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Winter Canola in Pennsylvania: Production and Agronomic Recommendations

HISTORY

Canola's origin dates back to an oilseed crop grown in the thirteenth century called rapeseed. Although this crop was cultivated centuries ago, rapeseed was not used extensively until World War II when it was discovered to be an excellent lubricant for steam engines in ships. The first edible rapeseed was developed in Canada in 1956, and "canola" was registered as a name for this crop in the late 1970s.

Canola was developed by genetically altering rapeseed to reduce the levels of glucosinolates (which contribute to the sharp taste in mustard) and erucic acid (a fatty acid not essential for human growth). For a rapeseed variety to be classified as canola, the erucic acid content of its oil must be less than 2 percent, and in its solids, glucosinolate levels must be less than 30 micromoles per gram. In 1985 the U.S. Food and Drug Administration (FDA) declared canola "Generally Recognized as Safe" (GRAS), leading to a significant growth in consumption of canola oil and production of the crop in this country.

Most canola production in the United States occurs in North Dakota and is spring canola; however, winter canola varieties have been developed and bred for improving levels of winterhardiness, increasing the range and potential of the winter types.



DESCRIPTION AND ADAPTATION

Canola is a cool-season crop, adapted to long, wet, cool springs. It performs best on well-drained deep silt loam soils but is also adapted to some of the shallower soils in Pennsylvania, where corn production is limited. Canola does not perform well on poorly drained soils. It is somewhat tolerant of soil pH as low as 5.5 but is best adapted to soils with a pH above 6.0.

Canola varieties have been developed as both spring and winter types. Winter types are somewhat sensitive to winterkill and are best adapted to the warmer regions of Pennsylvania, probably those with growing seasons similar to or cooler than those found in State College. Winter types must be planted early enough to develop adequately before winter. Winter varieties yield 30 to 40 percent better than spring lines, but they may lack the winterhardiness to survive consistently in the short-season areas of the state (see corn maturity zone 1 in Figure 1).

VARIETIES

Winter canola varieties are available as open pollinated or hybrid and also as conventional and transgenic types with tolerance to glyphosate. Winterhardiness is a key characteristic in variety selection. Considerable progress has been made in developing winter-hardy canola during the past 15 years. An extensive national winter canola testing program is coordinated by Kansas State University (www.agronomy.ksu.edu/extension/DesktopDefault.aspx?tabid=98).

CROP ROTATIONS

Winter canola is an ideal crop to follow small grains in a rotation but can also do well following hay or corn silage. The main challenge in winter canola production in Pennsylvania is the early fall planting date required for winter canola (see "Seeding" below). Herbicide carryover can be an issue for canola, particularly with sulfonylurea, imidazolinone, and triazine herbicides. Some of this carryover can be avoided with imidazilone- or sulfonylurea-tolerant varieties.

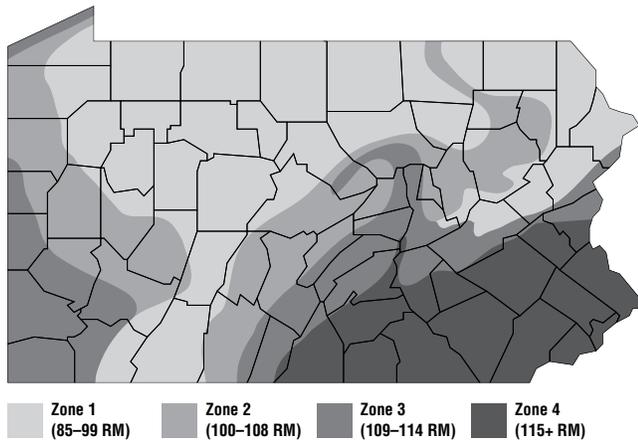
Be sure to check the recrop interval associated with the previous crop's herbicide program. Canola is susceptible to

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Figure 1. Pennsylvania corn maturity zones and the approximate maximum relative maturity (RM) of adapted hybrids for full-season grain production. Winter canola is best adapted to maturity zones 2-4.



sclerotinia stem rot, so avoiding regular, close rotations with soybeans in fields prone to this disease is also warranted.

There is usually some seed shattering with canola, so following canola with a crop where volunteer canola can be controlled is another issue. This is especially true in fields where Roundup Ready winter canola varieties are planted since the volunteers may be resistant to the typical glyphosate herbicides used to control weeds in grain stubble. Many seeds germinate immediately following harvest and can be controlled with tillage or other herbicides at that point.

Canola seed can also be lost from combines during wheat harvest, so wheat stubble in fields harvested with a combine used on canola should be monitored for volunteer Roundup Ready canola and controlled as necessary with herbicides other than Roundup. There are some indications that canola residues can result in mild allelopathy to succeeding corn crops, with the effects of delayed early season corn growth and occasionally lower corn yields than when following other crops.

