SUCCESS STARTS FROM THE SEED. AND GROWS WITH A PLAN.

As the demand for canola rises worldwide, the industry has turned its focus to maximizing yield and quality on every acre. The target? 52 bu/ac by the year 2025. This goal has been set by the Canola Council of Canada with The Food and Agriculture Organization’s prediction that the world’s need for food will double by 2050 – with a major increase in food demand to 2025.

Collaborating with industry experts and organizations, our goal is to help you reach that target by providing some of the most innovative advice and tools on the market. Get the most out of your investment by harnessing the most trusted canola seed on the market and protecting its potential throughout the season.

Turn the page and take the first step to protecting and building a stronger, more successful canola crop this season.
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A HISTORY STEEPED IN GOLDEN INNOVATION.

A combination of the words “Canada” and “ola” (meaning oil), canola was bred by researchers from Agriculture and Agri-food Canada and the University of Manitoba. Today, canola is one of the most sought-after oils in the world.
Canola was Canada’s agricultural success story. And still is.

First developed in the 1970s by Canadian researchers, global demand for canola continues to rise – and with it, the relative value of the crop, driving its continued growth in acres. Canola makes up 25% of all farm cash receipts, making it our nation’s most valuable crop. As the third most exported grain in Canada, canola generates $26.7 billion in national economic activity and 250,000 jobs for Canadians annually. It’s not just Western Canada – the economic benefits are seen in every province.

http://www.canolacouncil.org/markets-stats/industry-overview/
Why the demand?  
It’s good for your heart.

Known for being one of the healthiest vegetable oils worldwide, canola oil is the lowest in saturated fats. It’s high in omega-6, omega-3 and monounsaturated fatty acids, which have been shown to reduce the risk of coronary heart disease and help regulate blood sugar levels.\(^4\) With heightened consumer awareness around healthy eating habits, many food manufacturers have replaced trans and saturated fats with healthier alternatives such as canola oil, further driving the expansion of the canola processing industry in North America.\(^5\)

![Dietary Fat Fatty Acid Content](http://canolagrowers.com/wp-content/uploads/2014/11/Canola_Glossy2010_1.pdf)
Celebrated worldwide, it’s got fans across the globe.

Approximately 90% of Canada’s canola is exported, whether as seed, oil or meal. China is the second largest export market for canola after the United States. With a ban on loose oils and fats in some Chinese cities, combined with a growing, health-oriented middle class, Chinese consumers are turning to packaged vegetable and seed oils. Canadian canola seed exported to China reached a record 4 million tonnes in the 2017 season and is projected to continue its rise.

Canola is in many things. Your coffee creamer is one of them.

With over 40% of the seed being oil, most exported canola seeds are crushed for that purpose. But the leftover high-protein meal is also used and sold in mash or pellet-form. Canola meal is one of the most traded protein ingredients for animal feed mainly due to its favourable amino acid profile. It’s mixed into feed for dairy and beef cattle, swine, poultry and even fish. Other than Canada, major canola meal producers include Australia, China, the European Union and India.

<table>
<thead>
<tr>
<th>Food products from canola oil:</th>
<th>Non-food products from canola oil:</th>
<th>Products from canola meal:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• High stability frying oil</td>
<td>• Cosmetics - lip gloss,</td>
<td>• Protein isolates for</td>
</tr>
<tr>
<td>• Margarine</td>
<td>creams, shampoo, soap,</td>
<td>human food</td>
</tr>
<tr>
<td>• Salad oil</td>
<td>lipstick, massage oils</td>
<td>• Livestock feed</td>
</tr>
<tr>
<td>• Cooking spray</td>
<td>Biodiesel</td>
<td>• Poultry feed</td>
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<tr>
<td>• Shortening</td>
<td>Dust depressants</td>
<td>• Pet food</td>
</tr>
<tr>
<td>• Liquid shortening</td>
<td>De-icer for airplanes</td>
<td>• Fish food</td>
</tr>
<tr>
<td>• Mayonnaise</td>
<td>Printing ink</td>
<td>• Fertilizer</td>
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<tr>
<td>• Sandwich spread</td>
<td>Suntan oil</td>
<td></td>
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<tr>
<td>• Coffee whitener</td>
<td>Antistatic for paper and</td>
<td></td>
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<tr>
<td>• Creamer</td>
<td>plastic wrap</td>
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<tr>
<td>• Cookies</td>
<td>Biodegradable greases</td>
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<td>• Crackers</td>
<td>Bioplastics</td>
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<tr>
<td>• Cake mixes</td>
<td>Industrial lubricants</td>
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<tr>
<td>• Bread</td>
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<tr>
<td>• Snack foods</td>
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</tbody>
</table>

Maximize potential at every stage.

Crop establishment, as well as insect, weed, disease and harvest management are five key areas growers need to focus on – each one is an opportunity to protect yield potential. Discover how you can tackle production challenges at every stage of your canola crop and maximize your returns.
Solutions for canola.

InVigor® canola hybrids will be treated with Prosper® Evergo®, a seed treatment which controls flea beetles and the most damaging diseases. Jumpstart® phosphate inoculant and/or DuPont™ Lumiderm® insecticide seed treatment are also available on all InVigor hybrids.
CROP ESTABLISHMENT
TAKE THE SEASON HEAD ON. EARLY ON.

A strong start is essential to achieving success. Take steps to prepare your canola for the challenges ahead, including nutrient management, seeding rates, hybrid choice and more. Lay down the foundations for a strong, uniform stand so you can maximize the potential of your inputs later in the season.
Feed your crop what it needs.

Every canola plant requires nutrients to survive, grow and handle stresses, including harsh environmental conditions, disease and more. For canola, there are 14 essential nutrients – 6 macros and 8 micros. These nutrients are often taken up from the soil, highlighting the importance of managing soil fertility both in the short-term and in the long-run.

Top 4 macronutrients.

