Crop Profile for Canola in Kentucky

Prepared: February 2010

Introduction
In Kentucky “canola” is the commonly used term applied to both oil and the plant, specifically selected from *Brassica napus* (Brassicaceae) to produce oil known to contain reduced levels of uric acid and glucosinolates. The term canola was originated and trademarked by the Western Canadian Oilseed Crushers' Association (now the Canadian Oilseed Processors Association) to differentiate the superior low-erucic acid and low-glucosinolate varieties and their products from the older rapeseed varieties (Canola Council n.d.).

General Production Information

**Production Facts:** Canola was first grown in Kentucky in the late 1980s. Research and production began essentially at the same time. University of Kentucky Extension Specialists estimate that at one time production increased to approximately 20,000 acres. However lack of winter hardy varieties and a reliable market proved to be a problem. A winter with very cold temperatures resulted in immense stand loss which reduced producer’s willingness to risk planting canola. Canola has continued to be researched and grown on a limited basis since that time. Positive changes over the years include: an improved genetic base, a higher oilseed loan rate compared to wheat, possible use as a biodiesel fuel, and a regional market.

Production of canola in Kentucky has been too limited to establish a state ranking in national production of canola or to determine Kentucky’s contribution to the total U.S. production. However, for the past twenty years, 1989 – 2009, the acreage has varied from year to year. Limited available data from University Extension publications and private consultants indicate that acreage appears to be fairly stable at approximately 2,000 acres. The only information available from the USDA National Agricultural Statistics Service (Kentucky Office) regarding canola is from the 2007 Census of Agriculture. The county summary for Kentucky showed that in the 2002 census there were 3 farms that harvested 1,994 acres of canola. However in 2007, no farms reported canola on the census of agriculture. Private consultants estimate the current acreage at approximately 2,000.
**Production Regions:** Canola is generally produced in western Kentucky predominantly in southern counties. Average yield is approximately 50 bushels per acre.

**Figure 1.** 2009 distribution of canola production in Kentucky.

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**Cultural Practices**

**Field Selection**
A medium textured, well-drained soil is best for canola, although it will grow over a wide range of soil textures. Since canola does not tolerate waterlogged conditions, it should not be planted on fields prone to standing water, flooding or poor drainage. Heavy clay and waterlogged soils also increase the risk of heaving if not planted early for a well established root system. Soil compaction, soils that tend to crust and a lack of surface soil moisture at planting time can also affect canola establishment.

Producers should select fields and rotation systems that prevent a buildup of pests (insects, diseases and weeds) allowing at least four years between canola crops on the same field. This is particularly important for fields that have been infected with sclerotinia white mold or blackleg and also applies to any adjacent fields. Avoid fields infested with garlic, wild mustard and hard-to-control weeds. Plan ahead so that residual herbicides used on the previous crop do not carry-over in the soil and adversely affect canola. Avoid planting within a mile of a field of industrial rape to avoid contamination which may result in lower seed quality and grade standards.

**Variety Selection**
There are two types of canola available for planting: spring and winter. Spring types are grown in areas where winterkill is a problem for fall seedings. Winter types are fall-seeded and require a specific amount of chilling temperature for vernalization (flower induction). Winter canola fits best into Kentucky's cropping systems, has a higher yield potential and has sufficient cold hardiness to survive most winters.

Variety selection is important for producing a canola crop that contains desirable performance traits and also quality seed. Only cultivars with canola-quality standards (an oil with less than two percent erucic acid and a meal with less than 30 micromoles glucosinolates per gram) are
recommended. This is essential for canola to be an economically competitive, marketable product. Because of the oil and meal quality differences among the various types of rapeseed, it is important to not plant varieties of unknown or unsubstantiated quality. Other characteristics to choose in a canola variety are: high yield potential, acceptable test weight (50 lbs/bu), winter hardiness and lodging resistance. Relatively early maturity is also desirable if the canola is to be double-cropped with soybeans. While disease resistance is a desirable trait, there is currently limited varietal resistance in canola to most diseases common in Kentucky. However, there is moderate resistance to blackleg in some canola varieties and few cultivars have good plant resistance to Sclerotinia stem rot.

Information on varieties best suited for Kentucky can be found on the U.S. Canola Association web site. As a part of the canola breeding efforts at Kansas State University, University of Arkansas, Virginia State University and the University of Idaho, breeding and seed companies test cultivars in U.S. regions for adaptability and yield. Through collaboration with Kansas State University and Miles Enterprises, a host site for the National Winter Canola Variety Trails is located in southern Kentucky. Data for cultivars grown in Kentucky are included as a part of the Midwest region cultivars. There is no published data as to what canola varieties are currently being grown in Kentucky; however; crop consultants use the regional results of the National Winter Canola Variety Trails to recommend varieties.

Seed Selection
Only certified seed should be used since it assures true canola quality with no contamination from mustards, high erucic acid rapeseeds and weed seeds. It has also been tested for germination and purity to ensure seed quality. Because product quality is critical for canola, producers must be sure of the genetic purity of the seed. Proper seed conditioning and fungicide seed treatments are recommended to avoid certain diseases. In Kentucky, all classes of certified seed must be treated with an approved seed treatment fungicide to control blackleg fungus. Kentucky state law prohibits the planting of canola seed that is not certified.

Tillage and Seedbed Preparation
Seedbed preparation is important. Conditions that promote rapid germination and early, uniform stands and growth are important for weed control, winter hardiness and yield. The seedbed should be fairly level, well-packed and moist throughout its depth. The soil surface should have a good granular structure. If the seedbed is too fine (overworked), it can result in loss of surface soil moisture and promote crusting; if too coarse, poor seed placement and moisture loss. Rollers or cultipackers should be used with or after the last tillage operation to firm the soil to allow proper seeding depth and to provide good seed-soil contact.

Approximately 90% of the canola acres in Kentucky are tilled with 10% being in no-till. The no-till method of planting is a means of eliminating tillage for seeding canola. By eliminating tillage, no-till also allows earlier planting. Successful stand establishment is more difficult with no-till due to existing crop residue, resulting in uneven seed depth placement.

Planting Date
Planting dates of September 1 through September 25 should provide the best yields. Seeding too early or too late can increase the likelihood of winterkill. A good rule of thumb is to plant canola approximately four to five weeks before the normal planting date for winter wheat. Planting too
early can result in winter injury if bud formation and stem elongation occur prior to winter dormancy. Late plantings (after October 1) reduce yields, increase heaving (due to smaller root system) and reduce winter survivability. Generally, canola needs 30 days (6-8 leaves) before the first killing frost to generate enough growth for winter hardiness. Based on 1989 results, planting date studies showed a 1.7 percent yield loss per day when planting after September 20 but before October 1. Planting after October 1 resulted in a 2.1 percent per day yield loss. Ideal planting dates for optimum yields vary from region to region as plantings move North (slightly earlier) or South (slightly later).

Planting date also effects maturity, canopy cover and weed control. October planting may result in reduced fall foliage production (canopy cover) which can allow weed growth and can delay the harvest date.

**Planting Methods**

The most common planting method is with a drill. The broadcast method can also be used to save time and reduce machinery requirements but stand reliability is sometimes reduced using this method. It is very dependent on good surface soil moisture at seeding or rainfall immediately following seeding. The major disadvantages of broadcast seeding are shallow placement of seed, uneven planting depth, poor seed distribution and a greater dependency on moisture. Care must be taken to assure good seed distribution and soil coverage. Working the seed into soil after broadcasting is a critical step. A roller or cultipacker is the most common method and gives good seed-to-soil contact and also retains moisture. This also prevents a deep seed placement problem as other implements can place the seed too deep.

Drilling is the most reliable and preferred method. However, proper drill calibration and settings are required with this method to do a good job of seeding. Advantages of drilling include better seed placement, better seed-to-soil contact and uniformity of stand. Depth placement is important since moisture is usually critical at this time of year and deep seed placement results in failure. Cultipacking is recommended prior to drilling to firm the seedbed and help control the seeding depth.

