



## FLAX

A Crop from America's Past With Renewed Potential

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### Overview



Flax was one of the most important crops to early American farmers and to the economy of our emerging nation. Grown in almost every state east of the Mississippi River, and some beyond, flax was literally the fiber and preservative that helped sustain our people. Before the spread of the mechanical cotton gin in the early 1800s, most Americans had a choice of two clothing fibers – wool or linen. Even after the advent of inexpensive cotton, linen fiber from the stems of flax would remain an important source of fiber for clothes and other products. In the early part of this century, flax was still being grown in most crop producing counties of Missouri.

In addition to being a fiber source, flax was also an important oilseed in America until the mid-1900s. Linseed oil, squeezed out of flax seed, can still be found in most hardware stores and is used as a preservative finish on wood. Despite the valuable characteristics of both linseed oil and linen fiber, flax began to fade from American farms after the development of the petroleum industry, especially following World War II. Many farms moved away from a rotation of flax and small grains (wheat, oats and sometimes barley or rye), to a rotation of corn followed by soybeans.

Fortunately, U.S. flax is not a lost crop, though the production area is much more limited. Flax is now grown almost exclusively in North Dakota and Minnesota, despite the fact that it is agronomically adapted to most Eastern and Midwestern states, as evidenced by its earlier production for many decades in these regions. Part of the reason flax has remained competitive in North Dakota and Minnesota, is that these states need fast maturing, cool season crops. Flax, like spring oats or spring wheat, is planted as soon as the soils begin to warm (typically April), and can be harvested in August, well before the early frosts that can hit the northern U.S. In Missouri, the crop is planted earlier and harvested earlier, and normally ready for combining in the third or fourth week of July.

The renewed interest in flax has been partially based on increased demand for linen clothing, but more so because of certain healthful properties of the seed oil. Flax oil is high in omega-3 fatty acid, which is believed to be helpful in lowering cholesterol when included in the diet. This same fatty acid is found in fish, one reason that seafood is advocated for those with cholesterol problems. The high omega content of flax is playing an increased role in foods. Flax seed is being fed to chickens, with the eggs from those chickens sometimes being marketed as high omega eggs.

Flax is currently grown on about 12 million acres worldwide, with the majority of the production in northern Europe and Russia. Flax was originally brought to America from Europe by early immigrants. Although there were close to two million acres of flax in the U.S. as recently as the early 1970s, U.S. acreage dropped substantially. However, acreage has been about one-half million acres, and is gradually increasing.

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## **Plant Description**



Flax (*Linum usitatissimum* L.) is a broadleaf with very small, narrow leaves that are less than an inch long. Stems are branched near the base of the plant, with plants reaching 30 to 36 inches in height. The multiple stems or branches of a flax plant are slender and flexible, dividing at their tips into inflorescences bearing attractive blue flowers. Flowers are mostly self-pollinated, with some cross pollination by insects. New flowers will emerge for a few weeks, each developing into a round seed capsule or

boll about one-third inch in diameter. Each capsule contains 4 to 10 seeds; North Dakota tests indicate 6 seeds per capsule is the average. Glossy in appearance, flax seeds have traditionally been brown in color; however, a new variety of flax, Omega, is golden-colored to make it more acceptable in the food market. If exposed to water, flax seeds will become sticky due to mucilage in the seed coat.

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## **Utilization**

Although the U.S. market for linen flax is on the upswing again, the better opportunity for flax in Missouri is as an oilseed crop, since the fiber flax market is well established in northern Europe. Fiber flax has reportedly been grown very little in the U.S. since the 1950s.

Flax is roughly 40% oil by weight, about 55% of which is alpha linolenic acid (also called omega-3 fatty acid). Linseed oil from flax dries rapidly, due to linolenic acid, which helps make the oil suitable for varnishes and paints that need to dry quickly. The use of linseed oil has diminished over the last 50 years, but it is still marketed widely, in places like the paints department of hardware stores.

