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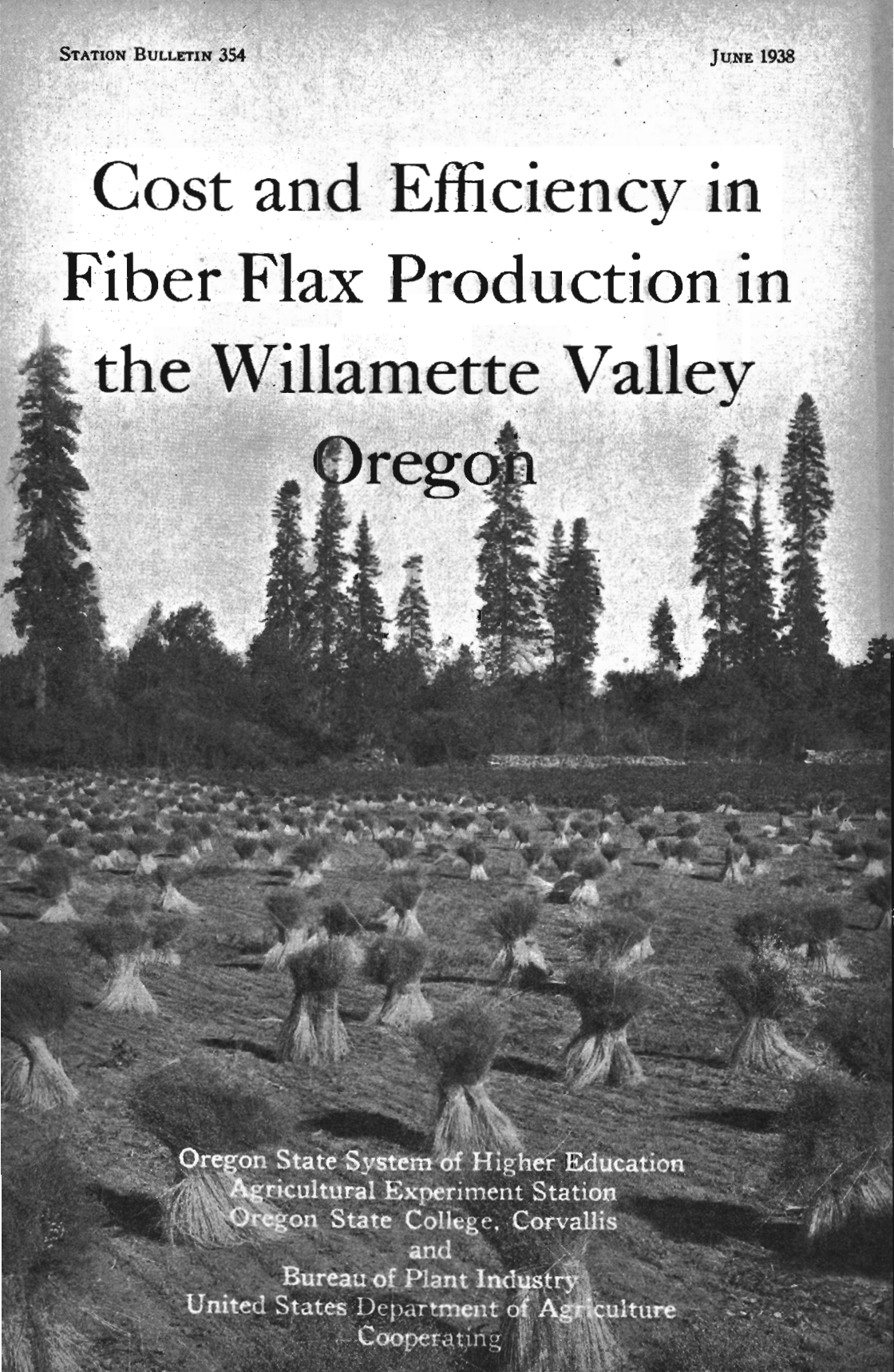
Cost and Efficiency in Fiber Flax Production in the Willamette Valley Oregon



Oregon State System of Higher Education
Agricultural Experiment Station
Oregon State College, Corvallis
and
Bureau of Plant Industry
United States Department of Agriculture
Cooperating

SUMMARY

The average cost of growing an acre of flax in 1934 and 1936 was $36.18.

The average yield for these two years was 2.1 tons, which made the cost $17.50 a ton. The average yield of all flax delivered to the State Flax Industry for the period 1925-1937 was 1.65 tons. At this yield the cost of growing would have been $21.93 a ton. These costs are for the flax straw delivered to the processing plant.

A yield of 1.65 tons of flax straw is estimated to produce 230 to 300 pounds of line fiber ready for spinning, 100 to 130 pounds of tow and pullings ready for spinning, 250 pounds of stock feed, and 500 to 600 pounds of seed.

The practices in growing flax now being followed by Willamette Valley farmers are thoroughly modern; namely, use of suitable soil, good seed, good cultural methods, and modern machinery. Material reductions in cost are therefore unlikely.

Considerable risk is involved in growing flax as two-thirds of the estimated cost is cash, and that must be paid before the farmer receives anything for his labor or for the use of his land.

As there seems little likelihood of reducing the cost of growing, the greatest opportunity for reduction in the cost of flax fiber seems to lie in processing.

Prices paid for flax straw in the past have given the farmer wages for his labor and fair rent for his land. Flax growing in Oregon has received special aid from state and Federal sources and such aid has materially furthered the establishment of the industry.

Cost and Efficiency in Fiber-Flax Production in the Willamette Valley, Oregon*

By

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THE major objective of this study is to determine the costs of growing fiber flax in the Willamette Valley and the significance of these costs to the economic status of the industry.

This study logically follows Circular 118 of the Oregon Experiment Station on "Fiber Flax in Oregon," which discusses the climatic, soil, and cultural requirements of flax production.

STATUS OF THE FIBER-FLAX INDUSTRY

World production. Flax for fiber and seed has been widely grown for many centuries. Before the introduction of the cotton gin flax was the most widely used vegetable fiber. Since that event, except for Russia and the Baltic countries, production of flax for fiber has been very limited.

The estimated average annual acreage of flax planted in the main flax-growing countries for the 3-year period ending June 30, 1936, was as follows:*

	Number of acres	Seed produced	Fiber produced
		bushels	*tons*
WORLD	18,733,333	139,000,000	852,633
Argentina	5,690,000	66,138,333	.....
India	3,323,333	16,026,667	.....
Europe (except Russia)	947,900	6,549,667	180,917
Russia	5,908,713	28,076,500‡	599,192
United States	1,477,333	9,028,333	200§
All others	1,386,054	13,180,500	72,324

Approximately two-thirds of the world's flax is grown for seed only. Approximately one-third of the flax is used for fiber. The flax used for fiber produces seed as well and is, therefore a minor source of flax seed

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‡Average of 2-year period ending June 30, 1935. Data for the 1935-36 period were not available.

§United States fiber production from June 30, 1933, to June 30, 1936, is estimated by the writers because of lack of official production statistics. Other production data were obtained from the 1937 Yearbook of Agriculture, United States Department of Agriculture.

for commercial purposes. The large acreages of flax in Argentina, India, and the United States are grown almost entirely for the seed. In Russia, 10 to 20 per cent of the acreage is grown primarily for seed, but the remainder is grown for fiber. Russia, the Baltic countries, and Poland together have produced 85 per cent of the world's estimated production of fiber during the past three years.

In France, Holland, Germany, Czechoslovakia, and Poland the fiber-flax industry has been heavily subsidized during recent years; as a result production increased, especially in Germany.

United States production. Oregon and Michigan are the only states that have consistently grown fiber flax during the past 10 years. The states of Virginia, South Carolina, and Maryland, however, have each made one or more attempts to start the enterprise during this period. Of the total estimated United States acreage of fiber flax Oregon now grows from 80 to 90 per cent.*

Fiber flax requires an abundance of rainfall; cool, cloudy weather during the growing season; a precipitation distributed in many light showers rather than in downpours, which may cause lodging of the plants; and a deep, fertile, well-drained soil. The United States has a considerable area meeting these conditions. The present limited production cannot, therefore, be attributed to lack of suitable land.

