APRIL, 1938 CIRCULAR 191

AGRICULTURAL EXPERIMENT STATION

KANSAS STATE COLLEGE OF AGRICULTURE
AND APPLIED SCIENCE

MANHATTAN, KANSAS

DEPARTMENT OF AGRONOMY

Density of growth on these plots indicates effect of previous crop on flax production. (A) Flax following soybeans. (B) Flax following oats. See page 8 for discussion of "Crop Sequence."

Flax Production in Kansas[1]

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Flax is not a new crop in Kansas. The records of the Kansas State Board of Agriculture show that 63,478 bushels of flaxseed were raised in the state in 1873. After this date the production of flax increased rapidly until 1890, in which year 2,173,800 bushels were produced on 228,839 acres. That year marked the peak of flax production in Kansas, but for twelve more years, or until 1902, the Kansas crop continued to exceed one million bushels annually. The acreage decreased rather gradually until the World War, when the appeal for increased wheat production caused a sharp drop in the flax acreage. The smallest crop since 1873 was grown in 1919 when 85,048 bushels were produced on 13,926 acres, according to the reports of the Kansas State Board of Agriculture.

During the 10-year period, 1927-1936, the average flax acreage was 42,603 acres and the average production 241,294 bushels. About 85 percent of this was produced in Allen, Linn, Neosho, Wilson, Anderson, and Bourbon counties. The remainder was grown south of the Kaw river and east of the Flint Hills. During this period flax was not a crop of major im-

1. Contribution No. 278 from the Department of Agronomy. This is a revision of Circular 173 by I. K. Landon.

portance even in these six principal flax-producing counties. However, the soils and climate of eastern Kansas are well adapted to flax production and with the adoption of improved practices that will raise the average yield, flax might well assume an important place in the agriculture of this part of the state.

Flax is the only important grain crop grown in the United States which normally is on an import basis. Each year since 1909, the United States has consumed more flaxseed and flaxseed products than it has produced. The peak of consumption was reached in 1929 when 42,000,000 bushels were crushed. The domestic production was less than half of this amount so that more than 23,000,000 bushels were imported.

Since 1929 the reduction in the amount of new construction and delayed repainting has materially reduced the consumption of linseed oil, but the United States is still on a flax-importing basis. In this connection it is interesting to note that the domestic production in recent years has decreased to a point where the 1933 crop in this country was only 7,500,000 bushels as compared with an average annual production of over 20,000,000 bushels between 1924 and 1929.

With the resumption of a normal schedule of building and repairing, the consumption of linseed oil should again increase so that a moderate expansion of flax production would be possible without creating a surplus. The tariff on flax is now 65 cents per bushel with a compensatory duty on linseed oil, its chief product. This gives the flax producers in the United States a very real market advantage over foreign flax producers, which advantage they will continue to enjoy as long as the domestic production does not exceed the consumption.

The linseed oil mill at Fredonia, in Wilson county, has an annual crushing capacity of 1,500,000 bushels of flaxseed or about six times the amount of the average Kansas flax crop. This furnishes a local market for Kansas-grown flax.

Flax is grown primarily as a cash crop and it is on this basis that it must compete with other crops for a place in the agricultural program, There are, however, some other features of flax production that should be given consideration.

FLAX AS A NURSE CROP

Flax is considered superior to other small grains as a nurse crop for clovers or grasses because it does not shade the ground so densely and also because the leaves fall off gradually as the plant matures, allowing the sunlight to reach and harden the clover before the nurse crop is removed. This makes the shock to the clover, upon the removal of the nurse crop, less severe than when wheat or oats are used. In order not to smother out the clover it is usually necessary to seed oats at only one-half to one-third the customary rate per acre, which reduces the yield of grain. Flax can be seeded at the optimum rate without seriously interfering with the clover.

FLAX STRAW AS FEED

Flax straw, with the chaff included, is superior to wheat or oats straw as a feed for live stock. Practically all feeders consider it superior to prairie hay. The value of the straw as feed is governed very largely by the stage at which it is cut and by the amount of seed blown into the straw. When the amount of seed in the straw is large, care should be taken to limit the amount fed, because of the laxative effect of the oil in the seed.

