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# Growing FLAX

630.4  
C212  
P 545  
1968  
(1969 print)  
c.3

PUBLICATION 545 1968



## FLAX FACTS

Our export trade in flaxseed has been well sustained in recent years. Canada is supplying seed of higher oil content and quality than any other country.

Flax is now a safe crop to grow because disease-resistant varieties have been developed, herbicides may be used to control weeds, the crop fits well in rotations and there is a ready market for it in our export trade.

Flax can be sown, harvested and threshed with exactly the same equipment as that used for wheat or other small grains.

Flax is useful in a rotation because it is not subject to the common diseases of other crops and it has long been accepted as the best companion crop for a new seeding of legumes and grasses.

Flax is one of the few crops that tolerate herbicides for both grassy and broad-leaved weeds.

For a high yield of seed of good quality:

- Use a variety that is resistant to rust and wilt.
- Have a firm, weed-free seedbed on soil that keeps uniformly moist.
- Sow clean, sound seed. Treat the seed with a recommended fungicide.
- Sow early. If unable to seed early, use an early-maturing variety.
- If you need to use herbicides, see page 9.
- If insects attack the plants, see page 13.
- Cut the crop when the bolls are ripe and the stems are yellow.
- Thresh carefully to avoid cracking the seed.

Flax is grown mainly in the Prairie Provinces. In the period from 1961 to 1965 Manitoba had an average of 929,000 acres, Saskatchewan 583,500 acres and Alberta 338,000 acres. Ontario and Quebec had an average of 46,500 acres in the same five-year period. Less than 3,000 acres of flax is grown in British Columbia.

Little flax is grown for fiber in Canada. The varieties suitable for fiber are different from those grown for seed.

## DESCRIPTION OF THE PLANT

The flax plant<sup>2</sup> is an annual with a short taproot, and with fibrous branch roots that grow as deep as four feet in light soil. It has one main stem, which grows as high as four feet. In thick stands only the main stem develops, but in thin ones four or more branches, or tillers, may develop.

The flowers may be white, blue, pink or violet, depending on variety. They open shortly after sunrise and the petals usually drop before noon. If the plants have enough food and water, flowering continues for three weeks or more. The blossoms are usually self-pollinating, but several species of insects may be important in cross-fertilization of some varieties. Each seed capsule contains up to ten seeds, which range from reddish or deep brown to smoky yellow. The seed is covered with a mucilaginous material that gives it a high gloss and becomes sticky when wet.

## SEEDING

Flax grows well on any clean soil that is suitable for cereals but does best on the heavier loams that retain moisture well. Because of its rather limited root system it may not thrive on sandy soil. It is somewhat drought-susceptible and competes rather poorly with weeds. Sow clean, pure seed of good vitality.

### Preparing the Seedbed

Prepare the seedbed with the following objectives: control of weeds, conservation of soil moisture and a firm seedbed. The best method depends on the crop grown just before the flax and on the condition of the field. Summerfallow usually gives the best results. Flax does well after cereals, including corn, but not on loose soil after potatoes or sugar beets. It yields well following legume crops.

On stubble land in medium-textured and light soil areas it is best to use the one-way disc or to plow and harrow. On heavy clay soils that do not readily pack, preferably use the one-way disc with a seeder attachment. Work stubble land lightly the previous fall, unless there is danger of

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<sup>2</sup>*Linum usitatissimum* L.



soil drifting or unless standing stubble is required to trap snow in winter. Shallow tillage before seeding reduces the chances of bringing weed seeds to the surface to germinate and cause a weed problem.

The seedlings are much less able than those of wheat to force their way through a surface crust resulting from a heavy rain. Hence, occasionally it is necessary to harrow to facilitate emergence of the seedlings.

### Depth of Seeding

Sow at an even depth, covering the seed with 1 to 1½ inches of soil. Sowing deep in dry, loose soil gives uneven germination and a patchy stand. Drilling gives more even depth of planting than broadcasting and compacts the moist soil better around the seed to ensure more even germination.

### Date of Seeding

Sow the seed when the soil is moderately warm: about the second week in May or a week after seeding wheat commences. Early sowing gives better seed yields than late sowing, better control of late-starting weeds and generally less damage from disease and insects.

Seeding may need to be delayed to destroy early-starting weeds such as wild oats. Then disc early in the spring, allowing two to three weeks for the weeds to make a start, and seed toward the end of May. If you need to sow late, to control weeds or for any other reason, use an early variety like Raja.