Utilization of the European fiber-flax crop. In much of Europe the retting and scutching is done by the farmers who grow the flax. In many European countries, and especially in Russia, home spinning of flax fiber is still widely practiced. Of the commercial flax spinning about one-third is done at Belfast, Ireland. Belgium, Czechoslovakia, Germany, and France are also important commercial flax-spinning centers.

These European mills have been long established and have available labor trained in the technique of flax spinning. They are, therefore, in a dominant position, particularly as regards the production of fine linen goods such as table damask and thread for lace, which are made from the finest quality "line" fiber by the most skilled workmen.

The United States is the best customer of the European flax spinning and weaving mills. Annual importations of thread and linen goods are valued at approximately 35 to 45 million dollars. These imported linen goods are subject to an ad valorem tariff ranging from 35 per cent upward. In addition to manufactured fiber, imports of unmanufactured flax fiber during the 3-year period ending June 30, 1936, amounted to 5,101 tons annually. This imported unmanufactured fiber is subject to a tariff amounting to 1½ cents a pound for scutched flax, 3 cents a pound for hackled flax, and 1 cent a pound for flax tow.

Utilization of fiber flax in the United States. Most of the fiber produced in Oregon is spun in Oregon or in the neighboring state of Washington. The bulk of this fiber is spun into sack twine or twine for fish lines and nets, although limited amounts have been used for cloth such as toweling. Fine linen goods like those manufactured in Europe are not made in Oregon mills.

* Estimates by Oregon Office of Fiber Plant Investigations, Bureau of Plant Industry, United States Department of Agriculture.

Besides the spinning mills on the Pacific Coast which utilize most of the domestic crop, spinning mills in New York, New Jersey, Massachusetts, and Pennsylvania utilize large amounts of imported fiber.

In addition to the "line" flax fiber the flax straw as delivered by the farmers yields other products, including seed, tow, pullings, stock feed, and shives. By "line" fiber is meant the longer, untangled flax fiber suitable for the general flax-spinning trade. Tow and pullings consist of shorter, tangled fibers and are used for making low grades of twine and toweling. The shives consist of the woody part of the stem and have little value other than for fuel in the flax mills. The seed in excess of that needed for planting is used for the extraction of linseed oil and for stock feed. The shriveled seed, screenings, and other waste are sometimes manufactured into stock feed. The experience of Oregon retting and scutching plants indicates that one ton of unthreshed flax straw as delivered to the plant may be expected to yield 140 to 180 pounds of scutched line fiber, 60 to 80 pounds of tow and pullings, and 5 to 6½ bushels of seed. The scutched line fiber loses 17 to 20 per cent in the final hackling process just before spinning as commonly prepared in Oregon.

If the United States grew all the flax now used for its domestic requirements the area required would be about 125,000 acres. To grow this acreage annually at least 500,000 acres of suitable land would be required as flax must be rotated with soil-building crops such as legumes. There is this much suitable land in the Willamette Valley. It should not be assumed, however, that the demand for flax in the United States is permanently limited to the amount now being used. Any reduction in price would greatly increase the outlet.

Competitive factors. Most of the countries producing fiber flax do so with cheaper labor than is available in the United States. The labor for retting, scutching, and spinning is for the most part, also, more skillful. Even with these advantages Western Europe apparently finds it difficult to maintain the flax industry without the aid of subsidies. It seems reasonable to suppose, therefore, that any considerable development of the fiber-flax industry in the United States must be with the aid of tariffs, subsidies, or improved technical processes.

Flax produced in the United States not only must compete against European flax but must compete with other fibers, especially cotton. Flax fiber (linen) is superior to cotton for many purposes for which cotton is now used. It is stronger, more durable, and is more absorbent. Cotton is used in preference to flax primarily because it is cheaper when spun and woven. The use of flax is therefore limited to those uses where particular characteristics outweigh the difference in price.

The method of separating the flax fiber from the straw is much the same as it was 2,000 years ago. Some new machinery has been introduced, but the basic processes are the same and much hand labor is necessary. As the retting, as practiced in Oregon, can be done only in dry weather the major portion of the crop cannot be processed until the summer following the year in which it is grown. This means added costs for storage and insurance and a year's delay in selling the product. The present processing methods are also far from perfect from the standpoint of the finished product. At present approximately two-thirds of the fiber in the straw reaches the spinner as "long line" flax—that is, flax fiber that is straight,

untangled, and unbroken The remainder is short, broken, and tangled tow. The hackling process at the spinning plant results in approximately 20 per cent of the line fiber being reduced to a medium high-grade spinning fiber known as hackle and tow.

Table 1. AVERAGE PRICE PER POUND OF IMPORTED AND OREGON FLAX FIBER, 1931-1937.

County	1931	1932	1933	1934	1935	1936	1937	Average
	Cents	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*
Oregon								
F.o.b. Salem								
Best grades	20	17	21	21.5	23	23	25	21.50
All grades	16	14	16	19.5	22.5	22.5	24.5	19.29
Imported								
F.o.b. New York								
Courtrai (Belgian)	20.75	15.75	19	22.5	23.75	25	28	22.11
Dutch	13.75	12.75	16.25	20.75	22.5	22.5	25.5	19.14
Russian	9.25	8.5	13.5	13	17.75	21.5	20	15.07
Livonian	9.75	9	11.5	16	19.25	16.25	19.5	14.46

Data from the State Flax Industry.

Flax fiber prices. The average prices of domestic and imported flax fiber for 1931-1937 are shown in Table 1. These prices indicate that Oregon flax fiber is equal or superior in quality to the Dutch fiber and distinctly superior to that from Russia or Livonia. It is surpassed only by the best Belgian flax. It is apparent from these data that Oregon flax is of high quality.

Fiber flax in Oregon. Flax fiber has been grown in Oregon since the earliest pioneer days and was used by the pioneers chiefly for making their own clothing. It was not until the nineties that commercial fiber flax production was begun. At that time Mrs. Wm. P. Lord, wife of the Governor of Oregon, greatly stimulated interest in fiber-flax production through her efforts to attract state and national attention to the value and quality of Oregon's flax fiber. The Oregon Agricultural Experiment Station issued its first bulletin on flax in 1897. By 1915 interest in this crop had become so great that the Oregon State Legislature appropriated $50,000 to establish a flax mill at the penitentiary.

During the early development of the flax industry a number of small private companies attempted, unsuccessfully, to develop fiber-flax processing and manufacturing.

The flax industry of Oregon is at present confined to the Willamette Valley, where soil and climatic conditions are especially favorable. Except during the four worst depression years, 1931 to 1934 inclusive, the acreage planted has been fairly constant.

The "State Flax Industry" was established in 1915 to provide retting, scutching, and marketing facilities for Oregon grown flax. This institution is owned and operated by the state. It is located at the state penitentiary at Salem and is operated with convict labor. This institution has provided a steady cash market for the flax straw for the past 22 years. The acreage, production, price of flax straw, and gross income per acre for all fiber flax sold to the State Flax Industry from 1925 to 1936, inclusive, are shown in Table 2. For the years 1925 to 1930 the average price paid to growers for flax straw delivered to the plant was $34.69 a ton. For the years 1931 to 1937 the average price was $21.54.

In 1934 a Federal law permitted the various states to prohibit the sale of products made in whole or in part in penal institutions. A large number of states have taken advantage of this act, with the result that the State

Table 2. ACREAGE, PRODUCTION, AND PRICES OF FIBER FLAX SOLD TO STATE FLAX INDUSTRY, 1925-1937.

Year	Number of growers	Acreage grown	Yield	Average price per ton paid growers	Gross returns per acre	Percentage long flax*
		Acres	*Tons*			*Per cent*
1925	225	2,100	1.26	$31.60	$39.82	74
1926	141	1,644	1.44	37.20	53.75	93
1927	127	2,100	1.81	34.85	63.10	84.5
1928	205	2,782	1.37	33.85	46.30	88.5
1929	277	3,462	1.72	34.65	59.50	96
1930	332	3,811	2.29	36.00	82.55	93.5
1931	208	1,793	1.68	23.35	39.28	37.5
1932	103	713	1.46	21.17	32.38	68
1933	52	461	2.04	19.41	39.57	99
1934	228	1,904	2.04	22.50	45.85	100
1935	271	2,465	0.58†	16.30	9.45	37
1936	181	1,516	2.14	23.12	49.58	91
1937	103	1,090	1.6	24.93	39.60	86.5
Average (13 years)		1,988	1.65	$30.34	$50.10	85

Data from the State Flax Industry.
*Straw measuring 30 inches or more in length.
†Also harvested 1,131 bushels of seed from flax too poor to be delivered. This seed was valued at $1,810 and is included in gross returns listed.