Grain drills, particularly late model drills, can effectively plant canola through the main seedbox. However, some grain drills may not close down enough for the small seeding rates needed and may require special drive attachments or small seed attachments. Calibration is needed with any seeding method but is particularly essential if using a drill.

Although more difficult, the no-till method of seeding can be used with canola. Use of a suitable no-till drill, proper calibration and no-till planting experience are needed to ensure good stand establishment. Depending on the seed drill capabilities, excessive crop residue on the soil surface can cause uneven seed placement. However, no-till drills that can deliver precise seed depth placement can make no-till planting successful. If the field is heavily infested with weeds or grasses, a contact herbicide at planting would be important for no-till planting. Producers in Kentucky have no-tilled canola into previous crop residue with good results. Presently a variety of equipment is being used by producers to plant canola including box drills, air seeders and row unit planters.

**Seeding Depth**

Since canola seeds are very small, careful placement is required at a relatively shallow depth. The ideal seeding depth is 1/2-inch in a firm seedered. The range can be from 1/4- to 1-inch. It is important to plant into moisture within this range, unless rain is imminent. Deeper depths delay
emergence, reduce seedling vigor, and delay fall growth and development. It is difficult for canola to force its way through thick soil cover or crusts. At shallower depths the seedbed may dry too fast for uniform germination.

**Seeding Rates**
Canola is a very flexible plant that can adapt to a wide range of populations due to its ability to branch. Research studies have shown similar yields for seeding rates ranging from four to 10 pounds per acre if an adequate plant stand has been obtained. A harvest population of six to 10 plants per square foot is considered adequate for top yields. Significant yield differences are not usually found unless populations at harvest are under three to four plants per square foot or higher than 15 plants per square foot. Carefully evaluate before destroying a crop that has a spring stand of only one to two plants per square foot since canola can compensate for wider spacing between plants by promoting branching. In a stand density study conducted at the University of Kentucky, even at one to two plants per square foot, yields were 60 to 70 percent of the optimum yield which occurred at six to eight plants per square foot. These plants compensated by producing more basal branches although they were not as productive as the earlier, main stem branch. Even though plant stands of one to two plants per square foot have given relatively good yields, it is still recommended that seeding rates be utilized to achieve at least five to seven plants per square foot. Low seeding rates often produce thin stands and result in more weed problems because they cannot effectively form a complete canopy. Although thicker stands can promote earlier and more uniform maturity and thinner stalks which are easier to harvest, populations above 15 plants per square foot do not increase yield, may cause lodging and also increase chances of disease. Higher seeding rates may be used if planting is delayed or when seed placement is affected by surface residue.

The average seed size of canola (*Brassica Napus*) is about 115,000 seeds per pound (with a range of 80,000 to 150,000 seeds per pound). With average seed size, a five to six pound per acre seeding rate would plant about 13 to 15 seeds per square foot. The percent emergence varies with soil and moisture conditions and seeding methods. Check the seed tag for seed size (seed count per pound) to determine the appropriate seeding rate. The recommended seeding rates are: 4 1/2 to 6 pounds per acre for drilling and 6 1/2 to 8 pounds per acre for broadcast seeding. The higher seeding rate for broadcast seeding is due to expected lower emergence.

**Row Spacing**
Studies have shown row widths between seven inches and 14 inches to have little impact on yield. Row spacings below seven inches might result in small yield increases under certain conditions. Likewise, row spacing above 10 inches could result in small reductions in yield. The narrower row spacings of six to eight inches provide quicker row closure and reduce weed competition. The six- to 10-inch row spacing provided by most commercial grain drills is acceptable for winter canola production. Some Kentucky producers are planting 15 inch rows.

**Fertilization**
A soil test is the most accurate method of determining the soils nutrient status. Reliable recommendations for phosphorus, potassium and lime can be made from a soil test.
Nitrogen
Canola responds to a fairly high level of nitrogen. The present recommendation is 120 pounds of nitrogen per acre. With good stands, lower rates may reduce yields. Higher rates may occasionally result in a higher yield, but it also increases chances of lodging and disease susceptibility. Most or all of the nitrogen should be applied at green up in the spring (March). If possible, it should be applied before budding and stem elongation to prevent damage to the main stem from ground spreading equipment. Ground equipment should never be used when the soil is frozen. Kentucky research shows no benefit for fall application of nitrogen. In many cases, additions of nitrogen in the fall (even in small amounts, 20-30 lb/ac.) increased fall growth and contributed to winter kill. In some years, the winter loss, due to fall nitrogen, has been significant. Large amounts of nitrogen carried over from the preceding crop can also produce the same results. If fall nitrogen is needed for some reason, no more than 30 pounds nitrogen per acre should be added.
A nitrogen deficiency results in stunted growth with a pale green color, early flowering and early maturity. The application of liquid nitrogen could result in scorched leaves, depending on weather and method of application.

Phosphorus and Potassium
Both of these nutrients should be applied in the fall according to soil tests. Recommendations in the following table are based on crop requirements and Kentucky soil characteristics. The recommendations may change as information is gained from research with this crop. Tentative results indicate that canola is very sensitive to phosphorus and recommendations should be liberal for this nutrient. The crop appears to be less sensitive to potassium and the recommendations can be conservative.

Table 1. -- Phosphorus and Potash Recommendations. Pounds per acre to apply

<table>
<thead>
<tr>
<th>Soil Test Level</th>
<th>P2O5</th>
<th>K2O</th>
</tr>
</thead>
<tbody>
<tr>
<td>High (above 60P, 300K)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Medium (30-60P, 200-300K)</td>
<td>0 - 85</td>
<td>0 - 40</td>
</tr>
<tr>
<td>Low (below 30P, 200K)</td>
<td>85 - 120</td>
<td>40 - 80</td>
</tr>
</tbody>
</table>

Other Nutrients

- **Sulfur** - Canola is sensitive to sulfur deficiency. However, research has not shown a need for sulfur application to this crop or any other sulfur-sensitive crop in Kentucky. If a deficiency is identified, it can be corrected with a sulfur application of 15 to 20 pounds per acre.
- **Lime** - For best performance of the canola and succeeding crops in the rotation and for efficient use of herbicides and fertilizers, the pH should be maintained between 6.0 and 7.0.
**Fertilizer-Seed Contact**

Because canola is sensitive to direct seed contact with fertilizers, nitrogen and potassium should be limited to no more than 10 pounds per acre, if the combined amounts of N and K₂O are placed with the seed.

**Crop Rotation**

It is important that canola be in a rotation with other crops. The ideal rotation is to plant canola or other rapeseed or *Brassica* crops (cabbage, broccoli, etc.) only once every five years to reduce potential pest problems. This rotation helps to minimize the buildup of difficult to control weeds, insects and diseases that continuous planting of canola may perpetuate. Producers must plan ahead in their rotation systems so that herbicide residues from preceding corn or soybean crops do not limit their options for planting canola. Canola is sensitive to some herbicides, particularly broadleaf herbicides, depending on the rate used and other factors involved (weather, tillage, etc.). Herbicide residues from Scepter, Canopy, Classic, Pursuit and Atrazine (particularly high rates) can damage canola so caution is advised for planting canola following crops in which these herbicides have been used. Volunteer canola can be a problem in succeeding crops. However, it can be easily controlled through use of a rotation and use of herbicides in the succeeding crop that are labeled for mustards. Cropping systems in Kentucky that best lend themselves to canola are set-a-side, fallow and early planted, medium maturity corn.

**Conservation Aspects**

Ground cover by the canola plant is excellent. If the crop is planted in mid-September, there will be virtually a 100 percent ground cover prior to winter. This cover, along with an excellent root system, protects the soil from erosion as well as or better than a small grain cover crop. The residue produced from canola is about the same as that produced with small grain, although the seed yields will be about two-thirds to three-fourths that of wheat. The residue appears to decompose more quickly than small grain residue.

