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Canola Production

Canola, which produces a vegetable oil low in saturated fat, has potential for becoming an alternative crop for Nebraska agriculture.

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Canola produces an oil that has the lowest saturated fat content of any vegetable oil. Today, there is an increasing demand for this oil by diet-conscious consumers.

In 1985, the U.S. Food and Drug Administration (FDA) recognized rapeseed and canola as two different species, based on their content and uses. Rapeseed oil is used in industry, while canola oil is used for human consumption. High erucic acid rapeseed (HEAR) oil contains 22-60 percent erucic acid, while low erucic acid rapeseed (LEAR) oil has less than 2 percent erucic acid. Meal with less than 30 µmol/g glucosinolates is from canola. Livestock can safely eat canola meal, but high glucosinolate

rapeseed meal should only be fed to cattle because it may cause thyroid problems in monogastric livestock.

A canola plant from a Nebraska field.

Rapeseed has been grown in India for more than 3000 years and in Europe since the 13th century. The 1950s saw the start of large scale rapeseed production in Europe. Total world rapeseed/canola production is more than 22.5 million metric tons.

In 1989, the United States had 65,000 acres in canola production, about 500 of which were in Nebraska. It's estimated that U.S. farmers would have to produce at least 450,000 acres of canola to meet American consumer demand.

Farmers in Canada began producing canola oil in 1968. Early canola cultivars were known as single zero cultivars because their oil contained 5 percent or less erucic acid, but glucosinolates were high. In 1974, the first licensed double zero cultivars (low erucic acid and low glucosinolates) were grown. Today all canola cultivars are double zero cultivars. Canola is an acronym for Canada Oil Low Acid. Canola has come to mean all rapeseed cultivars that produce oil with less than 2 percent erucic acid and meal with less than 30 µmol/g of glucosinolates.

Canola production uses small grain equipment, limiting the need for large investments in machinery. Planting costs of canola are similar to those for winter wheat. The low investment costs and increasing consumer demand for canola oil make it a potentially good alternative crop for Nebraska growers.

General Agronomics

Canola seed is small (6,000 seed/oz), and management practices and field choices influence its yield performance. A field with good internal drainage is essential for stand establishment and yield because canola does not tolerate standing water.

Canola should be grown in fields not recently planted with canola or other cole crops (rapeseed, cabbage, broccoli, and turnips), or infested with weedy mustards. **Do not plant near a rapeseed field. Pollen contamination will cause an intermediate erucic acid content and make the crop unmarketable.** Canola fits well into a one-in-four year rotation schedule. This type of rotation will help decrease potential problems with sclerotinia, root rot, and stem rot.

Winter and Spring Canola Cultivars

Both winter and spring types can be grown in the United States. Winter canola is an alternative to winter wheat in the southern third of Nebraska. Because of winter hardiness problems, it should only be planted south of Interstate 80. About 80 percent of U.S. grown canola is the winter type. However, in the 1990 and 1991 Nebraska and Kansas yield performance trials, winter canola had stand reductions due to a lack of winter hardiness. The cultivars tested in Nebraska include Bienvenu, Cascade, Ceres, Svper, SV01531, SV01532, SV01533, SV1551, SV01552, and Tapidor. The 1990 yield trials had yields from 0 (SV01531, SV01532, SV1551, and SV01552) to 367 lbs/acre (Ceres). All the cultivars in the 1991 yield trials were winter killed. Cascade was the only cultivar that had any surviving plants.

Spring canola is grown in the northern tier states, such as Minnesota, North Dakota, and Montana. Spring canola grows in Nebraska but does not yield well, primarily due to high summer temperatures (85°F to 90°F). The high temperatures during the flowering and pod-filling period reduce yield and quality. The cultivars tested in Nebraska were Delta, Global, Hero, Legend, Profit, and Westar. The 1990 yields at Sidney averaged 254 lbs per acre due to a spring freeze, hail, drought and high

temperatures. The 1990 Cuming County trial averaged 1065 lbs per acre.

Seed Quality

Cultivars should be of the double zero oil type because both oil quality and glucosinolate levels are important for marketing potential. Environmental and outcrossing effects can increase the glucosinolate content in the meal. Do not use seed of suspect quality because acceptable germination and double zero tolerances are important. Planting certified seed is good insurance that the seed will have acceptable genetic and physical purity. It also is good insurance against planting seed that has exceeded the double zero tolerances.