Figure 1. PROCESSING THE 1936 CROP AT THE MOUNT ANGEL COOPERATIVE MILL.
The flax is stored in large open sheds from which the seed can then be threshed and the threshed straw retted. After being retted in water, the straw is taken from the tank and set up in "wigwams" to dry.

Flax Industry is seriously handicapped in the disposition of its product. This situation led to the establishment of three farmers' cooperative retting and scutching plants in 1936. These plants were built very largely with Federal assistance and with the State of Oregon as the official sponsor. The State of Oregon holds title to the plants and leases them to the cooperative associations at a nominal rental. Each of these three plants has an estimated capacity of 1,200 tons a year. They are equipped to ret and scutch according to standard practices. Figure 1 shows part of the Mount Angel cooperative mill.

The estimated acreage of flax handled by these three mills during the past two years has been as follows:

Location of retting and scutching mill	1937 acreage	1936 acreage
Mount Angel	474	678
Canby	541	597
Springfield	192	390

In addition to the three retting and scutching mills, three flax-spinning mills are now operating on the Pacific Coast, two at Salem, Oregon, and one at Vancouver, Washington. Most of the fiber produced in Oregon is spun by these mills.

The Agricultural Adjustment Administration offered benefit payments to flax growers of approximately $5.00 a ton in 1936 and $7.50 a ton in 1937. It will be noted, therefore, that Oregon flax production has received special assistance from state and Federal sources.

COST OF PRODUCING FLAX IN OREGON

In studying the cost of producing fiber flax the authors and field assistants from the Oregon Agricultural Experiment Station interviewed 176 flax growers and obtained from them data regarding costs incurred and practices used in growing fiber flax. These growers were scattered over the five leading flax counties as follows: Clackamas 84, Marion 57, Linn 15, Lane 9, and Yamhill 11. An effort was made to obtain records from each grower for each of the three years, but this was not always possible. This study was carried on over the 3-year period 1934 to 1936, inclusive, and during this period a total of 239 flax-enterprise records were obtained. It is estimated that this study covered 59 per cent of the flax acreage grown in 1934, 17 per cent in 1935, and 30 per cent in 1936 (Table 3).

Table 3. EXTENT OF THE FLAX STUDY.

Year	Number of growers of fiber flax in Willamette Valley	Number of field schedules obtained	Acreage of fiber flax in the Willamette Valley	Acreage of flax included in study	Percentage of flax acreage studied
			Acres	*Acres*	*Per cent*
1934	228	124	1,904	1,119	59
1935	271*	31	2,465*	425	17*
1936	282	84	2,460	735	30

*These figures are exclusive of a number of farmers who contracted in 1935 to grow about 1,200 acres of fiber flax for the Champagne Paper Corporation of New York.

Owing to drought fiber flax in 1935 was a failure on many farms. Nevertheless, data were gathered on 31 of the farms previously visited in 1934 in order to appraise the effect of this adverse season on the cost of production and the method of disposal of the resultant short crop. The results from this year's production, being far below normal, are presented separately.

Table 4. LAND UTILIZATION ON FARMS GROWING FIBER FLAX.
Average for 124 farms, 1934.

Use of land	Number of farms having the item	Acreage per farm having the item	Acreage per farm for all farms
		Acres	*Acres*
Fiber flax	124	9.0	9.0
Wheat	95	13.6	10.5
Oats	94	16.0	12.3
Barley	38	10.5	3.4
Alfalfa	13	9.5	1.0
Clover	95	17.0	13.2
Vetch hay	57	10.5	4.9
Vetch seed and Austrian peas	33	13.1	3.5
Other cash crops (hops, seed flax, etc.)	16	13.6	1.8
Other hay crops	22	6.1	1.1
Tillage pasture	39	14.3	4.5
Corn	87	7.9	5.6
Potatoes	58	7.4	3.5
Berries	13	3.2	.3
Orchard	11	3.9	.3
Truck garden	18	5.1	.7
Fallow	34	5.0	1.4
Unspecified	20	5.9	1.0
TOTAL TILLAGE	124	78.0	78.0
Other pasture and woods	87	64.0	45.0
Farmstead and waste	115	6.4	6.0
TOTAL LAND IN FARM	124	129.1	129.1

The 124 records taken in 1934 and the 84 records taken in 1936 are similar as to costs and yields; hence the data for these two years were combined. It is believed that these data are fairly representative of the conditions and acre-costs that careful growers may expect to encounter in the enterprise over a period of years, subject, of course, to any changes that may occur in price levels or in the technique of growing flax. Some question, however, may be raised as to yields. The yields on the farms studied averaged 2.1 tons, which is almost exactly the same as the average for all the farms selling to the State Flax Industry for the same years. Reference to Table 2 shows, however, that the average for 1925 to 1937 inclusive was 1.65 tons.

Table 5. LIVESTOCK ON FLAX PRODUCING FARMS.

Kind of livestock	Number of farms reporting	Average number of livestock kept per farm reporting
Horses	115	3
Milk cows	119	6
Other cattle	87	4
Sheep or goats	46	56
Swine	99	17
Poultry	115	117

Fiber flax in the farm organization. Flax, though distinctly a commercial or cash-producing enterprise, has been grown as a minor crop on diversified farms. Apparently every effort was made by the field men of the State Flax Industry to insure a combination of suitable land, good management, and minimum risk. This has resulted in small flax acreages per farm but in quality crops.

The average size of all farms included in the 1934 survey was 129 acres, with 78 acres under cultivation, of which 9 acres were in fiber flax. The other crops on these farms are shown in Table 4. The extent of livestock kept is indicated in Table 5. Owing to the necessity of rotating flax with legumes and cultivated crops it seems probable that fiber flax should not occupy a larger place in the farm organization that it has in the past.

Capital requirements for fiber-flax growing. The fiber-flax enterprise does not require a heavy outlay of capital for special equipment. Flax is usually grown on diversified farms, and except for the mechanical puller the regular farm equipment is used. Pullers, which cost about $1,300 each, are owned by only a few growers who contract to pull the acreage of their immediate neighborhood.

The land used for flax was valued at an average price of $132 an acre. Farmers generally stated that they reserved their best land for flax production, and gave flax the best year in the cropping program; namely, following a cultivated crop like corn or potatoes, or a legume like clover or alfalfa. The bottom-land soils of the Chehalis series and the old valley-filling soils of the Willamette series seemed to be especially suited for flax growing, and most flax fields studied were located on these soils. In considering the returns from flax it should be remembered that these are the best soils and are also suitable for growing hops, alfalfa, truck crops, small fruits, tree fruits, nuts, and other crops which likewise may yield rather high returns.

MAJOR ITEMS OF COST

The average cost of producing fiber-flax straw in the Willamette Valley for 1934 and 1936 was $36.18 an acre (Table 6). The yield was 2.1 tons per acre, making the cost $17.50 a ton. This includes all costs of growing the crop and delivering it to the flax storage sheds at the retting plants, less a small credit for seed threshed from flax straw which was too short to process profitably and which the State Flax Industry would not buy. Almost one-fourth of the total cost, or $8.56 an acre, was a charge made for the use of the land; a little more than one-fourth of the cost, or $10.58, was preharvest expense; while $17.25, or practically half of the total, was harvesting expense including hauling the crop to the processing plant.

The costs per ton for the two years were quite similar, being $16.53 in 1934 and $18.47 in 1936. The difference was largely in the greater cost of harvesting the 1936 crop because it was somewhat lodged and weedy. Yields of a little more than two tons an acre were obtained in each of these two years and the costs per ton are, of course, calculated on those yields.