<table>
<thead>
<tr>
<th>Macronutrient</th>
<th>Nitrogen (N)</th>
<th>Phosphorous (P)</th>
<th>Potassium (K)</th>
<th>Sulphur (S)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effects on canola</td>
<td>Results in increased growth for greater plant height, plant weight, along with more flowers, pods and seeds.</td>
<td>Builds starch and helps take up nutrients. P fertilizer can increase yield, protein and oil content in low-P soils.</td>
<td>Draw water into roots and prevents excessive water loss. Deficiency reduces growth and leads to uneven pod maturity.</td>
<td>Chlorophyll synthesis for leaf colour and photosynthesis. Deficiency can reduce branching, flower/pod size and number, seeds and seed weight.</td>
</tr>
<tr>
<td>Overall need</td>
<td>2 to 2.5 lb of available N per bushel.</td>
<td>1.3 to 1.6 lb of phosphate per bushel.</td>
<td>2.5 lb of K per bushel.</td>
<td>0.6 to 0.8 lb of S per bushel. Due to variability across fields, add 10 to 20 lb/ac regardless of soil test results.</td>
</tr>
</tbody>
</table>


Symptoms of nutrient deficiency.

From left to right: Nitrogen, phosphorus, potassium and sulphur deficiencies

The advantage of a targeted plant population.

Extensive research by BASF’s Agronomics Services team shows that a targeted plant population of 5 to 7 plants/ft² can help maximize the yield, performance and consistency of your InVigor hybrid canola. The benefits of implementing a targeted plant population include:

- Improved seedbed utilization
- More efficient use of available resources
- Elevated stress tolerance
- Increased plant productivity and yield performance
- Improved lodging resistance and lower sclerotinia incidence
- More even maturity and uniform plant structure

An optimal target plant population is achieved by considering thousand seed weight (TSW) and survivability and adjusting the seeding rate appropriately.

The targeted plant population of 5 to 7 plants/ft² produces the most consistently high-performing canola in fields. This number is not a set rule across all fields since field conditions vary and specific issues that arise in different fields may require an adjustment of these guidelines (e.g. A field that sees increased lodging at low plant populations will not see improved lodging resistance when raising their plant population in the field).
Problems seeding above the optimal rate.

Reduced survivability.
Increased intra-crop competition causes higher in-season mortality rates, whereby the seedlings will essentially choke each other out (reducing survivability).

Competition for resources.
Like weed competitors, canola plants in over-populated crops fight amongst themselves for available resources and do not significantly contribute to yield.

Lodging.
Plants are less robust, thinner and have weaker stems, leaving plants more susceptible to lodging.

Disease.
Lodging combined with an overly-dense crop canopy traps moisture, creating the perfect environment for sclerotinia to spread.

Stress tolerance.
Plants in an over-populated stand may be more susceptible to the negative impacts of heat stress and low moisture.
Problems seeding below an optimal rate.

Weed competition.
With an abundance of space and resources, lower plant populations allow weed competition to increase significantly.

Poor weed control.
Due to reduced crop competition, the effectiveness of herbicide applications are decreased.

Poor seedbed utilization.
Not fully utilizing the seedbed, inefficient use of resources such as moisture, nutrients, sunlight and space.

Delayed maturity.
Drastically affects the plant architecture, resulting in larger plants with uneven and delayed flowering and maturity.

Fungicide timing.
Difficult to stage for fungicide application, swathing and harvest.

No room for loss.
Leaves no room for plant loss throughout the season.

Result of seeding rate of 4 seeds/ft²
Low plant population causing weed escapes

Result of seeding rate of 10 seeds/ft²
Ideal plant population with better crop competition

Source: Product Excellence Trial, Cheadle AB. Results may vary on your farm due to environmental factors and preferred management practices.
Make every plant count.

Achieving your optimal plant population (5 to 7 plants/ft²) requires careful consideration of both your seeding rate and plant survivability. BASF recommends planting 10 seeds per square foot to target your ideal plant population. However, every field and season are different, so ongoing monitoring to understand the unique survivability of your fields is essential to your crop’s success.

Establishment and survivability counts.

STEP 1: Establishment count.

This count is performed at emergence. Simply count the number of plants in a linear foot of a row and measure row width.

Plant density is determined by:

\[
\text{PLANTS/FT}^2 = \frac{\text{AVERAGE # OF PLANTS IN LINEAR FOOT OF ROW}}{\text{ROW WIDTH (in.)}} \times 12
\]

STEP 2: Fall stubble count.

Survivability (number of plants that contribute to your yield) is determined from your fall stubble count after harvest. Simply count the number of canola stalks within a linear foot of a row and know your seeding rate.

Survivability is determined by:

\[
\% \text{ SURVIVABILITY} = \frac{\text{# OF PLANTS/FT}^2 \text{ (FALL STUBBLE COUNT)}}{\text{# OF SEEDS PLANTED} \text{ (SEEDING RATE (lbs./ac.) / TSW (grams) / 0.096)}} \times 100
\]

Survivability is dependent on more than just crop practices.

Pest pressures, unfavourable weather conditions and other crop stressors will have an influence on your crop’s survivability. When/if plant populations fall outside the ideal 5 to 7 plants/ft², adjust your seeding rate accordingly.

Common crop stressors and management areas.

<table>
<thead>
<tr>
<th>Biotic/living</th>
<th>Abiotic/mechanical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disease</td>
<td>Equipment calibration</td>
</tr>
<tr>
<td>Insects</td>
<td>Soil conditions</td>
</tr>
<tr>
<td>Weeds</td>
<td>Seeding depth and speed</td>
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<tr>
<td></td>
<td>Crop residue</td>
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<td></td>
<td>Fertilizer placement</td>
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</tbody>
</table>
Success starts the same way your season does. From the seed.

When evaluating the best hybrid(s) for your farm, there are a few things to consider, such as disease resistance, maturity, yield potential and other traits suitable for your fields.

Here are some factors to consider when choosing your next canola hybrid:

For over 22 years, growers have trusted InVigor hybrid canola as an integral tool in their crop rotation. InVigor hybrids have achieved this level of trust by constantly evolving with the ever-changing needs of the grower to consistently deliver top-performing yields and innovative solutions to their fields. These solutions come in the form of specialty hybrids, such as InVigor Health, hybrids that harness the patented Pod Shatter Reduction technology and hybrids that contain first and second generation clubroot resistance profiles.

Yield. Pick a hybrid that delivers consistent yields, even under stressed growing conditions. The Demonstration Strip Trials (DSTs) offer complete transparency with regards to how InVigor hybrids perform in different localized areas. Compare yield, ease-of-harvest and maturity ratings at InVigorResults.ca to make informed decisions on the hybrid that’s right for your field.

Disease. New blackleg- and clubroot-resistant hybrids offer robust resistance profiles to various disease pathotypes/races that could inhabit a single field.

