**Crop Profile for Canola in Washington**

**Production Facts**
- In 1998, Washington State ranked 5th in U.S. canola production, with 8% of U.S. total.
- Approximately 10,000 acres of canola are planted and harvested annually.
- Yields average over 2000 pounds per acre, with product valued at $0.11 per pound.
- Canola provides a cash value of $2,200,000 per crop year to the Washington economy.
- Production costs average $130 per acre for all unfixed costs (i.e., seed, planting, fertilizer, pesticides and harvest).

**Production Regions**
Canola is produced only in the intermediate and higher rainfall zones of the dryland areas of eastern Washington. It is excluded from the irrigated areas of the Columbia Basin by state law to prevent possible hybridity with other Brassica seed crops and to exclude such diseases as blackleg and Phoma. The dryland production area includes Adams, Garfield, Columbia, Lincoln, Spokane, Walla Walla, and Whitman counties.
General Information

“Canola” is a marketing name registered by the Western Canadian Oilseed Crushers Association for food-quality rapeseed oil. Generic rapeseed oil is not edible and is used only as a machine lubricant or for diesel-like fuel for farm machinery. Canola is low in erucic acid and low in glucosinolate, making it suitable for human consumption and, in fact, superior to other food oils in certain qualities associated with dietary health.

Canola produced in Washington (Brassica napus x Brassica campestris, Brassica x Hybrids) is sold as raw seed for crushing into canola oil. The seed contains approximately 40% oil. The remaining by-product is a high-protein meal used for animal feed.

Cultural Practices

Practices for all of the Pacific Northwest canola production area (Oregon, Washington, Idaho, and Montana) are identical.

Canola is an annual dryland crop grown on sandy clay loam and clay loam soils in areas that receive 13 inches to over 24 inches of rainfall. Seedbed preparation is critical; a fine, firm soil surface is required. Seeding dates for spring canola range from late March through early May, with soil temperatures above 48°F. Fall-seeded canola is sown in September to October with the idea of a rosette forming by cold weather that can survive the winter. In Washington, fall seeding is mostly done in the lower Columbia Basin area north of Pendleton and south of Walla Walla. Fall seeding allows earlier bloom and larger yields before the hot weather intervenes in late May.

Seeding may be done using an air seeder (“Valmar-type” machine), by hoe, or with a double-disc drill. Seeding rate is 6 to 8 pounds of seed per acre depending on variety. Air seeding followed by a packer/roller allows the use of borted gypsum for ballast, and readily allows fourteen plants per square foot, which is ideal for maximum yield.

Boron is an essential nutrient for all Brassica crops and must be supplied for each crop as Boron leaches in the field. Approximately 120 pounds of nitrogen and 40 pounds of phosphate per acre, based on soil tests, is also applied.

Crop emergence is approximately nine days after seeding, with full bloom occurring approximately 45 days after emergence for modern spring-seeded varieties. Temperatures above 85°F for more than three days from early bloom through early pod formation abort flowers and result in greatly reduced yields, hence the short-season Canadian varieties are preferred by southeastern Washington growers. Pollination by insects is neither required nor desired, especially for self-fertile hybrid varieties.

Washington canola is harvested in late August using one of two systems. When all seeds are black, the crop is cut standing with a conventional dryland combine. Or, when just 60% of the seeds are black, swathing and windrowing is done prior
to harvest with a combine equipped with a swath attachment (i.e., a grass attachment or “pea bar”). No chemical desiccants are required in either case.

Harvested seed is shipped to Japanese or California crushing plants via Snake and Columbia river ports. Most producers grow under contract, using specified seed varieties and operating for a fixed return. A few experienced growers watch the Winnipeg prices and sell on the open market without a contract, making direct contact with a trader.

**General Pest Management**

**Considerations**

Weeds and insects are both economic problems for spring canola depending on location. Of these, insects require some form of control each crop season, and are thus the more important economic factor for pest management in the crop. Winter canola rarely suffers from weed problems. Diseases are managed through seed treatment.

**Insects**

The following insect species are equal in economic importance based on crop location/agronomic production zone. All except diamondback moth are primary pests. The primary pests are presented in order of their appearance in the crop cycle.

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**Flea Beetles**

Cabbage Flea Beetle, *Phyllostreta cruciferae* (Goeze)

The cabbage flea beetle is a frequent annual pest of both fall- and spring-seeded canola. These tiny Chrysomelid beetles invade seedling canola from surrounding vegetation on warm, calm days. Grass is especially prone to serve as a refuge for flea beetle; growers alternating grass seed, grass pastures, or CRP plantings with canola are most likely to have economic loss.