Labor requirements. An average of 25.6 hours of man labor, in addition to the contract work, was required to produce an acre of fiber flax. The cost of this labor, valued at 26.2¢ an hour, was $6.70 an acre.

Table 6. COST OF PRODUCING FIBER FLAX IN THE WILLAMETTE VALLEY, OREGON.
Average of 2 years, 1934, 1936.
For 208 flax fields containing 1,854 acres of flax, producing 3,871 tons of flax straw. Average yield 2.1 tons per acre.

	Average cost per acre	Average cost per ton	Percentage of total cost
			Per cent
Fertilizing	$ 0.52	$ 0.26	1.5
Preparing seed bed	4.06	1.96	11.1
Seed and sowing	5.05	2.44	13.9
Weeding	.95	.46	2.6
PREHARVEST COSTS	$10.58	$ 5.12	29.1
Pulling	$ 9.35	$ 4.53	25.7
Shocking, tying, and loading	1.94	.93	5.3
Hauling to storage shed	5.96	2.87	16.3
HARVEST COSTS	$17.25	$ 8.33	47.3
Taxes on land	$ 1.85	$ .90	5.1
Interest on land at 5 per cent	6.71	3.25	18.5
USE OF LAND	$ 8.56	$ 4.15	23.6
TOTAL COST OF PRODUCTION	$36.39	$17.60	100.0
Credit for threshed flax*	$ .21	$ .10	----
NET COST OF FLAX STRAW	36.18	17.50	----
Total cost, 1934	$35.49	$16.53	----
Total cost, 1936	37.28	18.47	----

*In 1936 a scattered acreage of flax that was of too poor a quality for fiber was cut and threshed for seed.

Table 7. LABOR REQUIREMENTS FOR FIBER-FLAX PRODUCTION.
Average of two years, 1934 and 1936.

Operation	Horse, tractor, or hand	Number of records averaged	Acreage covered	Percentage of total acreage	Times over	Labor per acre			Labor per acre per operation		
						Man	Horse	Tractor	Man	Horse	Tractor
			Acres	*Per cent*		*Hours*	*Hours*	*Hours*	*Hours*	*Hours*	*Hours*
Manuring	Horse	20	133	7	1.0	5.4	8.9	----	5.4	8.9	----
Plowing	Horse	130	955	52	1.0	5.0	13.6	----	5.0	13.6	----
Plowing	Tractor	76	871	48	1.0	1.5	----	1.5	1.5	----	1.5
Harrowing	Horse	146	1,249	68	1.5	1.3	3.4	----	.8	2.2	----
Harrowing	Tractor	8	93	5	2.2	.8	----	.8	.4	----	.4
Springtooth	Horse	55	428	23	1.8	2.2	5.9	----	1.2	3.3	----
Springtooth	Tractor	31	372	20	1.4	.8	----	.8	.6	----	.6
Disking	Horse	34	277	15	1.5	2.3	6.6	----	1.5	4.4	----
Disking	Tractor	83	821	45	1.4	.4	----	.4	.3	----	.3
Pulverizing	Horse	27	266	15	1.2	1.1	2.7	----	1.0	2.3	----
Pulverizing	Tractor	6	63	3	1.0	.6	----	.6	.6	----	.6
Seeding	Horse	177	1,633	90	1.0	1.2	2.2	----	1.2	2.2	----
Seeding	Tractor	5	46	3	1.0	2.0	----	2.0	2.0	----	2.0
Seeding	Hand	21	145	8	1.0	1.4	----	----	1.4	----	----
Covering seed	Horse	70	984	54	1.1	.8	1.9	----	.6	1.7	----
Covering seed	Tractor	4	29	2	1.0	.4	----	.4	.4	----	.4
Weeding	Hand	115	1,824	100	1.0	3.8	----	----	3.8	----	----
Hand pulling	Hand	51	194	11	1.0	68.5	----	----	68.5	----	----
Machine pulling	Tractor	174	1,630	89	----	5.5	----	1.8	5.5	----	1.8
Shock-tie-load	Hand	203	1,824	100	----	6.7	----	----	6.7	----	----
Hauling	*	203	1,824	100	----	4.1	----	----	4.1	----	----

*Mostly by truck.

The average cost of contract work was $13.63 an acre. Of this cost $5.78 was for hauling, $7.54 for harvesting, and 31¢ miscellaneous.

The man, horse, and tractor labor required to perform individual operations pertaining to flax production is shown in Table 7. Reference to this table shows that plowing, disking, spike harrowing, and springtooth harrowing were common operations in preparing the seedbed. On about half the acreage a light harrowing was given shortly after seeding to cover the seed and to kill out newly sprouted weeds. Hand weeding of the growing crop prior to and at the time of harvest was quite generally practiced. Harvest labor included pulling, shocking, tying, loading, and hauling to market. The monthly distribution of man labor required for a typical 10-acre flax crop is shown in Figure 2.

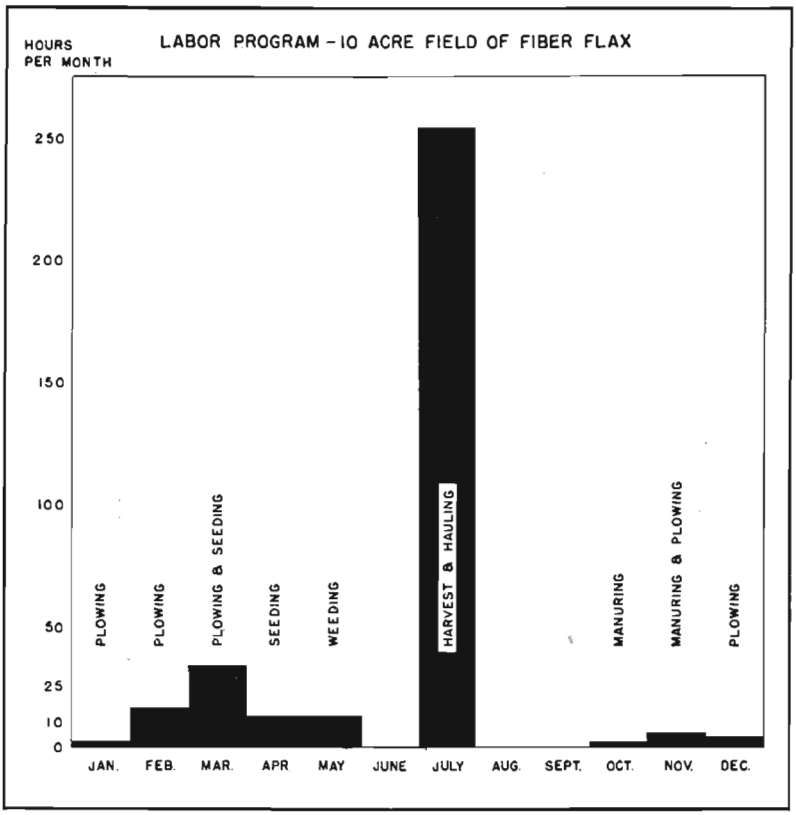

Figure 2. MONTHLY DISTRIBUTION OF MAN LABOR FOR A 10-ACRE FIELD OF FIBER FLAX. The labor required to grow an average field of fiber flax is nominal except at harvest time during July. As most harvest work is contracted, the heavy labor requirement during this period usually does not seriously interfere with other farm work. In some years, however, weedy or lodged fields necessitate considerable hand pulling, and often require so much attention from the farm operator that the entire farm program is adversely affected.

The graph reveals that at harvest time (July) flax would seriously compete with other farm crops for the farmer's time were it not for the fact that much of the harvesting is done by contract. In 1934 when the flax was in good condition to be pulled by machine, the growers were enthusiastic. In 1936, however, part of the flax was blown down by a storm and required some hand pulling, and weeds were worse than usual, necessitating additional work to remove them, and many farmers complained that flax interfered seriously with other farm work.

Seed. Seed costs amounted to $4.08 an acre. Growers obtained their seed from the State Flax Industry at a cost of $2.50 a bushel, f. o. b. Salem. The average rate of seeding was about 1.6 bushels an acre, following closely the rate of 1.5 bushels recommended by the State Flax Industry.