Spring frosts seldom damage flax seedlings. Plants just emerging are the most tender, but even they will withstand a moderate frost, especially if the soil is moist and they are not injured further by drying winds. After the plants have passed the two-leaf stage and are hardened by exposure they will stand temperatures as low as 18°F for a short time without damage.

### Rate of Seeding

In the Prairie Provinces, sow 28 to 40 pounds per acre; in Eastern Canada or under irrigation, as much as 45 pounds. Nothing is gained by increasing the size of a stand if the moisture supply cannot support it. You may need to change the rate because of size of seed, percentage germination, soil fertility or weediness.

### Treating the Seed

Treat the seed with a recommended fungicide to protect it from disease and to improve emergence. Clean, dry seed can be treated several weeks before sowing.

Treatment is particularly important because threshing, especially under

dry conditions, may cause small cracks in the seed coat. These cracks may be too fine to be seen without the aid of a strong hand lens. They are caused by setting the concaves too close and running the threshing machine too fast when the grain is dry and brittle. Large-seeded varieties are damaged more than small-seeded ones. The cracks allow fungi to enter, and the seed either fails to germinate or produces stunted plants. Treatment also protects the germinating seed to some extent against injury from soil-borne organisms that cause damping-off and seedling blight.

## FERTILIZERS

Generally speaking, flax responds less well to fertilizer than most cereals. Soils that give high yields of small grains are usually fertile enough to give good yields of flax. The decomposition of fresh organic matter from plowing down legume or grass sod releases nitrogen and minerals to the growing plants. The use of commercial fertilizer is expanding and many flax fields are now fertilized.

Nitrogen is the chief factor in promoting increased yields, but in many instances a combination of nitrogen and phosphorus is superior to nitrogen alone. Fertilizer recommendations vary from farm to farm, depending on the soil type and its previous crop history. Soil tests now provided by soil-testing laboratories form the basis of recommendations for individual fields. See the nearest agricultural representative or district agriculturist for details. In the absence of tests the following general recommendations can be followed. In Alberta, where fertilizer is used on fallow, apply 5 pounds of nitrogen and 15 pounds of phosphorus per acre on Dark Brown and Thin Black soils; 5 pounds of nitrogen and 20 pounds of phosphorus per acre on Black and Dark Gray Wooded soils; and 5–10 pounds of nitrogen and 15–20 pounds of phosphorus per acre on Gray Wooded soils. On stubble and grass-sod breaking, apply 35 pounds of nitrogen per acre on Dark Brown soils; 35 pounds of nitrogen and 15 pounds of phosphorus per acre on Thin Black soils; 45 pounds of nitrogen and 20 pounds of phosphorus per acre on Black and Gray Wooded soils; and 30–40 pounds of nitrogen and 15–20 pounds of phosphorus per acre on Gray Wooded soils. Where both nitrogen and phosphorus are used, broadcast nitrogen in the fall or early spring and drill in phosphorus at seeding. In the Gray Wooded soil zones, sulfur as well as nitrogen, phosphorus and organic matter may be low. In this area, therefore, 16-20-0 (with 14 percent sulfur) and 21-0-0 (with 34 percent sulfur) are likely to give the best results. Preferably apply them to the legume crop or another crop in the rotation rather than to flax.

Fertilizer is not recommended on summerfallow in Saskatchewan and Manitoba. A broadcast application of 35 pounds of nitrogen per acre in Saskatchewan, and 20–40 pounds per acre in Manitoba is recommended on stubble.



In Ontario, where no manure is applied, use 5-20-20 on sandy or loamy soils or 5-20-10 on clay soils at 200 pounds per acre. Where manure is applied, use 0-20-20 on sandy or loamy soils or 0-20-10 on clay soils at 200 pounds per acre. Fertilizer injury may result if more than 200 pounds of fertilizer per acre is placed in contact with the flax seed.

## CONTROL OF WEEDS

Weeds have been a serious problem in growing flax. The same characteristics that make flax a good companion crop for grasses and clovers make it a poor competitor of weeds. Flax does not shade the ground as much as wheat, oats or barley, and so gives weeds an excellent chance to develop.

Weeds not only compete with the growing flax but also cause losses from dockage in seed shipments. Dockage annually amounts to thousands of tons and is a direct charge against marketing costs. Dockage is also objectionable to the crusher because it absorbs oil during processing.