Seedbed Preparation

Proper seedbed preparation is essential for the successful establishment of both canola types. Canola needs a seedbed that is free of debris, firm and well packed to allow for proper seeding depth and seed-soil contact. After disking, a final harrowing or rolling should create a firm packed planting surface. Excessive tillage can cause soil moisture loss and surface crusting. The final tillage operation should be less than a week before planting to kill weed seedlings and move soil moisture into the seeding depth zone. A well prepared seedbed is essential for promoting emergence, and achieving desired stands and decreased weed pressure. Conventional tillage is more effective than no-till for canola.

Planting Methods and Rates

Sow winter canola early, before winter wheat, to increase winter hardiness and develop a more vigorous plant. Plants with eight to ten true leaves, a five to six inch tap root and a 3/8 inch crown have better winter survival. This amount of growth will take about six to eight weeks. Winter canola is sown from mid-August to early September in Nebraska (about a month before winter wheat). Planting the crop too early will make the crop more winter tender and more susceptible to flea beetles at emergence, while late planting makes the plant susceptible to winter kill.

Begin planting spring canola in April when soil temperatures are 50°F or warmer. Planting too early can reduce stand establishment due to cold soil temperatures. Spring canola yields decline with delayed seeding due to hot summer temperatures.

Seeding rates vary from three to six pounds pure live seed per acre. Use seeding rates above eight pounds in irrigationd, weedy, or high surface residue fields, or when using broadcast spreaders for planting. The higher seeding rates produce stems that are more sensitive to lodging, but the added plant density will reduce time to maturity. A shorter maturation period might be better in late spring plantings. Use seeding rates of four to seven pounds for areas where late season drought can be a problem.

The size of canola seed limits planting depths to 1/8 to two inches. Seeding depths of ½ to one inch are optimal when moisture is adequate. Deeper seeding depths (two inches and deeper) can delay the fall development of winter canola making it more winter tender.

A grain drill is desirable for seeding canola but a broadcast spreader is acceptable. Drills with 6- to 14-inch row spacings are adequate for canola planting. The narrow row spacings will enable the stand to cover the soil surface more quickly and reduce weed competition. Growers should consult their drill's calibration charts for the proper settings. Double disk openers are better than hoe-type openers because of their improved precision in seed placement. Hoe-type openers are more desirable in rough fields. Broadcast spreaders can produce uneven stands due to poor seed placement. A harrow, roller, or a culti-

packer with the teeth raised is essential to incorporate the seed after broadcasting. Stands of one to two plants per square foot are salvageable because canola compensates by branching in thin stands.

Soil Fertility

Canola benefits from a proper fertilization program. Soil testing is the most effective monitoring device a grower can have to manage a fertility programs. Adequate levels of nitrogen, phosphorus, and potassium are essential for rapid stand establishment.

Both winter and spring canola types are heavy nitrogen users. Canola will show greater response to high nitrogen levels than wheat and barley. It needs a total availability of 150 pounds of nitrogen to produce 2,000 pounds of grain per acre in Canada and Illinois. Growers can use two methods of nitrogen application. An early spring application is as effective as split applications. A split application of 35 to 50 pounds preplant nitrogen with the remaining nitrogen applied as a topdress in early spring (not past the rosette stage) is also effective. Excessive preplant nitrogen levels will increase canola's chances of winterkilling. If the canola crop follows a nitrogen fixing legume, reduce the nitrogen application. Canola is sensitive to fertilizer burning due to furrow applications of both nitrogen and sulfur. Where soil moisture might be limiting during germination, we do not recommend in-furrow nitrogen and sulfur applications.

Canola's phosphorus and potassium requirements are similar to those needed by high yielding wheat crops. Apply both nutrients after soil testing and interpretation as a preplant treatment. Production fields need a pH of 5.8 to 7.5. Boron is a pH sensitive micronutrient and boron deficiencies can be seen in sandy and high pH soils. Canola uses more boron than the other crops in its rotation. Growers should be careful to avoid elevating boron soil concentration to toxic levels. Boron application is done in preplant split applications.