DAMAGE FROM INSECTS

Flax has no serious insect pests. The only insect damage to the Kansas flax crop reported has been by grasshoppers in occasional years. They do not eat the flax but do cut off the bolls before maturity. This injury can generally be avoided by early seeding since most of the damage is in late flax that is still green after the other small-grain crops have ripened.

FLAX DISEASES

Flax wilt, flax rust, and pasmo are the only diseases of flax that cause appreciable losses in the United States. Of these, flax wilt is the only one that has ever been a factor in Kansas flax production. Flax wilt is a fungous disease that attacks only the flax plant. When once introduced, usually on the seed or in manure which contains infected flax straw, it persists in the soil for several years, ready at any time to attack any flax that may be sown there. The damage from flax wilt can be lessened by early planting and may be somewhat reduced by rotation. The use of wilt-resistant varieties is unquestionably the best means for reducing wilt losses.

In communities where flax has been produced regularly over a long period of years, it has become the accepted custom not to plant flax frequently on the same ground. This practice was adopted to control the wilt. At present there are several varieties of flax that are resistant to both wilt and rust. Among these varieties are Linota, Redwing, and Bison, the latter being the most disease-resistant.

INFLUENCE OF FLAX ON THE SOIL

Flax leaves the soil in a very loose, mellow condition, similar in many respects to the after effects of soybeans or cowpeas. This is particularly noticeable on the tight, heavy soils that are inclined to puddle when handled wet. It is frequently possible to plow flax stubble during dry periods in the summer when oats or wheat stubble on similar soils is too hard to plow.

IS FLAX HARD ON THE LAND?

There is a prevalent opinion that flax is hard on the land. Flax is not any harder on the land than any other small-grain crop. In fact, the average flax crop removes from the soil less phosphorus and potash and only slightly more nitrogen than an average crop of wheat or oats. This prejudice against flax probably gained its popularity before the cause of flax wilt was discovered. At that time it was known that successive crops of flax could not be grown on even the best land. The disease which caused the failure of the later flax crops being unknown, the erroneous conclusion was reached that flax was hard on the land.

Some rotations comparing wheat and flax preceding corn were continued for a few years at the Parsons Experiment Field. The yields of corn in these rotations are shown in Table I.

TABLE I.—YIELDS OF CORN IN ROTATIONS AT PARSONS
(Bushels per acre)

Rotation	1931	1932	Av.	Difference
Soybeans, flax, corn	28.0	33.4	30.7	8.5
Soybeans, wheat, corn	20.6	23.8	22.2	
Oats, flax, corn	28.8	27.6	28.2	5.5
Oats, wheat, corn	23.8	21.6	22.7	

FLAX PRODUCTION MAY AID LABOR DISTRIBUTION

Flax should be seeded soon after oats and before time for planting corn. It is harvested from two to four weeks later than wheat and oats. This spreading of the season at which these operations can be done increases the efficiency of the farm labor. If the acreage of oats is increased beyond what one drill can handle, either another drill must be used or some of the oats will be seeded too late. However, if flax is substituted for part of the oats, both crops can be seeded at their proper times. If more

wheat and oats are to be harvested than can be handled in a reasonable time with one harvesting unit, it means either more machinery or part of the crop must stand too long.

CLIMATIC REQUIREMENTS OF FLAX

Flax is a reasonably dependable crop in localities that have a rainfall of more than 30 inches annually and areas that are not subject to hot, dry winds or extremely high temperatures during the period that the flax is blooming, filling, and ripening. This limits the territory in Kansas in which it is advisable to grow flax to the region east of the Flint Hills. It is possible to grow good crops of flax west of this region in some years but the greatest probability of drought and high temperatures in June and early July makes flax production rather hazardous. Flax does best under cool growing conditions and any circumstance that increases the amount of growth before the soil becomes warm is favorable for flax production.

Yields of Linota flax in comparison with Kanota oats in central Kansas are given in Table II. In the tests at Hays flax failed four times in ten years, at Manhattan twice in eight years, and at Kingman once in six years. Flax has proved less well adapted at the Colby, Tribune, and Garden City experiment stations.

TABLE II.—YIELDS OF LINOTA FLAX COMPARED WITH KANOTA OATS IN CENTRAL KANSAS (a)

Location	County	Number of years compared	Bushels per acre	
			Linota flax	Kanota oats
Wichita	Sedgwick	6	8.5	35.7
Kingman	Kingman	6	6.7	40.6
Manhattan	Riley	8	8.7	58.8
Hays	Ellis	10	7.1	34.3

(a) The data for Wichita and Kingman were supplied by C. E. Crews and those for Hays by A. F. Swanson.