Sow only thoroughly cleaned seed on the cleanest land available. Keep all preceding crops in the rotation as free of weeds as possible. If many weeds have matured it is best to cultivate immediately after harvest to promote germination before freeze-up.

Spring tillage to promote germination of weed seeds before seeding may also help. If seeding of early maturing varieties is delayed as long as possible, many wild oats can be killed by two or more tillings before seeding.

### Chemical Control

When using postemergence herbicides where flax has been planted, apply them as soon as there are enough weeds to make it practical and within the safe period for treatment recommended below for the particular herbicide. Early treatment of annual weeds with herbicide gives the most benefit. Weeds are more susceptible to herbicide in the seedling stage, and their early removal is necessary to minimize crop losses caused by weed competition. In addition, there is usually less risk of crop injury from early treatment. It is also possible to reduce risk of crop injury by using spray volumes of at least 10 to 15 gallons of water per acre. If some crop injury should occur from the use of herbicides it will most often be more than offset by increased yield if the infestation of susceptible weeds is moderate to high.

Use MCPA for control of broad-leaved weeds in flax except when certain problem weeds such as Russian thistle, perennial sowthistle, cow-cockle or smartweed make up a major part of the infestation. Use 2,4-D for control of Russian thistle and top-growth control of perennial sowthistle. Several new herbicides are becoming available for control of some of the other problem weeds. Consult your local agricultural representative

or weed supervisor for the latest information on special measures to control problem weeds. The safest period for applying MCPA or 2,4-D is from the time the flax plants reach a height of about two inches to just before bud formation.

Green foxtail may be controlled with TCA or dalapon. Apply these herbicides when the green foxtail is in an early stage of growth, preferably before the three-leaf stage is passed. The safest period for applying these herbicides is when the flax is four to six inches high. Use a spray volume of 10 to 15 gallons per acre. Avoid overlapping spray swaths. Both dalapon and TCA may be mixed with MCPA or 2,4-D for combined control of green foxtail and broad-leaved weeds.

For wild oats, mix diallate into the top 3 inches of soil before seeding. A disc-type implement may be used for mixing the herbicide into the soil. Go over the area at least twice if the soil is wet or cloddy or has a heavy trash cover. Double harrowing can be used on well-worked soil. On land that can be given fall tillage it is possible to apply diallate in the fall before the cropping season. Another herbicide, barban, is used to control wild oats. Apply barban when most of the wild oat plants are in the two-leaf stage. Because the degree of control depends largely on the uniformity of emergence of the wild oats, carry out preseeding tillage so as to produce as uniform an emergence of wild oats as possible. Injury to the flax is likely to occur if barban is applied during the cotyledon stage or after it has reached the 12-leaf stage.

*Read and follow label instructions carefully when using herbicides*

## HARVESTING AND THRESHING

Cut flax when it is fully mature. If the bloom on secondary growth continues into the fall, harvest the crop when the ripest seed can be obtained. Some varieties have more late bloom than others. It is best not to delay the harvest too long as this usually exposes the crop to more wet weather.

Harvest by straight combining, or cut with a swather and then thresh with a combine. Weedy crops may be handled to advantage with a swather, which allows the straw and weeds to dry out before threshing. Leave about 6 inches of straw to have enough stubble to hold the windrows off the ground. Swathing and then combining has become more general because this method assures drier seed than straight combining. If free from weeds, flax is easier to straight combine than other grains as it does not shatter readily.

Keep the cutter bars of combines or swathers clean and sharp to ensure a smooth cut and to keep immature flax from collecting under the knife. To



reduce gumming of the cutting parts, apply water or kerosene to them often.

Thresh flax only when it is thoroughly dry and the seeds give a dry rattle in the boll. Usually, early-sown flax is easier to thresh than late-sown flax because it has a better chance to mature under drier conditions before it is harvested.

To avoid injury to the seed during threshing:

- Space the front concave and the cylinder about half as far apart as for wheat, from 1/8 to 1/4 or 5/16 inch depending on threshing conditions; have a rear clearance ranging from 1/16 to 1/8 inch.
- Run the cylinder at about 6,200 feet per minute.
- See that there is no end play in the cylinder.
- Check the manual on threshing flax for the type of machine being used.