As an oilseed, flax is somewhat unique in that the oil has almost never been used for cooking purposes or other food uses. The role of flax in the human diet has been as a whole seed, cracked seed or ground flour, used in a variety of baked products. Part of the attraction of flax is also its high fiber content and relatively high potassium content. Besides baked products, flax has been used in fruit juice drinks, and some people sprinkle the seed on breakfast cereals or salads. Due to the high level of mucilage in its seed coat, flax is sometimes consumed as a laxative. The relatively high content of lignans in flax seed has prompted studies by the National Cancer Institute on use of flax to help prevent cancer. Some studies with rats have shown that flax helps reduce the occurrence of certain cancers. The potential of flax as an anti-cancer agent in the human diet is still being studied.

After the oil is extracted from the seed, the remaining material (meal) can be fed to a variety of livestock. In current U.S. areas of production, the meal primarily used in cattle feed. The use of whole seed or ground seed for chickens is increasing, due to the omega properties described earlier.

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## **Markets and Economics**

Current delivery points for flax are in North Dakota and Minnesota. To be processed for oil, flax grown in Missouri would likely have to be shipped out-of-state, adding significant transportation costs. Selling flax in-state to keep down transportation costs would probably be based on selling whole or cracked seed, or ground flax flour. Developing in-state markets would require some direct marketing efforts to find food brokers or bakers or pet food manufacturers interested in buying the flax. Another possibility is to sell the flax to poultry producers, which are concentrated in southern Missouri. Small quantities of flax could potentially be sold to health food stores or other retailers.

Market price for flax upon delivery in North Dakota has ranged from \$0.09 to \$0.14 per pound. Yields of better flax varieties have been 1200 to 1400 pounds per acre in replicated yield trials, so at \$0.10 per pound, gross income per acre would be a modest \$120 to \$140. This would not be enough to cover the production costs of growing flax, which are similar to the cost of growing oats or soybeans. If the flax has to be shipped all the way to Minnesota, profit potential is further reduced. On the positive side, LDP payments for flax are available, boosting profit potential.

The way to make flax a profitable alternative in Missouri is to double crop it with buckwheat, planting the flax in early spring, harvesting in late July, then immediately planting the buckwheat. In extensive Missouri field trials, buckwheat performed best when planted in late July or early August, and still matures before frost in October. This system might not work in the northern tier of Missouri counties, but should work well in central and southern areas. Buckwheat will yield about 1000 to 1200 pounds per acre, with up to 1500 pounds under optimum conditions, and sells for about \$0.10 per pound. Delivery points for buckwheat are currently in Minnesota and North Dakota, with the crop mostly exported to Japan (see [University of Missouri extension guide 4306](#) for more information on buckwheat). The combined income of the two crops should be in the \$200 to \$250 range, not high, but competitive with soybeans on some soils, especially when soybean prices are low. The extra cost of growing the second crop, buckwheat, would be about \$25 per acre for seed and fertilizer, plus equipment, fuel and labor expense to plant and harvest. The main challenges in this system would be getting the flax planted early enough in a wet spring, planting buckwheat into the tough flax crop residue, and arranging for buyers and delivery of the crops.

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## **How to Grow Flax**

Management practices for oilseed flax are similar to that of spring oats. It is adapted to soils that are good for wheat or oats, but is not suited to poorly drained soils. Flax should not be grown in the same field every year, but instead should be rotated with other crops to reduce disease potential and improve yields. As described in the economics section of this publication, the greatest opportunity for flax may be in growing it as a double crop with buckwheat, thereby getting two crop incomes in one growing season.

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## **Variety and Seed Selection**

There are several varieties of oilseed flax available, most of them having been developed by plant breeders in North Dakota, Minnesota and Canada. Varieties tested in University of Missouri field trials in the early 1990s were Rahab, Culbert, Neche, Dufferin, Verne, Omega and Linton. Omega, Linton, and Rahab had the best yields when averaged over two locations, with yields typically in the 1200 to 1400 pound per acre range. All of these varieties are brown-seeded, except for Omega, a

golden-colored seed, which was the newest variety among the group tested. For the food market, Omega might carry a slight premium in sales prices, but for industrial uses, would be priced no differently. Omega variety seed can be obtained from Reimers Seed Farm, Carrington, North Dakota (701-652-3322).

Fiber flax varieties are taller than oilseed types and have much lower seed yields. There are also varieties which are considered "dual purpose" for both fiber and seed, being intermediate in production of both products. Commercial production of fiber flax is not recommended in Missouri at this time.