SOIL REQUIREMENTS

Flax does better on heavy, tight lands that are slow to warm in the spring, than on the looser, sandy soils. Flax does not compete well with weeds and for that reason should not be sown except on fields that are known to be reasonably free from weeds. Creek and river bottoms that occasionally overflow are not generally recommended for flax on this account. Flax production has been and probably should be confined to uplands where the yields of wheat and oats are less profitable.

FLAX COMPARED WITH OTHER CROPS

Flax competes with oats and wheat for a place in the rotation since it has about the same labor distribution and requires similar machinery and fleld operations.

In comparing the incomes from the different crops it is hardly accurate to take the state or county average yields. Flax is grown almost wholly on the less productive uplands while wheat and oats are frequently grown on the more fertile creek and river bottoms and are often fertilized. It would be fairer to compare the yields or incomes from the different crops when grown on the same land with equally good farming practices.

On the McLouth Experiment Field in Jefferson county the six-year average yield of flax was 10.2 bushels compared with 47.8 bushels per acre for oats. In Table III are shown the five-year average yields of kafir, corn, oats, and flax at the Rest Experiment Field in Wilson county.

TABLE III.—COMPARATIVE YIELDS OF KAFIR, CORN, OATS, AND FLAX ON THE REST EXPERIMENT FIELD (WILSON COUNTY)

(Yields, bushels per acre, in a rotation of red clover, kafir, corn, oats, and flax)

Crop	1927	1928	1929	1930	1931	Av.
Kafir	38.2	41.4	17.2	11.9	7.5	23.2
Corn	49.9	45.8	26.3	7.4	23.4	30.6
Oats	15.6	42.8	29.0	46.2	55.8	37.9
Flax	13.0	11.2	10.4	13.8	12.6	12.2

Kafir and corn utilize a different part of the growing season and so the yields of these crops, even on the same field, are not strictly comparable with the yields of oats and flax. The average yield of oats at the Rest field was 37.9 bushels per acre or about three times that of flax which was 12.2 bushels. However, the price per bushel of flax was enough higher to make that crop considerably more profitable than oats. No wheat was grown in this rotation.

The comparative average yields of wheat, oats, corn, soybeans, and flax on the Columbus Experiment Field in Cherokee county are shown in Table IV.

TABLE IV.—COMPARATIVE YIELDS OF WHEAT, OATS, CORN, SOYBEANS AND FLAX ON THE COLUMBUS EXPERIMENT FIELD (CHEROKEE COUNTY)

(Yields, bushels per acre, on lime and superphosphate plots in a rotation of wheat, oats, and sweet clover, corn, soybeans, and flax)

	Yield of grain—bushels per acre				
Year	Flax	Oats	Wheat	Corn	Soybeans
1930	17.7	36.3	26.1	38.8	17.4
1931	8.2	58.0	32.0	46.6	10.5
1932	12.4	24.2	33.1	42.6	13.7
1933	14.8	46.9	15.0	19.7	20.1
1934	7.6	43.2	37.7	0	10.0
1935	5.3	22.7	18.4	0	0
1936	4.7	45.2	44.0	21.6	2.3
1937	9.9	50.1	25.7	45.0	17.4
Av.	10.1	40.8	29.0	26.8	11.4

The average yield of oats was 40.8 bushels per acre or about four times that of flax which was 10.1 bushels. In these experiments also flax gave a greater gross return per acre than oats although the yield ratio in favor of flax was not as high as at Rest. The comparative yields of flax and wheat indicate that the latter was somewhat more profitable. However, the use of both crops permits a more efficient distribution of labor without additional machinery and tends toward a more uniform annual income in years when the yield or price of wheat is low.

METHODS OF GROWING FLAX

In order to produce profitable yields of flax it is essential that a satisfactory stand be obtained. The stand is affected not only by the weather conditions, over which the grower has no control, but also by the germina-

tion of the seed, the rate of seeding, the condition of the seed bed, the method of seeding, and date of seeding, all of which are more or less under the control of the grower.