Store flax in a dry place. If green weed seeds are present they may raise the moisture content enough to cause heating and molding. Remove them before storing the seed. This will also reduce the amount of dockage.

Clean flax for seed carefully, because chaff and broken stems may carry spores of rust or other diseases over to the next crop.

## DISEASES

To guard against diseases in flax:

- Grow varieties that are resistant to rust and wilt.
- Sow early so that the crop matures earlier.
- Sow only sound, clean, disease-free seed.
- Pack the land after seeding to ensure a firm seedbed.
- Avoid flax after flax in the rotation.

Most diseases may be controlled by recommended practices, but those resulting from climatic conditions are generally beyond the control of the grower.

### Rust

Rust is a constant threat to flax and is potentially its most dangerous enemy. New races are apt to arise if susceptible varieties are grown, and varieties once resistant to rust may become susceptible.

The first conspicuous symptoms are bright-orange pustules on the leaves and stems of plants. Each pustule produces numerous spores, which are carried by wind and infect other plants. Later in the season the pustules turn black and produce overwintering spores. These black spores germinate the following spring and will infect the flax if it is susceptible. Flax rust therefore differs from wheat rust in that the whole life cycle is spent on the flax plant. Old flax straw, stubble and volunteer flax are sources of infection and should be plowed down. Growing varieties that are resistant, however, is the best safeguard against rust.

## Wilt

Flax wilt usually occurs each season, but it causes little damage in recommended varieties. A suitable rotation in which flax does not follow flax is beneficial, but the best control is attained by growing wilt-resistant varieties.

Wilt is caused by a fungus that is both seed- and soil-borne and that may live in the soil for several years. The seedlings may wilt and die; or at any stage of development the plants may stop growing, the leaves and stems turn yellow and the stems droop and turn brown. The roots turn ashen gray.

## Seedling Blight and Root Rot

Seedling blight often causes serious damage to flax. The most common organisms causing it, *Rhizoctonia* spp., appear to be most destructive on loose, warm, moist, well-worked soil. To avoid damage, sow flax early after another crop rather than on summerfallow, and use a packer to make a firm seedbed. Sow only clean, treated seed. Seedlings from cracked seed succumb most easily to root-rotting organisms.

The fungi that cause seedling blight are carried both in the soil and on the seed. Affected seedlings turn yellow, wilt and die. Newly attacked plants have reddish to brown areas on the roots. Usually the germinating seedlings rot before they emerge, or the seed is killed before it germinates. This type of infection is most common when the seed coats are cracked, split or chipped during threshing.

## Pasmo

The fungus that causes pasmo overwinters on the seed and on the straw and stubble in the field. Therefore, sow flax away from fields previously seeded to flax and sow only clean, treated seed. Early sowing also helps.

Pasmo causes brown, irregular areas on the leaves, stems and seed capsules, and the plants ripen prematurely. It is most easily recognized as the plants approach maturity. At first, brown lesions develop on the lower leaves and irregular brown bands on the stem alternate with bands of green; later on, the leaves drop prematurely and the entire stem may turn brown. All commercial varieties are susceptible but some varieties are less susceptible than others.

## Heat Canker and Frost Canker

During hot dry weather, high temperatures at the surface of the soil injure the plant tissues in contact with it. This usually occurs when the plants are less than six inches tall. The stems become constricted at the soil line, the tissue collapses and the plants break off. In older plants,

brittle scar tissue is formed so that the plants break off when exposed to strong winds.

Seedlings may also be damaged by freezing temperatures at the ground level. As in heat canker, the stems become constricted at the soil line. Plants in low spots and in other "frost pockets" are most liable to frost canker.

Packing the soil at seeding time, and sowing at an increased rate are recommended. Sowing early in a north-south direction is especially advised where heat canker is anticipated.

### Aster Yellows

An insect, the six-spotted leafhopper, transmits the virus that causes aster yellows. The leafhopper also transmits blue dwarf virus of oats and this virus causes "crinkle" disease in flax. Aster yellows gradually increased in Western Canada until 1957, when it was the most destructive disease on flax, but it has not been severe since.

Symptoms include yellowing of the top part of the plant, stunt and most conspicuous malformation of the flowers, which are sterile and fail to produce seed bolls. All flower parts, including the blue or white petals, are converted into small, yellowish green leaves. The severity of the disease depends on the stage at which plants become infected. Early infection usually destroys the entire plant but late infection may affect only some of the flowers. Many weeds, such as stinkweed, prickly lettuce, flixweed, goldenrod, wild carrot, perennial sowthistle, milkweed, plantain, groundsel and Canada fleabane, are a source of the virus and hence should be destroyed. As yet there are no practical control measures.