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## **Planting**

Flax should be planted in early April in northern Missouri, or late March in southern Missouri. Although late frosts may occur after flax emergence, they are unlikely to damage flax. North Dakota researchers report that flax seedlings can survive temperatures down to 28°F. upon emergence, and can tolerate the low 20s after they reach the two leaf stage. Seed should be planted 1/2 to 1 inch deep, or up to 1 1/2 inches on coarser soils (such as sandy loams). A standard grain drill can be used with flax, planting it in narrow rows (preferably 6 inches or less). Seed treatment with a fungicide is frequently recommended in North Dakota, especially for the golden-seeded type, but in rapidly warming soils such seed treatment is probably not necessary.

Recommended seeding rate is 50 pounds per acre. North Dakota extension staff recommends that an optimum plant population for flax is 70 plants per square foot, with a minimum stand of 40 plants per square foot. If flax stands are too thin, weeds will be more of a problem and light will get down into the canopy, stimulating an extended flowering period and slower plant dry down. At seeding rates that are too high, branching of the stem into multiple seed capsules is inhibited, leading to fewer capsules and lower yields. Fiber flax is seeded at double the rate of oilseed flax, to reduce branching and promote higher fiber yields.

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## **Fertility**

Flax has moderate fertility needs, similar to that for spring oats. For nitrogen, 50 to 80 pounds per acre should be applied, using the lower figure following soybeans or another legume. Nitrogen needs can be met by organic sources such as manure or leguminous cover crops. Phosphorous and potassium should be based on soil test levels – application rates can be the same as for oats or wheat.

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## **Pest Management**

### **Weeds**

Since flax is planted early in the spring, it gets a head start on many summer annual weeds. However, flax is not very competitive with weeds, in part because the small leaves of flax keep it from shading the ground completely. Herbicides\* available for flax include bromoxynil, Poast and sodium chlorate. Flax should not be planted in fields known to have a heavy population of cool season weeds, such as wild mustards.

## ***Insects***

In four years of field trials with flax in Missouri, insects and diseases were not a problem. In North Dakota, grasshopper, cutworms, armyworms, aphids, wireworms and leaf hoppers (introducing aster yellow disease) have sometimes caused damage. Labeled insecticides\* are Malathion, Sevin, Telone and certain pyrethrin products.

## ***Diseases***

Flax has occasionally suffered from severe disease. Early in this century, a wilt disease was devastating to flax fields, and later rust became a problem. Fortunately, both of these problems have been overcome by development of wilt and rust resistant varieties. Aster yellows will sometimes affect a small percentage of flax plants, while cool soils may contribute to damping off of seedlings. In general, it is a good practice to rotate flax with other crops to avoid disease build-up. Labeled fungicides\* are Busam, Captan, Mancozeb and Maxim.

\*Pesticides mentioned as being labeled in this publication are based on reference lists published in the Thomson Publications "Quick Guide" on crop pesticides, 2002 edition. These lists are believed to be accurate, but given the changing nature of pesticide registrations, labels and relevant government pesticide regulations should be checked before applying any herbicide or other pesticide.

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## **Harvest and Storage**



Flax is not like a soybean plant that completely turns brown and drops its leaves before harvest. Instead, at the time when it is ready to be harvested, there will usually be a few flowers in bloom and a few green leaves on the plant. A rule of thumb is to harvest when 90% of the seed capsules are brown. In northern states, flax is normally direct combined, but sometimes is swathed and allowed to dry in the field before picking it up with a combine. In Missouri, the approach should usually be direct combining the crop. It is important to fine tune the combine settings to avoid damaging flax seed.

Recommended storage moisture is 11%. **A note of caution** on handling flax in a storage bin: extension literature on flax from North Dakota indicates that people trying to stand on flax in a bin have sometimes sunk in very rapidly, because the slippery flax flows rapidly. Some individuals have sunk in over their head in flax bins and have suffocated – obviously, precautions should be taken when entering stored flax.

A minor concern may be flax leaking out of holes in the bin, which will happen more readily than with traditional commodities. Monitoring for grain weevils is recommended if flax is stored for more than a year. Also, if green material is present in the harvested flax, cleaning the grain is recommended before storing it.

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