**Double-Cropping**

Being a winter crop, canola gives Kentucky farmers an alternative to small grains and offers the same double-cropping potential with soybeans. Harvest maturity for wheat and canola are very similar with canola being as much as three days earlier in some seasons. Research studies at the University of Kentucky compared soybeans double-cropped after canola and wheat on the same planting date. Two-year results have shown two to seven bushels per acre yield advantage for soybeans double-cropped after canola as compared to soybeans double-cropped after wheat. No definite conclusions have been reached regarding the reason for this yield advantage which has also been reported in studies from other states.

**Worker Activities:**

Labor needs for canola production are almost identical to those of wheat. Both production processes in Kentucky are highly mechanized systems using the same equipment. Little or no hand work is done to the crop. The exception would be scouting, which is usually done by consultants or the producer/farmer. Scouting intervals will vary with environmental conditions.
and with the commitment of the producer/farmer. Scouting of the crop for pest management needs may range from a weekly basis to once or twice per growing season. Applications of fungicides, herbicides and insecticides would be made as needed. It is recommended that most or all of the nitrogen should be applied at green up in the spring (March) and Phosphorus and Potassium should be applied in the fall at levels recommended from soil test results.

**Planting:** Canola is planted in September, with planting dates of September 1 – 25 providing the best yields. Seeds can be either broadcast or drilled; however drilling is the preferred method as it is more reliable.

**Pesticide & Fertilizer Application:** Most producers apply pesticides with a boom sprayer and a closed cab tractor. It is also common for producers to hire a local cooperative or ag-supply dealer to do pesticide and fertilizer applications with closed cab spraying equipment.

**Harvesting:** Harvest is done with closed cab combines.

### Time Line of Mechanized Field Activities

**September:** Planting. Seedbed preparation should be done as close to planting date as possible to conserve soil moisture needed for seed germination. This includes application and incorporation of pre-plan fertilizer specifically Potassium and Phosphorus. Optimal planting dates are September 1 – 25. Earlier dates may result in winter injury. October planting results in reduced fall foliage production (canopy cover) which can allow weed growth and can delay the harvest date. The most common planting methods are broadcast and drilled. The broadcast method can save time and reduce machinery requirements but stand reliability is sometimes reduced using this method. It is very dependent on good surface soil moisture at seeding or rainfall immediately following seeding. Canola can also be planting using the no-till method. For more detailed information on planting procedures see University of Kentucky Extension Publication ID -114, Canola Production and Management.

**March:** Most or all of the nitrogen should be applied at green-up in the spring, usually March. If possible, it should be applied before budding and stem elongation to prevent damage to the main stem from ground spreading equipment.

**June through July:** Harvest.

### Integrated Pest Management

**IPM Programs:** In Kentucky, IPM programs for field crops have been in place since the late 1970's. Initially these were large scale demonstration programs. However, in recent years efforts have been directed toward education programs and demonstration/research. The core of our efforts in monitoring field crops are the proper use of scouting, identification, and economic thresholds to make chemical use decisions; and the use of critical cultural practices e.g. planting date, variety selection, tillage, etc. to avoid pest problems.
The KY-IPM program provides education through training sessions, publications, and video tapes of hands-on sessions. An annual "scout school" is held each March which teaches general techniques and procedures and concentrates on insect, weed, and disease identification of the main field crops.

**Insect Pests**

Information about insect pests of canola in the Ohio River Valley production area is limited. As a result, much current thinking about canola insect pests in Kentucky is derived from observations, very recent experiments and opinions that can be reasonably inferred from the existing literature. Currently very few acres of canola are grown in Kentucky. Because the distribution and concentration of food are major factors in insect population dynamics, the insect pest complex will probably change as acreage increased and/or becomes more concentrated. Traditionally, increased and/or more concentrated acres have led to greater and more diverse insect problems.

In general, canola supports a very large and diverse group of insects, including most of the insects found on the *Brassica sp.* crops (cabbage, mustards). Fortunately, most of the insects are parasites, or predators of other insects and pollinators or plant feeders of little importance.

**Monitoring:** Scouting for pests in Canola will be similar to other crops. However, because of the growth pattern of this crop we have to adapt techniques from several different crops. Fall scouting will be relatively easy and straightforward. Spring scouting will be difficult, physically challenging and may require slight alteration to planting practices.

In order to get a complete look at a field it may be necessary to set across paths or "tram lines" in the field. This may be accomplished in several ways, planned "skips" during planting, cutting paths (after bolting) or simply tramping the same path each visit, are examples. It is important to understand that observing only field edges will **NOT** yield an accurate picture of field condition.

Scouting procedures for canola can be found in Kentucky Integrated Crop Management Manual for Field Crops - Canola. IPM-8.

**NOTE:** At the expiration of patent protection, products and labels for insecticides constantly change. As a result application rates, REI and PHI could vary among products with the same active ingredient. The information available on your product label should always be used when making application decisions. At the present time there is no official publication for the recommendation of insecticides for use on canola in Kentucky.

The following insect pests have been identified as being present in canola fields in Kentucky at this time. As acreage increases, the situations will possibly change with the number of pests of concern increasing. Little information is available for many of the pests in relationship to canola.
**Striped Flea Beetle (SFB)**
*(Phyllotreta striolata)*

This insect is a close relative of the tobacco and corn flea beetles but is much larger. The SFB is 1/8-inch long and brown with two yellow stripes down the back. These insects have the habit of quickly jumping away when disturbed. Infestation is limited to the fall.

The striped and other flea beetles use their chewing mouthparts to remove the upper surface of plant parts. This leaves a scared appearance, but not a hole at the damaged location. Canola, like soybeans, is most extensively damaged when this feeding occurs on the cotyledon (seed leaves). No yield loss to an individual plant is likely to occur unless the cotyledons are damaged to the point that the plant dies. In the north central states this pest has affected stand establishment.

**Chemical Controls:** There is no established number of SFBs, nor level of damage to trigger treatment. However, as a guideline do not control unless: plants are killed, the number of plants per square foot falls below the recommended minimum and live feeding SFBs are still present. The following insecticides are used in Kentucky to control flea beetle:

**Cultural Practices:** Control of brassicacous weeds in around fields to remove early food sources for larvae.

**Biological Controls:** None.

### Canola Aphids

- **Green peach aphid** *(Myzus persicae)*
- **Turnip aphid** *(Lipaphis erysimi)*
- **Cabbage aphid** *(Brevicoryne brassicae)*

A large number of aphid species are found on canola (e.g. turnip, cabbage, etc.). Currently, green peach aphid is the most common aphid known to infest, debilitate and, under some conditions, kill canola plants in Kentucky.

Green peach aphids are small (1/16-inch), tear drop shaped, soft bodied insects. They are usually found in colonies on the underside of leaves. (Aphids are attracted to the color yellow, so look at yellowing leaves first). Most aphids are wingless, though a few have wings and these winged individuals (usually <<10% of the colony) spread the infestation within and among fields. This particular group of aphids contains both green and red (rusty brown) forms and looks very much like the tobacco aphid.

Aphid problems usually occur in the fall on small plants. However, scattered but very large infestations have been observed in the spring, mainly on main stem pods. Aphids feed by sucking plant juices through their piercing-sucking mouthparts. No noticeable physical damage may be seen. Usually, when substantial damage occurs, the plant takes on an unthrifty appearance, wilts or changes colors.
Warning: Canola may take on a purple and or yellow color due to winter stress. Aphids are attracted to yellow and may congregate on yellow leaves which are normally older, lower on the plant and less thrifty. Aphids' presence on these leaves does not necessarily indicate that the aphids caused the color.

Chemical Controls: There is no established number of aphids per plant nor percent infested plants that trigger a control situation. However, control may be warranted if: (1) infested plants show an unthrifty appearance when compared to un-infested plants in a similar situation and (2) a large number of live aphids (a rating of 2 or 3) are present, and (3) the plant population is in danger of falling below the recommended minimum per square foot. Aphid populations are often very spotty. In many cases, border or spot applications provide very adequate control.

The following chemicals are used in Kentucky to control aphids on canola:

Biological Controls: Aphid populations may be controlled by the attacks of predatory syrphid flies, coccinellid beetles, parasitic wasps, lady beetle larva and lacewings. However, little direct research on these controls has been conducted. Therefore, the impact of these natural enemies in Kentucky is un-quantified.