## INSECTS<sup>3</sup>

Flax may be infested by various insect pests from time of emergence to maturity. To keep damage at a low level, examine your fields regularly for the pests and apply control measures promptly.

*Cutworms* damage the seedlings, cutting off the plants at or near the soil surface. Severe damage may be done in one or two days when the plants are young.

*Wireworms*, although often serious pests of cereal grains in the seedling stage, seldom damage flax.

*Aphids* sometimes become so abundant on succulent flax in midsummer that all the plants in a field may be covered with them. These infestations normally cause little damage.

The *six-spotted leafhopper*<sup>4</sup> and the *tarnished plant bug*,<sup>5</sup> like aphids,

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<sup>3</sup>Prepared by H. McDonald, Research Station, Saskatoon, Saskatchewan.

<sup>4</sup>*Macrostoteles fascifrons* (Stål).

<sup>5</sup>*Lygus lineolaris* (Palisot de Beauvois).



feed by sucking juices from the flax plants. This leafhopper may carry the virus that causes aster yellows and infect the plants with this disease while feeding. Tarnished plant bugs damage flax by feeding on the growing tips and causing them to be distorted and to die back. The damage from these insects is most serious on late-seeded crops.

The *bertha armyworm*,<sup>6</sup> a climbing cutworm, feeds on the leaves, flowers and bolls. The larvae occasionally cause serious damage by chewing through the stems below the bolls, dropping these to the ground. The older larvae are velvety black and easily seen on the plants.

The *flax bollworm*,<sup>7</sup> another climbing cutworm, lives inside the boll at first. After eating the seeds, the larvae chew a hole and emerge from the boll. They are green with four white strips and are easily seen on the plants. Economic infestations have occurred mainly in western Saskatchewan.

The *beet webworm*,<sup>8</sup> a slim, lively, dark-green caterpillar, may eat leaves, flowers and patches of bark from flax stems and branches. When abundant, usually in July and August, the larvae migrate in large "armies."

*Grasshoppers* may be a hazard to flax, especially before harvest. If flying adults invade a field, they may quickly cause large numbers of bolls to drop to the ground by chewing through the more succulent portions of the small stems below the bolls. In the spring, young hoppers may also damage seedling flax.

For more information on insects and their damage, and for up-to-date information on control, consult your district agriculturist, agricultural representative or provincial entomologist.

The current recommendations for the chemical control of insects on field crops are published annually by most provinces. It is suggested that you obtain a copy to ensure that you use only currently recommended insecticides.

**CAUTIONS:** *Follow closely all the cautions listed on the insecticide label. For some of the treatments the interval required between the last application and harvest varies with the material used, the number of applications and the amount applied. Keep to the interval given to avoid residues that would render the flax unfit for sale or for fodder.*

## VARIETIES

Most of the varieties now recommended are resistant to the common races of flax rust. Wherever flax is grown, rust is a hazard and it is not advisable to grow susceptible varieties.

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<sup>6</sup>*Mamestra configurata* (Walker).

<sup>7</sup>*Heliothis ononis* (Denis & Schiffermüller).

<sup>8</sup>*Loxostege sticticalis* (Linnaeus).

*Manitoba* – Redwood, Noralta, Raja and Rocket are the varieties recommended in Manitoba. Redwood and Rocket are medium-late varieties and must be sown early for maximum yield. For late sowing and in northern areas, use the early-maturing varieties Raja and Noralta. Although Raja is an early variety, it does not yield well in northern areas.

*Saskatchewan* – In the open plains of Saskatchewan, the medium-late varieties Redwood, Redwood 65, Norland and Rocket are recommended. Noralta is also suitable for this area, particularly in the Black soil zones. Raja should be used for delayed seeding and in the north. Noralta and Bolley are also recommended for northern areas of the province.

*Alberta* – Noralta is suitable for all areas of Alberta. Redwood is recommended only for the most southern areas of the province. Raja responds well to delayed seeding in the south. In the Peace River and Fort Vermilion areas, Redwing has been grown successfully for some time. However, since the variety is susceptible to rust it will probably be replaced by the rust-resistant variety Noralta.

