvesting time." (July 15 to August 15 in Oregon.)

A moist climate also is necessary for the best results in manufacturing. It is largely the climatic conditions that have made Irish manufactures of linen the finest in the world—and those conditions are the same as are found here. In fact even in Belfast it often is found advisable to add artificial moisture to the atmosphere of the manufacturing plants to get the desired results. Flax fibre or thread, woven in a dry climate, will be greatly inferior to exactly the same material woven under proper conditions of atmospheric moisture.

That Western Oregon meets all these conditions and has all these necessary elements is evident.

**Transportation**—Production without transportation is negation. Through her railroads and her outlet to the sea by way of Portland, Oregon has the facilities for reaching all the markets of the world.

**An Enormous Area**—Flax grows extremely well on new land and is one of the best crops for breaking sod and making it suitable for other crops. Thousands of acres of new land in Oregon are being brought into the market for cultivation by the operations of the logging industry and a large part of this enormous area is suitable for flax culture when cleared of stumps.

**In Conjunction with Dairying**—Dairying and the cultivation of flax operate to balance each other and make a combination that should be profitable. The clover and vetch crops that provide the fodder for cattle are the very crops that restore to the soil the nitrogen that is depleted by flax growing. The greatest demand upon the soil made by flax is for nitrogen—yet one crop of clover will restore as much of this element as is taken out by two crops of flax. The herds also supply the needed fertilizing material.

On the other hand, flax seed, hulls and straw all are good stock foods, the seed especially.

Western Oregon is especially adapted for both dairying and flax culture. Conditions become even more favorable when both are combined.

### **Some Expert Opinions on the Possibilities of Successful Flax Growing in Oregon**

A report of the United States Department of Agriculture states:

"Flax can be profitably grown in the Willamette Valley for the seed alone, and the indications are that the fibre production would be of no small moment. The natural fertility of the soil throughout a large portion of the valley would enable the farmer to grow the crop without the aid of commercial fertilizers. The Pacific Coast samples, submitted in comparison with the samples grown east of the Rocky Mountains, are remarkably fine, and if such straw can be produced economically we need not be troubled concerning future supplies of the fibre for the manufacture of fine linen. The Oregon samples are of such superb color that, if river retted to preserve the color, the fibre would resemble the flax of Courtrai. \* \* \* The samples were of good length, some of the straw quite coarse but well grown and cured and giving an abundance of clean, silky fibre of superb strength. Well prepared, it would make a superior fibre, fit for fine linen. This comes the nearest to the Courtrai straw, in appearance, of any examined from the United States, among the best and strongest received. \* \* \* There is far less percentage of woody matter, or shive, which breaks out readily when drawn through the fingers, leaving a clean ribbon, or filasse, that is soft, glossy and very strong. \* \* \* Oregon conditions are especially desirable for the growing of fine flax."

The United States Department of Agriculture, in a bulletin issued in 1897, stated that:

"A ton of flax grown in the Puget Sound region of Washington, under the direction of the Office of Fibre Investigation, was sent to a firm of famous flax manufacturers in Lisburn, Ireland, to be retted and scutched in order to determine the grade of the flax so produced. A very superior quality was produced, resembling that of the famous Courtrai region of Belgium. With the Irish report was received a large assortment of flax samples, the best fibre of which is valued at \$350 per ton; but out of the lot sent from Washington, fibre was hackled worth \$500 per ton. \* \* \* It is significant that represen-

tatives of Irish spinning mills have visited the Pacific Coast \* \* \* and speak in the most encouraging terms of the fitness of this region for the growth of fine flax. \* \* \* It is fully demonstrated that flax of the best quality can be grown in this country."

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Professor H. T. French, of the Oregon Agricultural Experiment Station, in Bulletin No. 43, stated:

"Some forty years ago there was a firm organized in the Willamette Valley for the purpose of manufacturing linen twine from the flax produced on the farms of the valley. The results were highly satisfactory as far as quality of product was concerned. The enterprise finally was abandoned owing to fire, bad management and spiteful competition. The exhibits of flax in its various stages of preparation, made by this firm at the Centennial Exposition in Philadelphia in 1876, won first prizes over all competitors, the other exhibits being from all the flax growing countries of Europe as well as from the other states of the Union. The samples of fibre and straw from Oregon were given first place by all the nine judges, each individual passing upon the samples separately and without knowledge of the action of the other judges.

"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. The crop will be ready to harvest from August 1 to 15. During this time there is no danger (in Oregon) of injurious rain storms. From all the 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."

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Dr. H. L. Deimel, president of the Deimel Linen-Mesh Company of New York, San Francisco, Detroit and Montreal, and one of the most thorough and practical flax experts in this country, with few equals in any part of the world, says:

"On July 17, 1915, I visited flax fields about Salem, Oregon, and was amazed at the general uniformity of the harvest. In the older flax-growing countries it has to be selected according to length, as it differs so materially. In the flax that was sent to me years ago the same uniform length was noted in the Oregon flax by my manager of the manufacturing plant, who insisted that the straw sent to us had been selected to give it that uniformity, and he refused to believe that it had not been selected and that it was only the general average. When proof was furnished that it was not selected and that it was but an average of the Oregon crop, the manager was astounded. I am familiar with the world's production and I am confident that Oregon can produce flax that can be made to equal the best in the world. The difficulty of producing a good quality of flax is the several changes in climatic conditions during the period of production. A severe dry spell during growing time produces a knotty condition of thread, due to a variation in the growth, similar to the variation in wool due to a change



in feeding. The even climate of Oregon makes possible a very fine quality. The uniformity of length and quality, as I observed it in this year's growth in the Salem fields, was quite a revelation to me and I think it will produce a thread ranging from numbers 50 to 100—or equal to the best Belgian. I had some underwear made from Oregon flax some twenty years ago, and the garments averaged to wear twice as long as those made from flax from other countries. My opinion is that Oregon needs especially to develop the science of production and to establish a reputation, because the value will depend upon a reputation for standard and uniform quality."

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Mr. J. C. Cady, who has had charge of the experimental work done by the State of Oregon in flax culture and manufacture, says:

"In my opinion both the soil and climate of Oregon are admirably adapted to the growing of flax of a high grade, and, also having the right kind of water, for the manufacture of the fibre. Oregon flax compares favorably with that grown anywhere in the world. We can grow just as fine flax in Oregon as they do in Belgium, Ireland, Russia or elsewhere."

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Mr. J. Sidney Starling, president and manager of the Flaxen Fibre-Down Co., of North Tonawanda, New York, in a letter dated February 17, 1916, says:

"The writer has been aware for some time past that the climatic conditions of Oregon are especially adapted to growing fibre flax. We have had quantities of flax straw shipped to our plant from every state where flax is grown and have carefully tested and tried out the various fibre-bearing qualities. The straw received from the states of Oregon and Washington produced a much larger quantity of good quality fibre than any produced elsewhere in other states. This is especially true with Oregon flax. Eastern grown flax does not grow nearly so well nor so thriftily as does Pacific Coast grown flax. Oregon fibre is much longer and stronger than we grow here, in addition to being of a much better color."

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(From the "Morning Register," Eugene, Oregon, March 2, 1916)

"Eugene Bosse, flax expert, spoke at considerable length of the possibilities of the crop.

"'Conditions in Oregon are ideal for the production of flax fibre of the highest grade,' said Mr. Bosse. 'Your soil, your climate and your water are all suitable for profitable production of this crop. It is not an experiment, and all that is necessary is to go into the enterprise with the determination to do it right. One of the advantages of flax is that it is a reliable crop. I know, for I have been in the business for fifty years and in that time I have seen but one crop failure. That was in 1864, and the cause was too much rain.

"**Oregon Water Suitable**—'Just to emphasize the excellence of conditions in the Willamette Valley for the growing of flax fibre, let me point out the water situation. In all of Europe there is but one river—

the river Lys, in Belgium—whose waters are wholly suitable for the retting of flax, but in the Willamette Valley all of your rivers are perfectly suited to this purpose.'

"Mr. Bosse explained that for retting flax soft water that has not been mineralized is a necessary requisite.

"An important detail in the growing of flax, he said, is proper preparation of the ground. It must be put in the best of condition, and a seed bed as nearly perfect as possible must be provided.

**"Eugene Complimented**—Dr. E. A. Pierce, chairman of the flax committee of the Portland Chamber of Commerce, told of the efforts that have been made to promote the growing of flax in the Willamette Valley, and complimented the Eugene Chamber on the promptness with which it took hold of the offer of cooperation from Portland.

"Hon. H. B. Miller, director of the University School of Commerce, told of the research into the flax industry that has been made by his department, and grew enthusiastic as he sketched the outlook for the future.

"I know," he said, "that Mr. Bosse is certain that the finest fibre in the world can be grown here, but even leaving that out of consideration the prospects for flax growers are bright. New uses for the cheaper grades of fiber are being continually found, and the market is widening rapidly as the product is being employed more extensively in the industries. The seed and the tow alone assure a profit.'

**"Present Outlook Good**—In response to an inquiry, Mr. Miller explained that the reason the flax outlook now is so much brighter than at any time in the 20 years in which efforts have been made to stimulate the industry in Oregon is because of changed conditions. The war has assured a market at high prices for several years to come, he said, and this will give time to get the business well established. Increasing uses for the cheaper grades of fibre are also a contributing factor.

"Frank C. Miles, flax expert of the Department of Agriculture and an authority on flax, said there is no doubt that fibre of the highest grade can be produced here.

**"Oregon Climate Right**—'Your climate,' said Mr. Miles, 'is peculiarly suited to the growing of fibre flax. You have plenty of moisture in the early stages of the crop and you have consistently dry weather at harvest time. These conditions are essential.'

"'Farmer' Smith, O.-W. R. & N. agriculturist, was introduced as a man who cannot talk on any topic without dragging in corn, and lived up to his reputation by asserting that the best way to prepare for a flax crop was by growing a crop of corn on the land. He urged flax growing as a means toward further diversification, declaring that diversified industry is the salvation of all farming communities.

"Professor G. H. Hyslop, of the Oregon Agricultural College, said that experiments conducted at the college have demonstrated conclusively that flax, even if grown for the seed alone, is a profitable crop. He went somewhat into detail as to proper methods of growing, laying particular stress upon rotation.

**"Proper Rotation Necessary**—'Flax,' said he, 'should not be grown for several consecutive years on the same land, and the best results are obtained by rotation systems bringing in a crop of flax about every

five or six years. This is due to soil diseases induced by flax rather than to soil exhaustion, for flax is no more exhausting to the soil than the average grain crop. Careful treating of the seed before planting is essential.'

"The interest of the railroads in the growing of flax and their readiness to lend all the assistance in their power were told by Wm. McMurray, general passenger agent of the O.-W. R. & N.; H. A. Hinshaw, general freight agent of the S. P. lines in Oregon, and D. C. Freeman, publicity agent of the Oregon-Electric."

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### A PROMISING INDUSTRY

(Editorial from "Morning Register," Eugene, Oregon, March 2, 1916)

"The effort to bring about the planting of several hundred acres of flax in the vicinity of Eugene this spring ought to be successful. The crop is not a risky one, for even if the fibre could not be sold at all the seed, at present prices, would yield a return equal to wheat or oats. Nor does the planting of flax require a heavy investment for new machinery, for the crop is put out and harvested almost exactly like the grain crops that are now grown here. Therefore, the experiment does not mean the learning of new farming methods or the employment of a new class of labor.

"Exhaustive investigation has established the fact that Western Oregon is better adapted to the growing of a high grade flax fibre than any other section of the United States, and competent experts do not hesitate to assert that fibre can be produced here that will equal the best grown in Belgium and Northern France—which, up to the present time, have been the sources of the best fibre in the world. Soil, water and climate combine here for the production of a high quality of fibre.

"The growing of flax is not new to many of the people who will be asked to put out an experimental crop this spring. Many Oregon farmers have grown flax here, and many who have come to Oregon from the Middle West are quite familiar with it, for flax is an important crop in many of the states of the Mississippi Valley. There is an essential difference, however, in the experiment that is proposed here and the way in which flax has hitherto been grown in this country, for the production of fibre is to be an important object.

"While flax is grown extensively in the Middle West, the seed is the only product of much value there, for the climatic and soil conditions are not right for the production of high-grade fibre. In Western Oregon, however, these conditions are right, and there seems to be little doubt that fibre from which the finest of linen can be made may be produced here.

"The present time is peculiarly fortuitous for such an experiment. Hitherto Belgium and Northern France have been the great sources of supply for fine flax fibre, and it is there that the great Irish mills have secured the principal part of their raw material. But Belgium and Northern France are now in ruins. The fertile and carefully tended farms where flax fibre was produced have been fought over, back and forth, until their power to produce crops has been materially lessened.

Many of the people have been killed and the rest have been driven from their homes. Even if the war should end within a short time, it will be years before these sections are brought back to full productive capacity.

"Meanwhile flax fibre of good quality must be secured from somewhere if the manufacture of linen is to continue. It has been definitely proved that Western Oregon can produce fibre of the best and there is no reason why the growing of flax should not become an important industry here. The Willamette Valley greatly needs new and profitable crops, and there ought to be no hesitation about trying the experiment that is proposed. There is nothing to lose, for the seed alone will equal ordinary hay and grain crops, and there is much to gain by the establishment of a new and profitable industry."

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### THE EUGENE CHAMBER OF COMMERCE FLAX PROJECT

(By S. Dike Hooper, Secretary Eugene Chamber of Commerce)

"Early in 1916 the Portland Chamber of Commerce, through its flax committee, offered the services of a Belgian flax expert, who has made a life study of fibre flax, to any chamber of commerce in the valley which would guarantee to arrange for the seeding, harvesting and manufacture of fibre on a sufficiently large scale to test the crop thoroughly. The Eugene Chamber of Commerce has accepted this proposal, and entered into reciprocal relations with the Portland Chamber on a cooperative basis, looking toward the scientific conduct of a thorough experiment.

"Many of the more experienced farmers of the Willamette Valley have successfully raised flax for seed purposes in years gone by, and the fibre movement has met with a very cordial reception. The sowing of 200 acres has been definitely arranged, and the erection of a fibre mill to care for this product is assured. The 'water retting' process will be employed exclusively, conclusive tests having demonstrated the fitness of the Willamette Valley waters for this purpose.

"All lands offered for flax culture were carefully examined by the expert in charge, and a great many tracts were rejected principally on the grounds of foulness, weeds, improper preparation the preceding. In the selection of lands the expert has given preference to small tracts of varying soil characteristics so that the tests may be as comprehensive as possible. The theory is that a few acres will receive better preparation, more attention during the growing season, and be more easily harvested at the right time than a large tract. Another important consideration is that small individual plantings will afford an opportunity to a larger proportion of the farmers who wish to conduct the experiment than any other arrangement.

"The amount of money estimated as necessary to carry the plans to a successful conclusion is \$12,000, which will be advanced as needed by the Eugene Chamber of Commerce. This sum will cover everything excepting the expert's salary, which has been assumed by the Portland Chamber of Commerce. The plan under which the flax is being planted is, in brief, as follows: The Eugene Chamber furnishes

at cost the highest grade fibre flax seed for which payment may be made after the crop is harvested. The soil is then prepared under the direction of the expert, who will keep in close touch with the crop during the growing period and dictate the time and manner of harvesting. The growers will deliver the straw at the plant, where due credit will be given each grower, based on the tonnage delivered. The proceeds from the sale of seed, fibre and tow will be disbursed in the following manner: First, the growers will receive \$7.50 per acre to partly cover the cost of seed, preparation of land, labor, etc. Beyond this point the net proceeds will be divided equally between the chamber of commerce and growers until the chamber recovers the sum advanced for flax purposes. The balance of the receipts will go to the growers.

"This experiment is of especial interest as an illustration of the growing recognition by both business men and the farmers of the partnership which must always exist between persons in whatever field of endeavor who draw their support from the same community. The fundamental principles of cooperation involved are broad and progressive and the outcome will be observed with great interest by representatives of commercial and agricultural interests in all parts of the country.

"April 27, 1916."

(Since the above was written the 200 acres near Eugene have been planted to flax under Mr. Bosse's supervision, the building for the mill rented and the machinery shipped from Salem to Eugene. By the time this bulletin is issued this machinery will be installed ready for use, and the retting tanks built. At this date, June 1, the crop is making a very excellent showing. The Eugene Chamber of Commerce recently has elected George Quayle as secretary of the Chamber and manager of the flax industry in Eugene.)

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#### **EXTRACT FROM ANNUAL REPORT OF PRESIDENT COLT, OF PORTLAND CHAMBER OF COMMERCE**

"A fair share of the credit for developing high grade flax fibre possibilities in the Willamette Valley belongs to a sub-committee of the Trade and Commerce Bureau known as the 'Flax Development Committee,' of which Dr. E. A. Pierce is the chairman. This committee is really a joint committee operating with the Oregon Development Bureau. The work of this committee is entitled to special mention because of the evident importance and profitable opportunity for the Willamette Valley and possibly one or two other parts of Western Oregon. For many years we have contended that high grade fibre flax could be grown in Western Oregon.

"To prove conclusively that the farmer of average ability can grow fibre flax at a profit, our flax committee, representing the chamber of commerce has entered into an arrangement with the Eugene Chamber of Commerce. As a result, about two hundred acres of flax will be planted under the directions of the best man available for supervision of such work. By the terms of this agreement, the Eugene people agree to provide necessary funds for establishing a retting plant equipped with the necessary tanks and machinery. It is estimated that it will be necessary to raise approximately \$5,000 in Eugene. This chamber of commerce has agreed to furnish \$1,000 for the purpose of paying the salary of the flax expert for a period of ten months.

"If it is proven by this experiment, or demonstration, that the farmer of average ability can grow high grade fibre at a profit, it is more than likely, in fact it is certain, that thousands of acres will be planted the following year. This is bound to result in the establishment of flax spinning and linen industries either in Portland or the Willamette Valley.

"Conditions are such in Europe as will cause linen manufacturers of Ireland and elsewhere, and flax growers of Belgium to come to Oregon if the raw material can be produced here. While there is a possibility that the result of the year's experiment at Eugene will not be all that is hoped for, those who have given the matter the closest study are confident that the results will be all that is anticipated and that linen manufacturing industries will, within a very few years, be located in this vicinity.