Adult flea beetles bite the cotyledons of seedlings, producing holes. Major damage occurs when the apical meristem of the seedling plant is damaged or destroyed, and total stand reduction can result. More typically, approximately 50% of the seedlings survive and produce seed. The flea beetles migrate into the fields from the edges and usually do economic damage no farther than 50 yards or so into the field. The larvae of cabbage flea beetle feed on the roots of members of the mustard family and produce no economic damage. However, a second, overwintering generation of adult beetles may emerge and attack the canola pods just as they mature and cause tremendous shatter damage with loss of seed from the pods reaching 400 pounds of seed per acre. These overwintering adults also attack seedling fall canola in some locations. It is common for the same fields to be infested year after year, while fields a short distance away are never attacked at an economic level.

Applying foliar insecticides after crop emergence and prior to beetle damage is very difficult due to factors including airplane scheduling, wind, and rain. Therefore, seed treatment insecticides are used. These protect seedlings during the emergence period through the rosette stage of growth, after which damage is unlikely.

The greatest likelihood of cabbage flea beetle damage occurs in the intermediate and higher
rainfall production zones near the Blue Mountains (Garfield, Columbia, and Walla Walla counties), and in the Palouse region (Whitman, Spokane, Lincoln counties) of eastern Washington. Most years, the cabbage flea beetle is the only region-wide major economic pest of canola in Washington.

**Controls**

**Cultural**

Cabbage flea beetles seldom invade canola fields farther than 50 yards from the edge adjacent to a refuge crop such as grass. Most of the severe injury to apical meristem and resulting reduction of stand occur in this edge zone. Therefore, many experienced canola growers double seed part of this zone—usually the first 100 feet adjacent to the refuge area. The flea beetles damage about half of the seedling canola plants between emergence and the rosette stage, leaving an adequate stand and not requiring chemical treatment. This practice is very effective, but can fail under unusual conditions of high flea beetle populations and weather that slows plant growth. Where refuge crops are numerous, invading beetles may cover a large field with damaging numbers. A population of 80+ flea beetles per 6.6 feet of row (one square meter) will cause economic damage loss to the stand if not treated with an insecticide immediately. This is becoming more likely each year in continuous canola production areas.

**Biological**

The chemical controls used by Washington canola growers have very low impact on beneficial insects (i.e., pollinators) and non-target species. In particular, these controls are very soft on Hymenoptera.

No biological controls are in use on canola and no natural enemies of cabbage flea beetle are present in Washington.

**Chemical**

**Imidacloprid** (Gaucho 480 at 8.0 to 10.0 oz. ai cwt). This seed treatment is applied to the seed in a slurry containing fungicides and is labeled up to 13.3 oz ai cwt. For flea beetle control most canola seed dealers and conditioners apply the lowest effective rate, 8.0 oz. ai per cwt. This rate is normally effective against moderate levels of flea beetle when rapid growth of the plant occurs. It is effective through the rosette stage of crop growth, after which flea beetle damage is normally not economic in nature. However, when conditions are cool, preventing rapid emergence and growth, the 8.0 oz. ai cwt rate is marginally effective compared to a higher rate of 10.0 oz. ai cwt. Most growers use the higher seed treatment rate at present.

**Bifenthrin** (Capture at 0.04 lbs. aia). Capture applied as a foliar spray has good residual activity at 0.04 lbs. aia and is equal to the best imidacloprid treatments. Only a few growers overwhelmed by huge numbers of flea beetle have used Capture as a “rescue” treatment behind a too-low imidacloprid seed treatment. Capture is the favored federally labeled foliar treatment for canola at present.

**Methyl Parathion** (Methyl Parathion 4 E at 0.5 lbs. aia). Methyl parathion is slightly more effective than an untreated check in research plots, and has only a very short period of residual activity. It is very difficult to find an aerial applicator willing to apply methyl parathion due to safety and liability restrictions. For these reasons it is not used much by the industry.

**Ongoing Research**

Coordinated efforts between the authors and Canadian entomologists at Ag Canada are ongoing in search of additional “soft chemistry” flea beetle controls. Several seed treatment insecticides including imidacloprid, thiomethoxam, and chemicals currently under secrecy agreements are under trial in both countries. Thiomethoxam (Helix at 400 grams ai/kg) is a seed treatment under experimentation for near-future registration in canola. Helix is equally effective to imidacloprid at the same active rates. Zeneca Ag is seeking labeling of lambda-cyhalothrin (Warrior also known as Karate
in Canada) for all canola insect pests including flea beetle at various experimental rates based on the author’s current research.