SEEDING

Winter canola can be established using either tillage or no-till methods. Producers have had good success direct seeding canola early in the late summer into a clean seedbed. Ideally, canola should be planted about six weeks prior to the first killing frost to achieve adequate fall growth and ensure winter survival. Delaying seeding past four weeks prior to fall frost greatly increases the potential of winterkill. Ideally, plants should have six leaves and a taproot the size of a pencil before the first killing frost. In central Pennsylvania, seeding from August 25 to September 10 is a good target. In longer season areas in the southern part of the state, planting can continue through mid- to late September.

The recommended seeding rate for canola is about five pounds of seed per acre. A stand of plants with a density of six to eight plants per square foot is ideal. Canola can branch considerably and fill in stands that have some winter kill. Stands should be assessed in the spring; consider keep-



ing canola stands if the plant density is as low as two to five plants per square foot.

Weed-free small grain stubble is an ideal seedbed for no-till winter canola. Corn stubble and even killed sods can be seeded. As with other crops, heavy and uneven residue can cause uneven stands and slug damage in no-till seedings. In tilled seedbeds, crusting can be a problem. Strive for a seed depth of $\frac{3}{8}$ – $\frac{3}{4}$ inch in a firm seedbed. Alfalfa seeding equipment works well, but the recommended seeding depth is greater than for alfalfa. Successful seedings have been accomplished using the small seed box found on grain drills. If broadcast seeded, some surface disturbance before and/or packing afterward generally improves this method of seeding.

FERTILITY

Apply 80 to 100 pounds of nitrogen (N) per acre in the spring or about 2 pounds of N per bushel of expected yield. In addition, 20 to 30 pounds of N can be applied in the fall at seeding. Excess fall nitrogen can reduce winterhardiness. Phosphorus (P) and potassium (K) requirements are similar to those of sunflower or small grains. For a 50-bushel-per-acre crop with optimum P and K levels, the $N-P_2O_5-K_2O$ recommendations would be 100-40-30. Use a soil test to determine the amount you should apply. Canola has a higher sulfur requirement than small grains so the application of 25 pounds per acre in the fall or spring may be warranted. Sulfur response has not been evaluated in Pennsylvania. Nitrogen and potassium should NOT be placed in direct contact with the seed, but should be broadcast.

WEED CONTROL

If established early at an appropriate density, canola is a good competitor against weeds. Canola seedlings are very sensitive to weed competition; therefore, it should be seeded in clean fields at narrow row spacings. This will result in an early leaf canopy, which will shade or smother weed growth.

Mixtures of canola with mustard and wild garlic can reduce the crop's market value. Volunteer winter small grains

can also be a problem with winter canola, so these plants should be controlled preplant or postemergence if possible to avoid small grains contaminating the canola at harvest. Both Roundup Ready and conventional varieties are available and different weed control options are available for each.

For Roundup Ready canola varieties, Roundup can be applied in a single application after emergence, followed by a spring application if necessary. Check with the seed supplier for current labeled rates and the maximum seasonal rates.

Conventional chemical weed control measures include applying Treflan (trifluralin) as a preplant incorporated herbicide for controlling many broadleaf weeds and suppressing some annual grasses. Postemergence grass herbicides such as Poast, Assure, or Select can be applied in the fall for postemergence grass control. Stinger (clopyralid) also is registered for use on winter canola and is effective in controlling many thistle-family weeds.

Winter canola varieties are available with herbicide resistance for glyphosate or imidazolinone herbicides but not glufosinate, as in spring canola. Also, varieties that are sulfonyleurea residual tolerant are now available, providing more flexibility for managing herbicide carryover issues.

DISEASES AND INSECTS

Because of limited canola production in Pennsylvania, disease and insect pests have generally not been a major problem in winter canola. General recommendations are to practice a four-year rotation between canola and other white mold-susceptible crops. These include soybeans and dry edible beans. Additional diseases that can be encountered in canola include white rust, downy mildew, and alternaria blackspot. Control of flea beetle may be necessary, especially when conditions are hot and dry after seeding. Seed treatments such as Helix or Prosper can provide some control. Other insects known to be a problem on canola include cabbage seedpod weevils, cabbage worms, various cutworms, various armyworms, alfalfa looper, diamond-back moth larvae, aphids, lygus bugs, and root maggots.

HARVESTING

Canola varieties vary by about 10 days in maturity. Winter canola matures about the same time as or slightly before winter wheat. Canola is ripe when plants turn a straw color and seeds become dark brown (typically early to mid-July). Often, seeds on the top of the plant will begin to shatter just as the pods ripen on the base of the inflorescence. This shattering is usually a good indication that the crop is nearly ready to harvest. Because of this shattering there are usually some immature seeds at harvest.

Canola should be cut just below the seed pods to keep crop residue from going through the combine. Combine cylinder speed should be one-half to three-quarters that used for wheat. Seed moisture should be 8–10 percent for direct combining. Volunteer plants may grow following harvest and/or the next season. Many of the herbicides presently used in soybeans and corn will control volunteer canola.

In some production areas canola is swathed when 40–50 percent of the seeds are mature. It is dried in the swath about 10 days to about 10 percent moisture. It is also cut high so that the stubble will hang onto the swath on windy days. Specialized windrow pick-up heads are used to gather the crop. In the Mid-Atlantic region, there is often a risk of rain while the crop is in the swath, which can increase crop losses.