"In this connection, it is cited that flax fibre from Russia could easily be brought to the manufacturing industries located in Portland."

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### THE OREGON STATE FLAX PROJECT

(Statement by Governor James D. Withycombe)

"For the purpose of providing employment for the inmates of the Oregon State Penitentiary the 1915 Legislature appropriated the sum of \$50,000, part to be used in establishing and maintaining a flax plant at the penitentiary in which prison labor might be utilized. About \$35,000 of this appropriation was expended for the establishment of the flax industry, \$10,000 of which was invested in the plant and the balance for the purchasing of flax straw, etc.

"The State purchased 500 bushels of Riga seed, grown in Michigan, and 150 bushels of seed imported from Riga, Russia. This seed was sold to farmers at \$2.50 per bushel. The crop from the seed was pulled by convict labor and purchased by the State at \$15.00 per ton, delivered at the penitentiary. Six hundred thirty-seven bushels of seed were sown on 357 acres of land and yielded 468 tons of straw and 2,235 bushels of seed. The maximum production per acre was four tons, running down as low as one ton per acre.

"Results of last season can scarcely be considered as a fair average on account of the fact that the movement was started rather late in the season with the consequence that the farmers had already sown the most of their best land to other crops and much of the flax was sown on rather poorly prepared land, unsuitable for the crop. Farmers should have no difficulty under good cultural methods in producing at least two tons of straw per acre.

"Sufficient data as yet are unavailable as to the total production of fibre from the straw produced from last year's crop. However, from present indications it will yield approximately 46 tons of fibre divided about equally between hackled flax and No. 1 and No. 2 tow.

"There is no question as to the very high quality of flax produced in Western Oregon, but there are numerous problems yet to be worked out, including labor, systems for retting and disposal of product.

The State has established an excellent plant, employing, when operated to its full capacity, one hundred men. This plant is capable of handling 2,000 tons of straw annually and it is anticipated that about 1,200 tons will be produced in the vicinity of the penitentiary this season."

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#### OBSERVATIONS BY DR. H. L. DEIMEL

As regards the production and manufacture of flax fibre, Dr. H. L. Deimel, president of the Deimel Linen-Mesh Company, of New York, San Francisco, Detroit and Montreal, unquestionably is one of the most thorough, practical experts in this country, with few equals in any part of the world. The Deimel Company has factories at Duren, Rhenish Prussia, near the Belgian border and close to Aix-la-Chapelle, and in England, under the name of the Deimel Fabric Company, at Stoke-Newington, for weaving and garment making. Dr. Deimel is the owner of all the stock of both the English and the German companies, and he is, therefore, as much interested, practically, in the cultivation of flax and a knowledge of the locations where the best fibre can be obtained and the methods of its production, as in its manufacture.

Dr. Deimel's knowledge is founded upon observation and experience, and he states that some fifteen years ago he procured from the Oregon Flax Fibre Association a lot of prepared flax which was sent to his associates in Duren, Germany, for spinning into as high a lea of yarn as the quality might justify. This proved to be No. 50 warp, which, while not a very high number, yet requires a fibre of superior evenness and good strength. Continuing, he said: "I used this yarn in the manufacture of my No. 50 linen cloth. Suits of this I sent to a number of my friends, some of them in Oregon, besides giving some of the garments a personal test. They gave uniform satisfaction, especially so from a wearing point of view, showing that the flax had not been overspun. I had requested that an average quality of flax should be shipped, but in conversation with Mr. Louis Buckless, of Duren, who had attended the spinning, I was told that the flax was of such uniform length that it could not have possibly grown that way, but must have been specially selected. This was strongly contradicted by Mr. Bosse, who made the shipment, and I am of the opinion, that, if Mr. Buckless could have inspected with me, this summer, the fields of flax around Salem, he would have withdrawn his statement. Personally I never saw a field of flax of such uniform height.

"There is a general deterioration in the quality of flax produced in all European countries—a gradual lowering of quality. Because of this, Oregon flax will have a long period of being the best quality—if quality is established and carefully maintained. Belgian flax is superior to all others in elasticity and strength for spinning.

"Constant opening up of new land in Oregon will give the best kind of land for flax for many years to come, while land in other countries is deteriorating.

"There has been a very heavy increase in the market price of flax during the past seven years, as may be seen in the following comparative statement of the selling prices per ton of four different qualities of flax fibre, after having been retted and scutched:

	<i>Livonian K.</i>	<i>Pernan D.</i>	<i>Courtrai</i>	<i>Irish</i>
1908 .....	£20 10s	£24 10s	£ 60 to 70	£45 to 60
1909 .....	23	26 5	70 to 78	60 to 70
1911 .....	26	29 10	90 to 110	85 to 105
1915 .....	60	68	*150 to 190	90 to 135

£ equals about \$4.80.

"Oregon flax probably would range between Irish and Courtrai—the latter being the best. That is, it would, provided, of course, that proper processes of culture and manufacturing were used.

"Courtrai flax is the best in the world at present. But the product is best when the Courtrai is taken to Belfast to manufacture into thread. All the best thread and yarn is made from flax grown and retted in Belgium and spun in Belfast. The climatic conditions in Belfast together with concentration of skilled labor, is the reason for its superiority, as certain humidity in the atmosphere is necessary for proper spinning of the yarn. While they have introduced the moist spray in factories producing yarn and use it even in Belfast, the humidity of the natural atmosphere still is a very important factor. Indeed this is a very important factor.

"The flax I buy is grown, retted and scutched in Belgium, spun into yarn and thread in Belfast and manufactured into underwear in Belgium, Germany, England, Canada and the United States.

"Russian flax is not equal to Belgian. It is strong but not fine. Austrians produce in their linen the finest damask, from the artistic point of view. They have more art instinct than Ireland. Therefore Irish linens are not equal to Austrian, artistically considered. But Austrian flax is not equal to Irish in its durability.

"The flax produced in Europe now ranges in number from Nos. 15 to 250, but 80 per cent of all flax used is between 15 and 50, for spinning. There is hardly any use for common purposes above No. 100. The Pope's robe is made out of No. 250 and cost \$5.00 per yard. I use from Nos. 50 to 80, mixed with fine Egyptian cotton. The purpose of mixture is to give more elasticity to the thread.

"The usual normal price paid for the straw is from 20 to 26 pounds sterling (\$96.80 to \$125.84) per ton for Russian, and 55 to 60 pounds (\$266.20 to \$290.40) for the Belgian; Irish from 40 to 45 pounds (\$193.00 to \$217.80)."

Dr. Deimel stated that he purchases annually at present for all his companies' products in all countries about \$800,000 worth of raw material in the shape of flax yarns, and he sells only in Great Britain, France, Canada and the United States; that portion of his products which went, heretofore, to Germany, was exported from England. The output of his factories in recent years has been limited, not, however, by the demand, but by his ability to get a proper supply of those qualities of material needed at reasonable prices, and by "reasonable" he said he meant as compared with values up to ten or twelve years ago.

\* This is the price quoted in Rotterdam.



Quoting prices, the doctor said: "If the average price per bundle of 60,000 yards of yarn has been 5s 7½d (\$1.35), I now pay 9s 1½d (\$2.19); that is, for what may be called superior linen warp. The manufacture of thread costs me \$2.50 per 88 pounds of yarn, including all spooling, etc., and labor. Of this, the direct labor cost would be about \$2.25. There is less than 1 per cent of waste.

"In Germany, the girls who make thread are paid 75 cents to 90 cents per day, while in small places in Germany the women get 45 cents a day as against 65 cents in Duren, which is a high wage district. In Ireland, the girls get 40 cents to 50 cents per day. Men textile workers receive 75 cents to \$1.15 in Germany. In the United States, female help is one-third higher than in England and 40 to 50 per cent higher than on the Continent, while male help in the United States is fully 100 per cent higher than on the Continent and 50 to 75 per cent higher than in England. I make it a rule to employ only natives of the country—Englishmen in England, Germans in Germany, and Americans in the United States. I manufacture thread, weave underwear, towels, corset covers, bandages, supporters, etc. I have not bought any straw or fibre, but contemplate doing so. My associates own spinning mills in Germany and employ about 2,200 flax spinners. Most of the flax that I use comes from the Courtrai district of Belgium.

"For retting and scutching, Belgian labor is the most efficient, because of development of the community spirit and home industrial life. The best work, which produces the best results comes from Belgium—better than the same class of work done in Ireland. Spinning labor is all that the United States must import; other classes of labor can be developed with American labor. For beginning, Belgians would have to be used for other processes, until labor here learned how.

"The flax industry in Russia is largely in the Baltic provinces, and the production and manufacture is a home industry; i. e., in the homes of the people. The principle of the whole operation is the labor problem.

"In Oregon, the labor will be a serious problem, in both production and manufacture; not merely wages but also settled conditions of production and manufacture. The special skill required has to come as the product of continuous effort in the district. It must be part of the community life—must be a 'flax atmosphere.'

"Artificial drying of straw is as good as the sun, as far as fibre goes. Flax does not need curing, like hay; wetting does not hurt, but it must be dry to be put through the breaker. Our retting is done by the farmer. We buy rough fibre, after retting and scutching. Some of the flax people of Ireland are considering seriously doing the retting and scutching for themselves at a central plant. Retting is very important, as, if it is carried too far, the fibre is attacked and weakened. Artificial inoculation of water for retting is all right.

"In Belgium, there is a tendency to concentrate the retting process along the river Lys. Oregon district should have a central point for retting, so as to give the product uniformity."

Dr. Deimel stated, further, that provided the production of good fibre is an assured and stable fact, he, together with his friends, would seriously consider the establishment in Oregon of a spinning, bleaching

and weaving plant, consuming a minimum of 2,000 tons of fibre a year (the product of 3,000 to 4,000 acres) and employing about 1,500 or 1,600 people.

The doctor added: "I have been thinking very seriously that I would put up a flax manufacturing plant in Oregon. Not to rett or scutch but to buy the fibre and manufacture it into various things.

"This would include a spinning plant of 12,000 spindles, requiring 500 horsepower, and would use about seven tons of fibre per day, employing about 1,600 people. Such a plant probably would cost, including building, machinery, power plant and lands: Building, \$100,000; machinery, \$150,000; power plant, \$50,000; total, \$300,000. Also, \$40,000 for a bleaching plant; \$250,000 for weaving plant of 600 looms; \$75,000 for building to house employes; \$35,000 for land."

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### EARLY EFFORTS OF WOMEN TO ESTABLISH THE FLAX INDUSTRY IN OREGON

(By Mrs. Wm. P. Lord, Salem, Oregon)

"In accordance with the request of the compilers of the Flax Bulletin, I will give a brief history of the work of the women of Oregon in their efforts to establish a flax industry. The first one to introduce flax to Oregon was Mrs. Owens, who planted seed at Clatsop, making fibre and strong twine, establishing an 'entente cordial' with the Indians, who gladly bartered fish and game for the twine, and also protected herself and family. Mr. Miller, a Kentucky farmer, located at Turner, with fine public spirit, sent products of Oregon soil in 1876 to the first great exposition, 'The Centennial,' capturing the first prize (requiring nine points of superiority). This came as a surprise to foreign manufacturers, one of whom, Mr. Barbour, of Ireland, at once sent two experts to Oregon to grow flax, and make fibre for his mill in Belfast. This flax straw, grown under supervision, was scutched at the penitentiary by convict labor. Mr. Barbour, in letters to the expert, which were read by the farmers, some of whom are still living, expressed his satisfaction with the fibre, some of which, he claimed was the highest grade ever spun in his mill. The fibre, especially noted, was grown on the red land, at Waldo Hills. When the second season's fibre was ready for shipment, it was destroyed by a fire of unknown origin, and the work was discontinued.

"For the fifteen years following, flax was grown for the seed only, straw, the valuable part, being burnt to get rid of it. Mr. Morton, Secretary of Agriculture in the Cleveland administration, knowing these facts, urged Oregon to diversify wheat with flax. A fibre bureau was particularly active, with Mr. Dodge as chief, and the aid of this bureau was offered to establish the industry.

"This suggestion, coming at a time of great depression, involving every class, especially the farmer who was facing the difficulty of meeting taxes, with wheat at 45 cents a bushel, was welcomed by my husband, then Governor of the State, as a solution of a very serious problem. To the writer was delegated the task of securing information,

and getting in touch with the fibre bureau. When compiled, facts were presented first at a called meeting of the Portland Manufacturers Association. Invaluable aid was rendered by Mr. Paul Wessinger, whose thorough knowledge of the linen industries of Europe, with which he had been associated, resulted in an indorsement by the association. The Women's Club of Portland named a working committee, which lost no time in forming "The Oregon Women's Flax Association." Mr. Henry W. Corbett, Mr. Henry Failing and Mrs. Weinhard headed a subscription list for stock. Had it not been for the most generous sums contributed by these citizens, who were always alert to help any enterprise which promised benefit to their beloved State, this work could not have been carried on. Not only money, but business advice, and valuable time was freely given to aid the women in this undertaking. The merchants of Portland did all in their power to support the project, as well as the citizens generally.

"Seed was planted, machinery for a scutching mill installed, and the women of the association divided the work of supervision. Four years of work followed, which was largely experimental, finding out how European conditions could be met in an entirely different environment. The Irish method, tried the first year, was discarded as unsatisfactory. The second year the Belgian method was tried. The fibre bureau sent to Belgium and secured the services of the inventor of the best method of retting the straw, and paid all the expenses of the experiment, except the lumber used in building the tanks, which was done by convict labor, on the creek at the penitentiary. The straw was ready for retting in July, was made into fibre, sent to Belgium, and returned to the association in the shape of choice linen, before January. Fibre from this handling was entered at the Paris Exposition in 1900 by Mr. Dodge, of the fibre bureau, and took the bronze medal, Mr. Dodge protesting that the Oregon product was not rated high enough. Mills in Europe were even at that time short on flax fibre, and orders came pouring in for which our limited means was a barrier to respond. Had a company been formed at that time, taking over our stock, with the advantage of all the experiments of four years of gratuitous work and well formulated plans, today we would be 'pointing with pride' to our great linen industries. The eastern mills had no use for home-grown fibre, especially so from a state to which they were selling millions annually of the products of flax fibre, in the shape of seine twine, and bag sewing twine. Never did the association receive a line of recognition to samples sent, or were we able to dispose of one pound of fibre in our own country for making into linen or twine. And here was the anomaly—Europe almost demanding our fibre, and our own country refusing it. Under these conditions, the association was obliged to suspend operations, but not until it had made known to every linen manufacturing country of Europe, that Oregon is the true home of the finest flax grown. To the ladies of this association is due the honor of introducing the culture of flax successfully in Oregon. The list: Mrs. Lord, first president of the association; Mrs. O. N. Denny, Mrs. Card, Mrs. Pittock, Mrs. Stearns, Mrs. Burrell, Mrs. Ben Selling, Mrs. Tilton, all of Portland; Mrs. Wallace and Mrs. Gilbert, of Salem."

## Soil Preparation, Planting, Harvesting, Crop Rotation

### A WRONG IMPRESSION

The more or less prevalent idea that flax is "hard on the land" is a mistake. It is not.

This mistaken belief arose from the practice of farmers, who grew the crop for the seed only, of persisting in growing it year after year on the same ground. As a result the ground became impregnated with flax-wilt or some other flax diseases that caused poor crops. The farmer was to blame—not the flax.

**With certain soils flax is absolutely beneficial. There is no other crop which will so thoroughly and quickly break up new land.**

The United States Department of Agriculture is authority for the statement that many common crops remove more fertility from the soil than does flax:

"A corn crop removes one-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 a flax crop. Compared with wheat, flax removes less phosphoric acid and potash per acre, and about one-half more nitrogen. Potatoes remove about the same amount of phosphoric acid, about one-third less nitrogen, and nearly three times more potash per acre than the average flax crop. In flax growing the heaviest draft falls upon the nitrogen, but one fair crop of clover will more than return all the nitrogen removed in two crops of flax."

**Rotate your crops.**

Indiscriminate planting of flax should not be practiced, but suitable soil carefully selected and the planting done only by those thoroughly familiar with the crop or under the supervision of some one who has had experience. This applies especially to flax that is grown for the fibre and cannot be too strongly emphasized. The same necessity for knowledge and correct methods applies to the preparation of the fibre after the crop is harvested. In marketing the product, there should be a definite organization serving the growers so that the business may be handled with skill, economy and to the profit of all concerned.

If flax is grown for the seed alone, less care is required and the soil need not be so carefully selected and prepared. But even in this branch of the industry experience, knowledge and ability will make their clear showing on the right side of the ledger.

Indiscriminate and inexperienced attempts at flax culture and manufacture unquestionably would result in failure.

(In addition to the bulletins of the United States Department of Agriculture that will be sent upon request to supplement this bulletin, the following suggestions are given as applying more particularly and specifically to Oregon conditions.)

(By Professor H. T. French, of the Oregon Agricultural Experiment Station, Corvallis, Oregon)

"Soil intended for flax growing should be plowed as deep as possible the preceding fall or winter and cross-plowed again to a depth of 5 or 6 inches. If possible, subsoiling should be practiced. The surface of the soil should be thoroughly pulverized before seeding. It is safe to roll only late in the season after the time when heavy rains may occur.

"Weeds must not be permitted in the flax field.

"The following crop rotation is presented as one of the best adapted to Western Oregon: (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 and in the order given is to clean the ground of weeds. By placing such crops immediately preceding the flax this object will be better obtained than when they occur earlier in the course.

"Manure which is intended to benefit the flax crop should be applied preceding the flax, unless some commercial fertilizer is used. It should be thoroughly incorporated with the soil before the flax seed is sown. Commercial fertilizers are used quite extensively in the flax districts of Europe.

"From all the sources of information it is safe to conclude that the flax crop has been charged with greater power of exhausting the soil than it 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. One fair crop of clover will more than return all the nitrogen removed in two crops of flax, and in flax growing the heaviest draft falls on nitrogen.

"From the information at our command we would conclude that not less than two bushels of seed to the acre should be sown, and we are inclined to think that two and one-half bushels to the acre will give better results. When flax is sown for seed alone, three-quarters of a bushel per acre is enough.

