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Spring Canola in Pennsylvania: Production and Agronomic Recommendations

HISTORY AND PRODUCTION

Canola's origins date back to an oilseed crop called rapeseed, which was grown in the thirteenth century. Although 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. The state produces approximately 88 percent of the canola grown in the country. Additional production areas include the Pacific Northwest and other regions of the northern plains. A very small amount of canola is grown outside these two regions.

Canola is a cool-season crop and requires more moisture than wheat. Soilborne diseases such as blackleg, sclerotinia stem rot, and rhizoctonia root rot can reduce yields extensively under some conditions. The impact of these diseases can be significantly reduced by good crop management, including sufficient rotation with other crops. The development of herbicide-tolerant varieties and the use of integrated pest management (IPM) have also decreased the risk of crop quality losses. As of 2009, canola has provided 13 percent of the world's oilseed supply, second only to soybeans. Canada's production is around 15 million acres of canola. U.S production has grown and is currently about 1.2 million acres (see Figure 1).

DESCRIPTION AND ADAPTATION

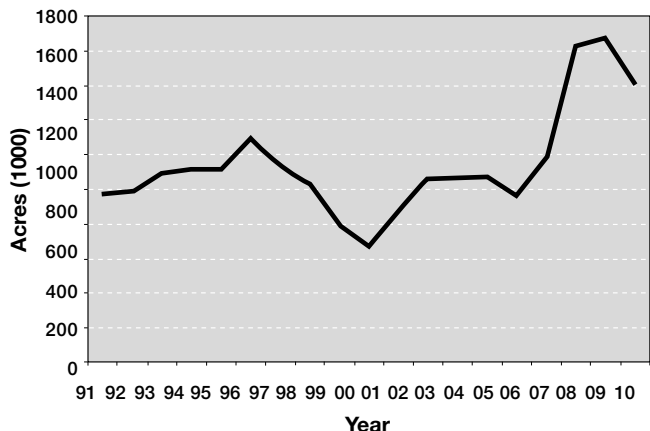
Canola is a cool-season crop, adapted to long, wet, cool springs. It performs best on well-drained, deep silt loam soils but is also adapted to some of the shallower soils in Pennsylvania, where corn production is limited. Canola does not perform well on poorly drained soils. It is somewhat tolerant 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. Spring types are somewhat sensitive to high temperatures during the summer and are best adapted to the cooler regions of Pennsylvania, probably those with growing seasons similar to corn maturity zones 1 and 2 (see Figure 2). Heat stress during flowering can cause flower abortion and could cause more issues in the warmer zones of the state, especially if planting is delayed in the spring. Winter varieties yield 30–40 percent better than spring lines, but they may lack the winterhardiness to survive consistently in the short-season areas of the state (maturity zone 1).

VARIETIES

Spring canola varieties are available as open pollinated or hybrid and also as conventional and transgenic types. Hybrid lines tend to be more expensive but may be higher

Figure 1. U.S. canola acres planted, 1991–2010.



yielding than open pollinated lines. For an example of extensive spring canola testing, visit the North Dakota State University canola variety testing site: www.ag.ndsu.edu/pubs/plantsci/crops/a1124.pdf. Many spring canola lines are transgenic, but some developed in public breeding programs such as these in Idaho (www.cals.uidaho.edu/brassica/forgrowers.htm#Sterling) are still available.

In Pennsylvania, seed producers such as Ernst Conservation Seeds or Seedway may be sources of canola. Also, some commercial nontransgenic lines are Clearfield lines, which reduce concerns from use or carryover from imidazilone and sulfonylurea herbicides. Transgenic lines are resistant to glufosinate (Liberty Link) or glyphosate (Roundup Ready). Companies that produce and market transgenic canola seed in Pennsylvania include Bayer Crop Science, Croplan Genetics, Monsanto, and Pioneer.

CROP ROTATIONS

Canola is an ideal crop to follow small grains in a rotation but can also do well following hay, soybeans, or corn. Herbicide carryover can be an issue with canola, particularly with sulfonylurea, imidazolinone, and triazine herbicides. Be sure to check the recrop interval associated with the previous crop's herbicide program. Canola is susceptible to 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 recommended. This is especially true where Roundup Ready, Liberty Link, or Clearfield canola are planted since the volunteers may be resistant to some common herbicides. Many seeds germinate immediately following harvest, and most spring canola is killed over winter, so these factors help reduce the volunteer canola establishment.

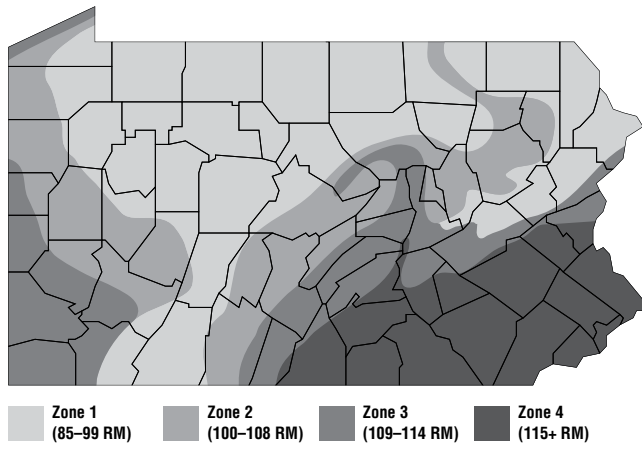
SEEDING

Canola is established similar to other spring grains, using either tillage or no-till methods. Producers have had good success direct seeding canola early in the spring into a clean seedbed. Delaying seeding past mid-May increases the potential for heat and drought stress and poor performance. The recommended seeding rate for spring canola is about five pounds of seed per acre. A good stand is ten to twelve plants per square foot, and a minimum stand is four plants per square foot. However, with herbicide-tolerant canola, stands can be as low as two plants per square foot, providing they are uniformly spaced.