Weeds. Rotating the herbicide mode of action within a field helps to manage volunteers and limit the risk of developing resistant weeds. Use an effective rotational chemistry such as Liberty® herbicide (Group 10) on InVigor hybrid canola to address both of these concerns.

Pod Shatter Reduction technology. Using an InVigor hybrid featuring the patented Pod Shatter Reduction technology provides the ultimate harvest flexibility. Whether you decide to straight cut or delay swathing, this trait allows you to balance your workload and reduce the potential for yield loss at harvest.

Standability. Good standability can help make your harvest easier and more efficient. Plus, less lodging helps reduce the risk of disease.

Maturity. Days to maturity is highly dependent on growing conditions and management practices. Use maturity ratings as guidelines to select the hybrids that are best for your region and crop plan.

Rotation. Follow at least a 1-in-3-year canola rotation. Tighter rotations increase disease and resistance pressures.

Contract premiums. Certain hybrids, such as InVigor Health, offer specialty contract premiums, increasing your opportunities for higher returns. Speak with your retailer for more information.
INSECT MANAGEMENT
A FINE CROP LIKE YOURS? EVERYTHING WANTS A BITE OF IT.

Insect pests can cause major crop losses if they aren’t managed properly. Insects can attack any part of the plant at any stage of development, which increases the risk of significant yield loss if insect populations are high. The first step to combatting insect infestations is identifying them.
Cycling through the stages.

There are several different stages of development insects go through to get from egg to adult. This process is known as ‘metamorphosis’, and there are two types:

**Incomplete metamorphosis.**

Insects that undergo incomplete metamorphosis go through three developmental stages: eggs, nymphs and adults.

Nymphs share the same body parts and body structure as adults, but they are smaller in size. They also lack functional wings and reproductive appendages.

**Complete metamorphosis.**

Insects that undergo complete metamorphosis go through four stages of development including eggs, larvae, pupae and adults.

Larvae feed on different hosts than adults. They go through four to five moulting stages known as instars, before they transform into pupae. Pupae are either covered by a protective case called a cocoon or exposed, and they’re typically hidden within or near the host plant.
The best of the worst:
Key insects you should know.

There are a number of insects that can appear in any canola field – some beneficial, some harmful. Insects not only damage crops, their feeding damage can create entrance points for disease. To manage detrimental insects, you’ll first need to recognize them in all their forms.

Each insect has a different economic threshold. Represented by the amount of crop damage inflicted through stem and leaf feeding or the number of insects in a given area, it marks the point where the yield benefits of an insecticide will balance out the costs of application. Any damage above the threshold will likely result in higher returns, if appropriate actions are taken.
Flea beetle.

*(Phyllotreta cruciferae and P. striolata)*.

**Identification.**
- **Mature larvae:** up to 6 mm long with whitish, slender body, brown head and 3 pairs of legs
- **Adults:** small, elliptical or oval-shaped, 2 to 3 mm long

There are two main types of flea beetles that attack canola in Western Canada:
- **Crucifer beetles** (*Phyllotreta cruciferae*) are shiny and bluish-black in colour
- **Striped beetles** (*P. striolata*) are black with two yellow waves

**Damage.**
- **Larvae:** feed on roots, but cause little damage
- **Adults:** feed on cotyledons, first true leaves, seedling stems and maturing pods
  - Stem damage can cause breakage, wilting and premature ripening under high populations
  - Damage to the first true leaves in the spring appears as shot holes, or tiny holes made by the insect as it feeds
  - While flea beetles may not do much on wet days, on cool and windy days they will move down to stems and keep feeding

**Economic threshold.**
- Consider a foliar insecticide when 25% of cotyledon leaves are damaged
- Threshold typically lower under drought conditions
- No current threshold for stem feeding, look for damage on small plants that likely won’t survive stem feeding
- **Scouting:** Start from field margins, examining emerging plants in the spring for shot-hole feeding damage to cotyledons and first true leaves

**Control.**
- Seed treatments and foliar insecticides can protect crops from damage
- Seed treatments are most effective because flea beetles emerge early and can migrate into seeded canola fields quickly
- Flea beetles need to take a bite(s) out of the canola plant to ingest the insecticidal seed treatment for them to be effective

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Source: Cranshaw, W., Colorado State University, Bugwood.org
Source: Agriculture and AgriFood Canada
Source: Saskatchewan Ministry of Agriculture
Source: Canola Council of Canada
Cutworms.

*(Agrotis and Euxoa spp.)*

**Identification.**

- Pale western and redbacked are most common; 1 generation per year

**Pale western cutworm.**

- **Larvae:** up to 40 mm long, pale to green-gray with yellow-brown heads, two vertical black dashes
- **Adults:** 19 mm long moth, light-gray forewings with indefinite markings, 38 mm wing span

**Redbacked cutworm.**

- **Larvae:** 38 mm long, reddish-brown stripe down the back, centre dark line bordered by a dark band on each side
- **Adults:** forewings are fawn to brick-red in colour, 40 mm wing span

**Damage.**

- Can reduce plant stand and yield potential when present at high populations
- **Young larvae:** eat into the stems and usually sever them at or just above the soil surface
- **Mature larvae:** move along rows cutting off leaves and severing plants below soil level
- **Adults:** feed on nectar of flowers

**Economic threshold.**

- A stand reduction of 25 to 30% appears to be the nominal threshold; more research is needed to determine accurate thresholds
- Scout seedlings every 3 to 4 days; noting bare patches, holes and notches in the leaves, plants that are wilted, cut or falling over
- Bare patches tend to appear first in areas that are warmer with lighter soil; check perimeter of bare patch for plants displaying symptoms and look for larvae in the top 5 cm of soil

**Control.**

- Apply insecticides in the late evening or at night as cutworms are nocturnal
- Infested fields should be sprayed before reseeding
Diamondback moth.