Taxes and interest on the land. The charge for the use of land includes taxes of $1.85 an acre and interest on the land at $6.71 an acre. The interest was figured at 5 per cent on an estimated value of $134.20 an acre. The valuation placed on the land seems to be in line with current prices of lands of similar productivity. In view of the fact, however, that flax must be rotated with other crops, some of which will be less profitable, the question may well be raised as to whether flax should not be charged with a little more than the normal rent and taxes on the land.

Miscellaneous costs. The minor items of cost, such as horse labor, interest, depreciation, repairs on machinery other than pullers, tractor fuel and oil, twine, and commercial fertilizer and manure, altogether amounted to $3.42 an acre.

Fertilizing. Charges for fertilizing as shown in Table 6 include an estimated value for all barnyard manure applied to the flax land, and a charge for the labor involved in applying these fertilizers. The cost also includes a small amount of commercial fertilizers used experimentally. Only about 7 per cent of the flax acreage was manured during the years it was in flax. The more usual practice was to apply the manure to the preceding clover or cultivated crop rather than directly to the flax crop. As farmers have approximately the same amount of manure available each season, the full charge for the actual acreage covered during the year was included, and no attempt was made to appraise the residual value of this manure to subsequent crops. While this procedure results in a relatively high charge for those fields receiving manure during the year that data were taken, the average cost for all fields is believed to be representative of the enterprise as a whole.

Preparing seedbed. The cultural practices for fiber flax in Oregon have been similar to those for spring grains in the same locality. The time of plowing extended from the fall season throughout the winter and as late as the first part of April in a few instances.

Seed and sowing. The cost of the seed, the expense in getting the seed to the farm, the actual sowing, and any subsequent harrowing or rolling to cover the seed are included in the seeding costs.

Flax was almost invariably sown early in the spring (late February, March, or early April). Many growers used a grain drill or an alfalfa drill, while others used either a broadcast seeder or a horn seeder, or scattered

the seed by hand. The prevailing seeding practice with a drill or seeder was to drop the seed on the ground or on a board attached beneath the machine, not using the disk blades or cultivator shovels. The seed was then covered as lightly as possible either by dragging the drill chains or by dragging a light plank behind the drill. Sometimes the seeding was followed by a light harrowing. With this shallow seeding an effort was made to have a rich, mellow seedbed with an adequate moisture content and sufficient organic matter to avoid excessive hardening of the surface soil if a heavy rain should fall before the tiny seedlings have emerged.

Weeding. Weeds in the flax bundles subject the flax to dockage. It is customary, therefore, to remove weeds by hand insofar as practicable. This cost of weeding amounted to 95¢ an acre. About a third of this cost was incurred for early weeding and two-thirds was for weeding at harvest time —usually just ahead of the pulling machine. A few growers undertook the more costly task of removing weeds from the bundles.

The rate of dockage varied from 0 to 7 per cent. It averaged 3.1 per cent for all growers in 1934, and 4.4 per cent of that part of the 1936 crop purchased by the State Flax Industry.

Harvesting. Costs of harvesting are much greater than the costs of growing the crop to the harvesting stage (Table 6). This harvesting work, moreover, is hired or contracted. The cost of pulling, as shown in Table 6, includes the cash outlay for machine pulling, a limited amount of hand

Figure 3. A MECHANICAL FLAX PULLER IN OPERATION.
The puller crew usually consists of three men, including the driver of the tractor.

pulling, and a very small item for cutting and threshing a small scattered acreage that was too short or too weedy to be processed for fiber.

Pulling has shifted from the hand method to the tractor-drawn mechanical puller (see Figure 3). Most of the hand pulling occurred in Linn and in Marion counties either where machine pullers were not readily available or where the flax acreage was very small or very weedy.

About one-fifth of the growers reported some hand pulling in 1934, but this amounted to only 8 per cent of the total acreage grown. This was in addition to hand pulling ahead of the tractor and puller for the opening swath. In 1936 about a third of the growers reported some hand pulling, amounting to nearly 14 per cent of the total acreage in this study. This large amount of hand work was caused by late, heavy rains and winds that caused lodging in the taller flax fields. The worst of these lodged areas were pulled by hand. The growers thereby salvaged the entire tonnage, but at an increased cost. The most common charge for machine pulling in 1934 was $3.50 a ton; in 1936 the charge was $3.50 or $4.00. The puller crew usually consisted of three men including the tractor operator. In addition, some farmers had men stationed around the edges of the field to pull the corners by hand in order to hasten the operation and to avoid having the machine run over any of the unharvested crop (see Figure 4). In weedy fields these helpers also removed the weeds from the standing flax just ahead of the machine. Seriously lodged areas in the field, as already mentioned, were generally pulled by hand.

Table 8. COST OF PULLING FIBER FLAX.

	Year and method of pulling							
	1934				1936			
	Hand		Machine		Hand		Machine	
Number of farms	19		105		12		72	
Total acres of flax	83		1036		61		674	
Yield per acre (tons)	2.2		2.1		2.7		1.9	
	Cost per acre	Cost per ton	Cost per acre	Cost per ton	Cost per acre	Cost per ton	Cost per acre	Cost per ton
Expense items								
Pulling	$11.68	$ 5.37	$ 7.92	$ 3.65	$22.87	$ 8.44	$ 9.34	$ 4.84
Shock-tie-load	1.65	.76	2.04	.95	2.02	.74	1.87	.97
All other costs	23.48	10.77	24.25	11.88	27.82	10.27	24.69	12.78
TOTAL	$36.81	$16.90	$34.21	$16.48	$52.71	$19.45	$35.90	$18.59

The total cost of harvesting with machine pullers, including extra labor, board, and twine, averaged $7.92 an acre in 1934 and $9.34 an acre in 1936, as compared to $11.68 an acre and $22.87 an acre for pulling by hand. Laborers in 1934 were willing to contract hand pulling at from $10 to $12 an acre where the crop was erect. In 1936 the flax was lodged and weedy and the growers had great difficulty in keeping men. Because of the higher yields obtained on the fields that were hand pulled the total cost of production per ton was very little higher on them than on the fields pulled by machines (Table 8). It is not assumed that hand pulling increased the yields but hand pulling was used more extensively where the flax was heavy and lodged.

Most of the flax growers rented a pulling machine. As the average of flax per farm was 9 acres and the average amount harvested by each machine was 85 acres, it is apparent that one machine will do the pulling for nine or ten farms and that only the occasional farmer will own a puller.

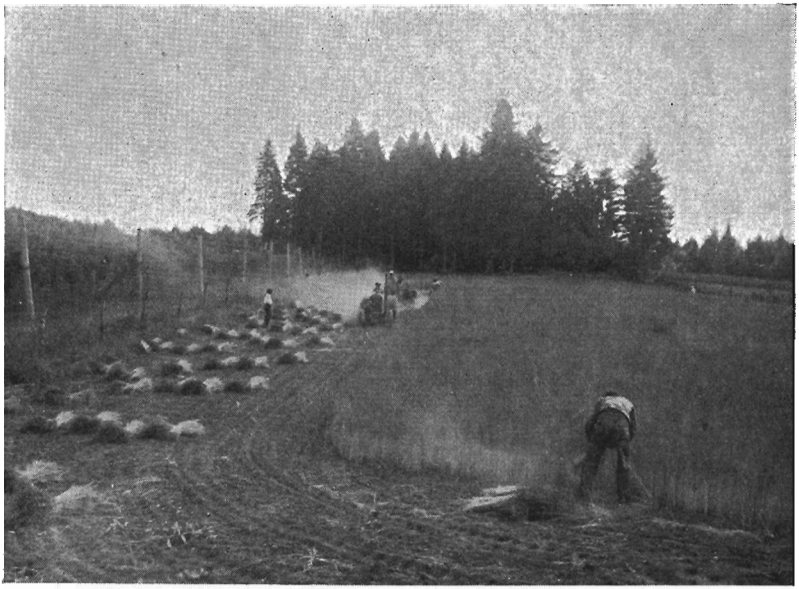

Figure 4. LONG, NARROW FIELDS ARE EASIER TO HARVEST.
The man in the foreground is hand pulling, or "rounding" the corners. The large weeds are also taken out of the flax ahead of the puller.