GERMINATION OF SEED

The germination of flaxseed is usually high but in some years the weather conditions at the time of ripening are such that seed of low viability is produced. To be safe, the germination of the seed to be used should be determined, either at home or at the state seed laboratory. Good flaxseed should have a germination of more than 95 percent.

RATE OF SEEDING

Many Kansas flax growers are accustomed to seeding at the rate of about two pecks of good seed per acre. On a very good seed bed this may be enough but for average field conditions, three pecks of the smaller seeded varieties are recommended. Various rates of seeding flax have been compared on the Southeast Kansas Experiment Fields for ten years. In these tests Linota seed was drilled in very good seed beds with a four-inch alfalfa or crass drill at the rate of 20, 30, 40, 50, and 60 pounds per acre. The yieldsof flaxseed secured from the various rates of seeding are shown in Table V.

TABLE V.—EFFECT OF RATE OF SEEDING ON YIELD OF FLAXSEED (SOUTHEASTERN KANSAS EXPERIMENT FIELDS)

Pounds of seed per acre	Yield—bushels per acre	
	Average 10 years	Average 7 years
20	.....	5.6
30	7.9	6.2
40	8.4	6.7
50	8.9	7.0
60	.....	6.7

The yield of flax increased one half bushel for each increase of 10 pounds in the seeding rate from 20 to 50 pounds per acre. The thicker stands obtained by heavier seeding helped control weeds. The experiments indicate that when as much as 60 pounds was planted the stands were too thick, resulting in a slight reduction in yield.

The data in Table V are for Linota, a small-seeded variety. The amount of seed should be increased about 15 pounds per acre when a large-seeded variety such as Bison is planted.

METHOD OF SEEDING

There are two common methods of seeding flax. Each method has both advantages and disadvantages. Drilling the flaxseed insures an even distribution over the field, uniform depth of covering, and the placing of the seed in contact with moist soil. The force feed type of drill is best suited for seeding flax.

When flax is seeded on unplowed corn land, the stalks may interfere with drilling so that broadcasting followed by disking may be the more feasible method of seeding. This has been a common method of seeding flax in spite of the fact that broadcasting does not distribute the seed so evenly as drilling and that the depth of seed coverage can not be regulated by disking or harrowing.

On the other hand, if heavy beating rains occur just after the flax is seeded, the drilled flax is in greater danger of being buried too deeply by the washed soil. If the soil is inclined to run together and bake, there is less danger of the flax being smothered under a crust when broadcast than

TABLE VI.—INFLUENCE OF TIME OF SEEDING FLAX ON THE YIELD AT THE REST AND COLUMBUS EXPERIMENT FIELDS

	Rest	Columbus								Av. yield	Yields of comparable years based on late March data
	1928	1930	1931	1932	1933	1934	1935	1936	1937		
Early Feb.	.....	.....	3.9	.....	.....	2.0	.....	.....	.....	3.0	2.3
Late Feb.	.....	.....	7.7	0*	.....	.....	.....	7.7	.....	5.1	7.9
Early Mar.	17.3	5.4	9.7	13.3	.....	8.3	.....	11.2	3.1	9.8	9.2
Late Mar.	18.7	5.3	.....	7.8	14.1	7.7	6.6	0*	4.1	8.0	8.0
Early Apr.	19.5	5.0	0	5.7	.....	4.9	5.0	.7	5.2	5.8	7.4
Late Apr.	16.8	.....	.....	.....	5.7	2.5	.....	.....	.....	8.3	2.8
Early May	.....	4.4	0	.....	3.2	.....	3.4	.....	.....	2.8	3.0

* Stands were killed by late freezes.

when drilled. With either method of seeding, the flax should be planted no deeper than necessary to cover it well. When all factors are considered drilling is preferable to broadcasting.

DATE OF SEEDING

Experiments have shown that it is usually advisable to sow flax as soon after the first of March as field conditions become favorable. In the study of this question it has been the plan to make one or two plantings of flax in February, if the land could be prepared, and continue plantings at intervals until in late April or early May, In two of the years for which data are reported in Table VI, conditions were not suitable for sowing flax until after the middle of March. In the other seven years, plantings were made in early March or in February. In seven of the nine years the highest yields were obtained by planting in early March or as soon thereafter as the land was dry enough to work. In one case flax planted the latter part of March was killed by frost. However in that year flax sown early in March survived. Flax will usually withstand the cold weather of March and April unless it occurs from about the time the plants emerge until they reach the three-leaf stage. During that period the crop is susceptible to frost injury.