*(Plutella xylostella).*

**Identification.**
- **Larvae:** 8 mm in length, with a wider middle that tapers at each end
  - Green in colour, with two fork-like legs that extend backwards
  - Release a silken thread as they move, allowing them to drop off the edge of leaves
- **Adults:** moths are 12 mm long, with an 18 to 20 mm wingspan
  - When wings are closed, diamond shapes are evident on the back
  - Several generations per growing season, often overlapping

**Damage.**
- **Adults:** feed on flower nectar
- **Larvae:** new larvae tunnel inside leaves, emerge and chew on leaf surface creating shot holes
  - Feed on flowers, developing pods, and strip bark from stems and pods
  - Damage can affect seed quality and yield

**Economic threshold.**
- 100 to 150 larvae/m² in young and flowering canola
- 200 to 300 larvae/m² in podded canola
- **Scouting:** use pheromone traps to detect arrival of moths in the spring, scout in July and August for signs of damage or larvae

**Control.**
- Various foliar insecticides available, check provincial crop protection guides from Alberta Agriculture and Forestry, Government of Saskatchewan and Manitoba Agriculture
Swede midge.

(*Contarinia nasturtii* (Keiffer)).

Note: though swede midge is currently localized to Quebec/Ontario, a newly-identified related species has been identified in Western Canada. Its potential impact, lifecycle and proliferation are still being studied.

**Identification.**

- **Larvae:** initially semi-transparent and gradually turn yellow, 3 to 4 mm long
- **Adults:** light brown to gray flies with long legs and antennae, 1.5 to 2 mm long
- Up to 3 overlapping generations per year, depending on conditions
- Only 2 generations demonstrated in the Prairies

**Damage.**

- **Larvae:** feed on canola flowers at the end of stems, damaging growing points, preventing stem elongation from occurring and creating a ‘palm tree’ clustering effect of pods
- **Adults:** feed on flower nectar but don’t cause any damage

**Economic threshold.**

- No established economic threshold, possible in future years as collection and research continues
- **Scouting:** pheromone traps can be set from May to October to detect the presence of adults

**Control.**

- Insecticides available to control eggs, larvae and adults
- Recommended to avoid spraying because of overlapping generations and random distribution within the field
- However, if necessary, apply prior to bloom to prevent eggs from being laid and larval damage based on individual assessments

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Source: Cheung, D., Swede Midge Identification & Hallett, R., Swede Midge Damage, School of Environmental Sciences, University of Guelph

Source: Canola Watch
Cabbage seedpod weevil.

(*Ceutorhynchus obstrictus*).

**Identification.**
- **Larvae:** white coloured body, brown head, 3 pairs of legs, 2 to 3 mm long
- **Adults:** long narrow snout, 3 to 4 mm long, play dead when disturbed
- 1 generation per year

**Damage.**
- **Larvae:** feed on seed throughout development, making those pods prone to shattering and fungal infection
  - Larvae generally consume up to 5 seeds each
- **Adults:** feed on buds, flowers and pods causing bud blast, but with no large impact on yield

**Economic threshold.**
- 3 to 4 adults/sweep
- **Scouting:** walk in a W pattern and take 10, 180° sweeps at early bud to flowering

**Control.**
- If the economic threshold is reached, spray insecticide at 10 to 20% flower (when 70% of plants have a minimum of 3 to 10 open flowers on the main stem)
- Reduces egg laying in newly developed pods
- Ensure applications are made later in the day when bees and other beneficial insects are less active

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Source: Canola Council of Canada

Source: Government of Alberta

Source: Government of Alberta
Lygus Bug.

(*Lygus spp.*)

**Identification.**¹²

- **Nymphs:** smaller than adults but the distinctive ‘V’ is not visible
  - Five black dots on the thorax and abdomen
  - Beginning of wing growth is noticeable at the nymph stage
- **Adult:** pale green to reddish-brown in colour, 6 mm long
  - Characteristic yellow V-shape on their back
  - 2 generations per year in Southern Prairies but only 1 in northern areas

**Damage.**

- **Both immature nymphs and adult bugs:** feed on new growth and reproductive plant parts (flower buds, seeds and pods)
  - Inject a toxin that causes shriveling and chalk spot on seed, decreasing seed quality
  - Typically move from cut alfalfa or hay fields and find refuge in crop fields where they feed and reproduce

**Economic threshold.**

- Varies from province to province; consult government extension websites
- **Scouting:** monitor canola when bolting begins until seeds are firm; take ten 180° sweeps of buds, flowers and pods at 15 sites; record cumulative total number of lygus bugs per sweep

**Control.**

- An insecticide application is recommended when economic threshold is reached
- Apply at the end of flowering or at the early pod stages

---

1. Lygus spp.
2. Identification:
   - Nymphs: smaller than adults but the distinctive ‘V’ is not visible
     - Five black dots on the thorax and abdomen
     - Beginning of wing growth is noticeable at the nymph stage
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3. Damage:
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4. Economic threshold:
   - Varies from province to province; consult government extension websites
   - Scouting: monitor canola when bolting begins until seeds are firm; take ten 180° sweeps of buds, flowers and pods at 15 sites; record cumulative total number of lygus bugs per sweep

5. Control:
   - An insecticide application is recommended when economic threshold is reached
   - Apply at the end of flowering or at the early pod stages
Bertha armyworm. 
(Mamestra configurata (Walker)).

Identification.\textsuperscript{12}
- \textbf{Larvae}: 44 mm long, velvety black caterpillars with a light brown head and broad, yellowish-orange stripe along each side 
  - Occasionally light green or light brown
- \textbf{Adults}: 20 mm long, greyish body with 40 mm wing span, characteristic markings on the forewing, white, kidney-shaped marking near the midpoint 
  - 1 generation per year

Damage.
- \textbf{Larvae}: ‘debark’ canola pods or consume seeds or entire pod in canola 
  - Severely stripped pods may prematurely shatter and crop appears frosted due to damage
- \textbf{Adults}: moths feed on flower nectar

Economic threshold.
- Thresholds are provided on government websites and depend on cost of insecticide used and canola price 
- \textbf{Scouting}: when canola is in the early pod stage, count the number of larvae in a 0.25 m\textsuperscript{2} area in at least three different locations, taking care to inspect soil and leaf litter

Control.
- Apply insecticides mid-morning or early evening
- More larvae will be exposed feeding at the top of the canopy
Root maggot.

(*Delia* spp.).

**Identification.**
- **Larvae:** 8 mm long, whiteish maggots
- **Adults:** 4 to 6 mm long, light grey flies; wings overlap when at rest

**Damage.**
- **Larvae:** feed on roots of seedlings and developing plants
  - Mature larvae create tunnels on or into tap roots, causing lower leaves to turn yellow
  - Damage may promote diseases such as blackleg
  - Heavy infestations can delay blooming, cause severe lodging and yield losses
  - Infested canola roots are often darker than normal roots
  - Infestations and damage are more severe under cool, damp soil conditions
- **Adults:** feed on flower nectar

**Economic threshold.**
- None established

**Control.**
- No chemical products registered in Canada
Best ways to get the bugs out.

Effective insect management relies on accurate timing and the selection of the most economical, effective and environmentally sound methods of pest control, before, during and after pests emerge.