"Broadcast seeding is generally recommended. A light smoothing harrow is sufficient to cover the seed, but if the ground is not thoroughly pulverized a second harrowing may be needed. This may be followed by the roller, which hastens germination. It is important that the plants should come up as evenly as possible, or they will not all mature at the same time. Under average climatic conditions we do not believe that it is safe to sow flax seed in the Willamette Valley before the first of May.

"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 obtained, and some of these are losing their prestige on account of no longer being able to produce the most desirable results. The conditions of soil and climate during the period of growth and extending through the preparation of the fibre have a marked influence upon the quality of the product.

"The fibre from which linen fabric finally is wrought is a delicate vegetable organism which is easily ruined by bad management or unfavorable conditions. It is not expected that the farmer will go further than to raise the straw. From this stage on the work can better be handled by the manufacturer, or in plants established for the purpose of preparing the fibre for manufacturing."

(By Eugene Bosse, a Belgian flax expert with over fifty years' experience in the flax industry)

"The question often has come to my mind why Oregon—which is a second Belgium as to climate, soft water and proper land for the production of fine flax—has not gone into the flax industry on an extensive scale.

"Many efforts have been made during the past fifteen years or more to push and develop the industry. Some of these efforts failed on account of insufficient knowledge of both growing and manufacture; others by lack of sufficient capital, accidents and other outside causes; and still others because the old European system of harvesting and caring for the crop was followed or attempted. The American is not willing to pull the flax by hand and do all the tedious hand work that is done in Europe by boys, girls, men and women for wages of twenty to sixty cents for ten hours' work. If the industry is to be successful in this country other methods must be found and followed. They have been found, and they can be followed successfully by anyone who is careful to work according to instructions.

"As a matter of fact, the growing of flax is extremely easy, simple and feasible, and it requires little, if any, more work than other crops and pays very much better on the average.

"**Preparing the Land**—The land intended for flax should be selected in the fall and should be clean land, rich enough to make a good crop of wheat; well drained; not too sandy. Whenever possible the preceding crop should have been one requiring cultivation, such as corn or potatoes; clover, hay or pasture, or grain are good rotating crops for flax land. The field should be plowed six to eight inches deep in November or December and allowed to rest until dry in March. It then should be cultivated twice, deep and crossways; allowed to rest another two weeks, when it should be harrowed deep and crossways, and then left until ready to seed, the first part of April. The land must be well refined before seeding. It is very important to keep flax as free as possible from weeds. These preparations and precautions always should be observed if success is to be attained.

"**Seeding**—If the crop is to be grown for seed alone, three-quarters of a bushel per acre is sufficient. But growing flax for fibre is a very much more profitable crop and for this there should be sown 90 to 100 pounds of good, clean foreign seed to the acre. In normal times, Belgian, Dutch or Russian seed can be had for about \$3.00 a bushel in the New York or Boston markets. This seed is good for three sowings—that is, the original sowing and the seed from the two succeeding crops. After the third crop new seed should be secured.

"The seed may be drilled or broadcasted, the latter probably being the better for fibre flax. The seed should be covered evenly to a depth of one to one and one-half inches, and, when the land is dry, rolled.

"**Reaping**—In the harvesting of flax there is no difference in the quality of that pulled and that which is cut. The only difference in these two methods is that there is a loss by cutting in the quantity, but this is so slight—from one-fifteenth to one-twentieth—that it is more than offset by the added cost of pulling. If the ground is properly prepared and level this loss amounts to very little, since there is a



EUGENE BOSSE, FLAX EXPERT OF FIFTY YEARS EXPERIENCE IN BELGIUM AND UNITED STATES, IN CHARGE OF WORK FOR EUGENE CHAMBER OF COMMERCE

Mr. Eugene Bosse, the Belgian flax expert who has had fifty years of experience in the culture and manufacture of flax, says:

"Oregon has the proper soil, the climate and the water—the three essentials for flax growing, and all that is needed, if they are made use of as they should be. We can grow just as good flax in Oregon as in the famous Courtrai district of Belgium, or any other place in the world, if we go at it right."

knot in the flax stalk, about one inch above the ground, below which there is no fibre at all. It takes a man five days to pull one acre of flax, while at least six acres can be cut in a day with a team, and with two men following to clean up when it is first grade flax cut with a dropping machine.

"When the flax is sufficiently dry it is raked and put into small shocks to get dry enough to be threshed. It then may be sent to the nearest mill, either loose or baled, to be threshed, retted, scutched and manufactured or shipped.

"**Retting**—Water retting—either river or tank—is very much better than dew retting. Water-retted flax is of a very much better color—a clear golden—while dew-retted flax is very apt to be discolored and inferior. As a rule water-retted flax is worth about fifty per cent more than dew-retted.

"**Grades**—Flax is, as a rule, divided into three grades. The first grade of flax must be clean, not less than 28 inches long, with the bolls off, cut straight and even, bound and shocked. Of this there should be from two to two and three-quarters tons of straw to the acre, which will bring \$20 to \$30 per ton.

"The second grade is tolerably clean, less than 28 and more than 15 inches long. May be cut with a mower and drawn outside of the next row. In two days, when dried, it may be raked like hay, and when dry enough threshed with an ordinary thresher with the concave teeth taken off and replaced by hard wood pieces, which saves cutting the straw. This straw may be spread on the ground with a manure spreader about two or three inches thick and when retted and dry raked up like hay and brought to the mill.

"The third grade may be generalized as waste. This should amount to only a very small percentage of the crop, grown in poor spots or damaged. It should be dealt with same as grade two, and will bring about \$10 per ton for bagging, upholstery tow, etc.

"Don't grow flax on poorly drained land.

"Don't grow flax on white clay.

"Don't grow flax on sour or sad land.

"Don't grow flax on muck of any kind.

"Don't grow flax on land dirty with weeds.

"A good crop of flax cannot be produced on a poor, wet, sour, weedy, dirty or half pulverized soil any more than can a good wheat crop."



### Costs, Production, Markets, Prices, Profits, Etc.

(In the following it will be noted that there is some variation in costs, production, prices and profits per acre, but this is natural since no two pieces of ground and no two men will yield exactly the same results. As much depends upon the man as upon the ground.)

The Department of Agriculture says (applicable to the present condition in Oregon for the culture of fibre flax):

"As the case stands, the farmer is hardly in a 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 or will 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. This simply means that what isolated farmers cannot accomplish alone must be accomplished by the establishment of little local industries. 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, to insure the growth of a quality of straw that will give the proper standard of fibre. It means that 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. By such cooperative arrangement the farmer



FLAX FIELD NEAR SALEM, OREGON—STATE PROJECT

is relieved from any responsibility in the matter, further than to produce a proper crop of straw. One good scutch mill will produce the flax grown on a score or more of farms.

"Local conditions will, in a measure, affect and give direction to the forms of culture and methods of handling the product. And in time, when experiment shall have determined which is the best practice for a given section, it will be followed, naturally, and a standard form of flax for this section will be the result, which will be recognized by the flax-buyers, and which will take its legitimate position among commercial products.

"The scutch or tow mills attend to the retting and cleaning of the fibre, which in turn is sold to the spinner. One good scutching mill will prepare the flax grown on a score or more of farms, and as the work is accomplished under one direction, or head, the product will be far more even, as to standards, than would be possible were it prepared by twenty men.

"Let him put in only a few acres of flax seed (say three or four acres) for fibre, at first, regarding it wholly as an experiment. When he has gained knowledge, and the different wheels in the flax industry have been put in position, and are beginning to move, he will know something then of the demand for flax fibre, and he can extend flax culture accordingly.

"Our farmers must know the difference between poorly grown and prepared flax, which is worthless for any purpose, and the grade of flax which a little better practice will give them, and which will be salable for some purpose. This information can not be obtained by them through the medium of the published literature of the subject, alone. Object lessons, in many instances, will be necessary, with opportunity to ask questions and examine and handle the well-grown product.

"Appreciating the situation, Canada already is looking forward to a time when they will be able to find in Europe a considerable market for Canadian-grown flax. We are not even growing what coarse flax we require to supply our flax-twine mills.

"The farmer has little incentive to grow flax until a market is assured, and a market can only be assured when scutch mills have been established to take the product off his hands when grown, and put it into a marketable condition. There should be good scutch mills in every flax-growing locality. With the establishment of these mills in considerable numbers, the farmer will be ready to raise flax for fibre, the manufacturers will avail themselves of the home supply, and the industry will be placed on a substantial footing. Small beginnings have been made, but there is a field for a larger enterprise in this direction, in which capital must lend a helping hand.

"The importance of re-establishing the flax-fibre industry in the United States will be fully appreciated by a perusal of the tables of imports of flax fibre and its manufacture in recent years. There is food for thought in the statement that these imports amount to over sixteen million dollars, in a single year, nearly two millions of this value representing raw flax fibre.

"Flax is now cultivated in the West by hundreds of thousands of acres for its seed only; but successful experiments have demonstrated the adaptability of our lands and climate to the growth of as good flax as may be demanded for any kind of linen."

In an experiment by a skilled flax grower of Wisconsin, a profit of \$229 was shown on a six-acre tract, and \$60 of this sum was received for seed, at \$1.00 a bushel. The expenses per acre, including retting and scutching (the latter costing \$20 an acre), amounted to a little more than \$39 an acre. The flax produced was worth eleven cents per pound.

The Portland Linseed Oil Works, of Portland, Oregon, will furnish seed at market prices to growers and contract with them for their entire crops. They are at present (March, 1916) guaranteeing a minimum price of \$1.25 per bushel when harvested, and are taking the matter up with their eastern connections with a view to increasing this guarantee to, say \$1.40 per bushel. This guarantee, of course, is for the purpose of affording a prospective grower absolute protection to the extent of the guarantee, so that in case anything unexpected should happen to the flaxseed market, they will pay the minimum price that they guarantee, even though the ruling market price is much less at the time the crop is harvested and ready for market. The present market price, however, is \$2.40, with every prospect of a continued rise in price, so this minimum guarantee will not cut much figure under present conditions. The Portland Linseed Oil Works paid last year as high as 2.10½ per bushel. The following table shows the prices of flax seed on the dates named:

June 1, 1914.....	\$1.60 ½
August 1, 1914.....	1.68 ½
October 1, 1914.....	1.38
January 1, 1915.....	1.60 ¼
January 1, 1916.....	2.17 ¾
February 14, 1916.....	2.33 ½
March, 1916 .....	2.40

The Portland Linseed Oil Works are at present drawing their supply of seed from the territory west of Havre, in Montana. Large quantities also are brought from Manchuria, China.

The present high price is due to shortage of crop in the United States and inability to obtain the seed from foreign countries, linseed oil being regarded as a contraband of war. Excessive increase in freight rates also discourage the importation of seed. In 1910, freight rates on flaxseed from Buenos Aires, Argentina, to New York, was 15½ cents per bushel; it is now 60 cents per bushel. There is also a tariff of 20 cents per bushel on flaxseed. This company is now importing considerable seed from Manchuria; they have 900 tons on the way at the present time. They have some samples of fibre flax seed from China, which is of very poor quality, and represents the kind of flax used in the linen industry of China.

Mr. Eugene Bosse made the following showing as the result of his cultivation of six acres of flax at Green Bay, Wisconsin. Mr. Bosse retted and scutched the flax on his own ground, and shipped it direct to the manufacturers:

Sowed nine bushels Belgian seed, at \$1.50 per bushel.....	\$ 13.50
Pulling by hand .....	32.59
Binding and sheltering .....	5.00
Threshing by hand .....	20.65
Retting on the ground.....	19.40
Scutching .....	120.83
Shipping .....	10.00
Freight to Boston, about .....	30.00
	\$251.97
Cost per acre .....	\$ 42.00
Product:	
60 bushels seed, valued at \$1.00.....	\$ 60.00
600 pounds tow, 2 cents per pound.....	12.00
3,718 pounds fibre, at 11 cents per pound, as offered by manufacturers, Ross, Turner & Co., of Boston .....	408.98
	\$480.98
Net profit .....	\$229.01
Net profit per acre .....	\$ 38.17

(Note that in the above cost estimate most of the labor was done by hand, an addition to the total cost which would be largely obviated by reaping and threshing by machinery.)

While a grower who disposes of his crop in the form of straw receives much less for his product than the man who rets his straw and turns it into fibre, it should be borne in mind that the grower in the first instance relieves himself of considerable extra labor and expense—and oftentimes the possibility of failure—which would largely offset the advantage of the better prices he might receive for his crop in the form of fibre.

Mr. Bosse states that it is possible to produce from two to two and three-quarter tons of first grade fibre straw per acre in Oregon, and that this fibre straw, exclusive of the seed, will bring a price of \$20 to \$30 per ton. (This, of course, is before it is retted, scutched, or in any way treated, and represents its value after it has simply been cut and dried, and the seed bolls removed.) Mr. Bosse also states that good foreign seed may be purchased in Boston at \$3.00 per bushel.

The cost of planting, cultivating, harvesting and hauling one acre of ordinary seed flax is shown as ranging from \$10 to \$12. Allowing for the increased cost of fibre flax seed and the extra expense of cultivating and handling a crop of fibre flax, a fair approximate cost per acre would be \$20.

Assuming that two tons of fibre straw are produced, also twenty bushels of seed, the result would be:

20 bushels seed, at \$3.00 .....	60.00
2 tons fibre straw, at say \$25.00 .....	\$50.00
	\$110.00
Cost .....	20.00
Profit per acre .....	\$ 90.00

Portland Linseed Oil Works state that they paid \$2.00 for the seed grown by the State at Salem. This price was based on the amount of oil contained in the seed.

The following statement by Mr. Bosse shows the profit to be made in the work of retting, scutching, etc. Mr. Bosse has already stated

that first grade fibre straw will sell for \$20 to \$30 per ton, after being cut and before being subjected to retting, scutching or any other process of preparation for market.

Assuming that man who prepares the fibre for market pays the grower \$20 per ton for his straw, the following figures show the result of his work:

2,000 pounds flax straw, cost per ton.....	\$20.00
1,500 pounds after being threshed, cost of threshing.....	2.00
1,050 pounds after retting, costing of retting.....	8.00
241 pounds *fibre at cost of 5 cents per pound to scutch.....	12.05
Extra expense .....	2.00
<b>Total cost of 241 pounds fibre.....</b>	<b>\$44.05</b>
Credit by four bushels seed .....	6.00
<b>Net cost .....</b>	<b>\$38.05</b>
(Or 15.79 cents per pound.)	

The fibre will bring 23 cents per pound at Belfast, at prices prevailing before the war.

Emil J. Hanset, flax expert, of Salem, Oregon, says that there is better flax land in the Willamette Valley than in any part of Belgium, and from land of this character two and one-half to three tons of fibre straw should be produced per acre. It is called straight or tangled flax, according to the way it is harvested and handled. The straight fibre means considerably more labor but is worth \$200 to \$300 per ton, while the tangled (harvested like hay) is worth only \$100 to \$160 per ton.

Mr. Hanset gives the following figures on the cost and return for the planting of one acre of flax:

**COST AND RETURN FOR FLAXSEED ALONE**  
(Based on breaking raw land with power plow)

Plowing, two discings, two harrow, sowing with drill or broadcast, and then rolling, per acre.....	\$ 4.00
Seed, one bushel at, per acre .....	1.75
Hauling seed eight miles, per acre .....	.25
Rental value of land, or interest on investment, per acre.....	3.00
Cutting and raking, per acre .....	.75
Stacking, per acre .....	1.00
Threshing, at 10 cents per bushel, per acre.....	1.50
<b>Total cost, per acre .....</b>	<b>\$12.25</b>
Estimate of fifteen bushels to the acre sell for \$1.40 per bushel.....	\$21.00
Less cost, per acre .....	12.25
<b>Net profit, per acre .....</b>	<b>\$ 8.75</b>

Add to the foregoing \$10 per acre for the ton of straw—f. o. b. factory:

**TO MANUFACTURE STRAW FROM SEED FIBRE**  
(Estimate one ton of tow from two acres)

Baling, per ton of tow .....	\$ 2.00
Hauling and freight, per ton .....	1.00
Manufacturing cost, per ton .....	15.00
Loading, per ton .....	.50
<b>Total .....</b>	<b>\$18.50</b>

\* It will be seen that one ton, or 2,000 pounds of flax straw will produce 241 pounds of finished fibre.

Tow is worth \$60 per ton f. o. b. Eugene, which shows profit of \$41.50, or \$20.75 per acre. This added to profit from seed shows \$29.50 net profit per acre.

Mr. Hanset further states that twenty-five to thirty-five million dollars worth of flax fibre is used annually in the United States, for nets, twines, etc., alone, not including any woven goods.

Flax fibre has been sold for as high as \$1,500 a ton by Mr. Lopens, of Belgium. He used a system of retting by running water, in imitation of river action.

The following figures are given as an illustration of the approximate cost and possible profit to be derived from the cultivation of one acre of flax grown for seed. Two sets of figures are given, one based upon a yield of fifteen bushels to the acre, the other upon a yield of twenty bushels to the acre. The possible profits are also shown, based upon two prices, \$2.00 and \$2.40 per bushel:

#### PROFIT IN GROWING FLAX SEED

Cost per acre on production of fifteen bushels and twenty bushels.

	<i>15 Bushels</i>	<i>20 Bushels</i>
Plowing .....	\$ 3.00	\$ 3.00
Seed (one and three-quarter bushels to acre) .....	4.10	4.10
Drilling .....	.50	.50
Harrowing .....	.50	.50
Sacks (or can be rented for 1c per bushel).....	1.50	2.00
Cutting .....	.50	.50
Threshing .....	1.20	1.60
Hauling to thresher .....	.50	.50
Loading on cars .....	.30	.40
Freight to Portland .....	1.50	2.00
Total cost per acre, f. o. b. Portland.....	<u>\$13.60</u>	<u>\$15.10</u>

If sold at \$2.00 per bushel, the profit per acre would be:

15 bushels at \$2.00 .....	\$30.00
Cost .....	13.60
Profit per acre .....	<u>\$16.40</u>
20 bushels at \$2.00 .....	\$40.00
Cost .....	15.10
Profit per acre .....	<u>\$24.90</u>

If sold at \$2.40 per bushel, the profit per acre would be:

15 bushels at \$2.40 .....	\$36.00
Cost .....	13.60
Profit per acre .....	<u>\$22.40</u>
20 bushels at \$2.40 .....	\$48.00
Cost .....	15.10
Profit per acre .....	<u>\$32.90</u>

There should also be at least one and one-half tons of straw per acre, which, if in the vicinity of a tow mill, could be sold for from \$2.50 to \$3.50 per ton, loose, for manufacture into packing material for crockery, glassware, etc., and into upholstery tow.