Cabbage Seed Pod Weevil (CSPW)  
(\textit{Ceutorhynchus assimilis})

CSPW is a small weevil which feeds on flowers and pods of canola and several other mustard plants. The beetle is actually black but appears gray because of its body hairs. When wet, it looks black. It has chewing mouthparts on the end of a long curved snout. This snout is easy to see even though the insect is quite small. The beetle is probably active on alternate hosts early in spring. CSPW moves into canola at bloom and stays, feeding on the blooms (which does no damage) and then laying eggs on the pods. The pod damage may affect yields.

In the normal weevil fashion, an adult female CSPW bites a hole in the surface of developing pods. It then turns around and puts an egg into this cavity and once again turns around to replace part of the plant material, thus covering the egg. The egg hatches and a CSPW grub burrows its way into the pod's interior, where it feeds on developing seeds until it matures. The final larval stage CSPW grubs chew their way out of the pod, drop to the ground, pupate and emerge as adults.

Risk of damage exists until the pest has completed its life cycle and chewed its escape hole in the pod wall. Normally, only one grub is in each pod and often only a portion of the seeds in an infested pod are damaged.

Thresholds: Ward et al (1985) suggest implementing control when populations reach two CSPW per plant. To examine the plant, observe it closely or tap the main raceme over a tray. Another method is to use a standard 15-inch insect sweep net. McCaffrey (1986) suggests that thresholds will be very low (2-3/sweep) and that controls should be applied after full bloom but before bloom ends.

Biological Controls: None specified.
Fall Armyworm
(*Spodoptera frugiperda*)

Larvae of fall armyworms vary from light tan to nearly black with three thin light yellow lines down the back. There is also a wider dark stripe and a wavy yellow red splotched stripe on each side. Fall armyworms resemble both armyworms and corn earworms. Fall armyworms, though, have a prominent inverted "Y" mark on the front of the head. The fall armyworm also can be distinguished from true armyworms by the time of year they appear and their habit of remaining and feeding on the plant during the day. True armyworms are present in Kentucky from April through June whereas the fall armyworm appears from October through December. Besides canola, other plant hosts include corn, sorghum, grasses, alfalfa, beans, wheat and other grains. Economic damage is the result of significant larval feeding on foliage and developing seedpods of canola.

**Thresholds:** No established thresholds.

**Biological Controls:** Little research specific to natural controls for fall armyworm has been done in Kentucky. Weather may at times act as a main source of control for fall armyworm. Cool weather with a frost, can eliminate the need for fall armyworm control.

Crane Fly Larvae

Common crane flies (*Tipulidae*) are long and thin with very long legs, and resemble giant mosquitoes. Unlike mosquitoes, though, crane flies do not bite humans or animals. Crane flies can be distinguished from other flies by the "V" shaped suture on their thorax. Like all true flies crane flies have only 2 wings. There are dozens of crane fly species in Kentucky, and most are similar in appearance and biology. The exact species suspected of causing damage to canola in the seedling stage has not been identified. Crane fly larvae (often called meadow maggots or leather jackets) are associated with moist habitats. Most crane flies are beneficial decomposers, However, large populations have been found to cause damage to grasses and corn in poorly-drained soils.

**Thresholds:** No established thresholds.

**Biological Controls:** None

Slugs

In Kentucky, slugs are common pests during wet weather and are known to damage many types of plants. Damage by slugs has been specifically identified as a problem in canola fields planted in the no-till method. The specific species of slug/slugs has not been identified.
Slugs rasp on leaves, stems, flowers and roots. They produce holes in the leaves or just scar the leaf surface. Small seedlings can be especially vulnerable to these creatures. Silvery slime trails are evidence of slug infestations.

**Thresholds:** No established thresholds.

**Biological Controls:** None

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**Pests Resulting from Specific Conditions**

**Drought**

*False Chinch Bug*

(Nysius raphanus)

Drought contributes to a complicated set of pest problems. Three conditions produce a perfect situation for infestation by the false chinch bug: drought, canola production, and double crop, no-till soybeans. The actual damage is to soybean seedlings but the heavy residue left from canola production produces the environment. Drought conditions favor false chinch bug development and slow soybean growth. This combination has seriously damaged soybeans in Kentucky. However, in all production years when one or more of these factors were absent, no infestation occurred. It is very likely that drought is the most important of these factors.

**Chemical Controls:** It appears that application with an insecticide with known soil activity gives the best results. Plants are growing too slowly for systemic soil insecticides to have much effect and are too small for treatment of only the plant. For best results, use a broadcast spray with a lot of water, which saturates the canola residue, forcing the false chinch bug to crawl through a layer of insecticide residue.

**Biological Control:** None specified

**Poorly Drained Soils**

Several Kentucky producers have suffered extreme loss in plant stands and at first the cause was unknown. This problem, commonly known as Winter Decline Syndrome, could have several causes (Refer to Diseases -- for other causes). Water saturated soils were a common factor in these cases and examination revealed small fly maggots and pupae. Species identification has not been established, but they are probably flies from the genus *Delia*. *Delia radium* (L.) the cabbage root fly and *D. platura* (Meigen) the seed corn maggot are likely culprits. No thresholds or treatments are known. Canadian research indicates that these pests are common and are not important under good growing conditions. But under stress, especially water saturated soils, this insect is extremely important with no rescue control available.
**Recommended Cultural Practices:**
Several current and potential insect pests exist on Kentucky-grown canola. The number of pests is likely to increase as production increases and becomes established. There are no insect pests currently or likely which would prevent the economic production of canola in Kentucky although developing a comprehensive pest management system will be important to economically protect this crop.

Increasing acreage, compacting distribution, continuous cropping history and use of un-recommended fields and practices will likely increase insect pest significance. To that end the following cultural practices are recommended:

1. Plant only on recommended (especially well-drained) soil.
2. Follow all recommended agronomic practices to produce fields with vigorous plants and a stand of six or more plants per square foot.
3. Rotate the field and locations if possible on the farm. Try not to plant near other rape fields.
4. Control all volunteer rapes and other *Brassica* sp. weeds (wild mustard, yellow rocket).
5. Scout the crop weekly and more often as infestations arise.
6. Watch for insect pests in following crops, especially soybeans.
**Chemical Controls**

Table 2. The following insecticides have been identified as presently being used on canola in Kentucky by consultants and growers attending a March 4, 2010 Canola Crop Profile and PMSP planning meeting.

<table>
<thead>
<tr>
<th>Product</th>
<th>Active Ingredient</th>
<th>Group (MOA)</th>
<th>Pests on label</th>
<th>Formulation</th>
<th>Rate</th>
<th>PHI</th>
<th>REI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gaucho (Seed Treatment)</td>
<td>imadacloprid</td>
<td>4A</td>
<td>Early season protection of seedlings against injury by aphids, flea beetles and wireworm. Suppression of Lygus bugs in their second generation and cabbage seedpod weevil larvae.</td>
<td>5 lbs. a.i./gallon</td>
<td>0.96 - 1.92 oz./A</td>
<td>7 days</td>
<td>24 hrs.</td>
</tr>
<tr>
<td>Warrior</td>
<td>Lambda-Cyhalothrin</td>
<td>3</td>
<td>Cutworms, Flea Beetles, Looper, Cabbage Seedpod weevil, Armyworm, Lygus Bug, Diamondback moth, cabbage aphid, grasshopper</td>
<td>1 lb a.i./gallon</td>
<td>1.92 – 3.84 oz./A</td>
<td>7 days</td>
<td>24 hrs.</td>
</tr>
</tbody>
</table>
Table 3. Insecticides containing the following active ingredients are labeled for use in Kentucky.

**Note** – This list is based on CDMS label search, current as of February 2010. Always read and follow label directions when making a pesticide application. This is not an endorsement, recommendation or an acknowledgement of use by Kentucky producers of products containing the following active ingredients.