**Change up your strategies.**
The less frequent a specific insecticide mode of action is used, the longer it will take the insect population to shift towards a resistant one. Some insects have multiple hosts across major crop groups. Use cultural practices like crop rotation, beneficial insects, weed control and when available, biological controls.

**Accurate identification of pests, pest damage and natural enemies.**
There is no single solution for all pests. Identify which pests are present and at what infestation level before choosing a management method.

**Use recommended rates at economic thresholds.**
Ensure spraying is timed accurately and applied at the correct rates to target the most vulnerable stage of the pest when economic thresholds are reached.

**Be cautious of beneficial pollinators.**
Provide nearby beekeepers 48 hours’ notice before applying an insecticide. Spray at dawn or dusk when honeybees are not foraging. Communicate with beekeepers through the BeeConnected® app at [http://croplife.ca/beeconnected-app](http://croplife.ca/beeconnected-app). Pay attention to any non-pest insects during scouting to assess the level of natural pest predators to determine the need for a foliar insecticide.
Canola insect management.  
At a glance.

<table>
<thead>
<tr>
<th>Insect</th>
<th>Seed Treatment</th>
<th>Foliar Insecticide</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Belowground and surface feeders</td>
<td></td>
</tr>
<tr>
<td>Cutworms</td>
<td>Fortenza®, Lumiderm</td>
<td>Coragen®, Decis® 5EC, Matador®, Pounce®/Perm-UP®, Ambush®, Lorsban®</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sap and fluid feeders</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lygus bugs</td>
<td></td>
<td>Decis 5EC/Poleci™, Matador/Silencer®, Voliam Xpress®, Lorsban</td>
</tr>
<tr>
<td>Swede midge</td>
<td></td>
<td>Coragen, Matador/Silencer</td>
</tr>
<tr>
<td></td>
<td>Defoliators</td>
<td></td>
</tr>
<tr>
<td>Cabbage seedpod weevil</td>
<td>Matador/Silencer, Decis 5EC/Poleci (for adult control only), Voliam Xpress</td>
<td></td>
</tr>
<tr>
<td>Diamondback moth</td>
<td>Coragen, Decis 5EC/Poleci, Matador/Silencer, Voliam Xpress, Malathion 500, Malathion 85E, Lorsban</td>
<td></td>
</tr>
<tr>
<td>Bertha armyworm</td>
<td>Coragen, Decis 5EC/Poleci, Mako®, UP-Cyde®, Matador/Silencer, Voliam Xpress, Lannate®, Lorsban</td>
<td></td>
</tr>
<tr>
<td>Crucifer flea beetle and/or striped flea beetle</td>
<td>Helix® Vibrance®, Prosper EverGol, Lumiderm, Fortenza, Visivio™, Nipsit Inside® 600, Gaucho® CS FL, Sombrero®</td>
<td>Decis 5EC/Poleci, Mako, UP-Cyde, Matador/Silencer, Pounce, Ambush, Voliam Xpress, Malathion 500, Malathion 85E</td>
</tr>
</tbody>
</table>

Source: Adapted from Insect Control, Guide to Crop Protection, Government of Saskatchewan, 2017
Scouting Schedule by Plant Growth Stage

<table>
<thead>
<tr>
<th>Pre-seed/Seedling</th>
<th>Seedling</th>
<th>Rosette</th>
<th>Budding</th>
<th>Flowering</th>
<th>Ripening</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Bertha armyworm $m^2$</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Cabbage root maggot</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Cabbage seedpod weevil</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Cutworms</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Diamondback moth</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Flea beetles</td>
<td>Flea beetles</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Grasshopper $m^2$</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Lygus bug</td>
</tr>
</tbody>
</table>

- **Plant counts** – The number of insects per canola plant
- **$m^2$ Area insect count** – The number of insects/metre$^2$
- **Sweep net count** – Using a 38 cm diameter net, sweep a full 180° arc 10 times/100 acres
- **Root zone inspection** – Look for insects near roots or on plants
- **Percentage defoliation** – Percentage of area eaten away

WEED MANAGEMENT
TAKE WEEDS OUT OF THE EQUATION. AND ADD YIELD.

Providing a weed-free period during early canola development, from emergence through to the 6-leaf stage, allows the crop to maintain yield potential free of competition. Discover strategies for managing weeds and minimize the risk of resistance.
Eliminate the competition.

Weed pressure of any kind has the potential to significantly reduce yield. The presence of weeds means the crop will be competing for resources including moisture, light and nutrients. Weeds can also host insects and diseases that can affect crop growth and reduce quality at harvest.

The usual suspects.

Prevalent weeds in Western Canada.

- Cleavers
- Chickweed
- Cow cockle
- Downy brome grass
- Green foxtail
- Hemp-nettle
- Kochia
- Lamb’s quarters
- Wild mustard
- Narrow-leaved hawk’s beard
- Persian darnel
- Redroot pigweed
- Russian thistle
- Shepherd’s-purse
- Pale smartweed
- Sow thistle
- Wild buckwheat
- Wild oats

With 65 unique cases, Canada has the 3rd highest number of resistant weeds.

Stay ahead of resistance to stay on top of your game.

Reducing the risk of developing herbicide-resistant weeds should be a priority on every farm. Resistance occurs through the repeated application of herbicides on the same field, using the same modes of action from the same herbicide group. Rotating chemistries and using tank mixes with more than one mode of action are essential to slowing the development of weed resistance. To target weeds that have already developed resistance, use effective modes of action that the weed isn’t resistant to.

- Natural mutations occur that confer resistance to a specific herbicide or herbicide mode of action
- Over time, susceptible weeds are eliminated while resistant weeds survive after an application of the same herbicide or mode of action. These resistant biotypes then propagate and create the next generation
- Eventually the majority of the weed population is no longer controlled by that herbicide or mode of action
- Liberty herbicide is a Group 10 chemistry and is applied exclusively as an in-crop herbicide to InVigor hybrid canola, making it a strong choice for managing herbicide resistance

Herbicides have been used commercially for over 60 years. The number of resistant weed species has been increasing since the early 1970’s. We will continue to see more herbicides become ineffective against certain weeds if multiple modes of action are not incorporated onto every farm along with cultural techniques that disrupt the lifecycle of the weed population. The most effective means of reducing resistance development is to use an integrated weed management approach, since resistance development cannot be managed through herbicides alone.