*Eastern Canada* – In Ontario and Quebec, where moisture is usually adequate and the common flax diseases are a potential hazard, the early, disease-resistant varieties are best. Give Noralta or Raja first preference, followed by Redwood or Rocket. The medium-late varieties are more liable to produce second growth, particularly in wet seasons, and become difficult to harvest.

## Early Varieties

*Noralta* – Noralta is an early, high-yielding variety with straw of good length and strength. It matures 2 to 3 days later than Redwing. Noralta is resistant to rust, resistant to wilt, and moderately tolerant to pasmo. It has medium to low oil content and the oil has fair iodine value. The flower is light blue and the anthers are blue. This variety is particularly well adapted to the Black and Gray-black soil zones and is nearly equal to Redwood on Brown soils of the Prairie Provinces. Noralta was developed from the cross Redwing X Rocket by the Canada Department of Agriculture at Ottawa, Ontario, and Fort Vermilion, Alberta. It was licensed in 1965.

*Raja* – Raja is one of the earliest-maturing varieties grown in Canada and it yields well in late seedings. However, in northern areas it does not yield as well as Redwing and may mature later. It has an open, funnel-like, blue flower with large brown seeds. The smooth false septum in each cell of the boll distinguishes this variety from other commercial varieties. Raja is resistant to rust and flax wilt but is susceptible to pasmo. This variety was selected at the Central Experimental Farm, Ottawa, from a cross of an Argentine selection with a line selected from the fiber variety J.W.S.

*Redwing* – This is the oldest variety still grown commercially in Canada. Its ability to yield well and mature early has permitted Redwing



to remain on the recommended list for northern areas where frost may be a hazard. However, since it is susceptible to flax rust it will probably be replaced by Noralta. Redwing is medium in height and has strong straw. The flower is small and very pale blue; the small brown seed is below average in oil content. It was distributed in 1932 from the Minnesota Agricultural Experiment Station.

### Medium-late Varieties

*Redwood* – The straw of Redwood is of good length and strength. It has a blue-violet flower of medium size and brown seed of high oil content and good quality. Redwood is resistant to the common forms of flax rust as well as to wilt and is fairly resistant to pasmo. It yields well and is recommended for all southern and central areas of the Prairie Provinces. This variety was developed from the cross Redson X C.I. 980 at the Minnesota Agricultural Experiment Station in cooperation with the United States Department of Agriculture.

*Redwood 65* – This variety is an irradiated selection of Redwood developed by the Crop Science Department, University of Saskatchewan. It was licensed in 1965. Redwood 65 is similar to Redwood in maturity, appearance and disease reaction, but superior to Redwood in seed yield on the Brown soils of Saskatchewan and Alberta. It is also superior in oil content, yielding approximately 1 percent more oil than Redwood.

*Rocket* – The flower of Rocket, of medium size, is open, funnel-like and medium violet, and the seed is medium large and light brown. The oil content of the seed is high and of good quality. Rocket is resistant to rust, semiresistant to wilt, but susceptible to pasmo. This variety was selected at the Central Experimental Farm, Ottawa, from a cross of Argentine 8C X Redwing.

*Norland* – Norland has a large, rather flat, white flower with blue anthers and produces brown seed. Norland is resistant to all races of rust now common, and moderately resistant to wilt. Good yields of fair quality have been produced with Norland but it is rather later in maturity than Redwood and has not been grown extensively except in Saskatchewan. The variety is a selection of Victory made at the North Dakota Agricultural Experiment Station. Victory, as introduced, was a composite of strains that were irregular in both height and maturity. Norland was distributed by the University of Saskatchewan in 1954.

*Bolley* – Bolley is a brown-seeded, blue-flowered variety of medium maturity. It is several days earlier than Redwood and superior to Redwood for late sowing. Bolley is resistant to rust, moderately resistant to wilt and moderately susceptible to pasmo. It is high in oil content and the oil is of good quality. This variety was developed at the North Dakota Agricultural Experiment Station from the cross of Birio X C.I. 1134.



## MARKETING

Flaxseed is marketed according to statutory grades established under the Canada Grain Act. The standards of quality are given in the table below.

Any western flaxseed that does not qualify for a statutory or commercial grade or an off-grade as named and defined in the Act is graded "Sample," with the addition of, and made part of such grade name, words to indicate the damage or admixtures.