Clean small-grain stubble or soybean stubble are ideal seedbeds for no-till spring canola. Corn stubble and even killed sods can be seeded. As with other crops, heavy and uneven residue can cause uneven stands 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. If broadcast seeded, some surface disturbance before and/or packing afterward gener-



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



ally improves this method of seeding. Canola seed is small enough to be metered through the small seed box found on grain drills.

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. Phosphorus (P) and potassium (K) requirements are similar to those for sunflower or small grains. For a 40-bushel-per-acre crop with optimum P and K levels, the N-P₂O₅-K₂O recommendations would be 80-30-20. Use a soil test to determine the amount you should apply. Canola has a higher sulfur requirement than small grains, so an application of 25 pounds per acre 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 weed competitor. Canola seedlings are very sensitive to weed competition; therefore, canola 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. Canola contaminated with mustard and wild garlic can reduce the market value of the crop. Herbicide resistance for glyphosate, glufosinate, or imidazolinone herbicides are available in canola varieties and offer an assortment of weed control tactics.

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

DISEASES AND INSECTS

Diseases are generally not a major problem. 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 on canola include white rust, downy mildew, and alternaria blackspot. Control of flea beetle may be necessary, especially after a mild winter and when conditions are hot and dry after seeding. Seed treatments 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, diamondback moth larvae, aphids, lygus bugs, and root maggots.

HARVESTING

Canola varieties vary by about 10 days in maturity. Spring canola matures about the same time as spring oats in late July or early August. Canola is ripe when plants turn a straw color and seeds become dark brown. Seeds on top of the plant often 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 effect, there are usually some immature seeds at harvest.

Canola should be cut just below the seed pods to lessen the amount of crop residue going through the combine. The 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 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.

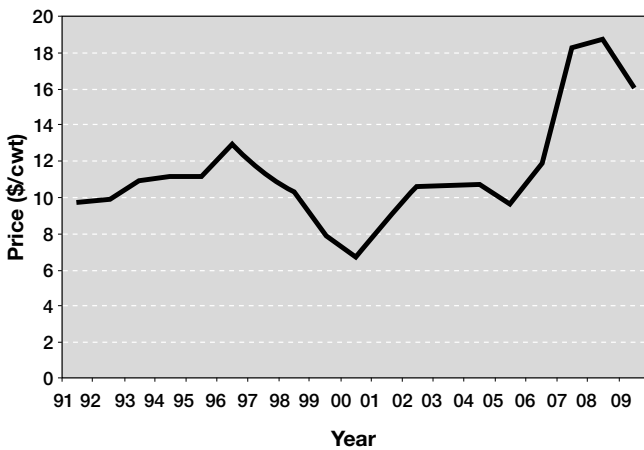
YIELDS

Typically, yields average 30–50 bushels per acre (1,500–2,500 pounds per acre) or more. Yield goals of 40–60 bushels per acre are realistic, and yields of up to 70 bushels per acre have been reported with new varieties. Spring canola grown in Pennsylvania contains between 40 and 45 percent oil. At an oil content of 40 percent and a yield of 2,000 pounds per acre, a spring canola crop will yield approximately 800 pounds or 105 gallons of oil. Usually with a mechanical press, only 80 percent or 84 gallons of the oil is recoverable.

CANOLA PRICES

Figure 3 shows canola prices in the United States from 1991 to 2009. Recent canola prices, like those of other oilseed crops, have been relatively high. The price of canola follows prices 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 trade canola futures contracts.

Figure 3. U.S. canola prices, 1991–2009.



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. Therefore, something such as 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 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 and spring canola is similar to western canola in oil content and oil quality. On a smaller scale, mechanically pressed canola oil can also be used as food grade oil with appropriate processing. Then waste oil can be collected for fuel processing. As a bio-diesel 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). The meal is commonly fed at the rate of a few pounds per cow per day in dairy rations. While some canola oil is fed to livestock, most is crushed into oil for use 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

The profitability of spring canola production can often be lower than that of other grain crops such as soybeans or corn. Canola production costs are similar to or greater than costs for soybean production, owing to the canola crop’s nitrogen requirement. However, by taking advantage of the earlier planting and harvest of spring canola, it may be possible to devise cropping systems that are competitive with or more profitable than conventional systems. One approach is to plant a red clover cover crop immediately following spring canola harvest. The clover cover crop could provide a substantial nitrogen credit and a rotation effect for the succeeding corn crop. A no-till rotation of corn, soybean, spring canola, and clover could allow a continuous no-till crop rotation, spread labor requirements, build soil quality, and reduce nitrogen requirements compared to a conventional corn-soybean rotation where no cover crops are possible.

OTHER RESOURCES

For more information on spring canola production and uses, visit these links:

Northern Canola Growers Association
www.northerncanola.com

Canola Council of Canada
www.canola-council.org/portal.html

Canola production at North Dakota State University
www.ag.ndsu.edu/pubs/plantsci/crops/a686w.htm

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

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extension.psu.edu

Penn State College of Agricultural Sciences research and extension programs are funded in part by Pennsylvania counties, the Commonwealth of Pennsylvania, and the U.S. Department of Agriculture.

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Produced by Ag Communications and Marketing

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Code UC213 04/14pod