<table>
<thead>
<tr>
<th>Active Ingredient</th>
<th>Group (MOA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbaryl</td>
<td>1A</td>
</tr>
<tr>
<td>Methyl parathion</td>
<td>1B</td>
</tr>
<tr>
<td>Deltamethrin</td>
<td>3</td>
</tr>
<tr>
<td>Bifenthrin</td>
<td>3</td>
</tr>
<tr>
<td>Gamma-cyhalothrin</td>
<td>3</td>
</tr>
<tr>
<td>Lambda-cyhalothrin</td>
<td>3</td>
</tr>
<tr>
<td>Pyrethrins</td>
<td>3</td>
</tr>
<tr>
<td>Zeta-cypermethrin</td>
<td>3</td>
</tr>
<tr>
<td>Piperonyl butoxide</td>
<td>3</td>
</tr>
<tr>
<td>Imidacloprid</td>
<td>4A</td>
</tr>
<tr>
<td>Clothianidin</td>
<td>4A</td>
</tr>
<tr>
<td>Spinosad</td>
<td>5</td>
</tr>
<tr>
<td>(S)-Methoprene</td>
<td>7A</td>
</tr>
<tr>
<td>1,3-dichloropropene; Chloropicrin</td>
<td>8B</td>
</tr>
<tr>
<td>Bacillus thuringiensis subspecies kurstaki strain HD1</td>
<td>11</td>
</tr>
<tr>
<td>Bacillus thuringiensis subspecies aizawai strain</td>
<td>11</td>
</tr>
<tr>
<td>Tebufenozide</td>
<td>18</td>
</tr>
<tr>
<td>Potassium salts of fatty acids</td>
<td></td>
</tr>
<tr>
<td>Clove Oil; Cottonseed oil; Garlic Oil</td>
<td></td>
</tr>
</tbody>
</table>
Diseases

Canola is susceptible to attack by disease organisms any time from seeding through maturity. These organisms originate from many sources including soil, infested or infected seed, infested crop residue, or air-borne spores blown in from volunteer canola plants, certain weeds, neighboring fields of canola, and related vegetable crops or other crop plants. Although canola has a short history in Kentucky, many of the disease organisms that affect canola have been here for a long time. We know this because these organisms also attack other brassicas, both cultivated and weedy, and other common crop plants in Kentucky. While many of these disease organisms are presently at low levels, intensive cropping of canola may provide for their rapid build-up. Then, given the proper environmental conditions, the development of serious disease epidemics in the canola crop are possible. Crop failures due to disease have already been documented for two pathogens. Growers need to follow strict crop management practices to reduce the chances of the development of serious epidemics. The following canola diseases have been documented in Kentucky and have the potential for causing serious crop losses:

**Sclerotinia Stem Rot**  
(*Sclerotinia sclerotiorum*)

Symptoms of stem rot appear in Kentucky from May onwards. The disease is characterized by narrowly elliptical, slightly sunken, light tan to gray lesions usually in the mid- to lower stem. Hard, irregularly shaped (1/8- to 1/2-inch long x 1/8- to 1/4-inch wide), black resting bodies of the fungus (sclerotia) are found within the stem cavity of affected plants. Sclerotia may also develop on the outer stems of plants under extremely humid/wet conditions and in the upper taproot. Plants infected late in the season, after most pods have developed, may lodge due to stem breakage but experience few other yield effects. However, when plants are infected during the early to mid-flowering stages, plants may have fewer pods, fewer seeds per pod and smaller, shrunken seed. These plants ripen prematurely and suffer severe lodging. Crop lodging greatly slows the harvesting process and increases yield losses due to shattering.

Sclerotia fall to the ground during harvest or as stems break when lodging occurs. From mid-April to mid-May, sclerotia in the upper one to two inches of soil germinate to produce small golf tee-shaped structures called apothecia. Sclerotia buried deep in the soil remain dormant (8 years or longer) until brought near the surface by cultivation. A single sclerotium can produce from one to 15 apothecia.

Apothecial formation on individual sclerotia can occur all at once or over a period of weeks; the process requires that soil moisture levels be high and temperatures low to moderate for at least 10 consecutive days. Both cooler temperatures and adequate soil moisture are favored within dense, vigorously-growing canola stands and within thinner stands with heavy weed pressure. Canopy density also affects the length of time that individual apothecia remain active.

Apothecia release spores (ascospores) during wet weather and periods of heavy dew. The spores are blown to and infect flower petals of canola plants. Ascospores can be blown into a crop from a relatively distant source; however, the most important source of stem rot inoculum comes from within a field or from immediately adjacent fields and areas. Infected, fallen petals that lodge on
leaf surfaces, in leaf axils and on plant stems then serve as sites where the fungus moves into the main stems of plants during wet or humid conditions. Ascospores are unable to infect canola plants directly. Conversely, direct infection of stems as a result of sclerotal germination, without apothecia or ascospores being produced, has been documented in more southern production areas. Once plants are infected, symptoms of stem rot appear after about 10 to 14 days.

**Chemical Controls:** See table 4 for products presently being used in Kentucky on canola for disease control.

**Cultural Controls:** The control of *Sclerotinia* stem rot in Kentucky is difficult for a variety of reasons. The most notable of these is the wide distribution of the causal fungus and the frequent occurrence of conditions favorable to stem rot during the period that canola varieties flower in Kentucky. Because of this, the moderation of stem rot problems is only possible when growers are consistent in the implementation of a specific set of management practices. The use of any single measure frequently results in unacceptable levels of stem rot in production fields.

- Not growing canola or other stem rot susceptible crops in a field or nearby fields more frequently than one in five years helps limit the build-up of the stem rot fungus where low levels of the fungus currently exist. The stem rot fungus can infect 145 plant genera and literally hundreds of species. As a result, selection of an acceptable non-host crop is very important. In Kentucky, wheat, barley, corn, milo and other grass crops are good choices. Soybeans, while susceptible to stem rot, rarely develop the disease in Kentucky because late spring and summer conditions are usually not supportive of disease development. Thus, soybeans appear to be an acceptable non-host crop in canola production areas in Kentucky.

- The value of crop rotation is greatly diminished where high pathogen levels are being maintained in and around fields infested with stem rot susceptible weed hosts such as field pennycress, shepherd's purse, wild mustard and related species. In these situations, crop rotation of canola must be coupled with the use of cropping systems and weed management practices, in of-canola years, which limit the development of stem rot susceptible weeds. Even where these practices are strictly followed, the danger of a serious stem rot problem still exists due to the possible movement of spores from adjacent farms where these practices are not followed and from nearby tree lines, fence rows, pastures and fallow areas which are heavily infested with weeds susceptible to stem rot. This is much less of a factor the further away poorly managed farms and non-crop areas are from properly managed canola fields. This is due to the fact that most spores which cause severe stem rot problems come from within or nearby the field, rather than from significantly distant sources.

- In addition to crop rotation, other cultural practices may help to moderate stem rot problems. Plowdown of stem rot-infested residue, immediately following canola harvest or after double- cropped soybeans are harvested, buries sclerotia and reduces apothecial production in the next crop. For plowdown to be effective, subsequent crops must be planted using minimum or no-tillage practices so that sclerotia are not returned to the soil surface. Also, planting more than one canola variety greatly reduces the chances that all the acreage will be involved in a stem rot epidemic. This is because each variety has a slightly
different flowering period and it is less likely that stem rot favorable conditions will exist during the early to mid-bloom periods for each of the varieties grown.

• Further help can be achieved by avoiding excessive canopy density in canola by using proper seeding rates and adequate, but not excessive, nitrogen. This promotes air circulation and light penetration into the canopy and reduces the time that conditions are optimal for spore production, spore release and infection by the stem rot fungus. The management of weeds in canola fields is also important as an excessive weed canopy provides an exceptional environment for the fungus to develop. This can result in high stem rot levels even when the canola canopy is not excessive.

Thresholds: Fungicides must be applied prior to any symptom expression in order to be effective. Therefore, no disease threshold is possible.