These prices refer to the very lowest grade of straw. The tow commands a much higher price, from \$16 up.

The flax committee of the Eugene Chamber of Commerce made the following approximate estimate of the probable costs and returns to the farmer from flax culture, selling the straw to the scutching mill without retting or other treatment, but simply as it comes from the fields:

COST TO FARMER PER ACRE

Plowing .....	\$ 2.00
Harrowing .....	2.00
Seed, at \$2.00 per bushel.....	4.00
Planting .....	.50
Cutting .....	1.00
Hauling .....	4.00
Total.....	<u>\$13.50</u>

RECEIPTS PER ACRE

Seed, 10 bushels, at \$2.00.....	\$20.00
Straw, 2 tons, at \$15.00.....	30.00
Total.....	<u>\$50.00</u>
Expense .....	13.50
Net return.....	<u>\$36.50</u>

While some of the items in the above may vary in individual instances it is safe to say that the net return is a conservative estimate of what may be expected under present conditions and prices.



DEMONSTRATION OF METHOD OF PULLING FLAX—STATE PROJECT, SALEM, OREGON

Golden flax seed grown at Brownsville, Oregon, yielded sixteen bushels to an acre, after cleaning, and produced 22 pounds of oil per bushel. The average yield of oil is between eighteen and one-half and nineteen pounds.

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The American Thread Company is prepared to use fibre to the extent of 2,000,000 acres annually.

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The yield per acre in North Dakota is from nine to fourteen bushels per acre. A North Dakota farmer considers that if he raises nine bushels per acre and receives \$1.00 per bushel, he is making money.

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A flax crop in Oregon, grown as a combination of seed and tow, can be made a very profitable one.

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The fibre obtained from seed flax is known as tow, and is used for upholstery stuffing, crockery and glassware packing, etc., and is worth \$60 or more per ton.



HARVESTING FLAX NEAR SALEM, OREGON—STATE PROJECT



**THE DEMAND FOR FLAX**

(From the Eugene "Register," March 17, 1916)

"Eastern linen factories have enough flax on hand to last them until May, and after that the buyers do not know where they are going to procure any more flax unless some change takes place in the present state of international trade conditions with the belligerent countries, according to Professor Lawrence S. Mayo, of Harvard University, whose father is treasurer of one of the large linen factories in Massachusetts, the center of the linen manufacturing district in this country:

" 'Now and for some time past it has been difficult for the linen factories to get flax and the question has been keeping them on edge for some time,' said Professor Mayo. 'Since the supply from Belgium was cut short, a trade with Russia was started. Then England began holding up the shipments and taking charge of them for her own manufacture. It has been necessary for the linen manufactories to get in touch with their congressmen at Washington, who then see Secretary Lansing, who secures England's permission to let a shipment of flax through to this country. It is becoming almost impossible to receive any shipments at all. Shortly after the war began all flax trade with Belgium, the main source, was shut off.

" 'England desires the flax for aeroplane manufacture, as linen aeroplane wings are said to be the best. It is understood that she is manufacturing many of them for war use.' "

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(Extract from Great Falls Daily Tribune, March 19, 1916)

"The Northern Flax Fiber Company, with its plant at Conrad, Montana, has invested for development work for the construction of its mill for perfecting its processes and for other purposes up to this time about \$90,000. It has full confidence in its processes as well as in the excellence of the territory adjacent to its mill for the production of a high grade of flax.

"A small acreage of flax was raised last year, and the company now has on hand sufficient straw to make about 125 tons of line and tow. One carload of flax consisting of 16 tons has been shipped to Belfast, Ireland, to the York Street Flax Spinning Company. The officials of the local company have been notified by this company that efforts are being made through the government to provide vessel room for prompt shipment of more flax as soon as it is ready, and the local company has been urged to have all the flax raised that can be raised this year, because of the extraordinary demand for it on account of the war and the good prices prevailing.

"The company has men now obtaining contracts for flax this year, and expects to have from 3,000 to 4,000 acres grown. This acreage will produce all the flax that can be handled by the company in its single mill.

"The company pays \$15 a ton for the flax unthreshed. Farmers raise from two to three and one-half tons to the acre, though under experimental conditions the yields in the state have been much higher. The company makes no claim, however, that the farmer inexperienced

in the production of this crop will raise more than the tonnage stated, though it is believed that the production will be gradually increased as the farmers become more familiar with the crop.

"The company, in addition to guaranteeing to take all the flax grown by the farmer at \$15 per ton, guarantees to each farmer who follows directions in the handling and irrigating of the crop a revenue of \$15 an acre. The company also takes a hail insurance of \$15 an acre on each acre of flax planted for it and turns it over to the farmer without expense.

"Last year only three farmers failed to grow sufficient flax to yield them an income of \$15 an acre, and the company was required to pay out because of its guarantee only \$24.85. One farmer had a revenue of \$39.22 an acre from his crop; another \$27.67 and another \$25.88. The majority of the farmers growing flax last year got a revenue from the land cultivated of \$20 an acre or more.

"The company has experts in the production of flax to instruct the farmers about every detail of the work from the preparation of the seed bed to the harvesting of the crop. The company also furnishes the seed, charging the growers the market price for it.

"The special advantage which the local company claims over other companies, and particularly over the companies producing the same class of fibre it produces, is the secret process for retting the flax. Under the old system of dew retting it required from five to eight weeks to get the flax straw in proper condition to take the fibre from them, while under the system employed by the Northern Company the straw is prepared for stripping in about three days.

"Flax requires about the same cultivation as wheat or other grain, so that the farmer can produce a large acreage at small expense. It demands but little from the soil, leaving the land after a crop is grown but little different in productive elements as when the crop was planted. A table prepared by Professor Snyder of the Montana state college shows that flax takes less from the soil than any crop grown extensively in this territory. Comparisons are made with wheat, barley, oats, peas and potatoes and flax is last on the list in the amount of the elements of fertility taken from the soil."

### FREIGHT RATES

(By J. H. Lothrop, Secretary Traffic and Transportation Bureau,  
Portland Chamber of Commerce)

"The present freight rates from Portland to New York are as follows:

COMMODITY	Rail Per 100 lbs.		Rail Per 100 lbs.	
	LCL	CL	LCL	CL
Fibre, flax, compressed in bales, 24 M minimum.....	\$3.20	\$1.00	\$ .80	\$ .45
Flax seed in packages, 30 M minimum.....	1.50	1.25	.90	.60
Flax, straw, unthreshed, in packages, 24 M minimum.....	2.25	1.52	.80	.45
Flax, tow, in packages, 22 M minimum.....	3.20	2.25	1.00	1.00

"It is difficult to guess what rates may be expected to be in effect under normal conditions via the Panama Canal. Generally speaking, the present rates by water as shown above average closely to rates on other articles upon which the competition has been keen. Further reductions would depend upon the volume of traffic and the competition for business.

"For a rate from New York to Belfast, we are advised that at present steamship lines will not quote through rates to Belfast, Ireland. The present rate to Liverpool is 79 cents per cubic foot, which would mean about \$1.00 per cubic foot from New York to Belfast. At normal times the rate from New York to Belfast via Liverpool would be 22 cents to 25 cents per cubic foot."

### FEEDING VALUE OF FLAX STRAW

The North Dakota Agricultural Experiment Station states that thoroughly ripened flax straw has but slight feeding value. When, however, the straw is cut green, it is the consensus of opinion that the feeding value is high. Some who have fed large herds of stock place it almost as high in forage value as alfalfa or clover hay. This is probably exaggerating its value but existing data indicates that the average flax straw, when properly used, is a valuable asset for feeding stock. It is important that the stock should be well salted and have free access to a good water supply and that the straw should be fed in association with other types of roughage.

Many farmers have cut green flax and used it as hay without injury when it is properly sun-cured. Numerous others have turned their stock into flax stubble and unharvested flax with good results.

The conclusion seems to be that flax straw is a valuable forage, quite nutritious and beneficial, particularly to cattle—not harmful if fed with reasonable care.

### Extracts from Letters

(Showing Market Conditions in the United States)

**United States Department of Agriculture, Bureau of Plant Industry**  
—"The term flax tow is commonly used to designate several different products from flax plants. In the upholstering trade it means the fibre roughly prepared from seed flax, or from coarse fibre flax, to be used in upholstering furniture, car seats, automobile cushions, etc. In the spinning trade it means the short fibre combed out in the various processes of preparing the long fibre for spinning, and by the flax-fibre producers it usually means either the scutching tow, which is the fibre beaten off in scutching the long fibre, or the hackled tow, which is combed out in hackling the fibre after it has been scutched.

"Upholstering tow is produced most extensively as a kind of by-product at the insulating fibre mills at St. Paul and Winona, Minnesota. It is made at these large mills from seed-flax straw which is found to be not suitable for the preparation of a better grade of fibre, to be used in

insulating board. Upholstering tow is also produced by several small mills scattered throughout the seed-flax growing region of Minnesota and the Dakotas.

"Most of the upholstering tow is prepared from straw that has been grown primarily for seed production and has been threshed by ordinary grain threshing machines. It is run through a series of fluted rollers, usually followed by a shaking or beating device, but no attempt is made to beat out all of the shives. A ton of straw will produce from 1,200 to 1,600 pounds of upholstering tow. This material commands a price of \$30 to \$40 per ton, delivered at the factories where it is to be used.

"Small quantities of tow prepared in the same manner, only run through the machine three or more times to beat out more of the shives, are now being used by large paper mills in New England States in the manufacture of counter boards for heels and box toes of shoes.

"The normal prices of fibre for spinning purposes range from 7 to 12 cents per pound for the tow, and 15 to 20 cents per pound for the line fibre. At the present time these prices are nearly doubled, owing to the difficulty of securing the usual supplies from Russia and Belgium.

"The principal markets for spinning flax in this country are in New England, New York and New Jersey. The largest mills are at Paterson, New Jersey; Andover, Fall River, Webster, Millbury, and North Grafton, Massachusetts; and Auburn, Greenwich, and Schaghticoke, New York. There are about twenty flax spinning mills in this country. The only company on the Pacific Coast using flax fibre is the Oakland Cotton Mills, Oakland, California.

"Flax fibre is not quoted in any of the markets in this country, and so far as I am aware quotations can only be obtained by direct correspondence with the producers."

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**Will Lipman, of Lipman, Wolfe & Co., Portland, Ore., June 3, 1916—**

"Reports of the development of flax around Eugene have reached the East and inquiries from the largest Scotch, English, and Irish linen houses have been made through their representatives.

"I don't believe the people realize the magnitude of the undertaking you are fostering and developing in your city. I do not believe the people comprehend what this is going to mean to our State. The income from flax will amount to more than the combined products of wheat, wool, fish, and lumber, and should give employment to 100,000 skilled workmen, to say nothing of the people employed in the manufacture of the by-products of flax, such as mattress fillings, refrigerator linings and dozens of other articles.

"If the people were only alive to the importance of the raising of flax you would have no trouble in raising \$50,000.00 instead of \$5,000.00. There is no question in my mind that with the demonstration that Oregon can raise flax as fine as any in the world, that Eugene has before her a remarkable future, indeed it may become the center of an industry unequalled in importance in any other city in the United States. Wishing you every success that your organization so richly deserves."

**Hemp and Flax Hose, No. 20896**—An American consular officer in Norway writes that a firm in his district desires to be placed in touch with American manufacturers of hemp and flax hose. It is stated that the firm is willing to either buy the hose on its own account or act as agent on a commission basis. Samples, with quotations f. o. b. New York, should be sent. Correspondence may be in English.

**Geo. R. Hyslop, Associate Professor of Crop Production, Oregon Agricultural College, April 29, 1916**—"In reply to yours of April 27, and in keeping with a promise made some time ago, and also another letter from Mr. J. Frederic Thorne, I am giving you the following summary of work which we have accomplished with flax:

"In 1915, we had some thirty-one different lots of seed flax from all parts of the world which were grown in plots to determine their ability to produce flax seed. In addition to this, we had some twenty-eight small lots which were given a trial in the nursery. These small lots included both fibre and seed flax. Yields of flax as a seed crop amounted to, in several cases, nearly fourteen bushels per acre of re-cleaned flax of excellent quality. Our best results were secured with various varieties with various selections from North Dakota, 155. We also had six different plantings of flax for fibre purposes in small plots which yielded from 1,460 pounds to 2,880 pounds of flax straw, after the seed had been removed by stripping.

"Our work for this year will involve experiments with cultural methods, rate of seeding, variety testing and the trying out of a large number of selections which have been made on the college farm and some 200 fibre selections made by the Office of Fibre Investigations."

**Cable Flax Mills, Schaghticoke, N. Y.**—"We use flax for making thread only. Good rough flax as it comes from the scutching mill is worth, at present, 20 to 25 cents per pound, delivered at a twine factory. This is at least twice the normal price of the last few years. Will be pleased to have samples."

**Eugene Bosse**—"Manila and Yucatan fibres used annually in United States for binder twine amount to \$30,000,000. This raw material costs 6 to 7 cents per pound in New York. We could furnish good tow cheaper than that, which would make better twine, after the fine grade fibre has been sorted out."

**V. R. Blehdon, Buffalo, N. Y.**—"Freight on tow from Eastern North Dakota to New York is \$10. Makes three grades of tow: Medium, at \$18 per ton; extra medium, or No. 2 fine, at \$24 per ton; fine, at \$28 per ton, f. o. b. mill.

"Most of the tow is used in the East by parlor furniture manufacturers; for two or three years back, however, it has been used for lining railroad refrigerator cars, after being boiled, chemically prepared and making it solid under very powerful presses. After this is done, the walls, bottom and ceilings of cars may be lined with this preparation. Has been trying to buy and ship flax straw from Montana to his mills but it was impossible on account of exorbitant freight rates."

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**James Thompson Co., Valley Falls, N. Y.**—"Flax fibre in this country has been confined to the making of twine and thread. Have paid, under normal conditions, 10 to 15 cents per pound for good quality in the rough."

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**Union Fibre Company, Winona, Minn.**—"We manufacture principally insulating products, pipe-coverings, etc. We draw straw each fall from Southern Minnesota and Eastern South Dakota from distances up to about three hundred miles, and freight rates up to 15 cents per cwt., or \$3.00 per ton. For several years past we have been able to fill our average annual requirements of 7,500 to 10,000 tons at an average of \$7.25 to \$7.50 per ton, delivered Winona, but on account of the cutting off of import fibres by the European war, flax tow is in somewhat better demand this year, and consequently flax straw has increased until the average price this season is about \$8.50 per ton, delivered Winona.

"Flax straw, after being passed through the usual size of tow brake, made up of about sixteen pairs of rolls, suffers about 50 per cent shrinkage in weight, on account of the inside pith or shive being broken away, and the resultant product is called coarse flax tow, or upholstering tow. A second run through a single tow brake, or a single run through a double brake such as we have, makes medium tow, and a third or even a fourth run, manufactures fine tow, from which practically all of the shive and woody particles have been taken, leaving almost clean fibre. A fair estimate of present prices on these three grades of tow, f. o. b. Chicago market is as follows: Coarse tow, \$25 per ton; medium tow, \$40 per ton; fine tow, \$55 to \$70 per ton (depending on number of runs).

"This tow is mostly used by furniture manufacturers for upholstering purposes, although its uses this year have become a little more diversified as a substitution for import fibres."

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**Oregon Chair Co., Portland, Oregon**—"We are using a quality known as 'fine tow,' which costs us, in Portland, \$46 per ton. We also have used some medium tow, which sells at points of origin for about \$21 to \$24 per ton."

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**Klopstock Bros. Wholesale Upholstery, San Francisco, California**—"We have not used flax tow owing to the fact that the freight rate from the East is prohibitive. The price is from \$18 to \$22 per ton, and if you can produce the same to sell at that price or cheaper we would use it in our manufacture. We will do all we can to promote the industry."

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**Hulse-Bradford Co., Upholstery Goods, San Francisco, California**—"The total consumption of upholstery tow on the Pacific Coast amongst the manufacturers is about six carloads a year. This refers to the cured article, used for upholstery purposes, for which green tow would not be feasible. The tow, to be of practicable use, would have to be put up in bales of, say 150 pounds, properly slatted and wired. Loose and bulky packages of this commodity are not merchantable. The market value would depend upon its resiliency and filling capacity, but \$30 per ton, f. o. b. point of shipment would be a fair average estimate."

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**Columbia Rope Co., Auburn, N. Y.**—"Flax should be grown in this country, and if it can be grown it would prove of great value to the manufacturers, and there would be an enormous sale of same, as it is a very rapidly increasing industry.

"Flax is used in making linen of all kinds, such as table cloths, napkins, shirts, handkerchiefs, etc., and has a durability two or three times as great as cotton.

"Flaxes of all kinds vary in prices. Under normal conditions it sells for from 8 cents to 16 cents or 17 cents per pound, according to the quality, while the tow sells for from 6 cents to 10 cents."

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**U. S. Department of Agriculture**—"Flax fibre is used in the manufacture of 2,000 tons, or more, of binder twine, each year. Only the better grades of clean straight flax can be successfully used for this purpose. Much of the flax grown for seed is too short and too weedy to be used for binder twine. Flax and hemp are the only plants producing fibres at all suited for binder twine that may be successfully cultivated in the United States."

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**Summers Linen Company, Port Huron, Michigan**—"All our material comes to us in straw form. We do our own retting. There is a strong demand for good fibre and the value of it depends entirely on how it is grown and prepared, values varying from nothing to 70 cents per pound. There is no doubt but that you could grow excellent straw in Oregon, but unless it is properly grown and prepared the value would be small. Under proper supervision it would be possible to produce fibre from Oregon straw, worth on the market today 40 cents per pound."