Any western flaxseed containing over one percent admixtures, but not over 2½ percent, of shrunken or broken grain or weed seeds that are not readily removable, is graded according to the requirements of the grade for which it would otherwise qualify, but with the addition of, and made part of the grade name, the words "Rejected – Account Admixture." Flax containing 2½ percent and over of cereal grain or mixtures of cereal grains that can be separated by approved equipment for cleaning samples is graded "Machine Separation" (M.S.), the term being used to designate such separation to be made. Wild oats in flax is classed as dockage.

<i>Grade</i>	<i>Minimum pounds per bushel</i>	<i>Soundness</i>	<i>Cleaness</i>
1 C.W.	51	Matured and sweet. May contain 12½ per cent damaged seeds including broken seeds.	Clean, commercially pure seed
2 C.W.	50	Matured and sweet. May contain 25 percent damaged seeds including broken seeds.	Clean, commercially pure seed
3. C.W.	47	May contain 5 percent heat damage.	Clean, commercially pure seed
4 C.W.	44	May contain 10 percent heat damage.	Clean, commercially pure seed

Flaxseed weighing less than 44 pounds per bushel is graded "Sample C.W. Flaxseed a/c Light Weight."

Flax mixed with broken grain of any description that cannot be classified under any established grade and does not contain more than one percent other material is designated as "Flax and Broken Grain."

Flaxseed containing excessive moisture is graded according to the grade requirements and there is added to, and made a part of the grade name, the word "tough" (containing 10.6 to 13.5 percent moisture) or "damp" (containing over 13.5 percent moisture).

## USES

### Linseed Oil

Seed flax is grown mainly for the oil extracted from the seed. The traditional use of linseed oil in protective coatings depends on the fact that it dries to a durable finish. Ability to dry quickly is measured by the iodine value, which varies from 170 to 205.

Canadian flaxseed contains from 35 to 45 percent oil. In commercial crushing about 19 pounds, or 2½ gallons, of oil are obtained from a bushel (56 pounds) of seed. Although varieties differ in oil content and iodine value, these qualities are also influenced by environment. When grown in a cool northern area flaxseed has a higher oil content and iodine value than when grown in a warmer area, and Canadian flaxseed therefore is higher in quality than any other on the world market.

Many types of oil produced from raw linseed oil are used in industry. Most of it goes into paints and varnishes, including new emulsion paints that dry quickly into a tough film. The oil is also used in linoleum, oilcloth, printer's ink, soaps, putty, and patent and imitation leather, as a core oil in making sand forms for metal castings, and recently as a salt-resistant coating for cement surfaces of sidewalks and highways.

### Linseed Meal

Oil cake, or oil cake meal, is a by-product of the production of linseed oil. The protein in the meal is about 35 percent, of which 85 percent is digestible. It is especially useful for supplementing the proteins of other feedstuffs. The unique feature of linseed meal and the characteristic that has made it so popular with livestock feeders is its ability to act in a gentle regulating way upon the digestive system. Most stockmen are familiar with this characteristic, and include a small percentage of linseed meal in the ration as insurance against animals going off feed.

The whole seed is very rarely fed to livestock. Commercial preparations containing a high percentage of flax have been used in supplements to skim milk for calves.

### Feeding Value of Flax Straw

Flax straw is rarely fed to livestock. It can be used as the only roughage for cattle if mature and of good quality. Green flax straw should be fed with caution because immature flax may contain poisonous amounts of prussic acid. The danger is greater if the immature flax is frozen.

### Flax Straw as a Source of Fiber

The fiber from seed flax is short and has been used to some extent as tow in the upholstering of furniture. In recent years, flax straw has become

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a source of fiber for the production of cigarette and fine bond paper. Straw is collected near the center of production and processed to remove the shives; then the tow is shipped to the paper mill. On the average, one third of a ton of straw is produced per acre and 3 tons of straw are required to produce one ton of paper stock.

*Some brand names are used in this publication because the chemical names are difficult for general use and there are no official common names for the active ingredients.*



First Printed . . . . . 1936  
Revised 1946, 1963, 1968  
Reprinted . . . . . 1969

Copies of this publication may be obtained from:

**INFORMATION DIVISION  
CANADA DEPARTMENT OF AGRICULTURE  
OTTAWA**

Queen's Printer for Canada  
Ottawa, 1969