It is advisable to take some chance of frost injury, however, because if flax is planted late, the crop is forced to mature seed in the hot, dry weather in July. This lowers the yield very materially, as indicated by the data in Table VI.

CROP SEQUENCE

Yields of flax when grown after several other crops are given in Table VII. Comparing the better method of preparation in each case the seven-year average yield of flax was about three bushels higher after soybeans than after corn, four bushels higher than after kafir, and two bushels higher than after oats. Flax has done particularly well not only after soybeans but also after other legumes, such as alfalfa and sweet clover and following perennial grass that has been used for meadow or pasture.

TABLE VII.—YIELD OF FLAX AFTER A LEGUME COMPARED WITH OTHER CROPS (COLUMBUS EXPERIMENT FIELD, 1931-1937)

Crop that preceded flax	Preparation of land	Yield bus. per acre Av. 7 years
Soybeans	Disked in spring	10.5
"	Plowed in Dec.	10.1
Corn	Plowed in Dec.	7.4
"	Disked in spring	6.4
Kafir	Plowed in Dec.	6.6
"	Disked in spring	5.6
Oats	Plowed in summer	8.2
"	Plowed in Dec.	3.8

SEED BED PREPARATION

Flax, like other small-seeded crops, requires a firm, compact seed bed with sufficient moisture for quick germination and continued growth. If the seed bed is too loose or too dry, some of the flax will not germinate or will perish soon after germination. In either case the results will be a reduced stand.

The methods of preparing the seed bed for flax are determined considerably by what crop was on the land the previous year. Following soybeans, only little preparatory tillage is needed provided the land is clean. A light disking in the spring gave slightly higher yields of flax than

plowing in December as shown in Table VII. In the preparation of corn and kafir land, however, fall plowing was superior to spring disking, the average yields of flax being one bushel higher in each case. Following oats, flax yielded 8.2 bushels on land plowed in late July or August compared to 3.8 bushels on late fall-plowed land. The advantage of the earlier preparation was probably due to the more favorable conditions for the development of nitrates.

Plowing in preparation for flax should be done in the summer or fall since that will allow time for the ground to settle during the winter. The surface tillage may be done with the springtooth harrow, disk, duckfoot, smoothing harrow, or cultipacker, or several of these implements, and should be continued until the seed bed has a firm subsurface and a granular surface.

FERTILITY REQUIREMENTS OF FLAX

The yield of flax probably can be increased more efficiently by using legumes in the rotation than by any other fertility practice. When grown in two-year rotations with several other crops, the seven-year average yield of flax was about three bushels higher after soybeans than after corn, four bushels higher than after kafir, and two bushels higher than after oats. Flax does well also after other legumes and sod grasses. The beneficial effect derived from legumes is probably due to the greater supply of nitrates and organic matter and to the better physical condition of the soil.

Several nitrogenous fertilizers were applied with flax at the Parsons Experiment Field for two years and at Columbus for one year. The yields and increases obtained in these tests are shown in Table VIII. The largest increase obtained was only one bushel per acre, from applying 100 pounds of cyanamid per acre about two weeks before seeding flax.

TABLE VIII.—EFFECT OF NITROGENOUS FERTILIZERS ON YIELDS OF FLAXSEED ON THE SOUTHEASTERN KANSAS EXPERIMENT FIELDS

Treatment	Yield—bushels per acre				Increase for fertilizer
	Parsons		Columbus		
	1932	1933	1934	Av.	
No fertilizer	11.8	10.3	3.9	8.7	
Nitrate of soda 100 pounds per acre	12.7	11.1	4.4	9.4	.7
Ammonium sulphate 100 pounds per acre	13.1	10.9	4.5	9.5	.8
Cyanamid 100 pounds per acre	13.6	10.8	4.5	9.6	1.0

Phosphate and potash applied directly to the flax crop have not noticeably increased the yield of flaxseed, The yield of flax was materially increased where lime and phosphates were applied in rotation with alfalfa or clover, as shown in Table IX, but apparently the increase was an indirect one resulting from the more vigorous growth of the legumes and consequent greater fixation of nitrogen. Phosphates have in some seasons hastened the maturity of the flax but significant increases in yield apparently should be attributed to an increased supply of available nitrates resulting from the legume crop.