Aphids

Cabbage Aphid, *Brevicoryne brassicae* (L.)

The cabbage aphid has become one of the three primary pests of fall- and spring-seeded canola in southeastern Washington. Cabbage aphid pressure just prior to and during bloom aborts flower buds, deforms developing pods, and generally saps vigor from plants resulting in yield losses of up to 40 percent in untreated fields. Colonies of more than 300 aphids per raceme are common each season throughout the entire Washington production area.

**Controls**

**Biological and IPM**

Both Capture and Gaucho are soft chemical insecticides that impact few non-target species, especially the Braconid aphid parasitoids typified by *Diaeretiella rapae* (M’Tosh) in southeastern Washington. Both products are very soft on hymenopterous insects and allow parasitic wasps to develop on aphids escaping treatment. However, there are no actual IPM or biological control programs for cabbage aphid in canola due to the short growth season of the crop and the habit of the aphid attacking at bloom. Due to the vagility and wide host range of the aphid, isolation of canola is not effective.

**Chemical**

**Bifenthrin (Capture 2 E at 0.04 lbs. a.i.)** A very effective product at this rate; also safe to bees. Applied when aphid colonies appear at or just before bloom. Capture is now the standard control insecticide where late-season pests occur throughout the canola production areas.

**Imidacloprid (Gaucho 480 at 10.0 -13.3 ozs. ai cwt.).** This is a seed treatment that provides season-long (through pod ripening) cabbage aphid control.

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**Ongoing Research**

Since labeling exists for soft chemical control of cabbage aphid, a need for identification and development of efficacious new products is not a high priority with the canola industry. However, Gustafson (manufacturer of Gaucho) indicates reluctance to continue to support full-season insect control using higher rates of imidacloprid (Gaucho), preferring to maintain a market share in flea beetle control. Therefore, Novartis is seeking labeling for thiomethoxam at full-season crop protection rates for both seed treatment (Helix) and floral (Actara) applications both in the United States and Canada. Zeneca Ag is seriously seeking labeling for lambda-cyhalothrin (Warrior, Karate) for floral application to control aphids. Bayer-Ag has requested testing of imidacloprid alone (Provado) and in combination with cyfluthrin (Baythroid) as floral sprays applied at full bloom. These products are pyrethroid and neonicotinoid compounds of proven efficacy and soft chemical nature. Since cabbage aphids are notoriously quick to develop resistance to repeated applications of pyrethroids, availability of options is essential for continued control. Helix may be available by 2001 as a seed treatment, and labeling of Warrior is possible by the spring of 2001 as well.
Weevils
Cabbage Seedpod Weevil,
*Ceutorhynchus asimilis* (Paykull)

The cabbage seedpod weevil, a Bruchid weevil, is a univoltine, and occasionally divoltine (especially in Alberta), primary pest of both fall- and spring-seeded canola. Introduced from Scotland to British Columbia, it is now present throughout the Pacific Northwest region west of the Rocky Mountains. The weevil overwinters as an adult beetle in forest duff. The beetles fly to blooming canola fields in the late spring, mate after pollen meals are taken by both sexes, and oviposit directly into developing pods. The female weevil makes an oviposition bite with her mouthparts, and then deposits one egg into the site. As many as three or four eggs per pod are laid under high population densities. The first instar larva “surface feeds” in the cuticle of the pod, molts, and the second instar larva bores into the pod. One larva will consume approximately one-third of the seed in the pod before making an exit hole as a fourth instar larva. The emerged larva drops to the ground and pupates in the surface of the soil. The adult emerges approximately 30 to 45 days later and migrates to its overwintering site. In some locations, adults overwinter in the field. Direct seeding seems to facilitate this behavior by providing shelter.

Loss occurs from both the destruction of developing seeds and the subsequent shatter of the pod prior to harvest. It is common for more than one larva to develop in a pod, with resulting total destruction of the seed where populations are dense. The economic threshold for cabbage seedpod weevil, established by Dr. Joe McCaffrey of the University of Idaho, is two adults per 180-degree sweep with a net at bloom. Two beats over a 15-inch white plastic five-gallon bucket are equal to the sweep-net sampling method and is a less crop-destructive method.

Cabbage seedpod weevil has been the key pest of canola that must be controlled in each planting each year to avoid severe economic losses of up to 70 percent of the potential yield. Losses of 20 to 40 percent are common.

Controls

Cultural

No cultural practices are known to be effective for cabbage seedpod weevil.