The mechanical flax puller is of rather recent origin; hence the operators had relatively meager experience on which to estimate cost. Data were obtained on 8 pullers in 1934 and on 12 pullers in 1936. These machines had been acquired at a price of approximately $1,300 each during the period 1928-1930. The total life of the pullers was estimated at from 10 to

Table 9. COST OF OPERATING FLAX-PULLING MACHINES.
Averages of two years, 1934 and 1936.
20 records on 1,697 acres producing 3,394 tons of flax.

Item	Average cost per machine	Average cost per acre	Average cost per ton
Interest at 5 per cent	$ 35.20	$ 0.41	$ 0.21
Depreciation at 8.4 per cent	109.20	1.28	.64
Repairs	79.65	.94	.47
Twine (339 pounds at 9¢)	30.51	.36	.18
Man labor (467 hours at 35¢)	163.33	1.92	.87
Tractor use (156 hours at 75¢)	117.09	1.38	.63
TOTAL COST*	$534.98	$ 6.29	$ 3.00

*This expense is for actual work done only and does not take into account the time and expense involved in moving from one farm to another, or for time lost in breakdown of equipment.

15 years. Depreciation in itself was believed to be small, but breakage and redesigning expense was generally heavy.

The cost of operating these pullers averaged $3.00 a ton in addition to the expense of moving from one farm to another (Table 9). The flax harvested during a season by each puller ranged from 45 to 140 acres, or an average of 85 acres. The operation required an average of 2½ hours of man

Figure 5. BUNDLES OF PULLED FLAX ARE SET UP IN SMALL SHOCKS TO DRY.
After the flax is pulled the bundles are set in small shocks to dry before hauling to the storage sheds. These bundles were retied into larger sheaves before they were shocked.

labor and .84 hour of tractor work a ton of flax harvested. Interest computed at 5 per cent on the estimated present value of $704, and depreciation figured at 8.4 per cent on the original investment, amounted to 21¢ and 64¢ a ton, respectively. Repairs averaged about $80 a year or 47¢ a ton of flax pulled. Binding twine, usually furnished by the custom operator, averaged about 2 pounds to each ton of flax.

Shocking, tying, and loading. Immediately after the fiber flax has been pulled the bundles are set up in shocks to dry for a few days (see Figure 5). As the straw dries it shrinks and loosens the bands, thus making the bundles hard to handle. Therefore it is customary just before loading to tie together three loose bundles into a large, firm bundle. As all the growers did not handle these three operations separately, the costs were combined into the one figure, which amounted to $1.94 an acre or 93¢ a ton.

Hauling. Because of its bulky nature, fiber flax must necessarily be grown within easy trucking distance of the processing plant. By 1934 hauling of flax to the State Flax Industry at Salem had developed almost entirely into a commercial trucking proposition. Large loads enabled the commercial haulers to minimize the cost per ton, even on long hauls.

The average distance from field to Salem in 1934 was 25 miles, and the average hauling cost was $3.14 a ton or 13 cents a ton-mile. Only a few growers were located as far as 50 miles from Salem. The construction of three cooperative plants in the respective producing areas in 1936 enabled the growers themselves to deliver their crop either by means of farm truck or wagon at a considerable saving. The 42 growers who delivered their flax to these local plants had an average haul of 5⅛ miles at a cost of $1.76 a ton. Table 15 gives the costs of hauling for varying distances. Analysis of this Table indicates that it costs around $1.25 a ton to load and unload and about 8¢ a ton-mile to move the load on the road. Each additional mile therefore adds approximately 8¢ to the per-ton costs.

Cash and noncash costs of growing fiber flax. Few farm enterprises show such a high percentage of cash cost as fiber flax. The average cash cost of growing the 1934 and 1936 fiber-flax crops in the Willamette Valley was $22.94 an acre or 63 per cent of the total (Table 10). The largest items of cash cost were for contract harvesting, contract hauling, and seed. In the past it has been the practice of the State Flax Industry to finance these items and take its pay out of the crop. In view of these facts flax must be considered as a high-risk enterprise. A short crop or a low price may cause a heavy cash loss.

Table 10. CASH AND NONCASH COSTS OF PRODUCING FIBER FLAX.
Average of two years, 1934 and 1936

Cost items	Cash cost		Noncash cost	
	Cash cost per acre	Percentage of total cost	Noncash cost per acre	Percentage of total cost
Operator's labor (12.4 hours per acre)	$	.....	$ 3.26	9.0
Family labor (3.6 hours per acre)	.....	.....	.93	2.5
Hired labor (9.6 hours per acre)	2.51	6.9	.....	.....
TOTAL MAN LABOR (25.6 hours per acre)	$ 2.51	6.9	$ 4.19	11.5
Contract preharvest expense	$ .31	.8	.....	.....
Contract harvest expense	7.54	20.7	.....	.....
Contract hauling expense	5.78	15.9	.....	.....
TOTAL CONTRACT EXPENSE	$13.63	37.4	.....	.....
Use of horses (15.5 hours per acre)	$	.....	$ 1.55	4.3
Machinery depreciation	.....	.....	.52	1.4
Machinery repairs	.14	.4	.....	.....
Tractor fuel	.52	1.4	.....	.....
Twine for tying	.18	.5	.....	.....
Commercial fertilizer	.03	.1	.....	.....
Farm manure	.....	.....	.28	.8
Seed expense	4.08	11.2	.....	.....
Taxes on land	1.85	5.1	.....	.....
Interest on land	.....	.....	6.71	18.4
Interest on machinery	.....	.....	.20	.6
TOTAL GENERAL EXPENSE	$ 6.80	18.7	$ 9.26	25.5
TOTAL COST (two-year average)	$ 22.94	63.0	$13.45	37.0
Total cost, 1934	$ 22.11	62.0	$13.38	38.0
Total cost, 1936	$ 23.74	64.0	$13.54	36.0

Noncash items include charges for the work of the farm operator and his family, horse labor, depreciation on machinery, farm manure, interest on the value of the land and machinery. It is recognized that many farmers

are paying out cash for interest, but the amount of such cash interest that should be carried by the flax enterprise is almost impossible to determine. Therefore, in order to put all farms on the same basis for purposes of comparison, interest was considered as noncash and was figured on the entire value of the land and machinery regardless of whether any interest was actually paid.

Costs and returns in an adverse season. Adverse weather conditions in the spring of 1935 resulted in a very short growth. The average yield of .58 ton an acre reported for the acreage grown for the State mill in 1935 was less than half of the previous record low yield of 1.26 tons, which occurred in 1925. While some of the very earliest sown flax attained sufficient length to sell for spinning purposes at the standard contract price of $25 a ton, the bulk of the acreage was cut with the binder or mower and sold for upholstery stuffing. This short flax straw brought $12 a ton delivered in

Table 11. DISPOSAL, YIELD, AND INCOME FROM FIBER FLAX IN AN ADVERSE SEASON, 1935. 31 Willamette Valley growers, sowing 425 acres of flax.

Disposal of crop	Number of acres	Yield per acre	Gross returns per acre
Flax pulled for fiber	70	1.4 tons	$25.90
Flax mowed for fiber	251.5	0.46 tons	5.56
Flax threshed for seed	82	114 pounds	3.16
Flax acreage abandoned	21.5	.....	.....

Table 12. COST OF GROWING FIBER FLAX IN AN ADVERSE SEASON, 1935. 31 Willamette Valley growers who sowed 425 acres of flax. Average yield 0.5 ton per acre.

	Average cost per acre	Percentage of total cost
		Per cent
Fertilizing	$ 0.84	4.0
Preparing seed bed	3.59	16.9
Seed	4.13	19.4
Weeding	.09	.4
TOTAL PREHARVEST COSTS	$ 8.65	40.7
Pulling, mowing, threshing	$ 2.02	9.5
Shocking, tying, and loading	.50	2.3
Hauling	1.62	7.5
TOTAL HARVEST COSTS	$ 4.14	19.3
Taxes on land	$ 1.92	9.0
Interest on land at 5 per cent	$ 6.56	31.0
TOTAL LAND-USE COSTS	$ 8.48	40.0
TOTAL COST OF PRODUCTION	$21.27	100.0
Credit for threshed flax*	$ .61	.....
NET COST OF FLAX STRAW PER ACRE	20.66	.....
COST PER TON	$40.85	.....
AVERAGE PRICE RECEIVED PER TON OF STRAW	$15.00	.....