Biological Controls: None

**Blackleg**

*Leptosphaeria maculans* [anamorph = *Phoma lingam*)

In the spring of 1989, a highly aggressive strain of the blackleg fungus caused 75 to 90 percent yield losses in several production fields in southeast Logan County, Kentucky. This was the first report of a blackleg epidemic caused by the aggressive strain of *P. lingam* in canola in the United States. Subsequently, the highly aggressive strain of the blackleg fungus has been shown to occur in North Dakota, north central Tennessee and in southern portions of Indiana, Illinois and Michigan. The source of the aggressive strain in Kentucky is unknown. Contaminated seed brought in from outside Kentucky is the most likely source, however, indigenous populations of the aggressive strain may have existed on crops such as mustard greens or other brassicas before canola was introduced into the area.

This fungus survives at low levels in infected and infested seed (up to 3% of seed harboring the fungus), in infested, woody canola stubble and in certain weedy hosts. Fungal inoculum released from stubble, and not diseased or infested seed, is most responsible for initiating serious blackleg epidemics. Thus, in production areas already infested with the blackleg fungus, seed transmission is relatively unimportant. However, the use of diseased seed in uninfested areas is the principal means of spreading the fungus to new production areas.

The fungus in infested stubble develops two types of spores: ascospores and pycnidiospores. The former are the primary source of blackleg epidemics. Ascospores are forcibly ejected from stubble and may travel in wind currents as far as three miles from the original source. Under Kentucky conditions, the most prolific spore release occurs from first-year stubble from June through March or April, depending on the year. Spore production drops significantly in second-year stubble and is essentially non-existent in third-year stubble.

Ascospores blow into a field and infect plant foliage during periods of wetness. Symptoms readily develop at temperatures ranging from 59 to 84°F. The resulting spots are light green to
off-white in color and circular to irregular in shape. Spots become papery-thin and buff color with age, and bear numerous, black, pimple-like structures called pycnidia. Pycnidia are the source of pycnidiospores. During rainy weather, these spores are splashed from pycnidia for short distances and can result in secondary spread of the disease within a field. Infected stems develop cankers which are oval in shape, light brown to tan in color, and with a purplish margin. As with leaf spots, pycnidia are present in mature blackleg cankers. While cankers can develop anywhere on plant stems, it is the girdling, basal stem cankers which contribute most towards serious crop losses. Cankers of this type cause premature plant death and severe lodging.

Stem cankers resulting from direct infection of stem tissue by ascospores or pycnidiospores is uncommon. The more common means of stem infection results from the movement of the fungus from infected leaf tissue, down the leaf petiole and into the stem. Thus, foliar infection is essential if significant stem infection is to occur. Once the fungus reaches the stem, disease development ceases until the fungus is exposed to temperatures of 64 to 68°F for two to five weeks. At that point disease development resumes and a canker is formed. Because of this latent period, cankers typically develop in mid-spring after plants have flowered and after they have lost their capacity for compensatory growth. Plants are susceptible to this means of stem infection up to the six-leaf stage. Plants infected after this stage may develop foliar symptoms, but no or very limited stem cankers. In Kentucky the six-leaf stage is usually, but not always, reached prior to plants entering winter dormancy.

Symptoms resulting from infection by the blackleg fungus of pods and related structures generally resemble those of stem infections, but are of a reduced size. Seed may be diseased without any external evidence of pod infection. Infected seed may be discolored and/or shriveled, or may be symptomless. Pod/seed infections are usually initiated by pycnidiospores, although infection by ascospores may also occur. Infected and infested seed produce seedlings with lesions and pycnidia. Yield loss due to blackleg infection in canola is the result of premature plant death, pod shattering, reduced seed size and weight, and plant lodging.

**Chemical Controls:** See table 4 for products presently being used in Kentucky on canola for disease control.

**Cultural Controls:** Using the following cultural measures, while not eliminating the threat of blackleg, should reduce the spread of the disease to new areas and limit its seriousness in production areas where blackleg already exists.

- Use resistant varieties.
- Bury diseased stubble by deep plowing before canola emerges in neighboring fields in the fall. This is useful because the fungus survives in woody canola stubble and is the main source of infective spores.
- Where soybeans are to be double cropped following a blackleg-infected canola crop, deep plow the canola stubble before planting soybeans. Waiting to plow until after soybeans are harvested is not acceptable. This is because newly seeded canola in
neighboring fields will be up and growing before soybean harvest is complete and before deep plowing would be possible.

- Following deep plowing of stubble from a blackleg-infected canola crop, use minimum tillage or no-tillage practices in subsequent crops to avoid bringing infested stubble back to the surface.

- Isolate newly seeded canola as far as possible from the previous years' canola crop. Planting canola in the same or adjacent fields within three years of a previously diseased crop negates the value of deep plowing.

- Sow only certified seed treated with a fungicide effective against blackleg. Do not use saved seed, even if it has been treated with a fungicide. This is important because infested seed is the primary means of bringing blackleg into a previously uninfested area. Currently, benomyl is the only material registered in the United States for this use.

- Thoroughly clean any equipment used in blackleg-infested fields before moving the equipment to other fields or farms where the blackleg fungus does not exist.

- Use multiple planting dates when possible. Plants are highly susceptible to blackleg only up to the six-leaf stage and when conditions are favorable for disease development. Using more than one planting date increases the probability that at least a portion of the crop will escape serious damage.

- Where practical, control cruciferous weeds in and around production areas which may harbor the blackleg fungus.

**Thresholds:** Fungicides must be applied prior to any symptom expression in order to be effective. Therefore, no disease threshold is possible.

**Biological Controls:** None

**Alternaria Black Spot**

*Alternaria spp.*

*Alternaria* black spot, also called dark leaf and pod spot, is common wherever rapeseed or canola is grown. Depending upon the location, the species of *Alternaria* which cause damage are variable. In Kentucky and the lower midwest, the main pathogen appears to be *A. brassicicola*. All of this variation as to the causal organism results in considerable variability in the epidemiology and the symptoms of the disease from year to year and location to location. In England, *Alternaria* black spot is the most consistently serious disease of rapeseed. In Canada, while present at low levels in most years, severe instances of the disease have reduced yields by as much as 20 percent. Yield losses are primarily due to seed shrinkage and shattering. Severe instances of *Alternaria* black spot have occurred only sporadically in Kentucky, however, a high
incidence of low levels of the disease suggests that it has the potential to become a more serious problem as canola acreage increases.

All above-ground plant parts are susceptible to infection. The most common symptoms, however, are found on the leaves, pods and stems supporting the pods. Leaf spots can be found any time the crop is in the ground and range from small black spots the size of a pinhead to larger spots with concentric rings up to 1/4-inch in diameter. The color of spots is highly variable ranging from gray to black, depending on the weather. Spots may or may not have a purplish to black border. The most serious phase of the disease occurs when infections spread to newly set pods. Spots similar in appearance to leaf spots discolor and weaken the pods and seed. This results in premature ripening and seed shrinkage followed by shattering.

The fungus overwinters in infested crop residue, on or in seed and in certain weeds such as wild mustard. When infected or infested seed are sown, seed may rot in the ground or produce diseased seedlings. Plants can also be infected by wind-blown spores emanating from diseased canola stubble, neighboring canola crops or susceptible weeds crops. Warm, humid conditions favor disease development. Spores germinate, penetrate plant tissue and cause lesions in a span of a few days. These lesions produce new wind-blown spores which cause new infections on the same or neighboring plants.

**Chemical Controls:** See table 4 for products presently being used in Kentucky on canola for disease control.

**Cultural Controls:** Early maturing varieties may be more affected because of disease-favorable weather conditions during maturation.

- Plant well-cleaned seed to reduce the seed-borne levels of the black spot fungi.

- Allow at least four years between canola crops in a field and keep susceptible weeds and volunteer canola to a minimum during this period.

- Dispose of the previous year's canola stubble through deep tillage.

- Control *Sclerotinia* stem rot and insect damage where possible.

- In heavily diseased crops, timely harvest may prevent serious losses due to shattering.

**Thresholds:** Fungicides must be applied prior to any symptom expression in order to be effective. Therefore, no disease threshold is possible.