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**The Sarnia Board of Trade, Sarnia, Ontario, Canada**—"Up to the present our government has given no assistance whatever to the flax operators, but they are now having men investigate the business and we are hopeful of having them take an initiative in several propositions for improving the industry in Canada. The price received for dressed flax this year has averaged between 18 cents and 25 cents per pound for dew retted. The small quantity of water-retted flax sold for 45 cents a pound. The different grades of tow have run from 1 $\frac{3}{4}$  up to 16 cents. Most of the seed sold in this district by the mill went for \$1.50 per bushel right after being threshed. The average yield of White Blossom seed (the kind which, with Blue Blossom, has proved the most satisfactory) has been fourteen bushels to the acre. Blue Blossom runs ten bushels to the acre. Owing to the fall being very wet the fibre has run from 12 to 16 per cent, with a large portion of the lower rate. The water-retted flax averaged a very high percentage."

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**J. T. Smith, Flax Manufacturer, Hopkins, Minnesota**—"We pay from \$2.50 to \$3.50 per ton for tow delivered by the farmers after it is threshed at the tow mill. One and one-half ton of good flax straw will make one ton of good coarse tow, which is worth now at the mill from \$20 to \$25 per ton. Two tons of good flax straw will make one ton of fine tow, which is worth now at the mill from \$30 to \$35

per ton. We generally save one bushel of flax seed in making one ton of tow, which at present prices will more than pay for the labor in making the tow. There is now a good demand for tow made from green flax straw. The uses for green flax straw are numerous for upholstering furniture and insulating materials, for lining refrigerators, etc., and to manufacture crash for toweling. For this purpose there is no expense in preparing the flax straw to make green tow. Good, long flax straw can be made into spinning tow, which is worth from \$60 to \$100 per ton."

**California Cotton Mills Co., Oakland, California**—"To quote you the present price of flax would hardly be a fair guide to go by, for flax at the present time is almost unobtainable in this country. Under ordinary conditions tow sells from 6 to 9 cents per pound, depending on its quality and cleanliness. Line flax sells from 11 to 16 cents per pound, depending on its condition. At the present time very little tow can be obtained for less than 8 to 12 cents per pound, and line flax is selling, when it can be obtained, from 18 to 25 cents and even 30 cents per pound.

"If you get the industry started in a commercial way in your state and have any samples to submit to us, we would be glad to analyze them and to report to you what we consider them worth and what we could afford to pay for same.

"Of course, you understand that the high price of flax at present is on account of the fact that by far the greatest percentage of flax has been grown in Belgium and Russia. Ireland has been a large producer also, but the Irish supply is practically all taken up by the Irish manufacturers."

**The Flaxen Fibre-Down Co., North Tonawanda, New York, February 17, 1916**—"We average about two tons of straw to the acre in New York, Michigan and Ontario. The average amount of seed realized per ton is about five bushels—or about ten bushels to the acre. The average height of flax, as we grow it, is about three feet. The average amount of fibre realized from our flax straw is about 20 per cent. We have found, however, by testing, that Oregon grown flax produces as high as 25 per cent of fibre, and this Oregon fibre is longer and stronger than we grow here, in addition to being of much better color. \* \* \* We have been paying the farmers, of late, \$14 per ton for the flax straw. \* \* \* Our seed we procured from Belgium, Holland and other European countries. \* \* \* Together with our chemists and agricultural experts we have devoted our time and efforts entirely to the development and methods which will extract the fibre in good condition direct from the green straw as it comes from the field without any treatment whatsoever. In this we feel that we have attained more than ordinary success. Certainly our realizations have far exceeded our expectations. \* \* \* We make a very profitable and durable yarn suitable for making toweling, crash, canvas, etc., from the green flax fibre direct. At the same time we have machines and methods whereby we use every particle of the short waste fibre in making beautiful resilient batting from which we manufacture two attractive household necessities—mattresses and comforters."



**The Northern Insulating Co., Minnesota Transfer (St. Paul), Minn.**—“We are in the market this season—1915 to 1916— for 30,000 tons of threshed flax straw. In the manufacture of our product—flaxlinum—we can use the ordinary threshed flax straw. In the three states mentioned above, the straw will average approximately eight inches in length and will yield approximately one-third ton to the acre. Were the farmer to cultivate his land more thoroughly at seeding time—smooth it down after seeding, sowing three pecks to the acre, and, in harvesting, cut the crop very close to the ground—the yield of flax straw would be very close to one ton to the acre.

“This season we are paying at an average of \$8.00 per ton, f. o. b. Minnesota Transfer for dry, sound, baled flax straw averaging eight inches in length and containing not to exceed 10 per cent of foreign growth; subject to the weights of the Western Weighing Association at destination for final settlement. This price has been quoted by us to the farmers in North and South Dakota as well as in Minnesota, and nets the farmer at an average of \$5.00 per ton, f. o. b. shipping point for the baled flax straw, providing cars are loaded to the minimum required by the railroad company. However, the freight rate is so high from points west of the Missouri River that we have been unable to buy any of the straw in that section.

The freight rate from Oregon to this point would make the price of straw prohibitive for our purpose, and the freight rate from Oregon points to Chicago and eastern markets where upholstery tow is consumed, would also make the price prohibitive for that purpose, as seagrass, southern moss and foreign tow could be bought at eastern points much cheaper than the present freight rates would allow tow to be delivered in the east, from Oregon.

“However, for upholstering purposes in the State of Oregon or on the Coast, for the benefit of upholstered furniture manufacturers, it would no doubt pay to put in a small plant at some central point in Oregon where flax was raised and manufacture sufficient tow to take care of the western trade.

“The great drawback to the successful use of flax fibre is the distance between the area in which it is produced and the market for the manufactured product.”

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**Carman Manufacturing Co., Portland, Oregon**—“We are using in our Portland factory between two and three tons of flax tow a year, and there are about fifteen other factories on this Coast that are consuming about the same quantity, and, of course, there are innumerable small shops that would use a ton or so during that period. The demand is constantly increasing for the class of goods that require this kind of material in its construction, and, in consequence, there is an increasing demand for a good grade of tow.

“As to the comparative values of flax vs. tow: These materials are entirely different and one could not replace the other any more than you could use paint instead of shingles in covering a roof. For upholstering purposes the tow is the foundation of the filling and takes all the strain and wear and tear of the spring work. Over the tow is

used a filling of hair or moss, and cotton sometimes is used on top of these two fillings to give a smooth, soft surface; but on the best of work cotton is eliminated entirely."

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**Roberti Brothers, Los Angeles, California, April 15, 1916**—"Replying to yours of the eleventh instant, wish to state that we use flax only in our twine, of which we consume about 2,000 pounds per year."

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**Bailey-Schmitz Company, Upholstery and Bedding, Los Angeles, California**—"Our supply of flax tow comes mostly from Wisconsin or Minnesota. We do not use a great deal; possibly two carloads a year, but could use more if the prices were not so high. As freight from the Wisconsin market is about \$24 per ton, while the cost of tow, f. o. b. Wisconsin, ranges from \$20 to \$35, according to the quality.

"The amount of tow used on the Pacific Coast would be hard for us to estimate as some upholstering concerns use very little and others use a great deal. It seems to the writer if tow could be manufactured as cheap in Oregon as it could in Wisconsin, and with a much less rate of freight from Oregon points to California points, the use of same could possibly be increased double or triple, as it would be used more extensively instead of the excelsior, that is now used."

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**Klopstock Brothers, Wholesale Upholstery, Bedding, Woven Wire Springs, Tables, San Francisco, April 4, 1916**—"We, at present, use very little tow, owing to the fact that the price plus freight is almost prohibitive. The price is somewhere in the neighborhood of \$30 per ton, and the L. C. L. rate would probably be \$3.20, making the cost 6½ cents f. o. b. this city.

"There are a great many purposes to which tow might be used, not only in the manufacture of upholstered furniture but for mattresses, if the price was right.

"We would assume that it would be to your advantage to sell tow at any profitable figure irrespective of what the market might be from a commercial standpoint."

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**Conrad Townsite Company, Conrad, Montana**—"Flax is raised very successfully in this part of Montana, some of the crops grown for the Northern Flax Fiber Company yielding as much as three and one-half and four tons of straw to the acre. The soil is a heavy loam and seems to be ideal for flax raising. Of course, flax yielding as above stated is grown on irrigated land and is watered under the direction of the flax company. The water is derived from the Conrad-Valier Irrigation Project, and is nothing but pure mountain water. As I understand it, the retting process used by the flax company here is a bacteriological process."

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**Barker Brothers, Upholstery, Los Angeles, California**—"If prices for flax tow were satisfactory we could use three or four cars a year. Eastern prices are from \$15 to \$20 a ton. A large amount of flax tow could be used on this Coast if quoted at right prices. We would like to get a car at once if it could be purchased f. o. b. this city at \$40 a ton."

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**Washington Parlor Furniture Company, Tacoma, Washington**—"We use about 20 tons of flax tow, of a good quality per year, for which we pay \$44 a ton, f. o. b. Tacoma."

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**International Harvester Company, Chicago, Illinois, April 12, 1916**—"You have been correctly informed regarding our expensive experiments with flax as a material for binder twine. There is no difficulty about the strength and general qualities of flax fibre. Even an inferior quality of flax produces a good strong fibre, but there are some inherent difficulties which we have been unable to solve. All our efforts were in the direction of utilizing 'green' fibre. We simply cured it in the field and then extracted the fibre without the flax having gone through the retting process. This is absolutely necessary, so far as the manufacture of binder twine is concerned, for the reason that after flax has been retted the fibre is too valuable to be used for binder twine or any cheap cordage. The cost of producing flax fibre through the retting process makes it prohibitive for our use, and the fine, soft, retted fibre (very valuable for other purposes) does not—as strange as it may seem—make a satisfactory twine.

"Twine made from the green fibre contains some properties which seem to be attractive to crickets, grasshoppers and other insects. In addition to this and still more important, a sort of retting process will take place after the twine has been used and while the grain is still in the field, so that the twine will disintegrate and very often pull apart, leaving the grain loose. We did not discover this latter fact for several years and gave the insects credit for eating a greater proportion of the bands than the facts warranted.

"The result of our experiments leads us to believe that it is impossible to make a satisfactory twine from green flax, and that produced from retted flax is too high in price and not satisfactory in quality."

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**Angelus Couch & Furniture Manufacturing Co., Los Angeles, California, April 12, 1916**—"We use a carload of tow a year. The supply is available at all times. Quality is fine, and medium grades \$38 f. o. b. Los Angeles. We use it in upholstering only. As to the last question we cannot make estimate. We would judge that there are about eight or ten cars used in Los Angeles annually."

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**Continental Bedding Manufacturing Co., San Francisco, California, April 13, 1916**—"We are in receipt of your favor of the eleventh instant, and in reply will state that the tow that we use is the result of the combings of the flax. We use from four to five carloads per year.

"We enclose under separate cover sample of what we are using at present. The price of the quality of this sample is about \$25 per ton f. o. b. South Dakota, which would make the price approximately \$40 per ton f. o. b. San Francisco."

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**L. W. Stockwell Company, Los Angeles, California, April 14, 1916—**  
"Answering yours of April eleventh in regard to our consumption of what is commercially known as tow, would say that we probably would require a matter of something like 40 tons to carry us through for a matter of twelve months.

"Ordinarily, the price would range from \$22 to \$45 according to the quality. We are submitting you under separate package, a sample of two different qualities that we have lately bought, which is made, presumably, from what is termed the straw.

"If you develop anything that we can regularly use in our business, shall be glad indeed to have you submit us sample with prices."

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**T. G. Todd & Co., Import and Export Merchants, 42 Broadway, New York, May 15, 1916—**"We are interested in securing a quantity of flax suitable for weaving into heavy flax cloth, and if such merchandise is produced in your section of the country we will be very glad to be placed in touch with the parties who can offer same."

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### VARIETY OF USES FOR FLAX

One of the most encouraging features for the production of flax in Oregon is the fact that flax is being used in so many different ways and for so many different purposes that there is a very strong growing demand for the fibre, for the tow, and for the straw itself.

It is being extensively used in manufacturing of mattresses, pillows, comforters, etc. The variety of things for which there is a demand for flax is constantly growing and this brings an increased demand for its production. This will undoubtedly result in the development of many manufacturing industries being established in the State of Oregon, as soon as there is sufficient flax produced here.

Another encouraging feature in the matter of flax production which comes as the result of our world's survey of methods of handling it is that the old style of hand labor is undoubtedly going to be done away with. Flax will be cut with machinery, threshed by machinery, baled and retted by power methods of handling, scutched and manufactured all by machinery methods. The great amount of hand labor which has heretofore been necessary for the growing, and handling and preparing the crop for market is no longer necessary. There is a great development going on throughout the United States and Canada along these lines which are clearly shown in this bulletin.

### MANUFACTURED PRODUCTS USING FLAX

Linen; shirtings; dress goods; lace; knit underwear; toweling; flax lines; netting; seine twine; wrapping twine; binding twine; shoe thread; bookbinder's thread; upholstery stuffing; insulating for refrigerators, refrigerating cars, steam pipes, conduits, sound proof walls and floors, etc.; electrical insulation; packing for glassware and crockery; building paper; paper pulp.

A list of factories using flax for the manufacture of the above articles, and so offering possible markets for flax tow and fibre is on file with the Department of Commercial and Industrial Service, School of Commerce, University of Oregon, and will be furnished on request to anyone desiring the information.

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### Production in the United States

(United States Department of Agriculture.)

"In the United States flax is raised primarily for the sake of the seed, much less use being made of the fibre. The production of flaxseed is almost wholly confined to the North Central and Mountain States. In 1909 the value of this crop, \$28,971,000, represented 0.5 per cent of the total for all crops.

"The cultivation of flax is one of the oldest agricultural industries in the United States, but it has been forced to move steadily westward to new lands, as it became unprofitable in the older states. It was thought that flax exhausted the soil and could thus only be grown for a few years in one locality, but recent research has shown that the real cause of 'flax sick' land is a disease, the germ of which, living ever in the soil, soon makes it impossible to produce flax where this disease is prevalent. There are areas in this country where soil and climate conditions are as well suited to the growth of flax as anywhere in the world, yet nearly all the flax fibre used in our manufactures is imported.

"Reduction in the cost of producing the fibre must be brought about mainly by the introduction of improved methods of handling the crop and the substitution of machinery for the large amount of skilled hand labor which has heretofore been regarded as necessary in the preparation of the fibre.

"While *Linum usitatissimum* is considered the cultivated fibre species, botanists recognize upward of one hundred species in this genus. In many instances the distinctions between these species are so slight that the agriculturist or the industrialist would scarcely recognize them and they are therefore of botanical rather than economic interest.

"In central and northern Russia, in Holland, Belgium, Ireland and northern Italy, flax is cultivated primarily for the production of fibre. In southern Russia, British India, Argentina, and the United States, it is cultivated almost exclusively for seed production.

"All of the fibre flax in this country, as well as that of Ireland, Belgium and Holland, is grown from seed of Russian origin. The plants deteriorate when grown from seeds of the third or fourth generation

in this country, and, unless special attention is given to selection and the production of improved strains, it is necessary to import new stock every three or four years.

"The possibilities which the cultivation of flax fibre offers to the farmers of the West and Northwest (in the United States) is only equalled by the surprise that such possibilities have thus far been neglected, if, indeed, they are not altogether unknown. The climate, soil, and conditions generally in the Northwest are very favorable to the cultivation of the fibre as well as the seed. After a short experience as to the primary manipulation or handling of the flax fibre, our farmers would produce flax which would compare favorably with the best varieties of the fibre. It seems strange that a practical people like ourselves should for years have been satisfied to cultivate flax for the seed at a value of about \$15 per acre, and at the same time we allow 600 pounds of flax fibre per acre to rot on the ground, this fibre, after being manipulated, having a value of \$186 per ton. There should be a general and persistent effort made to encourage the cultivation of the flax fibre throughout the United States, with the view of establishing factories for the manufacture of twine and textiles."

### IMPORTS INTO UNITED STATES

The countries of origin of the imports during 1915 were as follows:

FLAX FIBRE		
	<i>Tons</i>	<i>Value</i>
Belgium .....	122	\$ 57,859
Russia in Europe .....	336	77,643
United Kingdom .....	3,749	1,628,052
Canada .....	244	37,702
Other countries .....	243	74,445
	4,694	\$1,875,701
FLAXSEED		
	<i>Bushels</i>	<i>Value</i>
Canada .....	6,629,860	\$ 8,843,489
Argentina .....	3,927,542	4,403,987
British India .....	39,990	50,269
Other countries .....	68,823	76,791
	10,666,215	\$13,374,536

Destinations of exports during 1915:

LINSEED OR FLAXSEED OIL CAKE		
	<i>Pounds</i>	<i>Value</i>
Belgium .....	26,931,718	\$ 414,301
France .....	1,375,773	20,945
Netherlands .....	431,248,843	7,499,917
United Kingdom .....	22,829,656	351,591
Other countries .....	42,408,444	761,307
	524,794,434	\$9,048,061

### FLAXSEED DURING 1914

	<i>Long Tons</i>
Belgium .....	1,266
Russia in Europe .....	2,735
United Kingdom .....	5,076
Other countries .....	808
	9,885

**FLAXSEED PRODUCTION, COMMERCE AND MANUFACTURE IN  
THE UNITED STATES**

(United States Department of Agriculture)

"The seed is rich in an oil of such superior drying qualities that it is an indispensable ingredient in paint and varnish, and in the manufacture of linoleum, oilcloth, printer's ink, patent leather and a few other products.

"As a business proposition, flax is almost universally raised, either chiefly for the fibre or exclusively for the seed, either as a source of raw material for the linen factory or for the linseed oil mill.

"In 1791 exports of flaxseed from the United States amounted to 292,460 bushels, a larger quantity, it is curious to note, than was exported in any year thereafter, until 1892.

"Imports from India continued to figure in the eastern markets, usually to the extent of from one-half to two and one-half million bushels a year, until 1892. In that year the United States, for the first time, took rank among the surplus flaxseed producing nations of the world.