Canola needs sulfur to take advantage of the higher nitrogen amounts. Avoid excessive sulfur levels due to the chance of increasing the glucosinolate content in the meal. If needed, apply sulfur preplant in a more available forms such as ammonium sulfate or ammonium thiosulfate rather than elemental sulfur.

Weed Management

Growers should be aware of canola's sensitivity to several broadleaf herbicides. Avoid fields with residual levels of triazines, imadazolinones, some sulfonylureas, picloram, and dicamba (for example: atrazine, Sceptor, Preview, Classic, Glean, Tordon, and Banvel). Consult herbicide labels and herbicide consultants for potential problems with residual herbicides.

Canola's ability to form a dense canopy enables it to compete with most weeds. August plantings of winter canola often get a better head start on the fall crop of weeds than the later September plantings. Growers should make a concerted effort to eliminate weeds and volunteer crops in canola fields before planting. Preplant tillage can control Canada thistle, field bindweed, volunteer wheat, and quackgrass, but a tillage-herbicide program will control problem infestations better than tillage alone. Use of fluazifop-butyl (Fusilade 2000) and glyphosate (Roundup), in addition to tillage, will control the above problem perennial weeds. Trifluralin (Treflan) is registered for use on winter and spring canola, but it will not control wild oats (*Avena fatua* L.) and many weedy mustards. Tillage will effectively control wild oats and weedy mustards in canola.

Disease Management

Several diseases can reduce the yield potential of canola, but proper management practices can reduce the threat of disease. These practices include a one-in-four year crop rotation, sanitized fields, and disease-free, certified seed.

Sclerotinia sclerotiorum (white mold or stem rot) survives in soil in its dormant stage called sclerotia. The stem, branches, pod, and leaves can become infected. White mold infection is caused by excessive use of nitrogen fertilizers, high inoculum levels, high plant populations, and high humidity. Effective control measures for white mold include rotating to nonhost crops, deep plowing, and use of certified seed free of sclerotia.

Black spot, *Alternaria brassicae* and *A. raphani*, is present in all canola and rapeseed production areas. Black spot overwinters on plant debris and seed. All above-ground plant parts are susceptible to infection from the spores produced on plant debris or infected seed. To limit problems, use disease-free certified seed, a one-in-four year rotation, and control weedy mustards and volunteer canola.

Seed rots, seedling blights, and root rots caused by *Fusarium* and *Pythium sp*., and *Rhizoctonia solani* can reduce canola stands. Proper seedbed preparation will create conditions favorable to rapid germination and emergence of seedlings. Seedling rots infect the emerging seedling and can prevent seedling emergence or leave it susceptible to other pathogens. Root rot symptoms include lesions at the stem bases and on the roots that can weaken or kill the plant. The fungicide, Captan, has been effective in preventing seed rots, but it does not protect against seedling blights and root rots. Recommended control practices include Captan seed treatment for the seed rots, and rotating to non host crops.

Stem canker or black leg caused by *Phoma lingum* is a devastating canola disease in Canada. Infected disease stocks or aerial spores spread stem canker. The reuse of common infected seed lots also spreads stem canker. Certified seed treated with benomyl is good insurance in Nebraska where the total canola acreage is low. If stem canker gets a foothold, plowing and a one-in-four year rotation will help control the problem.

Insect Pest Management

Several insects are known to infest canola. Flea beetles are a major pest in Canada and Idaho, and flea beetle infestations were seen in some of the 1991 Nebraska yield performance trials. Cabbage seedpod weevil and aphids are major pests in Idaho. There is little information available about the economic thresholds of Nebraska's canola pests. Monitoring of fields will guard against insect problems.

Flea beetle feeding damage is normally on the cotyledons and young leaves, and they are not usually a problem after the seedling stage. Canola is very tolerant to flea beetle leaf feeding. Large infestations can kill plants in hot dry weather.

The cabbage seedpod weevil is a major pest of winter canola. Spring canola flowers later than winter canola giving it a passive avoidance mechanism. The adults emerge and lay their eggs when winter canola is in full bloom. The larvae are the destructive stage of this insect. Larvae feed on the immature seed in the pods. Both parathion and endosulfan effectively control weevil infestations. Endosulfan's high cost and its lack of larvae control make it a second line insecticide compared to parathion. Economic threshold limits have not been set for this insect.