![Global increase in resistant weeds.](http://weedscience.org/Graphs/ChronologicalIncrease.aspx)
### Herbicide-resistant weeds in Western Canada.

<table>
<thead>
<tr>
<th>Resistant Weed</th>
<th>Herbicide Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ball mustard</td>
<td>2</td>
</tr>
<tr>
<td>Chickweed</td>
<td>2</td>
</tr>
<tr>
<td>Cleavers</td>
<td>2</td>
</tr>
<tr>
<td>Cow cockle</td>
<td>2</td>
</tr>
<tr>
<td>Green foxtail</td>
<td>1, 2, 3</td>
</tr>
<tr>
<td>Hemp-nettle</td>
<td>2, 4</td>
</tr>
<tr>
<td>Kochia</td>
<td>2, 4, 9</td>
</tr>
<tr>
<td>Lamb’s quarters</td>
<td>2</td>
</tr>
<tr>
<td>Narrow-leaved hawk’s beard</td>
<td>2</td>
</tr>
<tr>
<td>Persian darnel</td>
<td>1</td>
</tr>
<tr>
<td>Powell amaranth</td>
<td>2</td>
</tr>
<tr>
<td>Redroot pigweed</td>
<td>2</td>
</tr>
<tr>
<td>Russian thistle</td>
<td>2</td>
</tr>
<tr>
<td>Shepherd’s-purse</td>
<td>2</td>
</tr>
<tr>
<td>Smartweed</td>
<td>2</td>
</tr>
<tr>
<td>Spiny sowthistle</td>
<td>2</td>
</tr>
<tr>
<td>Stinkweed</td>
<td>2</td>
</tr>
<tr>
<td>Wild buckwheat</td>
<td>2</td>
</tr>
<tr>
<td>Wild mustard</td>
<td>2, 4, 5</td>
</tr>
<tr>
<td>Wild oat</td>
<td>1, 2, 8</td>
</tr>
</tbody>
</table>

The weed pressure is on. Make sure you’re ready.

Before deciding on a management plan, know the type and level of weeds in a field. Scout your fields in a W pattern and stop periodically to assess the weeds present. Watch for any herbicide-resistant species that might be present, keeping detailed records of the weeds, the herbicides used and the percent control achieved. You can now easily identify weeds and leaf disease present in your field just by taking a photo with the xarvio™ SCOUTING application, downloadable for free from the App Store® or Google Play®.

Determine weed pressure before making control decisions.

Do you have resistance on your hands?

First, rule out other factors such as spray misses or uneven application, unfavourable weather conditions, missed herbicide timing or flushing weeds (after a non-residual herbicide). Then go through this checklist:

- The herbicide controlled other weed species on the label
- There are discrete patches of the weed species in question
- There are dead weeds next to live weeds of the same species
- This herbicide, or herbicides with the same mode of action, have been used on this site for more than five years
- This species was controlled effectively in the past by this herbicide
- The same herbicide, or a herbicide with the same mode of action, failed in the same area of the field in the previous year

If any of these boxes were checked off, plant samples should be sent in for testing.
Integrate this into your approach.

With more resistant biotypes appearing every year, an effective management strategy integrates herbicidal control with different agronomic practices to help your crop outcompete the weeds. By using several different techniques, weeds are less likely to adapt and grow beyond our control.

Outcompete the weeds.
Target a plant population of 5 to 7 plants/ft² to reduce competition from weeds and ensure optimal efficacy of herbicide applications.

Vary seeding dates.
Seeding early in soils that are at least 5°C helps outcompete weeds that benefit from more growing degree days, such as green foxtail, lamb’s quarters and kochia. Though not ideal to the crop, delaying seeding may improve herbicide efficacy in fields heavily affected by cool-season weeds, such as wild oats and stinkweed.¹³

Use clean equipment.
This will help prevent the transfer of resistant weeds from one field to the next.

Fertility.
Compared to broadcast, banded nitrogen fertilizer is less available to weed seedlings.¹³ Ensure adequate levels of essential nutrients to encourage a competitive stand (see pg.12 for more).

Insect and disease management.
All InVigor hybrid canola comes with a seed treatment that protects against cutworms and flea beetles, with the option to add other seed treatments if there are other specific concerns.

Manage weeds in a timely manner.
Use an effective burndown that uses multiple modes of action (MOA) to start with clean fields. With the option to apply Liberty twice in crop, it is encouraged the first application be at the 2- to 4-leaf stage, and the second 10 to 14 days later in fields with high weed pressure or with later-emerging weed flushes. In fields where you have cleavers pressure, it is recommended to tank mix Facet™ L herbicide with Liberty for enhanced cleavers control.

Rotate crop types with modes of action.
Include a variety of different crop types, such as cereals, pulses and forage crops to switch up your herbicide chemistry and the weeds controlled.

Apply at full label rates.
A common pitfall, applying herbicides at reduced rates increases the chances of weed survival and in turn, increases the risk of resistance. Apply at correct timings and with correct water volumes. Liberty, Facet L and Centurion® herbicides provide flexible application rate options for more adaptable management practices.
Use multiple modes of action (MOA) and rotate them.

Rotate into different MOAs both within and between seasons. Rotating within a season helps control weeds that escaped burndown and managing them before they set seed. Use active ingredients with overlapping activity to avoid placing selection pressure on a single chemistry. Not all herbicides are suitable for all crops. The more resistance develops, the fewer options we have for cropping and weed control. If resistance isn’t kept in check, our need for multiple chemistries will only grow and potentially lead to higher costs.

Don’t let these volunteers come forward.

Volunteer canola from herbicide-tolerant (HT) systems present a management challenge that’s similar to herbicide resistance, in that the original system herbicide is not a control option. In tighter rotations, this can become a difficult problem unless alternative herbicides are introduced, since volunteers not only lower yield quality and grade, but can also act as an alternate host for disease and insects. Using an effective pre-seed herbicide helps to control these volunteers so that they don’t present management, pest and yield issues later in the season.