"There are two different varieties of flaxseed produced in the United States, the small-grained seed of the Southwest, usually credited by crushers with yielding an average of sixteen or seventeen pounds of oil to the bushel (56 pounds) of seed; and the larger-grained seed of the Northwest, credited by the same authorities with a yield of from eighteen to twenty pounds of oil to the bushel; the yield in all cases, of course, varies greatly with the climatic conditions under which the crops are grown and harvested.

"The principal product derived from flaxseed is linseed oil. The residue, after the extraction of the oil, constitutes the only by-product, linseed-oil cake, a valuable cattle food, which, when ground for feeding purposes, is known on the market as linseed-oil meal.

"In the oil making process, there is practically no waste, and on an average for the entire country it is generally accepted by the crushers that a bushel of flaxseed (56 pounds) is converted by manufacture into  $18\frac{3}{4}$  pounds of oil ( $2\frac{1}{2}$  gallons), and  $37\frac{1}{4}$  pounds of oil cake.

"The actual manufacture of linseed oil in the United States, however, is subject to a somewhat rigid limitation, arising from the fact that for this product there is little foreign demand. Importing nations, as a rule, import the raw material in the shape of flaxseed and make their own oil, and the foreign demand upon the United States amounts to only about 100,000 gallons a year (1,212,133 gallons in 1915).

"Linseed oil has a field of usefulness peculiarly its own. It has no uses as an illuminant, none as a lubricant; and, although small quantities fresh from the presses are utilized, curiously enough, as a cooking grease by an element of the foreign population in some of the large cities, commercially it is valueless as an edible oil. In fact, linseed oil is adapted to none of the industrial or edible uses to which other oils are ordinarily put, whether they be vegetable, animal or mineral. But possessing in an exceptional degree the property of absorbing oxygen upon exposure to the air, it is essentially a 'drying' oil, and, compounded on the one hand with divers pigments and on the other with various gums, it finds a field of usefulness in the composition of

## UNITED STATES IMPORTS AND EXPORTS

The following table shows the total imports and exports of flax and flax products for the years 1911, 1912, 1913, 1914 and 1915:

## FLAX AND FLAXSEED AND LINSEED OIL

Fiscal year ending June 30

## EXPORTS

1911		1912		1913		1914		1915	
Quantity Pounds	Value	Quantity Pounds	Value	Quantity Pounds	Value	Quantity Pounds	Value	Quantity Pounds	Value
Flaxseed or Linseed Oil-Cake and Cake-Meal— 559,674,653	\$ 8,361,666	596,114,536	\$ 9,735,022	838,119,654	\$ 12,982,423	662,868,639	\$ 9,650,379	524,794,434	\$ 9,048,061
Linseed Oil— Gallons 175,210	164,879	Gallons 246,965	208,591	Gallons 1,733,925	874,461	Gallons 239,188	134,540	Gallons 1,212,133	660,089
Flaxseed or Linseed— Bushels 976	2,520	Bushels 4,323	12,160	Bushels 16,894	26,699	Bushels 305,546	436,874	Bushels 4,145	9,748
IMPORTS									
Flax Fibre— Long Tons 7,782	2,668,538	Long Tons 10,900	3,778,501	Long Tons 12,421	3,950,020	Long Tons 9,885	2,870,274	Long Tons 4,694	1,875,701
New Zealand Flax— Long Tons 2,679	294,388	Long Tons 5,364	438,310	Long Tons 7,827	917,166	Long Tons 6,171	716,953	Long Tons 2,944	319,936
Flaxseed or Linseed Oil— ..... ..... .....	..... ..... .....	Gallons 737,256	486,060	Gallons 173,690	111,228	Gallons 192,282	91,555	Gallons 535,291	248,403
Flaxseed or Linseed— Bushels 10,499,227	.....	Bushels 6,841,806	12,995,250	Bushels 5,294,296	8,127,774	Bushels 8,653,235	10,571,410	Bushels 10,666,215	13,374,536



paints and varnishes to the almost total exclusion of all other oils. Its monopoly in this field is so complete that it has no adulterants, except those which detract greatly from its economic value, and no substitutes, except possibly the single competitor, corn oil. Linseed oil is also utilized to the practical exclusion of other oils in the manufacture of linoleum, oilcloth, oil silk, patent and enameled leather, and printer's ink. Probably 65 to 75 per cent of linseed oil manufactured in the United States is used in some form of paint or varnish. The bulk of the remainder is used for linoleum and oilcloth, although about a million gallons are used for printer's ink. It also is used for the manufacture of waterproof fabrics, not made of rubber, as an enamel for buttons made of wood pulp, in the manufacture of opaque window shades, for a few medicinal purposes, and for a soap especially valuable for washing woodwork.

**"Linseed Oil Cake**—Linseed oil cake is in very limited demand in the United States, but finds an extensive market abroad—used only as a cattle food, and highly prized by European stock raisers. Almost 80 per cent of this valuable cattle food (exceptionally valuable from an economic point of view, both as a fattening food and because of the high fertilizing properties of the manurial residue) is shipped abroad.

"In the order of the amount of their takings, the oil cake shipped from this country goes to Belgium, Holland, Great Britain, France and Germany.

**"Manufacture**—The most definite estimate that can be made as to the capacity of the average linseed press is that of 125 to 150 bushels per day. The average number of days that a press can be economically operated in a year is about 250, the annual capacity of a press is from 32,250 to 37,500 bushels. The number of presses to a mill, of course, vary widely, mills of twelve presses being the most common. Probably not far from 70 per cent of the flaxseed crushed in the United States is ordinarily crushed at the four great centers, Buffalo, Minneapolis, New York and Chicago."

## FLAXSEED

Acreage, production and total farm value, by states, 1914:

(Table compiled by United States Department of Agriculture)

	Acreage Acres	Average yield per acre Bushels	Produc- tion Bushels	Average farm price per bushel Dec. 1 Cents	Farm value Dec. 1 Dollars
Wisconsin .....	8,000	13.5	108,000	125	135,000
Minnesota .....	315,000	9.3	2,930,000	128	3,750,000
Iowa .....	20,000	9.5	190,000	120	228,000
Missouri .....	8,000	8.0	64,000	104	67,000
North Dakota .....	840,000	8.3	6,972,000	128	8,924,000
South Dakota .....	320,000	7.5	2,400,000	123	2,952,000
Nebraska .....	7,000	7.0	49,000	119	58,000
Kansas .....	45,000	6.0	270,000	125	338,000
Montana .....	320,000	8.0	2,560,000	120	3,072,000
Colorado .....	2,000	8.0	16,000	100	16,000
United States .....	1,885,000	8.3	14,559,000	125.6	19,540,000
United States (1915)....	1,367,000	10.1	13,845,000	174	24,080,000

### FLAX AREA AND PRODUCTION OF THE WORLD

The following table, compiled by the United States Department of Agriculture, shows the area and production of the flax-growing countries of the world for the fiscal years ending June 30, 1911, 1911, 1912 and 1913:

	AREA				PRODUCTION				
	Thousands of Acres				Thousands of Pounds				
	1911	1912	1913	1911	1912	1913	1911	1912	1913
United States .....	2,757	2,851	2,291	19,370	28,073	17,853	.....	.....	.....
Canada .....	879	2,022	1,553	10,075	26,130	17,539	.....	.....	.....
Mexico .....	.....	.....	.....	29,595	54,353	35,542	.....	.....	.....
Argentina .....	3,716	4,028	4,382	23,424	22,518	44,486	.....	.....	.....
Uruguay .....	95	143	141	660	879	1,302	.....	.....	.....
Austria-Hungary .....	.....	.....	.....	890	843	801	68,026	.....	.....
Belgium .....	49	54	57	515	514	387	52,000	64,000	39,437
Bulgaria .....	1	1	*	12	6	8	878	308	*
France .....	59	69	71	496	576	300	45,003	46,074	*
Italy .....	22	22	22	341	343	405	6,078	5,511	5,732
Netherlands .....	39	36	36	579	428	326	20,929	21,217	16,606
Roumania .....	52	79	67	607	772	569	4,530	8,353	4,759
European Russia .....	3,428	3,454	3,676	20,544	22,177	24,477	785,136	1,172,059	1,703,209
Servia .....	4	4	*	.....	.....	.....	2,091	2,095	*
Sweden .....	4	4	*	17	17	17	1,500	1,212	*
Ireland .....	67	55	59	*	*	*	25,179	29,021	28,341
British India .....	3,757	4,946	4,125	22,544	25,648	21,544	.....	.....	.....
Asiatic Russia .....	298	242	*	1,099	1,230	1,300	.....	.....	.....
Algeria .....	2	1	*	16	13	15	.....	.....	*

\* No official data.

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**THE INDUSTRY IN OIL SEEDS**

(United States Department of Agriculture)

"The United States has, within the past quarter century, become by far the heaviest producer of oleaginous seeds in the world. This has been wholly due to the utilization of the cotton crop and the expansion of flaxseed cultivation.

"The domestic consumption of all oils of this class amounted in 1860 to less than 9,000,000 gallons. At the present time there is annually manufactured from the domestic crops of flaxseed and cottonseed, a product of from 160,000,000 to 170,000,000 gallons of oil, three-fourths of which probably enters into home consumption.

"It was not until 1891 that domestic supply overtook demand. The European demand for flaxseed is supplied almost wholly by Russia, Argentina and British India, with a small percentage from the United States; but the six leading importing countries for oleaginous seeds, Great Britain, France, Germany, Holland, Belgium and Denmark, use about 3,000,000 tons annually, less by half a million tons than the quantities of cottonseed and flaxseed annually used in manufacture in the United States."

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**LINSEED OIL**

Frederick Walton, of London, happened to notice the film or skin that had formed on the top of a can of paint which had been left open for several days. Picking the skin up and working it into a ball with his fingers, he was surprised at its toughness and elasticity. At once his active mind began to wonder whether this peculiar property of linseed oil—changing into a rubber-like mass when exposed to the air—could not be turned to some good purpose. Experiment followed experiment and the result was the invention of linoleum in 1863.

Linseed oil, from which linoleum takes its name, is extracted from the seed of ordinary flax.

The seed not only yields the most valuable drying oil known to commerce, but in some countries serves as an article of food. The Abyssinians eat it roasted and the oil is used as an edible in certain parts of Russia, Poland and Hungary.

In extracting the oil, the first step is to clean the seed thoroughly by blowing out the dust and dirt. It is then crushed between corrugated steel rollers, heated, and run onto small collapsible frames with mohair bottoms. These frames, containing the oil-bearing meal, are placed one on top of the other in large presses, and the oil then expressed by means of a hydraulic ram. The last step is the filtering process, after which the oil is to run into storage tanks and thence transferred to tank cars for shipment.

## Notes on Flax Production, Conditions and Prices in Foreign Countries

### CANADA

The following are extracts from reports of the Department of Commerce:

#### Production of Canadian Flax

(Consul Henry P. Starrett, Fort William, Ontario, July 9, 1915)

"It is interesting to note the importance of Canada as a flax-producing country, the total production in the last five year (calendar) having been as follows:

	<i>Bushels</i>
1910 .....	4,244,566
1911 .....	10,075,500
1912 .....	26,130,000
1913 .....	17,539,000
1914 .....	7,175,200

"The largest part of the crop was produced in the Province of Saskatchewan, with Alberta and Manitoba furnishing the most of the balance in the order named. The great decrease in the 1914 crop was brought about by the low prices received for the crop of the previous year, together with the unfavorable weather conditions which prevailed throughout the growing area. At present, however, the export price for this product ranges from \$1.50 to \$1.60 per bushel, and the indications are that the crop for 1915 will be considerably larger than that of last year.

"The total flaxseed exports, showing quantities and values, from Canada during the fiscal years of 1912, 1913, and 1914 (year ending March 31), were as follows:

<i>COUNTRIES</i>	<i>Bushels</i>	<i>Value</i>
<i>1912</i>		
United States .....	991,802	\$ 1,802,894
United Kingdom .....	495,496	1,004,888
All other .....	17,230	34,460
Total.....	1,504,528	\$ 2,842,242
<i>1913</i>		
United States .....	7,561,004	\$11,885,186
United Kingdom .....	2,536,336	4,537,360
All other .....	26,353	26,353
Total.....	10,123,693	\$16,448,899
<i>1914</i>		
United States .....	10,164,536	\$11,910,681
United Kingdom .....	8,579,713	10,482,556
All other .....	1,903,078	2,423,096
Total.....	20,647,327	\$24,816,333

"During 1914 a considerable market was being developed on the Continent of Europe, the exports of Belgium having been valued at \$1,036,003; to the Netherland, \$898,763; to Germany, \$320,409; and to France \$295,427."

**"Destination of Flaxseed Exports**—In view of the interest which American manufacturers of linseed and other products have in the Canadian production of flaxseed, it is important to note that the United States is Canada's largest customer for this product, the United Kingdom being a close second.

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Previous to the war Canada produced 5 per cent of the world's crop of flax.

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### Revival in Flax-Fibre Growing in Ontario

(Consul Fred C. Slater, Sarnia, Canada, September 4)

"Flax is quite extensively grown in various parts of Canada, particularly in the northwestern provinces. However, the production of flax for fibre purposes has been almost negligible in quantity—practically all of it having been in the Sarnia consular district, where the climate, soil, and water conditions are most suitable. Recently the industry received a new impetus, as a result of finding water excellently suitable for retting purposes. Interest in raising flax has therefore been revived, as the retting with this water produces a quality not heretofore obtained.

"It is reported that half a century ago some seventeen prosperous scutch mills operated in this province. One pioneer of the industry relates that in one season he purchased 26,000 tons of Canadian flax, while other buyers did equally well. But those were times of cheaper labor, more new 'breaking' land, and less keen competition. It is claimed that by 1914 the number of mills in operation had fallen to less than a dozen. This year, however, there are twenty in operation to handle the 1915 crop, which is three times greater in acreage than that of 1914.

"For the last two or three years a few men of this Province have given special and careful attention to the raising of flax fibre and have met with exceptional encouragement. The raising of the product was considerably stimulated because of the European war increasing the price of the fibre from \$0.12 and \$0.14 to \$0.22 per pound. This, together with the already noted discovery of better water for retting purposes, has, for the time being, brought flax growing to the fore in this vicinity. Recently men from Ireland and New Jersey who are interested in flax have gone over the ground in this locality and have made very optimistic reports as to the growing of this commodity. Many of the old idle mills are being refitted and brought back to service.

"The following detailed explanation as to the water-retting process of flax fibre, as now conducted at Forest, Ontario, was furnished this consulate September 2 through the kindness of J. A. McCracken, secretary of the Canada Flax Growers, of St. Marys, Ontario:

"The flax is pulled a little greener than according to the old Canadian practice; that is, when the leaves a few inches up from the root are withered away. The retting tank (of which more may be built later) is 50 feet long, by 15 feet wide, by 4 feet deep. It is of concrete, with 10-inch walls, and has a partition across the center. Each half will hold a small wagonload of flax sheaves.

"The sheaves after threshing are set in on end, heads up, until the tank is filled. Planks are set on the tops of the flax, and stones on these, so as to keep the straw immersed when the water is turned on.

"Mr. Coey, of the Linen Thread Co., Newark, N. J., recently hackled at Forest some of the fibre obtained from representative samples of water-retted and dew-retted flax grown and treated at Forest. He declared that the water-retted fibre was of excellent quality, even in character, and of fine spinning texture. He declared that it was worth at least 2 cents a pound more than the dew-retted fibre. This is gratifying to Canadians, since the present shortage is chiefly of fine spinning fibres, of which the Belgian were the highest grade. Canadian flax manufacturers are hoping so to improve their plants and processes as to enter the best markets and thus place their industry on a permanent and prosperous footing. The Canadian Flax Growers, recently organized, are bending their energies to this end."

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### Reducing Cost of Production of Flax

Some important statements relating to the method and cost of production of flax have been made in connection with the recent discussion of the subject in Canada. The Evening Review of Niagara Falls, Ontario, published an article February 14, 1916, by a manufacturer whose company maintains a plant at St. Catherines. The writer said:

"The system hitherto employed is a tedious and expensive one, necessitating the employment of a large number of hands—the pulling of the flax, the hauling into the mill and threshing, hauling out again into the field and spreading on the grass, the turning of it upside down, the binding up into sheaves and hauling again to the mill, the breaking of the flax in fluted rollers, the hand scutching (the beating of the wood off the fibre by the scutching blades)—the whole thing being entirely dependent upon labor and weather conditions. If we could be assured of sufficient expert labor at reasonable prices, and if weather conditions could be controlled or overcome; if we could compete with cheap European labor, and if we could devise a process to overcome unfavorable weather conditions, we could soon make Canada the greatest linen manufacturing country in the world.

**"To Develop One of Great Industries—**To overcome this difficulty, to accomplish this purpose, to develop a process for the treatment of

the flax which would have for its object not only reduction in the cost, but a large and, shall I say, permanent increase in the quantity of the fibre produced, is the task we set ourselves years ago; in other words, to bring the flax industry within the category of great industries in Canada and make it capable of profitable expansion and large development. And this is what we claim to have accomplished.

"By the process which we have developed, the hand pulling will be largely done away with, and the subsequent spreading in the field entirely eliminated. In future, the flax will be brought direct from the field, threshed by specially designed threshing machines, and immediately baled by powerful hydraulic process into bales each containing about 700 pounds of flax straw. These bales are then carried by electric carriers, or hoists, and placed in large concrete tanks of a capacity of about 10 tons of flax each. Here the flax is treated by means of bacteria cultures, in water held constantly at the required temperature, and it is thoroughly 'retted' in from two to three days.

**"Product Made Ready for Baling and Shipment—**From the tank the wet flax is lifted by electric hoists and passed immediately to large, specially constructed dryers, where in the short space of three hours the moisture is removed, leaving the flax thoroughly dry and ready for the next operation. From the dryers the bales are carried by overhead conveyers to the machinery room, where they are mechanically fed into large breakers and the wood broken and crushed into fine particles, the fibre (or tow) being carried automatically into large shakers or beaters, where it is thoroughly cleaned and the resultant product deposited in large bins, ready for baling and shipment to the spinning mills.

"The process is short and inexpensive, is positive in its results, and will produce a uniform grade. It can be used with any quantity desired. It is entirely free from weather conditions and can be carried on the whole year round, not being limited to a few weeks in autumn, as is the present system. Our mill is designed to handle twenty tons of straw per day, but additional mills can be erected and machinery installed capable of treating all the flax that can be grown in the entire country and as rapidly as it can be produced by the farmers.