**Biological Controls:** None
Minor Diseases

The following canola diseases are known to occur in Kentucky, but are presently considered to be of minor importance.

**Gray Mold**

(*Botrytis cinerea*)

Gray mold occurs worldwide on many different crop plants. Infections usually occur on tissues damaged by frost or other agents such as insects or fertilizer. However, the fungus can infect undamaged plant parts when these come in contact with infected tissue. All aerial parts of canola plants are susceptible to attack by *B. cinerea*. Avoiding crop damage is the surest way to reduce losses due to gray mold.

Gray mold can be recognized by the development of a fuzzy, gray mold on injured tissues during humid or wet weather.

**Thresholds:** None.

**Biological Controls:** None

**Powdery Mildew**

(*Erysiphe cruciferarum*)

Powdery mildew is presently a minor disease of canola in Kentucky. In some production areas (e.g., south Georgia), however, powdery mildew has resulted in serious yield losses under limited production conditions. These yield losses have been associated with fall or very early spring development of the disease. In Kentucky, powdery mildew develops in the canola crop well after flowering, usually in late May. Earlier development, however, is possible and the disease may become more important as Kentucky’s canola acreage increases.

Powdery mildew can be recognized by the white dusty growth of the causal fungus on all above-ground plant parts. Generally the disease is favored during periods of moderate temperatures and high humidity. High nitrogen fertilization and excessive canopy density are also favorable to the development of powdery mildew.

**Thresholds:** None.

**Biological Controls:** None.
**Downy Mildew**  
*(Peronospora parasitica)*

The downy mildew fungus causes yellowing in irregular patches on upper leaf surfaces; this frequently gives the leaf a stippled appearance. Areas on the undersides of leaves corresponding to the yellow patches on the upper surface have a white, somewhat granular appearance. Affected areas usually become bleached with age. The disease is occasionally seen as sparse wefts of fungal growth on stems and pods. In Kentucky, downy mildew usually shows up in the crop following spring infections, which cause little damage. More severe damage, generally in the form of reduced winter hardiness, is usually associated with seedling infection in the fall.

Occasionally, a disease known as staghead is seen in some canola fields. Staghead is the result of dual infection by the downy mildew fungus and another disease organism, *Albugo candita*. *Albugo candita* is the cause of a minor, but common, disease called white rust. When both fungi infect canola, the terminal parts of flower stalks turn brown and hard and dry up. Portions of individual flowers may also become distorted.

**Thresholds:** None.

**Biological Controls:** None

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**Black Rot**  
*(Xanthomonas campestris)*

Black rot is a bacterial disease which affects canola. Infected leaves develop a bright yellowish discoloration in their margins. Leaf veins in infected areas appear dark in color. The causal bacterium is seed-borne and overwinters in infested canola stubble and in residue from other susceptible crops. Bacteria enter pores in leaf surfaces during periods of wind and splashing rain. Although the symptoms of black rot are quite visible and can cause great alarm to the producer, the disease up to now has not caused significant damage to canola in Kentucky.

**Thresholds:** None.

**Biological Controls:** None

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**Damping-Off Diseases**  
*(Pythium spp. and Rhizoctonia solani)*

*Pythium* and *Rhizoctonia* occasionally cause damage by rotting seed or seedlings shortly following germination. Losses, while rarely serious, usually occur when seeds are planted under adverse soil conditions, especially excessively cool and wet soils. Planting seed too deep may increase the incidence of damping-off. The risk of damage due to damping-off can be greatly
reduced by avoiding adverse soil conditions when planting. Using fungicide seed treatments such as captan or benomyl offers only limited protection against damping-off diseases.

**Thresholds:** None.

**Biological Controls:** None

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**Aster Yellows**
*(Mycoplasma-like organism)*

This disease is caused by an organism that is somewhat intermediate between a bacterium and a virus; it is quite common and can affect at least 300 plant species. The organism is apparently spread during the feeding activities of leaf hoppers.

Infected plants fail to set pods or they develop sterile, hollow bladders in place of normal pods. Although symptoms due to aster yellows are quite noticeable, serious yield damage due to the disease is rare.

**Thresholds:** None.

**Biological Controls:** None

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**Winter Decline Syndrome**

A stress related complex, Winter Decline Syndrome, is the rapid decline of canola stands during late winter and early spring. The tap roots and crowns of affected plants deteriorate, often becoming hollow, and the plants may die. Plant death can occur either prior to or after bolting, depending upon the timing and degree of damage. Some affected plants bolt normally, but suffer lodging later in the season due to weakened crown tissue. Occasionally, affected plants remain upright, but die prematurely with a greatly reduced seed yield. Stands can be reduced by over 90 percent in severe cases.

Various soil-borne bacteria and fungi have been isolated from affected tissue, but with no consistent patterns. In addition, affected roots are frequently, but not always, infested with maggots (refer to insect chapter for more information on maggots relative to this complex). The exact cause of winter decline syndrome is unknown. However, field observations suggest it is the result of physical damage that provides ports of entry for maggots and secondary disease organisms. Physical damage to roots and crowns is thought to involve sub-lethal, low temperature damage to plants not adequately cold-hardened, or that break dormancy prematurely in the spring. Plant heaving during freeze/thaw cycles and soil/oxygen depletion resulting from water-logged soils may also be contributing factors.
The best way to control winter decline syndrome is to plant canola only into well-drained soils and follow production practices that result in adequate fall growth, which promotes winter survival. Observed differences among cultivars with respect to winter decline syndrome may be related to different degrees of physical damage which, in some cases, may have a genetic basis.

**Cultural Controls**: The best defense against winter decline syndrome is to plant canola only in well drained soils and follow management practices which promote adequate, but not excessive, growth in the fall.

**Thresholds**: No established thresholds.

**Biological Controls**: None

Table 4. The following fungicides were identified as most likely to be used on canola in Kentucky by consultants and growers attending a March 4, 2010 Canola Crop Profile and PMSP planning meeting.

<table>
<thead>
<tr>
<th>Product</th>
<th>Active Ingredient(s)</th>
<th>Group (MOA)</th>
<th>Diseases list on label</th>
<th>Formulation</th>
<th>Rate</th>
<th>PHI</th>
<th>REI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proline</td>
<td>Prothioconazole</td>
<td>3</td>
<td>Sclerotinia Stem Rot</td>
<td>4 lbs. a.i./gallon</td>
<td>4.3 – 5.7 oz./A</td>
<td>36 days</td>
<td>48 hrs</td>
</tr>
<tr>
<td>Quadris</td>
<td>Azoxystribub</td>
<td>11</td>
<td>Blackleg, Alternaria blackspot, Sclerotinia Stem Rot</td>
<td>2.08 lbs a.i. / gallon</td>
<td>6.2 – 15.4 oz. / A</td>
<td>30 days</td>
<td>4 hrs</td>
</tr>
<tr>
<td>Endura</td>
<td>boscalid</td>
<td>7</td>
<td>Sclerotinia Stem Rot</td>
<td>70% a.i. (0.7 lb. a.i./ lb of product)</td>
<td>5-6 oz./A</td>
<td>21 days</td>
<td>12 hrs</td>
</tr>
</tbody>
</table>
**Table 5.** Fungicides containing the following active ingredients are labeled for use in Kentucky.

*Note* – This list is based on CDMS label search, current as of February 2010. Always read and follow label directions when making a pesticide application. This is not an endorsement, recommendation or an acknowledgement of use by Kentucky producers of products containing the following active ingredients.