*The flax on about one-fourth of this acreage that was of too poor a quality for fiber was cut and threshed, producing 9,377 pounds of seed valued at $260. This was considered as a credit, amounting to 61 cents an acre or $1.21 a ton when distributed over the entire tonnage of flax marketed.

Salem. Some of the harvested crop was not worth hauling to Salem, and was threshed for the seed, which brought an average of $1.60 a bushel. Some acreage was entirely abandoned.

A complete record of the production and income received by those growers who contracted to grow about 1,200 acres for the Champagne Paper Corporation of New York in 1935 was not available. Only 320 tons of flax straw were delivered, however, an average of 532 pounds per acre planted. Like the instance mentioned above, some of this harvested crop also was not worth hauling, and was threshed for the seed, while some acreage was entirely abandoned. A serious factor in this situation, accounting for even a poorer showing than that made by growers for the State Flax Industry, was that because of the late start made by the organization in signing its acreage, the crop was seeded too late in spring to withstand the dry summer that followed.

The gross return an acre for 425 acres covered by the study during 1935 is presented in Table 11. For this group of 31 flax growers as a whole the total production expense was $21.27 an acre. After deducting from total expense the receipts for seed threshed on the farms and sold the cost amounted to $40.85 a ton for the delivered flax straw (Table 12). Since the average price received for all the flax straw marketed was only $15 a ton, obviously the receipts from most fields were much below the cost of production and in some instances the crop did not even cover the seed expense.

While the job of harvesting this light crop was less costly than in normal years, the growing costs were no less, land costs were the same, while the expense of hauling loose straw to the plant was higher per ton than the expense for hauling the bundle flax of normal years.

Although drought years like 1935 have been infrequent in the history of Oregon's flax industry, their occasional occurrence emphasizes the wisdom of not putting too large a portion of the farm in flax.

Table 13. VARIATIONS IN THE COST OF PRODUCING FLAX.

Cost per ton	1934		1936	
	Number of records	Average cost per ton	Number of records	Average cost per ton
Below $14.00	12	$12.82	7	$13.26
$14.00—14.99	15	14.62	4	14.20
$15.00—15.99	21	15.47	7	15.37
$16.00—16.99	20	16.38	3	16.55
$17.00—17.99	12	17.59	10	17.60
$18.00—18.99	14	18.54	12	18.54
$19.00—19.99	13	19.61	13	19.35
$20.00—22.99	11	21.22	12	20.15
Over $23.00	6	25.88	16	26.54

Table 14. THE EFFECT OF YIELD ON COST.
Average of two years, 1934 and 1936

Yield of flax straw per acre	Percentage of records	Average yield per acre	Average cost per ton	Average cost per acre
	Per cent	*Tons*		
Below 2.0 tons	42	1.7	$19.77	$32.96
2.0 tons to 2.7 tons	47	2.3	16.58	38.15
2.8 tons and over	11	3.0	15.80	47.42
TOTAL	100	2.1	$17.50	$36.39

Variations in the cost of producing fiber flax. Data obtained during the three years of this study show not only the year-to-year variations in costs an acre and a ton for individual farms and for the enterprise as a whole, but also show the farm-to-farm variations during the same year.

For the three years covered by this study the production costs per acre were respectively $35.49, $21.27, and $37.28; while the production costs of flax straw per ton were $16.53, $40.85, and $18.47. Much of the variation in the unit costs was due to variations in yield. Reference to Table 2 shows that for the past 12 years yields for the flax under contract to the State Flax Industry have varied from a low of .58 ton an acre in 1935 to a high of 2.29 tons an acre in 1930. The average yield for this 12-year period was 1.66 tons an acre, which is 19 per cent less than the average yield for the years of 1934 and 1936. Hence the costs for this 12-year period probably averaged less an acre and more a ton than the average figures reported herein for 1934 and 1936.

Variation in production costs between different farms during the same year is presented in Table 13. Extremes in production cost ranged from a low point of $11.48 a ton for one very efficiently operated and high-yielding field to a high point of $30 a ton for a low-yielding, weedy field that was pulled by hand.

Although often quoted to show what can be done, individual figures showing extremely high yields and extremely low costs are of little significance unless it can be demonstrated that these records can be duplicated regularly year after year. In this study the growers who had low costs in one year of the study did not necessarily have low costs the other year. Of the growers who had costs below average in one year only 60 per cent were able to repeat that record the other year.

This naturally raises the question whether these differences in costs were due to differences in management or to factors beyond the farmer's control.

MAJOR FACTORS INFLUENCING COSTS AND PROFITS

Yield. Owing to the fact that most operations, aside from harvesting, cost about as much for a light as a heavy crop, and further, that costs for interest, taxes, and depreciation are practically constant, it is obvious that a large production to the acre tends to lower cost per ton. Approximately 30 per cent of the ups and downs of the cost per ton was found due to yield ($r^2 = .29$) (Table 14 and Figure 6).

The quality of the flax land was fairly uniform for the farms included in this study and was not a major cause of low yields (Figure 6). Most fields planted to flax have been deliberately selected with a view to good soil and in good condition.

Preharvest cost, such as cultivation and fertilizing, increased somewhat on the farms with the larger yields, which indicates that more care in growing increased the yields. The cost of harvesting, of course, increased directly as the yield per acre increased.

The effect of increasing yield on cost per ton is shown in the lower half of Figure 6. The unit fixed costs and unit seasonal preharvest cost declined

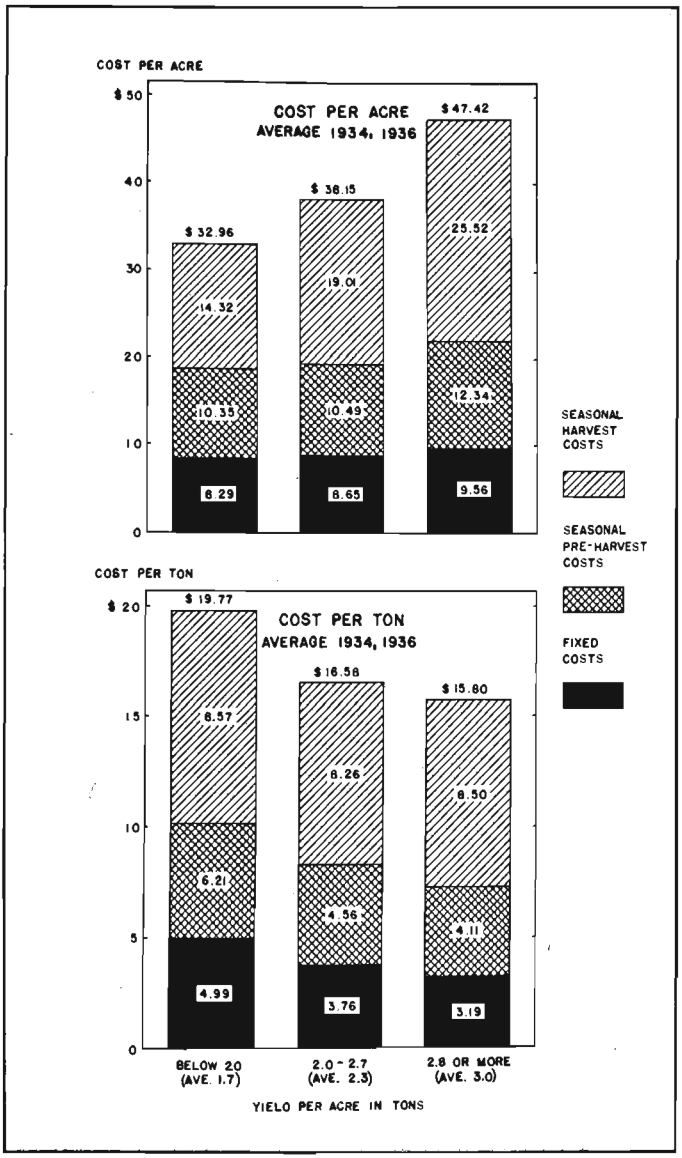

Figure 6. The Effect of Yield on Costs.
As yields increase costs per acre increase, owing chiefly to increasing harvest costs. Fixed and preharvest costs per acre remain fairly constant regardless of yield (see upper half of chart). Costs per ton decrease as the yield increases, owing chiefly to the fact that there are more tons of flax to absorb the fixed and preharvest costs. The harvest cost per ton is about the same for both light and heavy crops (see lower half of chart).

considerably with increased yield whereas unit harvest costs declined only slightly.