Biological

University of Idaho entomologists have found an adult parasitoid wasp emerging from early-season seedpod weevil adults reared from fall-seeded canola. Apparently, the parasitoids...
toxins overwinter with the beetles and follow them to the canola fields. No evidence of the parasitoid has been found in Washington. Idaho entomologists are conducting research on the potential of this parasitoid for biological control of the cabbage seedpod weevil at present. There are no other effective natural enemies of the weevil.

No canola varieties are resistant to canola seedpod weevil.

**Chemical**

**Methyl Parathion (Methyl Parathion).** Methyl parathion replaced ethyl parathion as the cabbage seedpod weevil control in canola after the latter was lost due to regulation changes for human safety (closed-system application and other restrictions). Ethyl parathion controlled both adult weevils and first instar larvae feeding in the pod cuticle. Methyl parathion is much less effective than ethyl parathion, controlling at best about 85 percent of the weevil population. Methyl parathion has also been identified as the culprit in bee poisonings in southeastern Washington, and has had its labels largely withdrawn in Washington as a result. Methyl parathion was also reported to cause rebound of cabbage aphid by impact on beneficial insects present at application.

**Bifenthrin (Capture 2E at 0.04 lb. a.i).** Used against aphids at full bloom in canola, bifenthrin has become the standard for cabbage seedpod weevil control throughout the Pacific Northwest canola production region. Although cabbage seedpod weevil is the key, primary pest of canola, product labeling in recent years has been for cabbage aphid control, allowing incidental control of cabbage seedpod weevil.

**Imidacloprid (Gaucho at 10.0 -13.3 oz ai cwt.).** Labeled for aphid and seedpod weevil control, imidacloprid has provided full crop season protection against all canola pests. The lower 8.0 oz ai cwt. flea beetle rate is not effective beyond the rosette stage of crop growth against any of the other insect pests.

**Ongoing Research**

Canadian problems with cabbage seedpod weevil in Alberta in recent years have raised international interest in cabbage seedpod control. Gaucho 480 is not labeled in Canada. Zeneca Ag’s lambda-cyhalothrin (Karate in Canada) has been used for cabbage seedpod control under emergency exemptions. Due to a lack of Canadian registrations for cabbage seedpod weevil control, coordinated research trials for efficacy of soft chemical insecticides are being conducted in both the United States and Canada. Products under trial with good chances for registration include imidacloprid (Provado), cyfluthrin (Baythroid), the combination of these (Legend), lambda-cyhalothrin (Warrior/Karate), thiomethoxam seed treatments (Helix), and thiomethoxam foliar treatments (Actara). These experimental compounds are either full-season seed treatments or full-bloom aerial applications. Labeling for the Novartis product Helix is expected by spring of 2001, and will be the first international label for canola as such. The pyrethroid, Deltamethrin (Decis) has been labeled in Canada.

**LEPIDOPTEROUS LARVAE**

**Diamondback Moth, Plutella xylostella (L.)**

The diamondback moth is a cosmopolitan pest of all members of the *Brassica* family, including canola. Diamondback moth is typically a pest of seedling fall-seeded canola in southeastern Washington near the Columbia Basin. It is highly cyclic in appearance, being scarce for several years then experiencing a population explosion due to a downturn in populations of its parasitoids. Moth larvae damage the apical meristem tissue of fall-seeded canola, resulting in a sterile or weakened plant, or excessive loss of leaf tissue resulting in reduced winter hardiness. Spring canola is attacked under cool, moist conditions. The authors have never observed a real economic loss in spring canola from diamondback moth. Damage to florets can
occur when late diamondback moth populations occur prior to and at bloom, resulting in some loss of potential seedpods.

**Controls**

**Cultural and Biological**

Natural enemies prevent diamondback moth from being more than an occasional, secondary pest of canola. No formal biological or cultural control is practiced, nor is research on control of diamondback moth currently being conducted in the Pacific Northwest.

**Chemical**

Endosulfan (Thiodan 3 EC; Micromix at 0.75 to 1 lb. a.i.). Once commonly used in fall-seeded canola for diamondback moth control, endosulfan is used less since the advent of bifenthrin. Application of bifenthrin as an aphid control has the incidental effect of controlling diamondback moth. Incidental control of diamondback moth can also occur as a by-product of weevil and/or aphid treatment with imidacloprid at higher rates. The latter is only effective through pod formation, after which the larvae pupate under the plant’s lower leaves.

*Bacillus thuringiensis*. Not used in southeastern Washington.