Maintaining a productive crop, especially under tighter canola rotations, requires a plan that includes managing volunteer canola. Canola seed left behind because of pod shatter or combine losses can remain viable in a field for two or more years.

Estimating canola yield losses from volunteer canola (using wild mustard).

Using wild mustard (a similar species to canola) as a stand-in, we can estimate how much yield is lost based on volunteer density. At 5 wild mustard plants per m², canola can lose 15% of its yield. Left uncontrolled, volunteer canola can reduce both yield potential and quality.

![Graph showing yield loss percentage based on weed density (wild mustard plants per m²)]

The targets? Integrity, yield and quality.

Volunteer canola is considered a weed. As second-generation canola, they yield less than the original hybrids,\textsuperscript{14} while stealing resources away from the current crop. Because canola volunteers appear in flushes, they are left unprotected by crop inputs, becoming hosts to insects and diseases that can be transferred to the healthy, new crop.

Canola volunteers can also introduce undesirable traits through cross-pollination and seed contamination. Undesirable traits include altered oil content of specialty canola and the potential for multiple resistance, producing volunteer canola with stacked herbicide tolerance. Volunteer canola varieties that are not from the seeded crop can impact marketability after harvest.
Defend your canola.

Managing volunteer canola is similar to managing other weeds – within an integrated pest management plan (IPM). In addition to the strategies mentioned earlier (see pg. 40), here are several things you can do to specifically target volunteer canola:

Look for volunteer canola.
Scout after emergence and look for early-germinating volunteers. Volunteer canola will typically be seen emerging between the rows at a different stage from the crop. Dig up any suspected seedlings. If there is no coloured seed coat, it means you have a canola volunteer. Scout during harvest for swath shattering or combine spreader patterns with seeds in them. Be diligent at field edges, roadsides and adjacent fields when scouting.

Manage harvest/swath timing.
Use proper settings to reduce canola losses from the combine. Allow fall germination of any canola seed on the soil surface after harvest, to reduce their chances of survival.

Get them while they’re young.
When spraying, spray early, as younger plants are more easily controlled. Choose an effective burndown or post-harvest application.
Liberty herbicide: Resistant weeds beware.

As weed management has become increasingly complex, the LibertyLink® system provides a simple solution to effectively control weeds and reduce herbicide resistance development.

Liberty herbicide harnesses a Group 10 mode of action for exceptional control of tough weeds, including some Group 1-, 2-, and 9-resistant weeds.

• Dependable, fast, broad-spectrum control of grassy and broadleaf weeds
• Exceptional crop safety, with no follow-crop restrictions
• Versatile rate range
• Flexible application timing

InVigor hybrid canola is tolerant to Liberty at all growth stages but for maximum yield, controlling weeds early is recommended.

Spray your best with Liberty herbicide.

1. Maintaining sufficient water volumes is critical with a contact herbicide. Spray Liberty with a minimum 10 gallons per acre for good contact and optimal coverage.

2. For control of difficult grassy weeds such as wild oats, foxtail barley, volunteer barley and others, include Centurion herbicide in your Liberty tank mix.

3. Liberty performs best when applied on relatively warm (10°C or more) and sunny days. Cloudy skies, windy conditions or days that are either excessively wet or dry can hinder product performance.

4. For optimal coverage, nozzle selection and droplet size are critical. Aim for medium to coarse droplets of 20 to 350 microns.

5. If considering a two-pass system, take the second pass in the reverse direction. Using the same tracks, go back through your crop to target any foliage that could have been sheltered during the first pass.

6. Keep it slow. While the temptation is there to get everything covered as quickly as possible, spraying too quickly can drastically reduce control. Keep your sprayer speeds under 15 mph to avoid drift and keep control.
Team up against the toughest offenders.

**Facet L herbicide.**

Cleavers are notorious for lowering canola yield and quality. As an excellent tank-mix partner with Liberty, Facet L provides a mode of action that targets cleavers in canola (Group 4 and 26).

- Compliments Liberty herbicide for enhanced control of cleavers
- Easy-to-use liquid formulation

---

Enhanced cleavers control when tank mixed with Liberty.

Enhanced cleavers control with Liberty + Facet L compared to Liberty alone.

<table>
<thead>
<tr>
<th>% Control</th>
<th>LIBERTY + FACET L</th>
<th>LIBERTY</th>
</tr>
</thead>
<tbody>
<tr>
<td>90</td>
<td>87</td>
<td>59</td>
</tr>
</tbody>
</table>

Source: BASF RCD Trials

**Facet L applied in-crop.**

Facet L applied in-crop, 53 days after application.

Source: BASF grower trials, 2018

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**Centurion herbicide.**

Enhance your grassy weed control by pairing Centurion with Liberty.

- Compliments Liberty herbicide for enhanced grassy weed control
- No follow-crop restrictions
- Excellent tank-mix partner that can be mixed with Liberty and Facet L
CANOLA DISEASES ARE PERSISTENT. BUT SO ARE OUR SOLUTIONS.

Disease is something growers need to think about every year, especially as rotations tighten with canola and other broadleaf crops that host similar diseases. Blackleg, sclerotinia and clubroot are three diseases with potential to cause severe yield loss in canola. Learn how to identify and scout for signs of disease in the field and approaches that can help protect your investment.

Blackleg, sclerotinia and clubroot are three of the most impactful diseases in Western Canada affecting canola yield potential and crop quality. Learn about their life cycles and impact on crops, as well as strategies for scouting and measurement for effective management. But how do you differentiate between them? This table will tell you how.