YIELDS

Typically, yields average 50–70 bushels per acre (2,500–3,500 pounds per acre) or more. Yield goals of 40 to 60 bushels per acre are realistic, and yields of up to 80 bushels per acre have been observed for new varieties on good soils. Canola grown in Pennsylvania contains between 40 and 45 percent oil.

At an oil content of 40 percent and a yield of 2,500 pounds per acre, a canola crop yields approximately 1,000 pounds or 131 gallons of oil. Usually with a mechanical press, only 80 percent or 105 gallons of the oil is recoverable.

CANOLA PRICES

Figure 2 shows canola prices in the United States from 1991 to 2009. Recent canola prices, like those of other oilseeds, have been relatively high. The price of canola follows that of other oilseed crops. Currently, none of the commodity exchanges in the United States trade canola, so prices are established based on Canadian prices. The Winnipeg grain exchange trades canola futures contracts.

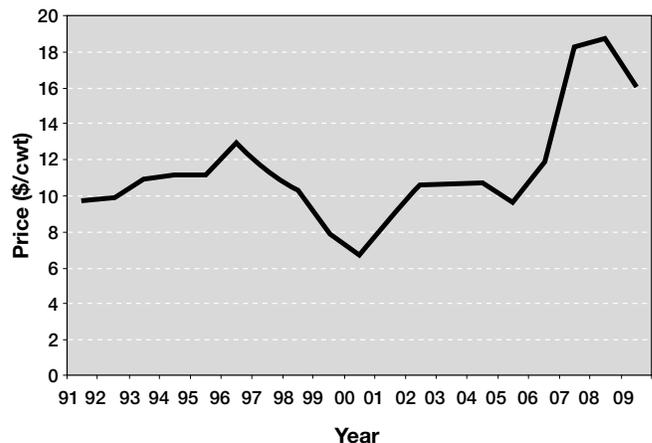
STORAGE

Newly harvested seed may go through a “sweat”; air movement should be provided in all canola storage bins. Canola seed is small enough to pass through many bin aeration floors. Thus, something like nylon mesh (window screen) may be needed on the bin floor and other ventilation channels.

USES AND DEMAND

A handful of plants process most of the canola grown in the United States. Archer Daniels Midland owns facilities in Windsor, Canada; Atlanta, Georgia; and Velva, North Dakota. Central Soya and Calgene operate a plant in Chattanooga, Tennessee, while Cargill also owns processing

Figure 2. U.S. canola prices, 1991–2009.



facilities in Clavet, Saskatchewan. Local markets are currently limited, but some small markets are developing using local mechanical pressing.

Uses of canola include oil for food consumption or bio-fuel feedstock, and meal for feed. Penn State studies have shown that locally grown winter canola is similar to western canola in oil content and oil quality. On a smaller scale, mechanically pressed canola oil can be used for food grade oil with appropriate processing. Then waste oil can be collected for fuel processing. As a biodiesel feedstock, canola oil is valued because canola-based biodiesel has a lower cloud point compared to biodiesel produced from soybeans or animal fats. Canola can also be processed as a feedstock for oil used as a fuel in straight-vegetable-oil (SVO) tractors or other vehicles.

Canola meal contains approximately 38 percent protein, and its amino acid profile complements that of soybean meal. Livestock are able to utilize a mix of soybeans and canola better than either of the meals separately. Meal from mechanical extraction contains residual oil at levels of about 6 percent (dry matter basis) and is commonly fed at rates of a few pounds per cow per day in dairy rations. While some canola oil is fed to livestock, most is crushed into oil and used in food products. Local uses in Pennsylvania would likely focus on producing mechanically crushed oil for biodiesel feedstock and high-oil meal to add to dairy rations to complement soybean meal.

PROFITABILITY

Profitability of winter canola production can often be lower compared to other grain crops such as winter wheat. Canola production costs are similar to winter wheat, but yields are often 70 percent of expected wheat yields and there is no straw revenue associated with canola. However, when oilseed prices are high and wheat prices are low, as has been the case recently, winter canola can be competitive economically with winter wheat. Enterprise budgets for canola and other crops are available in the *Penn State Agronomy Guide* (extension.psu.edu/agronomy-guide).

OTHER RESOURCES

For more information on winter canola production and utilization, visit these links:

ATTRA Oilseed Processing for Small-scale Producers
attra.ncat.org/attra-pub/oilseed.html

Producing winter-hardy canola in Oklahoma
agriportal.info/Ag%20Documents/Oklahoma%20canola.pdf

Maryland Canola Production Fact Sheet
www.agnr.umd.edu/MCE/Publications/PDFs/FS635.pdf

Canola production in Ohio
ohioline.osu.edu/agf-fact/0109.html

Canola Growers Manual, U.S. Canola Association
uscanola.com/index.asp?Type=B_BASIC&SEC={94B7ECA7-B45F-4B5F-8817-E58E-52A925BA}

“Canola, an Emerging Oilseed Alternative,” The Jefferson Institute, Columbia, MO
www.jeffersoninstitute.org/canola.php

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