**"Process One of Simplicity and Economy—**The object kept in view by designing and installing this plant for handling the flax has been simplicity and economy. These two words are written large over the entire process. From the harvesting of the flax right through to the baling and shipment of the fibre to the spinning mill, everything has been designed to handle the flax by the most economical labor-saving methods, so as to assure the farmer who grows the flax a steady market for his product and at profitable prices, and also to insure the plant a regular manufacturer's profit in producing the fibre for the trade."

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According to a report by Consul General R. E. Mansfield, at Vancouver, B. C., the estimated yield of flaxseed in Canada for 1915 was 12,199,600 bushels from 1,009,600 acres, or 12.08 bushels to the acre.

## BELGIUM

The finest flax grown in Europe is unquestionably produced in western Belgium, and largely in a region of country through which flows the river Lys, the town of Courtrai being the center of the industry. This is the creamy Flemish flax, from which the finest linen fabrics are made, and which owes its peculiar color to the waters of this famed stream, "the golden Lys" in which the Courtrai flax is always retted. From some cause or causes, as yet not fully understood, the water of the Lys for a distance of seventeen miles has the peculiar effect of imparting to flax retted in that stream softness and fineness of texture that can be produced nowhere else.

Flax is grown, however, in other sections of Belgium, a fine flax, but darker in color, coming from the country of Waes, and retted in stagnant water in specially constructed "pools." In the Brabant, too, considerable quantities of flax are grown, both dew and pool retted, and known as "blue flax" from its very dark color.

While the superior quality of Courtrai flax is claimed to be due, chiefly, to the action of the soft, slowly running, almost sluggish waters of the river Lys, without doubt there are three other important factors which aid in the result: First, a soil preparation with systematic rotation of crops and extent of fertilizing that few, if any, flax farmers in America have ever practiced; second, the use of only the best seed and lastly, most careful handling and skillful manipulation from the time the crop is ready to pull until the straw goes to the scutch mill. Nor is the care and vigilance relaxed, even here.

Exports from all of the consular districts in Belgium for flax were:

1913 .....	\$ 792,940
1914 .....	291,522

## MANUFACTURES OF FLAX

1913 .....	_____
1914 .....	\$1,085,758

(Detailed accounts from Belgium were not available owing to the war.)

## RUSSIA

Russia, alone, produces more flax than all the other countries of Europe combined—about two-thirds of the total.

There are 27 flax growing provinces in Russia, roughly divided into two vast areas, in which the culture is widely different in character and purpose. In the black soil provinces it is grown for seed alone, while in the common soil districts it is cultivated for both seed and fibre.

The following table gives an idea of the area and the general production of flax in the whole empire (both European and Asiatic):



## YIELD OF FLAX IN 1912

(According to the data of the Russian Government Central Statistical Bureau)

## PROVINCES PRODUCING PRINCIPALLY FIBRE FLAX

	Area in Acres	YIELD			
		Fibres		Seeds	
		Total in Thousands of Pounds	Per Acre	Total in Thousands of Pounds	Per Acre
European Russia and Caucasus	2,688,062	1,114,776.0	.....	859,582.8	.....
Asiatic Russia without Caucasus	128,621	55,980.8	.....	43,952.4	.....
Total.....	2,816,683	1,170,756.8	413	903,535.2	320

## PROVINCES PRODUCING PRINCIPALLY LINSEED

	Area in Acres	YIELD			
		Fibres		Seeds	
		Total in Thousands of Pounds	Per Acre	Total in Thousands of Pounds	Per Acre
European Russia and Caucasus	815,111	398,952.0	.....	389,804.4	.....
Asiatic Russia without Caucasus	204,097	79,340.4	.....	73,672.4	.....
Total.....	1,019,208	478,292.4	466	463,476.8	460

The average total yield of flax fibre in the northwestern region is estimated at about 360,000 tons, at a value of about \$400,000. Three-quarters of this quantity is exported. There are about 40,500,000 acres under the cultivation of flax in Russia, giving the farmers a larger profit than the cultivation of corn. It can be said safely, that the raw product yields an annual income of approximately \$103,000,000 to the agricultural classes. It must also be considered that flax culture is carried on at a time when all other agricultural labor rests.

The flax industry takes a prominent part in the empire's rural economy. But the impoverishment of the soil in the principal flax producing districts has become a very serious matter. The average yield per dissiatine (2.7 acres) in Russia is only 612 pounds, while it is 1,296 pounds in Prussia, 1,332 pounds in Ireland, 1,440 pounds in Belgium, and 2,088 pounds in France. With this falling off in the yield, the quality of the product deteriorates, and hence the Russian spinning mills are obliged to import flax for the finest counts.

Those who claim that good flax fibre and salable seed cannot be grown in the same crop should study the figures of seed production. In the black-soil provinces, where there is a small fibre product, 15,500,000 acres produce about 8,500,000 bushels of seed worth \$7,700,000, in round numbers, while in the common-soil provinces, in addition to the 260,000 tons of fibre produced, a little over 2,000,000 acres yield almost 9,500,000 bushels of seed, worth \$9,400,000 in round numbers.

In general, the manipulation of the flax in Russia is so primitive and poor that, as a result, the price offered for it abroad is much lower

than that paid for German, Austrian, Irish, and especially French and Belgian flax. When flax is purchased in the condition in which it enters the market, the manufacturer can not know what he is purchasing; that is to say, he does not know how much clean flax he will have, nor the quality. It is, therefore, easy to understand that the purchaser wishes to guarantee himself against such loss and, therefore, purchases at very low prices, a fact that causes the Russian farmers to lose needlessly about \$15,000,000 a year.

The Russian flax farmers pay little or no attention to sorting, mixing all grades together indiscriminately, when it is sold to the small buyers who purchase the product. The large merchants do the assorting, according to quality, though it is stated that this work is the most thoroughly done at the ports whence it is exported to reach foreign markets.

An important item of Russia's exports is linseed, and though it has to compete with the Argentine and East Indian, still reaches 114,692 metric tons, valued at about \$5,400,000. The shipments of linseed cake aggregate about 163,800 tons, valued at about \$4,890,000. Thus the exports of flax, linseed, and linseed cake reach a total of about \$43,510,000.

Flaxseed, as understood in Russia, comprises sowing seed and crushing seed. The first is a more carefully sorted quality, exported exclusively for sowing purposes. Crushing seed is the surplus. Of the total quantity exported about two-thirds is described as sowing seed. Good flaxseed for sowing purposes is highly esteemed and brings from \$3.10 to \$3.90 per bushel. Flax and its products amount to about one-sixth of all the goods exported from Russia.

An acre of good land gives 400 pounds, or more, of fibre, and from 400 to 535 pounds of seed, but an acre of poor soil will not yield more than 160 to 200 pounds of fibre and about 265 pounds of seed. The average yield may be considered to be from 265 to 330 pounds of flax fibre and 400 to 670 pounds of flaxseed per acre. The low qualities of the Russian flax are not the result of natural causes but of the ignorance as to the proper method of treating the flax. Another cause is to be found in the absence of a home demand for a high quality of fibre. Russian factories do not produce linen from the finest numbers of spun threads, and, therefore, do not require the highest class of flax. The aim of the producer is quantity rather than quality, and the result is a progressive reduction in the qualities of the fibre.

The most important markets for the sale of Russian flax fibre are Dundee, Scotland; Lille, France, Ghent and Antwerp, in Belgium.

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## IRELAND

The Department of Agriculture and Technical Instruction for Ireland gives the following figures relative to cost and profit per statute acre of cultivating and handling flax: (In translating these values into United States money the English pound sterling has been figured at \$4.80 and the shilling at 24 cents. The Irish statute acre is the same as that of the United States, 43,560 square feet.)

Rent of land, allowing for exhaustion of soil and fouling of land with weeds.....	\$19.20
Plowing .....	2.88
Cultivating .....	2.52
Harrowing, Rolling and sowing seed ) .....	4.20
Seed .....	2.88
Manures .....	1.20
Weeding .....	9.60
Pulling .....	10.80
Retting, drying, stacking, delivery at scutch mill, and marketing of scutch flax .....	9.60
Cost of scutching—4 cwts. scutched flax at \$2.40 per cwt.....	9.60
<b>Total .....</b>	<b>\$62.88</b>
Net profit per statute acre, 4 cwts. scutched flax at \$19.20 per cwt.....	\$76.80
Less cost of production .....	62.88
<b>Total net profit.....</b>	<b>\$13.92</b>

### Cost of Producing Flax

Flax from different sections of Ireland has different values, varying according to the quality of the seed sown, the kind of land and the care with which the various processes are carried out.

The cost of raising also varies at different times and places. The average cost of production per acre in Ireland is estimated as follows:

Rent and taxes.....	\$ 8.41
Seed .....	6.08
Preparing the land.....	5.60
Sowing .....	1.82
Weeding .....	1.21
Pulling .....	2.55
Retting .....	1.34
Grassing .....	2.92
Scutching .....	8.02
<b>Total.....</b>	<b>\$37.95</b>

Taking the above average cost of production, and the average yield of fibre as 525 pounds per acre, and figuring the average value of the flax as about 10.42 cents per pound, the average profits per acre are estimated as \$54.75 gross—minus the above cost—which yields \$16.80 net per acre.

### The Irish Flax Crop

“With reference to the official report on last season’s flax crop in Ireland it is worth noting,” stated the Textile Mercury (Manchester, England, February 16, 1916), “that the average production of fibre, working out at 407.4 pounds per statute acre, as compared with 369.6 pounds in 1914, was 36.4 pounds below the average for the ten years, 1905-1914.

“The total flax crop of Ireland in 1915 is estimated at 2,164,774 pounds, as against 1,820,179 pounds in 1914, an increase of 344,594 pounds, while the area showed an increase of 4,890 acres, from 49,253 to 54,143 acres.

The American Consul at Belfast, Ireland, reported April 19, 1915: “The Russian flax crop is reported as a failure. Prices are greatly

advanced. Medium quality flax sold July 1 at \$181.28, and on December 31 at \$364.99 per ton, while tow, which brought \$137.70 on July 1, sold for \$330.92 per ton on December 31.

"It was thought that after the outbreak of hostilities that consumers would be able to get their flax supplies from Belgium as usual, but this did not prove to be the case and toward the end of November shipments from that market practically ceased. Courtrai flax, which was selling July 1 at \$340.66 brought, on December 31, \$729.98 per ton.

"Ireland's flax acreage fell off from 59,305 to 49,253 acres. The yields of fibre were smaller than usual and the quality not up to the average. Prices for Irish flax advanced from \$243.33 on July 1 to \$583.98 per ton December 31; Irish tow, for the same period, from \$187.36 to \$350.39 per ton.

"The United States is, as always, an easy first in the foreign markets, taking more than half of the total exports of linen goods from this district.

"Australia has maintained its trade better than any other market except the United States. British South Africa marks a considerable decline. The British East Indies, after steadily expanding its trade for the past five years, shows a decrease. There is also a falling off in shipments to Japan.

"Exports of Linen Piece Goods from United Kingdom—The board of trade returns supply the following particulars with regard to the value of exports of linen piece goods from the United Kingdom during the past two years:

<i>COUNTRIES</i>	<i>1913</i>	<i>1914</i>
Argentina .....	\$ 1,035,995	\$ 579,016
Australia .....	2,473,102	2,323,875
Belgium .....	182,781	118,319
Brazil .....	853,526	412,660
British East Indies .....	1,310,582	1,129,826
British South Africa .....	457,091	306,911
British West Indies (including Bahamas and British Guiana) .....	112,105	93,938
Canada .....	1,438,615	1,067,861
Colombia and Panama .....	280,174	185,526
Cuba .....	1,051,329	870,451
Denmark .....	192,260	170,152
Dutch East Indies .....	307,602	271,410
Egypt .....	151,660	152,837
France .....	274,110	176,046
Germany .....	831,802	510,710
Italy .....	231,154	192,796
Japan .....	280,598	174,347
Mexico .....	128,738	33,769
Spain and Canaries .....	102,036	74,569
Switzerland .....	139,664	104,761
United States .....	14,841,696	15,991,480
Other countries .....	2,365,513	1,733,841
Total.....	\$29,042,133	\$26,675,191

"The following is a summary of the value of the exports of linen piece goods from the United Kingdom:

"Total, plain, unbleached or bleached, 1913, \$25,138,358; 1914, \$23,243,012; total, checked, printed, or dyed, and damasks or diapers, 1913, \$2,690,625; 1914, \$2,496,096; sailcloth, 1913, \$1,213,150; 1914, \$935,993."

Belfast Linen Trade Circular, July 31, 1915: "Latest advices from Russia point to the exhaustion of last year's crop, which was far from being a big one, while prospects in the flax growing districts this year are by no means good. What the actual position is in the Riga provinces it is difficult to ascertain. Flax is available in Brittany, but we understand the export is prohibited. Some parcels of Flemish flax have been sold as high as £120 (\$576.00) f. o. b. Dieppe. Rotterdam correspondents, writing under date twenty-sixth instant, state that there is a very strong demand for half-scutched flax at £80 to £90 (\$384.00 to \$432.00). They also say that more than half the crop is likely to go into half-scutched flax this season, and some farmers are already making contracts for the supply of from 100 to 300 bales monthly."

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### Flax Growing in the South of Ireland

(Consul Wesley Frost, Cork, Queenstown, January 28)

"The prospective dearth of flax for the linen trade of the North of Ireland has directed attention to the flax-growing possibilities of Munster and Leinster. The Belfast Linen Trade Circular, in a current issue, points out the success that would attend an expansion of the flax acreage in the South of Ireland, and the president of the Cork Chamber of Commerce and Shipping has reiterated and emphasized the suggestion.

"Flax ranks second in value among Ireland's imports of raw materials. Most of these shipments have in the past come from Belgium and Russia. The island's purchases of flax for the last five years have averaged 38,000 long tons; in 1912 they reached 42,144 tons, which was the record for the half decade. In 1913 Ireland's imports of foreign flax totaled 40,982 tons, whereas the Irish crop of flax was but 12,652 tons, or about one-fifth of the amount required to keep the linen mills of Ulster in operation. Any increase that can be brought about in the home supply will evidently be of great value for the coming year.

"As a matter of fact, the average yield of flax per acre has been decidedly greater in the South of Ireland than in the North. The Provinces rank in order as follows (1913): Average yield per acre in Munster, 546 pounds; in Conaught, 524 pounds; in Leinster, 505 pounds; and in Ulster, 477 pounds. The average for Ireland is 477 pounds, and the figures given are typical of normal conditions. County Cork has consistently given the highest yields per acre of any region in Ireland.

"The actual acreage and yield in Ulster, however, are far above those of all the rest of Ireland combined. The Province of Ulster in 1913 returned 58,577 acres as cultivated to flax, while Munster gave 400 acres, Connaught 283, and Leinster 48. County Antrim, in Ulster, produced 302,915 stones of flax, while County Cork, in Munster, produced 6,078 stones. The value of the total flax crop of Ireland in 1913 was \$3,542,581, the average price being \$1.75 per stone of 14 pounds, or 12½ cents per pound."

### Prices at Belfast

The York Street Flax Spinning Company, of Belfast, states that for flax of the same grade, as to length, strength, quality and cleanness, approximately equal prices are paid whether the flax is water or dew retted. However, dew retting is practiced only in the central part of Russia, and to a very small extent, in normal times, in Belgium, Brittany, and Ontario. Nine-tenths of the Belgian, Holland, and Ireland crops are water retted and fetch considerably higher prices than the average of dew retted flaxes. There are no recognized grades in most flax growing countries, each lot, as a rule, being sold on its individual merits. The following is given, however, as a rough average of the value of the crops as a whole:

Courtrai, formerly 24c per pound.....	now unprocurable
Flemish, formerly 13c per pound.....	now unprocurable
Dutch, formerly 14c per pound.....	now 26c per pound
Irish, formerly 12c per pound.....	now 24c per pound
Brittany, formerly 10c per pound.....	now 17c per pound
Russian, formerly 9c per pound.....	now 15c per pound

The vast bulk of the Irish flax crop is grown in Ulster, which in 1913 produced 1,996,543 stone (27,951,602 pounds). In 1914 the yield was only 1,285,382 stone (17,995,348 pounds). This was due to both decreased acreage and decreased yield per acre. The acreage in 1914 was 49,250 against 59,305 in 1913, and the average production per acre was 28 stone (392 pounds) in 1914 against 36 stone (504 pounds) in 1913. At the close of the year the prospective shortage of flax in Ireland, due both to the short crop and to the difficulties of importing supplies from Russia, had doubled the price.

While Irish flax has the reputation of being a superb flax, the Irish flax culture, as practiced by the small peasant farmers, is slovenly and wasteful to the last degree. The term "Irish flax" is frequently only a trade-mark, for a large portion of the flax of France and Belgium is exported to Great Britain, where it goes into manufactures that are regarded as derived from Irish flax.

Mr. Henry Wallace, who visited Ireland in 1891, and made a report the following year, states that the great bulk of Irish flax is grown in the province of Ulster, embracing the seven northern counties. The acreage has been gradually decreasing for the past 30 years, varying considerably from year to year, but declining from 229,178 acres in 1869, to 113,538 in 1888, with an estimated acreage in 1891 of 75,000 acres. The causes of this decrease have been various, but the principal one is the failure of the soil to grow profitable crops, except at long intervals.

The soil is said to be less fertile than in many portions of the Northern and Western states in our own country, and is polluted with weeds—deep rooted and growing in detached pieces—to be eradicated only by hand pulling.

The best seed that can be obtained is sown at the rate of two bushels to the acre. On heavy soil the Dutch seed is considered the most suitable, while the Riga seed is thought to answer better for the light or medium soils. The Dutch seed is Riga seed sown in Holland, just as "Belgian" is Riga seed sown one year in Belgium.

(From Pamphlet No. 6-2, I. A. O. S. Publications)

"There are few industries in Ireland, and, so far as Ulster is concerned, few of more importance than the flax growing. It is estimated that the manufacturers have invested no less a sum than 13,000,000 pounds sterling (\$52,400,000) in the linen business. For several generations Belfast has been the center of the linen industry where the product of thousands of the agricultural community found a profitable sale and provided a regular and profitable employment for upward of 65,000 skilled hands.