Barnyard manure noticeably increases the growth of flax. It is advisable, however, to apply the manure to some other crop in rotation rather than to flax. Most manure contains weed seeds and if applied just before the flax is sown competition with weeds is likely to be serious. In the experiments reported in Table IX, eight tons per acre of manure were applied two or more years ahead of the flax. Increased yields of flax were obtained on both of the experiment fields. Although part of the increase

may have been indirect, resulting from somewhat greater production of the legume on the manured areas, it appears that the highest yields of flax can be expected where a legume crop is grown and manure is applied in a properly arranged rotation.

TABLE IX.—YIELDS OF FLAX IN ROTATION-FERTILITY EXPERIMENT AT REST AND COLUMBUS EXPERIMENT FIELDS

(Rotation at Rest: Red clover, kafir, corn, oats, flax)
(Rotation at Columbus: Wheat, oats, and sweet clover, corn, soybeans, and flax)

Treatment	Average yields—bushels per acre	
	Rest, 5 years 1927-1931	Columbus, 8 years 1930-1937
No treatment	12.2	7.5
Lime	13.2	9.0
Lime and superphosphate	13.8	10.0
Lime and manure	14.6	10.3
Lime, manure, and superphosphate	14.7	10.6
Lime, manure, and rock phosphate	14.1	11.1
Manure	15.0	.....
Superphospate	13.3	.....
Lime and rock phosphate	.....	9.7
Lime, potash, and superphosphate	.....	9.3

FLAX VARIETIES

Yields of varieties of flax tested on the Southeast Kansas Experiment Fields, reported in Table X, show that Linota yielded as high or higher than other varieties at Rest and Columbus and was out yielded only by Redwing at Moran. In the 13 experiments in which Linota and Redwing were compared, the average yields were about the same, being 11.6 and 11.7 bushels, respectively. These varieties are also similar in several other respects. They are resistant to wilt, a fungous disease that infects the soil and injures varieties that are susceptible to it. They are moderately resistant to rust, a leaf disease that has not been a serious factor in Kansas. The seed of the two varieties has about the same bushel weight, as shown in Table XI. Also, the quality is about equal as indicated by the iodine number. The seed of Redwing has averaged slightly larger than Linota and the oil content has been a little higher. Redwing matures four or five days earlier than Linota, which may sometimes permit it to escape injury by drought.

The average yield of Bison, as shown in Table X, is one bushel per acre less than Linota. The data in Table XI show that it differs from Linota in several respects. The average size of Bison seed (Table XI) is nearly one-half larger than Linota, which necessitates a corresponding higher rate of seeding. The oil content of Bison is about 3 percent higher than Linota but the quality is poorer as indicated by the lower iodine number. The weight per bushel of Bison has usually been lower than Linota, indicating somewhat poorer development of the seed. This may be the result of its later maturity. Bison is highly resistant to both wilt and rust. Lodging has been more serious in Bison than in Linota in the few years when this has been a factor. It has been observed by those who are familiar with flax that more Bison seeds are cracked during threshing than of the small-seeded varieties.

TABLE X.—YIELDS OF VARIETIES OF FLAX GROWN ON THE EXPERIMENT FIELDS AT REST, COLUMBUS, AND MORAN

Varieties	Num. of years	Av. yield bus.	Yield of Linota in same yrs.	Percentage of Linota in same yrs.
		REST		
Linota	5	10.3	10.3	100
Bison	2	12.2	12.2	100
Rio	5	7.3	10.3	71
Redwing	4	9.9	10.4	95
Winona	3	11.0	11.3	97
Southwestern	3	10.2	11.4	89
		COLUMBUS		
Linota	3	10.4	10.4	100
Bison	3	8.9	10.4	86
Rio	3	9.4	10.4	90
Redwing	2	10.5	10.8	97
Winona	3	9.8	10.4	94
Southwestern	3	9.4	10.4	90
		MORAN		
Linota	8	12.6	12.6	100
Bison	8	10.6	12.6	84
Rio	7	10.7	13.0	82
Redwing	7	13.1	12.5	105
Winona	7	12.0	12.5	96
Southwestern	8	11.3	12.6	90
		ALL TESTS		
Linota	16	11.5	11.5	100
Bison	13	10.5	12.1	87
Rio	15	9.3	11.6	80
Redwing	13	11.7	11.6	101
Winona	13	11.2	11.8	95
Southwestern	14	10.6	11.9	89