<table>
<thead>
<tr>
<th>Active Ingredient</th>
<th>Group (MOA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metconazole</td>
<td>3</td>
</tr>
<tr>
<td>Prothioconazole</td>
<td>3</td>
</tr>
<tr>
<td>Thiram</td>
<td>M3</td>
</tr>
<tr>
<td>Metalaxyl</td>
<td>4</td>
</tr>
<tr>
<td>Boscalid</td>
<td>7</td>
</tr>
<tr>
<td>Azoxystrobin</td>
<td>11</td>
</tr>
<tr>
<td><em>Streptomyces lydicus</em> WYEC 108</td>
<td></td>
</tr>
<tr>
<td><em>Bacillus pumilus</em> strain QST 2808</td>
<td></td>
</tr>
<tr>
<td>Potassium phosphite</td>
<td></td>
</tr>
<tr>
<td>Corn Oil; Cottonseed oil; Garlic Oil</td>
<td></td>
</tr>
</tbody>
</table>
Weeds

Both the winter and summer complex of weeds can cause problems in canola in Kentucky. Wild garlic bulblet contamination reduces the market value of canola seed. Common chickweed, henbit, yellow rocket and volunteer wheat can overcome canola during the fall or late winter. Johnsongrass may cause harvesting problems in the spring, particularly when canola stands are thin. Volunteer corn, annual ryegrass and thistles have also been identified as causing problems in Kentucky canola fields:

**Common chickweed**  
*(Stellaria media)*

**Origin:** Europe

This species has the ability to grow as an annual or winter annual. Common chickweed has a prostrate growth habit and branches can be 5 to 50 cm in length. The leaves are opposite, and ovate to elliptic is shape. Each leaf will also have a sharply pointed tip. The upper stem and leaves will often be covered in short hairs. It has a shallow, fibrous roots system. Similar species include field chickweed and mouseear chickweed (perennials).

**Henbit**  
*(Lamiun amplexicaule)*

**Origin:** Europe

The cotyledons are rounded with a notch where it attaches to the petiole. The leaves are opposite, orbicular in shape, deeply lobed, and often appear to be wrapping around the stem. The stem is square and has short hairs pointing towards the base of the plant. The plant typically grows low to the ground and only achieves heights of 0.1 to 0.4 m. Purple deadnettle (*Lamium purpureum*) is a similar species that is often confuse with henbit.

**Wild garlic**  
*(Allium vineale)*

**Wild onion**  
*(Allium canadense)*

**Origin:** Native

Wild garlic and wild onion are similar in appearance and appear at similar times of the year. Wild garlic has linear leaves that are smooth, round, and hollow. The stems are smooth, erect, and leafless. The bulbs are covered by a papery outer coating. They reproduce by aerial and underground bulbs, rarely by seed. Wild onion leaves are smooth and flat. The bulb has a fibrous, net-veined covering.
**Italian ryegrass**  
*(Lolium multiflorum)*

**Origin:** Europe

This species is also referred to as annual ryegrass. It will range in height 0.3 to 1.0 m in height. The leaf blades are typically shiny and deep green in color. The blades are also flat and have prominent veins. It has a truncated, membranous ligule and small clasping auricles. It is often used as a temporary turf or pasture species since it grows quickly and thrives in cool conditions.

**Chemical controls:** Currently Treflan (trifluralin) is the most often used herbicide for weed control in canola in Kentucky. Treflan is applied and incorporated within the upper two to three inches of the soil profile for pre-emergence control of grassy weeds such as cheat. Canola tends to be shallow rooted during early development and can be injured by Treflan. To ensure against injury from Treflan read and follow label directions. The chance of canola injury may increase when Treflan is applied above the recommended rate or when seedling plants are stressed by soil that is dry or cool and wet.

**Table 6.** The herbicide Treflan was, identified as presently being used on canola in Kentucky by consultants and growers attending a March 4, 2010 Canola Crop Profile and PMSP planning meeting.

<table>
<thead>
<tr>
<th>Product</th>
<th>Active Ingredient</th>
<th>Group (MOA)</th>
<th>Weeds listed on label</th>
<th>Formulation</th>
<th>Rate</th>
<th>PHI</th>
<th>REI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treflan</td>
<td>Trifluralin</td>
<td>3</td>
<td>See product label for complete list of over 50 weed species.</td>
<td>4 lbs. a.i./gallon</td>
<td>See product label. Rates listed as 1 – 2 pints/A based on soil type.</td>
<td>none</td>
<td>12 hrs.</td>
</tr>
</tbody>
</table>
Herbicide Carryover: The fact that canola is extremely sensitive to many herbicides makes it a good candidate for injury from carryover of herbicide residues in the soil. Developing long-term weed control plans for rotational crops (up to 2 years or longer) may be necessary especially for fields where persistent herbicides are used. Fields treated with products containing chlorimuron, atrazine or simazine may be more prone to having carryover problems when soil pH is high. Hot spots that occur with overlaps of the spray boom or non-uniform spread of herbicide impregnated fertilizers may also lead to carryover problems to canola.

Alternative Controls: There are no viable alternative control measures for weed control in Kentucky canola.

Cultural Controls: Currently there are no weed control programs for a broad spectrum of weed species in canola; therefore, growers must rely on practices that limit the introduction or spread of weeds.

• Avoid weedy fields, especially those having a history of wild garlic problems.

• Rotate to other crops in which effective weed control programs are available. Wild garlic and other problem weeds may require more than one year rotation to a crop such as wheat to significantly reduce a heavy infestation.

• Use weed-free canola seed to prevent the introduction of wild mustard or other weeds.

• Seed Early - Establishing canola early in the season helps avoid competition from many weed species. The most critical period for weed competition to canola is during the first four to eight weeks after seeding. Canola plants tend to grow slowly during this period and can be overcome by certain weed species.

Preventative measures alone will not eliminate all problems with weeds. Management practices such as early seeding, tillage before planting and use of herbicides are sometimes necessary for weed control in canola.

Seeding Early
Establishing canola early in the season helps avoid competition from many weed species. The most critical period for weed competition to canola is during the first four to eight weeks after seeding. Canola plants tend to grow slowly during this period and can be overcome by certain weed species.

The peak period for emergence of such weeds as common chickweed and henbit usually occurs from late September through early November. Therefore, seeding in early September may give canola the competitive edge over these weed species.

Seeding early does not necessarily guarantee against problems from weeds. If stress factors such as lack of moisture, poor seeding or herbicide injury inhibit crop growth, canola seedlings may be overcome by weed competition.
Seeding early may also increase the likelihood of canola plants recovering from winter injury and competing against late emerging winter weed complex. Plants that are well established by the onset of winter are likely to survive cold temperatures better and generate new growth quicker than poorly developed plants.

**Tillage before Seeding**
In some instances, a light discing a few weeks prior to planting canola may stimulate seed germination of some weed species. The weeds that emerge can then be destroyed by tillage used for preparing the seedbed. This approach may be helpful in cases where problems with volunteer wheat are anticipated.

The potential disadvantage of this practice is that poor stands may occur in cases where tillage causes a significant loss of soil moisture. Shallow discing of the upper two inches of soil should be sufficient to encourage development of wheat and other potential weeds and not dramatically affect the amount of soil moisture.

**Biological Controls:** There are no biological control agents for weed control in Kentucky canola fields.

**Canola -- A Weed in Rotational Crops**

Seed loss, which occurs with natural shattering at plant maturity and from harvesting process, appears to be the major source of volunteer canola in rotational crops. Also, occasional plants that occur along roads, in nearby fields or beneath power-lines are believed to be from seed carried by leaking grain trucks, harvesting equipment and birds. Controlling the source of the spread is the first step in dealing with canola as a weed. Timely harvest of canola can reduce losses that occur with natural shattering or from bird feeding. Sealing cracks in equipment and covering the grain bed of trucks can help prevent seed loss when transporting grain between the field and the elevator.

Because canola is sensitive to many herbicides, it is fairly easy to control in succeeding crops such as wheat or double-cropped soybeans. Buctril and Harmony Extra effectively control canola in wheat if applications are made in the fall when canola plants are small. The use of 2,4-D may be preferred for controlling larger plants that have overwintered.

Although canola does not thrive well during the hot summer months there have been instances where plants have caused problems in no-till double-cropped soybeans. Potential problems may occur from seedlings or regrowth of harvested plants. Many soybean herbicides labeled for controlling wild mustard may also control canola.
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References


Canola Crop Profile and Pest Management Strategic Plan Meeting. March 4, 2010. Daviess County Extension Office. Owensboro, KY.