"The importance of the flax industry and some idea of its decline may be gathered from the following figures:

YEAR	Acres Under Crop	Values of Crop
1869-86 (Av.)*	120,245	£972,782
1899	34,989	298,000
Decrease	85,256	£674,782

"In 1898 the amount paid by spinners annually for foreign flax reached the enormous sum of £2,932,621 (\$14,271,600), representing no less than 97,252 tons of flax.

"It is estimated that in the hey-day of the industry 120,000 people found employment for four weeks in the year in growing, steeping, drying, etc., while 18,000 hands were employed for twenty weeks in each year in the process of scutching. The estimated number of persons now thus employed is reduced, respectively, to 35,000 and 5,250.

"While the number of spindles in Ireland has increased from 250,000 in 1841 to 855,650 in 1898, many mills have ceased altogether to buy Irish flax, solely because they cannot procure the quality they require, except from abroad.

"The decadence of the industry may briefly be assigned to the following causes: (1) The use of inferior seed; (2) the absence of proper methods of tilling, steeping, and scutching; (3) the want of cooperation between the grower, the scutcher and the manufacturer.

"It is not usually contended that Irish flax has materially deteriorated, but it is maintained that in Belgium and elsewhere the growers produce an article of a quality superior to that of Ireland, and that they moreover, have taken steps to secure a product that shall be, as far as possible, of uniform quality.

"There appears to be no evidence to show that the falling off in the growing of flax in Ireland is due to any climatic conditions. These appear to be as favorable as ever.

"It will be found that in cooperation, in which growers, scutchers, and mill owners are associated, lies the only hope of saving the industry.

"**Statements of Yield**—The usual yield per acre of flax in Ireland ranges from 450 to 600 pounds, the average for four principal counties in 1890, by calculation, being 475 pounds.

"Mr. Wallace gives some interesting figures regarding the cost of production, which also afford a hint in relation to yield. The first statement refers to a farm in Kilrea, County Londonderry:

	<i>Per Acre</i>
Plowing .....	\$ 2.00
Seed (eight pecks) .....	6.00
Sowing, harrowing, etc. ....	2.00
Weeding .....	.62 1/2
Pulling .....	3.00
Steeping, watering, lifting.....	2.25
Mill-dressing .....	12.00
Rent of land.....	12.00
Total.....	\$39.87 1/2
Yield per acre, pounds.....	600
Cost per pound.....	\$ .06 2/3

“The second refers to a farm of 150 acres in Movenis, Garvagh, County Derry:

	<i>Per Acre</i>
Plowing .....	\$ 2.50
Sowing, harrowing, cultivating.....	5.00
Seed .....	5.50
Pulling .....	2.00
Steeping, watering, and lifting.....	4.00
Mill-dressing .....	11.25
Rent .....	7.50
Total.....	\$37.75
Yield per acre, pounds.....	630
Cost per pound nearly.....	\$ .06

“Three-fourths of the farms in Ireland are small—under 40 acres—and a long rotation, which is essential, necessitates small fields; as a result, 75 per cent of the flax crop is grown in fields of two acres or under. Mr. Wallace says: ‘When the straw begins to turn yellow and the foliage within six inches of the ground is drooping, pull at once.’

“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. Many farmers sow Riga seed, while preference is generally given to the product of Riga seed sown one or two years in Holland. This is called Dutch seed. But the seed sown in Holland 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 fibre and not seed, flax is sown very thickly, averaging about two bushels per statute acre. 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 fibre. The finest fibre 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 fibre.”



## ENGLAND

**British Flax Decree and the Linen Trade**

(Consul H. D. Van Sant, Dunfermline, Scotland, February 14)

"In order to conserve the present and future supply of flax in the United Kingdom the following decree has been issued:

"No person shall from the date of this order, until further notice, buy, sell, or deal in dressed or undressed Russian flax or tow at present in stock in the United Kingdom, or hereafter buy, sell, or deal in stocks of dressed or undressed Russian flax or tow after they have been imported into this country, except under license from the war department."

"This government decree prohibiting the purchase and sale of flax except under license may seriously affect the linen trade of Dunfermline in the near future, especially as tending toward the increased restriction of the already decreasing linen exports to the United States from the Dunfermline consular district. It appears that a small portion of a cargo of 3,000 tons of flax recently arriving at Dundee from Archangel in Russia was secured by several of the Dunfermline manufacturers and that further supplies have been secured from time to time through Belfast and other sources, enough to carry on the American trade for a time at least until new Russian supplies might arrive. But this new prohibition of the use of the Russian supply, except under license, adds uncertainty to the future as regards American trade, with the probability of a further decrease in the total volume of exports at the end of the year unless new supplies of flax are allowed before the year is out."

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(By Chas. A. Holder, American Consul, London, September 29, 1915)

"The present market value of flax fibre is from \$486.65 to \$729.98 per ton for the scutched flax. Before the war, \$14.60 to \$19.47 per ton was obtained for the threshed straw. Present prices are: Seed, from \$12.16 to \$14.60 per 410 pounds; fibre, as quoted above; linseed chaff brings about 73 cents per cwt. for feeding cattle; tow is worth from \$194.66 to \$243.33 per ton straw, after the fibre has been removed, usually is burned, although it sometimes is used for thatching roofs, being tough and lasting. It also makes excellent packing material for crockery, but it is essential that it should be properly dried and kept straight and even in the sheaves if it is to be used for any of these purposes.

"The total cost of production per acre, including rent at \$7.30 per acre, can be given for Great Britain as between \$26.76 and \$31.63, but these figures are only approximate and do not include scutching. If scutching is included the additional cost is about \$12.16. The net profit per acre will depend, naturally, upon the value of the land or its rental, the cost of labor, the market for the crop and many other factors which will differ in various parts of the country."

## SCOTLAND

(Dundee, Scotland, Report dated April 21, 1915)

**"The Linen Trade—Flax Famine—**The linen trade in the early months of last year showed unsatisfactory signs, and there was a steady depreciation in raw material values. Prices for the fibre continued to rise until they were practically anything that sellers cared to ask. The new Russian flax crop, believed to be both inferior in quality and quantity, could not be shipped, and spinners were unable to replenish their new season's supplies.

"The war led to the appreciation of all linen-trade values by 100 per cent and more. A heavy strain was put on the manufacturers of the coarser fabrics for urgent government requirements. While the manufacturers of the heavier linens had more orders than they could possibly take care of, those manufacturing household linens and other finer textures did not fare so well and after the outbreak of hostilities had great difficulty in securing supplies of yarn.

"The following table shows the highest and lowest prices of flax yarns for the past two years, and the large increase in prices that took place as a result of the war:

YARNS	Highest		Lowest	
	1913	1914	1913	1914
3-pound flax warp yarn .....	\$0.597	\$1.34	\$0.567	\$0.567
4-pound tow warp yarn .....	.638	.97	.608	.59
3-pound tow weft yarn .....	.527	.77	.496	.476
40-lea line weft yarn .....	1.46	2.13	1.36	1.28

(American Consul, Dunfermline, Scotland, January 8, 1916)

**"Large Exports of Linens to the United States—High Prices—**Linen, or woven flax fabric, has been the principal item of export from Fifeshire to the United States for more than a half century. During the last year, owing to the war, the conditions of this trade have been without parallel in the history of the consulate, and the exports from this district show a loss of \$745,976 as compared with 1914. The quarter ended December 31 shows a decrease of \$238,838, while the September quarter shows a still heavier loss in volume of exports, one of \$389,677. The falling off in this trade has been still greater than the figures indicate, as prices are much higher than they were a year ago.

"Prices of yarns have advanced about 150 per cent since last July, and compared with prices of a few years ago, or of normal times, the advance is about 300 per cent, as stated recently by a leading linen expert. It is even claimed that the top price has not yet been reached. It has only been possible to produce linen damask at a big advance in price, the result being a large decrease in business. Manufacturers generally find themselves unable to give quotations because of the uncertainty of the yarn market. Yet in the last year when it was reported at different times that flax would soon be unobtainable new supplies arrived from unexpected quarters, so that looms have been kept going on part time.

"It is likely that sales to the United States will continue to be on a restricted basis until new supplies of flax and yarns arrive and the demand and lower prices restore the old volume of trade. During the greater part of 1915 nearly one-half of the looms were idle or turned to other account than the manufacture of woven flax fabrics for the export trade.

"The linoleum exports of 1915 to the United States show a decrease of \$40,908, as compared with the previous year. Considering the scarcity of hands, the increase in wages, and the strikes and fires in the Kirkcaldy factories that occurred during the year, the decrease is not more notable than the decrease of the previous year. It is said that the competition of American linoleum factories is becoming increasingly keen from year to year, and the high quality of the American product is becoming more generally recognized than it was a few years ago. An increase of linoleum exports to any marked degree is not likely during the continuance of the war, although afterwards, when the usual supply of labor is restored, the indications are that there will be a steady increase in this line of exports."

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#### EGYPT

G. C. Dudgeon, consulting agriculturist of the Ministry of Agriculture, at Cairo, Egypt, contributes the following information regarding the cultivation in that country: .

"Flax is grown on a small scale only in Egypt, and its manufacture is only conducted as a peasant industry by crude methods, which have probably been in employment since the earliest recorded times.

"The crop, as at present cultivated in Egypt, is chiefly grown for seed and fibre at the same time, for which reason the quality of the fibre produced is usually inferior.

"There are no factories for flax treatment or spinning in the country."

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#### AUSTRALIA

Consul John F. Jewell, of Melbourne, reports that the flax yield of the State of Victoria, Australia, for the past season is estimated at 1,800 tons, or double the quantity produced for the previous season.

The renewed attention being given by farmers to this industry is largely due to the bonus offered by the commonwealth government, amounting to 10 per cent on the value of the fibre and the linseed.

There are three delinting plants in operation, one of which is at the state penitentiary, and most of the output goes to rope factories for conversion into twine, window sash cord, and fishing lines. The plant grown in Victoria is the linen flax. Buyers of the past season's crops are highly pleased with its quality and it is probable an attempt will shortly be made to manufacture linen locally. The fibre realizes from \$20 to \$25 per ton, and the yield is about one and one-half tons per acre. The linseed amounts to about eighteen bushels per acre, and

sells at 7s. 6d. (\$1.82) to 8s. (\$1.94) per bushel wholesale for cattle feed. The returns for the new season's crop planted in June will probably show a large increase in acreage.

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American Consular Service, New South Wales: "The commonwealth of Australia has offered bounties on flax and hemp linseed, but so far no great advantage has been taken of these gratuities.

"During the fiscal year 1913-1914, 137 tons of flax and hemp were raised, yielding a bounty of \$574. There was no linseed produced during the same period, but in the year 1912-1913, 100 cwt. of linseed was made, which yielded a bounty of \$43. The State of Victoria claimed the total amounts paid for these products."

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Sidney, Australia, Department of Agriculture reports: "Cultivation of flax in this state has been on a very limited scale, confined mostly to experimental work. The result in most districts has not been promising."

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## FRANCE

The flax culture of France is confined, for the most part, to the departments of Nord, Pas-de-Calais, and others contiguous in the north, Lille being the center of the industry. It has suffered a considerable decline within two or three decades, having ceased entirely in some departments, while the quantity has diminished in nearly all, save perhaps in Nord, in which the city of Lille is located.

While a little of the fibre is used in France for sewing thread, the main product goes to Great Britain.

Prices of the different forms of flax fibre produced in France are quoted by M. Renouard as follows:

"Dew-retted, 75 to 100 francs per 100 kilograms (about 7½ to 10 cents per pound); tank-retted, 100 to 150 francs per 100 kilograms (about 10 to 15 cents per pound); river-retted, 150 to 300 francs per 100 kilograms (about 15 to 30 cents per pound)"

"The cultivator receives from 300 to 1,000 francs per hectare for the raw product; that is to say, approximately \$24 to \$80 per acre; but, in American money, about \$48 per acre, rental included; so that the farmer grows flax at a loss, if his sales fall below this figure, and at a profit, if the price realized gives him more than this sum per acre. Unfortunately, there has been loss in many districts in late years, which accounts for the decline of the industry in France."

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## THE NETHERLANDS

(Consul General S. Listoe, Rotterdam, January 25, 1916)

"One of the leading Rotterdam dealers in flax has estimated the production of flax in the Netherlands for the season of 1914-15 at 1,500 tons of blue Dutch fibre, 800 tons of white Dutch fibre (imita-

tion Courtrai retting), and 800 tons of Friesland fibre, a total of 3,100 tons, against approximately 1,600 tons blue and white Dutch and 1,200 tons Friesland for the previous season.

"While the prices of all fibres were low last season, viz., \$250 to \$384 for blue and white Dutch and \$192 to \$288 for Friesland, they have advanced markedly as a result of the European war and were on December 31, 1914, \$600 to \$744 for blue and white Dutch and \$408 to \$480 for Friesland. This extraordinary advance has been caused by the stoppage, through the war, of all supplies from Russia, which country produces annually 300,000 to 400,000 tons and usually exports three-fourths of the crop.

"During the 1914-15 season no flax straw has been exported from Holland to Belgium to be retted in the River Lys, nor have the Courtrai scutchers been able to bring home any of the flax straw which they had purchased in France. Notwithstanding this there would have been a large production in the Courtrai district this season on account of the unusually large stock of straw held over from last year, but none of this is now available for the consuming countries, since the Belgian, and later the German, authorities prohibited its exportation via Holland, which is the only exit."

(Extract from the "Frankfurter Gazette")

"Berlin, February 12. (Private telegram.) As already reported it is intended to increase the flax fibre culture in Germany during the present year from 10,000 to 20,000 or 30,000 hektar (one hektar is equal to two and one-half acres). In order to render it easier for the farmers to produce the flax, the empire, together with the industry (linen) offer a subvention up to 40 per cent to all who will establish retting and scutching mills. A bureau of information for retting has been established in Neusalz a O., which will furnish the farmers with free advice, plans and specifications for machinery, and attend to the supervision of the building and installation of plants and instruction of the first workers. All applications for subvention are to be addressed to said bureau. The (linen) industry on their part have decided to immediately put up a large number of retting establishments, which will be ready by the end of July to begin operations. On the twentieth of the month the flax committee will meet in Berlin with the members of the Farmers' Association and Farmers' Central Bureau to confer about all further steps. The farmers will be granted the right to sell and deliver their crops after the pulling of the straw. However, the profit on the retting and scutching processes has been made sufficiently large to induce the farmers to attend to these processes as well, and thereby secure for themselves additional profits.

"The prices for a good middle quality per 200 pounds are fixed as follows:

"Flax in the straw, \$5.00; retted, \$8.00; half scutched, \$12.50 to \$15.00; scutched, \$25.00 to \$35.00; heckled, \$55.00 to \$60.00.

"The War Association for Flax Culture has obtained seed in sufficient quantities, which is placed at the disposition of any and all farmers who are willing to enter into a contract with the War Association."

**GREATER FLAX CULTURE IN SILESIA PROPOSED**

(Consul Harry G. Seltzer, Breslau, March 14)

"A speaker at a general assembly of the Landwirtschaftliche Verein at Breslau advocated more extensive flax culture in Silesia. He stated that it was most important that the fullest possible attention should be paid to the question of supplying textile raw materials, and it was a national duty to provide for a large supply of the best fibres in time.

" 'The culture of flax is possible in Germany,' he said, 'but it was neglected before the war. Since the whole nation has a strong interest in the increase of flax production, it would be advisable for the government to enforce the cultivation of an area of 40,000 hectares (98,842 acres), and at the same time to fix maximum prices for raw and retted flax, thus assuring its sale.'

"It is stated that by the decreasing culture of sugar beets there will be a greater area for flax culture. In the province of Silesia this decreased sugar area is said to have amounted to 33 per cent last year, and this year it is expected to be about 50 per cent. The German linen industry is said to need annually about 45,000 tons of flax, but to have only the tenth part of it just now.

" 'An emancipation from foreign markets is absolutely necessary and the prospects are favorable at present,' was a statement of the speaker already quoted.'

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**FLAX PLANTED IN OREGON IN SPRING OF 1916**

About 600 acres of flax were planted this year in the vicinity of Salem. Seed was procured from the State. The flax will be harvested by convicts and the straw will be sold to the State at \$15.00 per ton. The raising of the flax is under the supervision of a State expert.

Private enterprise near Gaston put in 100 acres of flax, the seed procured from the State.

Eugene Chamber of Commerce, with the aid of the Portland Chamber of Commerce, has planted 200 acres, the cultivation of which is under the direction of Mr. Eugene Bosse, flax expert.

Roseburg has made an experimental planting of about six acres.

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**LATEST REPORT ON FLAX FROM AMERICAN CONSUL  
IN BELFAST, IRELAND**

The School of Commerce, University of Oregon, is just in receipt of the following report from Consul Hunter Sharp of Belfast, Ireland, in relation to the conditions of the linen industry, prices of flax, etc.

Prices of flax virtually doubled during the past twelve months. Large supplies of Russian flax were received, while Dutch supplies were small, and there were only odd lots of Belgian flaxes received, for which high prices were paid, touching even \$1,460.00 per ton. Russian flax was on a basis of about \$389.00 per ton; Dutch, \$1,314.00; and Irish flax as high as \$1,168.00.

Advanced prices for yarns have been responsible for stopping the manufacture of various lines of linen goods, some of which, over a series of years, were regarded as the steadiest branch of the business. This is notable in the case of linen damask, as large numbers of looms have been turned from making pure linen varieties to that of all cotton or union cloths.

The United States occupies first place in the purchases of linen goods, taking more than half of the total exports from Belfast. The exports of linen goods to Canada from Ireland show a perceptible increase over 1914. The total linen goods exported from Ireland in 1914 to all countries amounted to \$26,675,101.00; in 1915, \$24,027,500.00.

The total value of exports from Belfast to the United States was \$15,823,964.00 in 1915, a decrease of about \$2,000.00 over 1914. Hackled flax exported in 1915 to the United States amounted to over \$1,000,000.00.

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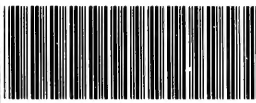








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