Yields and profits from flax grown on bottom land were generally higher than from flax grown on valley-floor soils. Flax grown after a cultivated crop, moreover, was more profitable on both bottom and valley-floor soils than flax grown after clover, alfalfa, or grains (Table 15). Cultivated crops are more commonly grown on the bottom lands than on valley-floor soils.

The time of planting is generally recognized as important in affecting the yield and quality of fiber flax. In five years of experimental work at the Oregon Agricultural Experiment Station, 1932 to 1936, the best yields were obtained from plantings made about March 30. As compared with plantings on March 30 plantings made April 6 averaged 8 per cent less; April 13, 19 per cent less; April 20, 24 per cent less.

Yields of fiber flax have usually been good. Under the supervision of the State Flax Industry the growers have been encouraged to grow flax only on the better types of soil, to plant flax following a legume or a cultivated crop in a crop-rotation system, and to sow the seed at the rate and in the season recommended. Thus, by careful management, the growers have kept yields at a maximum and have reduced the hazards of insect, disease, and weed infestations. How much further progress can be made in the direction of higher yields and lower costs it is not now possible to say.

Length of haul. As flax straw is a bulky crop it is expensive to haul for long distances. The effect of the length of haul on the cost of hauling is shown in Table 16 from which it is evident that every additional mile of haul adds approximately 8¢ a ton to the cost.

Table 15. EFFECT OF SOIL AND PRECEDING CROP ON YIELD AND COST OF GROWING FIBER FLAX. Average of two years, 1934 and 1936. 208 records

Items	Preceding crop					
	Cultivated crop		Clover or alfalfa		Small grain crop	
	Bottom land	Main valley floor	Bottom land	Main valley floor	Bottom land	Main valley floor
Number of farms	23	21	6	105	9	44
Yield (tons)	2.6	2.0	2.3	2.1	1.9	1.8
Cost per acre	$41.50	$37.20	$34.50	$37.15	$32.68	$32.50
Cost per ton	15.96	18.60	16.30	17.86	17.20	18.06

Table 16. THE EFFECT OF LENGTH OF HAUL ON THE COST OF HAULING FLAX STRAW. Average of two years, 1934 and 1936.

	Distance to flax plant							
	Under 6 miles	6–10 miles	11–15 miles	16–20 miles	21–25 miles	26–30 miles	Over 30 miles	All farms
Number of farms	31	13	13	35	37	52	27	208
Average haul (miles)	2.9	7.7	13.0	18.5	23.6	29.4	36.2	21.1
Cost per ton	$1.46	$2.02	$2.43	$2.62	$3.24	$3.45	$3.70	$2.92
Cost per ton-mile	.50	.26	.19	.14	.14	.12	.10	.14

Grade and price. Flax straw that measures 30 inches or more in length is at present graded No. 1 by the State Flax Industry. Flax straw less than 30 inches tall is graded No. 2. During the past 13 years the percentage of No. 1 has varied from 37 per cent in 1935 to 100 per cent in 1934, with an average of 85 per cent for the entire time (see Table 2). Most failures to produce No. 1 flax can be traced to late planting, unsuitable soil, drought during the early summer months, or strong winds shortly before pulling. Weeds also tend to shorten the straw as well as to decrease the yield. No. 2 flax normally sells at a substantial discount below the price for No. 1.

Flax straw containing much weed or other foreign matter is docked in proportion to the estimated amount of such foreign material. The figures in Table 2 are for the flax straw after the dockage has been deducted. In 1934 the average dockage was 3.1 per cent and in 1936, 4.4 per cent.

Under present conditions Oregon farmers cannot afford to produce flax grading less than No. 1. It normally costs no more to produce No. 1 flax than No. 2.

The cost of processing flax. A study of the flax problem in Oregon is not complete without consideration of the cost of processing, that is, of threshing the seed, retting, and scutching. Unfortunately it is impossible, under present conditions, to obtain data which will give us a satisfactory guide to costs in the future. Until 1936 the processing of flax in Oregon was done by the State Flax Industry. Since the State Flax Industry was organized partly to utilize convict labor and partly to develop the flax industry of Oregon it is impossible to say exactly what costs should be charged to the flax and what to other factors. The cost of processing at the State Flax Industry, however, is of diminishing importance in Oregon since restrictions on the sale of prison-made goods by many of our states are forcing our flax producers to have their flax processed elsewhere than at the plant of the State Flax Industry. The three cooperative retting and scutching plants established in 1936 at Canby, Mount Angel, and Springfield, were erected with Federal assistance but belong to the State of Oregon. They are rented to cooperative associations at a nominal rental. The associations, however, are obliged to supply some machinery and other equipment and to meet all operating costs. These cooperative plants have not been operating long enough to fully demonstrate what they can do. There are no privately owned processing plants in Oregon.

The processing of flax in Oregon other than with convict labor is in the experimental stage. Since the larger portion of the fiber flax grown in the United States is grown in Oregon we cannot go to other states for guidance. The processes used in Oregon are similar in basic principles to those used in Europe, but labor and climatic conditions are so radically different that European practices cannot be followed exactly.

In view of the fact that there are no private processing plants and the market of the State Flax Industry plant at Salem is being more and more limited by restrictive legislation on prison-made goods, it appears that in the future the farmers must depend upon cooperative plants operated by themselves and at their own expense. The cost of processing in that case becomes just as much the farmers' problem as the cost of plowing or seeding.

DISCUSSION AND CONCLUSIONS

This study leads to four primary conclusions: First, flax production on Willamette Valley farms is being conducted in a strictly modern manner and further reductions in the cost of production are not to be expected on the basis of present information as to the technique and methods of growing flax except possibly some improvement in harvest machinery. The industry has been fostered intelligently and carefully by the State Flax Industry so that the best methods of growing known to the industry are generally practiced. If there should be a large increase in flax production and less efficient growers brought into the business, costs might even increase.

Second, the costs of production as shown in this study are about the same as the prices that have been paid by the State Flax Industry. For the two years of the study the average cost a ton was $17.50 whereas the average selling price was $22.81 exclusive of Federal subsidies. These two years, however, were above average for yield. The average yield of all flax delivered to the State Flax Industry for the 13-year period 1925-1937 was 1.65 tons. If the yield in 1934 and 1936 had been the same as this long-time average the cost a ton would have been $21.93, or only 88¢ below the selling price. While this study was confined to 1934 and 1936, it would seem that the acre costs for these two years should be fairly representative of the depression period of 1931-1937. For this period the average price paid to growers by the State Flax Industry was $21.54. For the period 1925-1930 the average price paid to growers was $34.69. Accurate data on the costs of production for those years, are not available, but costs of the various items of production were distinctly higher during those years than in 1934-1936. These data indicate that flax has paid the grower for his labor and the use of his land but not much more.

Third, an unusually large amount of the cost is for hired labor or other contract work. While 37 per cent of the cost of production represented pay for the labor of the operator and his family and for the use of the land, the other 63 per cent is cash outlay that must be met regardless of the returns from the crop. For the two years of the study the flax producer had to meet a cash expense of $22.94 an acre before he got anything at all for his own labor or the use of the land. In the past the State Flax Industry has contracted much of the flax in advance. This has relieved the farmer of any risk as to price and thus to a considerable extent has offset the risk involved in the high cash outlay. In the cooperative processing plants, however, the members will be obliged to assume the risks of processing as well as of growing.

Fourth, the future of the flax industry and its ability to compete with foreign flax and with other fibers largely hinges on the cost of processing. As the processing is now shifting from the State Flax Industry, using convict labor, to cooperative plants built with Federal assistance, processing costs cannot be forecast with accuracy.

In view of the risks involved in flax culture and the small hope of large profit above wages and rent for the land, large increases in flax production are not to be expected until such time as processing costs are lowered.

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