Aphids can become a problem in the spring and fall. Aphids can reduce the vigor of winter canola rosettes in the fall. Aphids feeding on terminal flowering structures during flowering and pod-filling does not reduce yield because terminal pods do not add yield. Nebraska has no registered insecticides

for aphids.

Grasshoppers, armyworms, and cabbage worms are defoliators that feed on the leaves and seed pods. Heavy infestations of these insects can reduce yield. Dipel is registered for armyworm control in Nebraska. Always read the label before applying any pesticide.

Forage and Feed

Winter canola's abundant fall and early spring growth makes excellent forage during these periods. Livestock adjust to canola forage by mixing the feed rations over a 7-10 day period. This adjustment helps preventing bloating and other diseases.

In the spring, haying of winter canola should occur before it flowers (similar to alfalfa). The use of canola for high moisture silage may allow the grower to keep it longer due to canola's inherently high moisture content. Forage yield trials in Idaho and Montana have had recorded yields of 2-13 tons per acre.

Table 1. Economic analysis.

Item	*Price/Unit*	*Cost/Acre*
Variable Costs		
Canola seed @ 8 lbs/acre	0.20/lb	$ 1.60
Nitrogen @ 150 lbs/acre	0.22/lb	$ 33.00
Planting and tillage costs		
1. Machinery 2. Tractor 3. Fertilizer application		$ 14.30 $ 10.58 $ 9.50
Labor		
1. Production 2. Harvesting	$5.75/hr X 1.75hr $5.75/hr X 1.00hr	$ 10.06 $ 5.75
Harvesting Costs		
1. Machinery 2. Custom swath Land Costs--rental basis		$ 12.96 $ 10.00 $ 48.50
Total Variable Production Costs		$ 156.25
Fixed Costs		
Machinery		$ 37.74
Total Production Costs		**$ 193.99**

Economics and Marketing

There are few canola markets in Nebraska. Several companies offer contracts, a safer method of marketing alternative crops. Contact local extension agents for information about marketing a canola

crop in your area. Development of a commercial market and improved winter hardiness will help make canola an excellent alternative cash crop for Nebraska growers. *Table I* examines many of the costs involved with canola production.

Harvesting and Storage

Direct combine harvest of canola is the most popular method in North America and Europe. Swathing is also possible when weed or humidity problems make direct harvest difficult. Harvest should not begin until moisture is below 10 percent. Harvesting above 10 percent moisture will result in dockage due to green seeds and the chance of heating damage.

Growers usually use a combine with a reel head. Contact a dealer if the combine manuals lack the proper canola settings. A combine harvest speed of 2 ½ mph is recommended to get clean seed. Canola is a difficult crop to feed into the combine but it is an easy crop to thresh. The reels should be set high and reel speed should be set to match ground speed due to the chance of shattering. Periodic inspections are essential to insure that the harvesting equipment has no openings through which canola can leak.

Swathing and threshing is practical when the fields have heavy weed infestations. Seed moisture levels should be 30 percent or lower before swathing. When the seeds in the pods are 75 percent black, the seed moisture should be about 30 percent. Threshing should start when the seed is at 10 percent moisture and no green seed is present. Swathing too early will result in green seed, lower oil content and higher seed moisture. Swathing too late will result in excessive shattering.

Seed moisture should not exceed 8 percent for long term storage. Lining the floor with a fine nylon or metal mesh screen will solve bin leakage problems. When drying seed, temperatures above 104°F can change the seed oil composition and kill germination. Seed stored below 6 percent moisture will be susceptible to damage in handling.

Potential Canola Benefits

Potential benefits for growing canola include:

1. The potential for double cropping. Soybean yields are potentially higher after canola than after wheat.
2. The use of current small grain equipment reduces investment costs.
3. Adding another crop to a rotation will help break up pest cycles.
4. A fall seeded crop spreads out the farm work load and provides an early summer cash crop that may produce more income than wheat.
5. The use of a minor oilseed crop allows a farmer to maximize government farm program alternatives with flex acres.

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