**Weeds**

Spring canola has the agronomic advantage of allowing application of grass-specific herbicides to clean up fields for subsequent crops such as cereals and grass seed. A well-established stand of canola will form a canopy very rapidly and out-compete dryland crop weeds. Bird mustard (*Brassica nigra* (L.) Koch) is a potential seed contaminant of canola as are other *Brassica* species on occasion. These are difficult to control due to their close relationship with canola.

Other weeds found in all southeastern Washington crops are lambsquarters, mayweed, red-root pigweed, knapweed, wild oat, and various grasses. These are not pests of canola but of subsequent crop rotations. Canola is an excellent “clean-up crop” for rotation with cereal and grass seed crops. This is the point in the cycle where the grass-only herbicides remove grass weeds, or the newer Imazilone herbicides control a broad spectrum of weeds in canola.

Spring canola rarely survives the winter, but if seed germination occurs in the spring following canola production, the use of a general herbicide such as glyphosate prior to seeding will eliminate the problem.

**Biological**

Application of imazethapyr (Pursuit) and triallate (Far-Go) to dry peas has become a popular practice in the Palouse region of Washington and Idaho. In 2000, production of imazilone-resistant canola varieties (known as “imi canola”) began to allow canola to follow dry peas, extending the wheat rotation on the Palouse (Whitman, Spokane, Lincoln counties). The strategy is to plant imi canola on Pursuit ground and then apply Rap-
tor herbicide to remove any remaining weeds from the canola at rosette stage by aerial application.

Imi canola is not a genetically modified organism (GMO), but a natural mutation acceptable to the market for human food use. GMO canola varieties have been largely rejected by the market after years of production, and are being replaced with non-GMO hybrids from Canadian breeders.

**Chemical**

*Trifluralin (Treflan at 0.5 - 1 lbs. aia).* Must be incorporated within 24 hours of application prior to seeding. Several crop rotation restrictions apply to trifluralin use. Good for grass weed control. Becoming less popular as new chemistries are developed.

*Sethoxydim (Poast at 0.19 - 0.48 lbs. aia) and Quizalofop P-ethyl (Assure II at 0.03 - 0.08 lbs. aia).* These post-emergent, foliar herbicides control only annual and perennial grass species.

*Glyphosate (Roundup-Ready Canola)* and canola with other herbicide resistance genes are available in Canada and are on-line for registration in the United States. These resistance genes allow use of a broad spectrum herbicide without harm to the crop. However, this is an area under research and scrutiny by the canola industry at present and no acreage is planted in Washington.

**Diseases**

**Black Leg Disease**

*Phoma lingam*

(sexual stage: *Leptosphaeria maculans*)

**White Mold**

*Sclerotinia sclerotiorum*

All canola seed used for planting in Washington is required to have a phytosanitary label proving treatment with a fungicide to prevent black leg disease, a major pest of canola that can be transmitted to other *Brassica* crops.

White mold or white blight is a fungal disease affecting the crowns and stems of canola in some locations, causing stem collapse and rot. The fungus produces sclerotia, spores that persist in the soil for years, requiring fungicide treatment to prevent infection of subsequent crops. Damage to the vascular tissue of canola can greatly reduce seed yield.

**Controls**

**Cultural**

A four-year rotation between canola crops for disease prevention has been traditional, but growers in southern Alberta have attempted a two-year rotation or even annual cropping where fungicides are consistently used. Many southeastern Washington producers are currently successfully using a three-year rotation with wheat and/or barley.

**Chemical**

*Benomyl (Benlate 50W at 8 ozs. ai cwt.)*

Both fungal diseases are currently controlled by seed treatment applications in combination. Benomyl is being replaced by newer, experimental fungicides such as Maxim, Raxil, Dividend, and Apron in combinations.

*Thiram (various names at 8 ozs. ai cwt).*

Both fungal diseases are currently controlled by seed treatment applications in combination with Raxil.

**Research Considerations and Alternatives**

Other fungicide seed treatments are rapidly replacing benomyl in the United States and Canada. Canadian research indicates possible antagonism of insecticides by benomyl. Other products coming on-line include a Raxil-Thiram combination, and Dividend-Apron-Maxim combination for seed treatment, with research in both countries being conducted along with insect management research.
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References


Use pesticides with care. Apply them only to plants, animals, or sites listed on the label. When mixing and applying pesticides, follow all label precautions to protect yourself and others around you. It is a violation of the law to disregard label directions. If pesticides are spilled on skin or clothing, remove clothing and wash skin thoroughly. Store pesticides in their original containers and keep them out of the reach of children, pets, and livestock.