TABLE XI.—COMPARISON OF VARIETIES OF FLAX WITH RESPECT TO BUSHEL WEIGHT, SIZE OF SEED, OIL CONTENT, AND IODINE NUMBER

(These are average data obtained in the variety tests at Rest, Columbus, and Moran)

Varieties	Weight lbs. per bushel	Weight per 1000 seeds; grams	Oil content per cent	Iodine number
Linota	52.3	3.7	35.5	180
Bison	51.2	5.3	38.3	168
Rio	50.2	6.4	39.1	170
Redwing	52.5	4.0	36.2	180
Winona	52.4	3.8	36.4	178
Southwestern	52.5	3.7	36.6	177

The plant characters of Winona are similar to those of Linota but the average yield has been somewhat lower, indicating that Linota is better adapted for growing in Kansas. Southwestern is of the same general type as Linota but it is more susceptible to wilt, which may account for its lower yield.

Rio is a large-seeded variety similar to Bison but is less well adapted, as is indicated by the low yields it made in the experiments.

HANDLING THE MATURE CROP

HARVESTING

Flax should be harvested when the bolls have turned brown, the stems are turning yellow, and the leaves have fallen off. Wet weather in June may cause the flax to put out a late crop of bolls which will not be mature when the major crop is ready to harvest. Sometimes when the main crop is light and the late crop heavy it may be advisable to wait until all the

Fig. 1.—A portion of the platform canvas of a binder prepared for cutting flax by having a strip of canvas sewed on the front side.

bolls are ripe. This delay in harvesting will often cause some losses from shattering and weather damage of the first set of bolls. Delayed harvesting also increases the amount of weeds that must be handled with the flax.

Flax may be harvested satisfactorily with the self-rake reaper, the grain binder, or the combine harvester-thresher. Where a self-rake reaper is available it is usually used for flax as the losses from shattering are less than with a binder.

Grain binders are available in practically all communities and are satisfactory machines for harvesting flax, The packers of the binder may cause some shattering if the flax is over-ripe. Many flax growers do not use twine in the binder but let the flax fall from the machine in bunches which are matted together enough to be handled with a pitchfork. The flax straw is much tougher than wheat or oats but a sharp sickle will cut it without difficulty. The straw frequently catches under the slats of the platform canvas and is drawn under the platform, eventually stopping the machine. This trouble can be avoided by tacking or sewing a strip of canvas eight to 12 inches wide on top of the slats of the platform canvas at the forward edge as shown in figure 1.

After flax has been bound it should be cured in small shocks. Rain on

flax in the field damages it more than it does wheat or oats. If flax cannot be threshed from the fields as soon as it is cured sufficiently, it should be stacked and the stacks covered with long grass or canvas. Flax clings together so that it is not necessary or desirable to tramp it when loading on wagons or when stacking. In handling flax tight-bottomed wagons should be used to save the shattered grain.

When flax ripens evenly a combine harvester-thresher handles it very satisfactorily. When there is a second growth of flax or when there are many green weeds present, the flax cannot be separated or stored if combined directly. In this case a windrower and pickup attachment should be used.

THRESHING

Flax should be threshed only when thoroughly dry. When flax is dry enough to thresh and the grain is dry enough to store without danger, the little points on the end of the bolls will stand slightly apart. When, because of insufficient curing, rain, or atmospheric moisture, the flax is too moist to thresh, the points will be closed.

Flax can be threshed in any separator tight enough to prevent leaking of the grain by using sharp cylinder and concave teeth and the proper screens. Ample reserve power is needed for threshing because of the toughness of the straw. In order to do a good job of 'threshing it is essential that the flax be fed to the separator evenly. The profit from a flax crop is frequently lost by blowing part of the seed into the straw pile in an attempt to get dockage-free flax. Flax is bought on a dirt-free basis so that there should be no objection to a reasonable amount of trash in the grain as it comes from the separator. In threshing, the straw pile should be watched much closer than the grain spout.

STORING

Flaxseed is usually sacked at the thresher or hauled in canvas-lined wagons or trucks. The seed is so small and slick that only the tightest wagon-boxes or bins will hold it. If the flaxseed to be saved for planting is dry, there is little difficulty in storing it, the main requirements being a tight bin with a good roof. Before storing flaxseed it is advisable to remove the foreign material. The particles of stems and weeds are usually higher in moisture content than the seed.

MARKETING

Most Kansas flax is marketed direct from the thresher in July and August. There are two reasons for this. Flax is difficult to store on the farm and the price is better at that time of the year than any other time until late the next spring. The 37-year average monthly prices of flax at the Minneapolis market are shown in figure 2. The lowest prices occur in October when the bulk of the northern crop is coming on the market. Kansas flax is harvested in July and can usually be marketed in July or early August. The trend of monthly prices indicates that it is advisable to market early so as to take advantage of the old crop prices.

SUMMARY

Since 1909 the United States had consumed more flax than it has produced. This makes the 65-cent tariff effective.

Kansas has been producing about 260,000 bushels of flax annually, which is but one-sixth of the capacity of the linseed oil mill at Fredonia.

Flax is fairly comparable with wheat as a cash crop in southeast Kansas and more profitable than oats. The crop is not hard on the land. The straw is comparatively high in feeding value, and its inclusion in small-grain farming systems makes for more efficient labor distribution.

Flax has few disease and insect problems, is an excellent nurse crop, and leaves the soil in good physical condition.

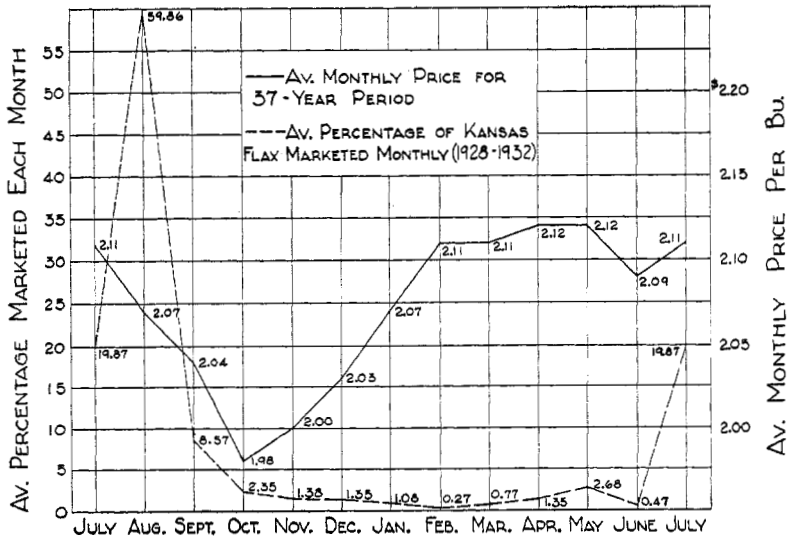

Fig. 2.—Average monthly fluctuations in the Minneapolis price of flaxseed and in the percentage of the Kansas flax crop delivered to market. The average price for each month is the grand average for a 37-year period, taking the average of the daily closing prices for each month as the price for the month. (Data from U. S. D. A. Yearbook, 1932, and Agricultural Statistics, 1937.) The percentage of Kansas flaxseed marketed each month is the average for the five-year period, 1928-'32. (Data compiled by the Fredonia Linseed Oil Works Company.)

A compact seed bed should be prepared early for flax. Three pecks of seed should be seeded preferably during the first half of March and should be planted no deeper than necessary to cover it well. It may be drilled or broadcast, drilling being preferable.

Linota is well adapted in eastern Kansas, is wilt-resistant, and has made high yields in variety tests.

Commercial fertilizers are not recommended for flax. Manure increases the yield but should be applied to some cultivated crop ahead of the flax.

Flax does best on heavy, cold lands but will not compete with weeds so successfully as other small grains. Legumes in the rotation increase the flax yields. Small-grain stubble plowed in late July or August has produced much better yields of flax than similar stubble plowed in December.

Flax can be harvested with a self-rake reaper, binder, or combine. The two former operations should be done when the bolls are ripe and the stems are drying. As soon as the flax is cured sufficiently, it should be threshed or stacked. Any good separator can thresh flax with the proper screens and adjustments. It is more important to keep the flaxseed out of the straw pile than to keep the trash out of the seed. Flax should be handled in sacks or very tight vehicles.

Kansas flax should be put on the market before the bulk of the northern crop has depressed the price.