<table>
<thead>
<tr>
<th></th>
<th>Blackleg</th>
<th>Sclerotinia</th>
<th>Clubroot</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pathogen</strong></td>
<td><em>Leptosphaeria maculans</em></td>
<td><em>Sclerotinia sclerotiorum</em></td>
<td><em>Plasmodiophora brassicae</em></td>
</tr>
<tr>
<td><strong>Visual symptoms</strong></td>
<td>Lesions on cotyledons, leaves, stems and pods.</td>
<td>Soft, watery rot on leaves or stems.</td>
<td>Irregular club-like galls on roots.</td>
</tr>
<tr>
<td></td>
<td>Leaf spots are dirty-white, roundish and spotted with pepper-like pycnidia.</td>
<td>Bleached, whitish appearance on stems. Split stems reveal round or cylindrical, seed-like sclerotia.</td>
<td>Early-season infection; appears heat- or drought-stressed.</td>
</tr>
<tr>
<td></td>
<td>Dry rot or cankers at base of stem.</td>
<td>Bleached stems with whitish appearance.</td>
<td></td>
</tr>
<tr>
<td><strong>Crop symptoms</strong></td>
<td>Severe cankers at stem base can girdle stem after flowering, and sever, resulting in lodging.</td>
<td>Severely infected, girdled stems wilt, ripen early and are straw-coloured in a crop that is otherwise green.</td>
<td>Wilting, stunted growth, yellowing or premature ripening and shriveled seed.</td>
</tr>
<tr>
<td><strong>Fungicide application</strong></td>
<td>Before symptoms appear. 2 to 6 leaf.</td>
<td>Before symptoms appear. 20% to 30% flowering, but can be applied up to 50% flowering.</td>
<td>No fungicide registered for control of clubroot.</td>
</tr>
<tr>
<td><strong>Scouting</strong></td>
<td>Begin scouting at cotyledon to determine if a problem exists and a fungicide is necessary.</td>
<td>Scout for moist conditions within the crop canopy and soil surface.</td>
<td>Scout for areas of premature ripening or thin canola. Pull plants in potentially infected areas to look for characteristic gall formations.</td>
</tr>
<tr>
<td></td>
<td>Scout at late flowering through swathing (prior to harvest), as several other diseases are often misdiagnosed as blackleg at this stage.</td>
<td>Scout in neighbouring fields where canola was grown the year prior to potentially identify apothecia.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Best time to scout is during cutting, either at swathing or at harvest if straight cutting.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Resistant varieties</strong></td>
<td>Resistant hybrids available.</td>
<td>A few hybrids provide varying levels of sclerotinia suppression are available.</td>
<td>Resistant hybrids available.</td>
</tr>
</tbody>
</table>


In the fall, blackleg, sclerotinia and clubroot can cause premature ripening. When severe, these diseases can cut off nutrient flow up the stem, producing a dead plant and increased lodging. Management requires identification of the correct disease.

**Know the difference between sclerotinia, blackleg and clubroot.**

**SCLEROTINIA**
- Sclerotinia on stem at harvest time.
- Sclerotia inside stem.

**BLACKLEG**
- Vascular tissue infection and cankers due to blackleg.

**CLUBROOT**

Sources:
A. BASF Canada, AB, 2017
B. Canola Council of Canada
C. Canola Council of Canada
D. BASF Canada, SK, 2015

Source: Hwang, S-F., Alberta Agriculture and Rural Development
Blackleg is adapting. So are the solutions.

Before the introduction of blackleg resistance genetics in the 1990s, blackleg was a common disease in canola. Between 1978 and 1981 the incidence of blackleg increased significantly and by the mid 1980s, it had become widespread across Canada. With the rise in canola demand and shortened rotations, blackleg is shifting towards increasingly virulent blackleg pathotypes. In order to manage these shifting populations, hybrids continue to be developed with both major and minor gene resistance.

What does genetic resistance mean?
Canola hybrids are rated for blackleg resistance by comparing them to one of the most susceptible varieties, Westar. Because ratings are relative, varieties that achieve an “R” resistant rating are simply less prone to infection – not immune.

There are three terms commonly used to describe the blackleg infection.

**Prevalence.**
Percentage of surveyed fields containing the disease.

**Incidence.**
Percentage of plants that are infected within a field.

**Severity.**
An estimate of the degree of infection using only the infected stems collected, based on a pre-established rating scale.

Resistance genetics generally fall under two categories:

**Major gene resistance** (aka seedling resistance) – occurs at the site of initial infection on the cotyledons or leaves to limit the spread of the disease. The canola genes involved recognize specific genes in the fungal pathogen to initiate the defense response. These genes are specific to each blackleg pathotype and if used alone induces high level of selection pressure.

**Minor gene resistance** (aka adult plant resistance) – occurs later during the formation of cankers to slow down the disease. There are multiple plant genes involved, each having a relatively small but additive effect on the pathogen. This type of resistance is more robust and reduces selection pressure on major genes since the genes are active across pathotypes.
Learn to recognize blackleg.

Yield loss is greatest when blackleg establishes during the early stages of crop development, from cotyledon to 3- and 4-leaf stages. Small greyish-white lesions form on the leaves, appearing round to irregular in shape. The centre of the lesion is often dotted with small, black fruiting bodies called pycnidia that look like black pepper. Similar lesions appear on the stems and eventually form sunken cankers with a dark black border.

Keeping an eye on blackleg.

Blackleg vs. grey stem.  
L: Blackleg  R: Grey stem  
Source: Kutcher, H.R.

Stem lesions.  
Source: AgSolutions Performance Trials, Western Canada, 2010

Interior stem cankers.  
Source: AgSolutions Performance Trials, Western Canada, 2010

Leaf lesions dotted with pycnidia.  
Source: BASF Canada, 2016
Don’t let blackleg slip under the radar.

Scouting for blackleg should begin before seeding starts and continue through the growing season. Growers should be looking for pseudothecia on old canola residue before seeding, and scout continuously through the growing season, starting as early as cotyledon, for leaf and stem lesions.

To determine the incidence and severity of blackleg in your field, the best time to scout is in the fall at or just before swathing or straight cutting. Pull up at least 50 plants in a W pattern described below. Clip at the base of stem/top of root and look for blackened tissue inside the crown of the stem. Use the 0-5 blackleg disease rating system to identify the incidence and severity of the disease to identify the risk and best management practices for the field in following years.

Ensure the identification of blackleg is not mistaken for any diseases that may look similar by consulting identification images.

Scouting at maturity.

Canadian researchers have identified the correlation between blackleg incidence, severity and yield loss. The results show that seed yield per plant was lowered by 1.8g for each unit-increase in blackleg severity (on a scale of 0 to 5) – that’s equivalent to a 17% reduction in yield per unit increase.16 The best time to determine severity is by scouting at maturity.

Potential yield loss in bushels per acre.

<table>
<thead>
<tr>
<th>Blackleg Severity of Infected Plants</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>15%</td>
<td>0.9</td>
<td>1.8</td>
<td>2.7</td>
<td>3.6</td>
<td>4.5</td>
</tr>
<tr>
<td>30%</td>
<td>1.8</td>
<td>3.6</td>
<td>5.4</td>
<td>7.2</td>
<td>9</td>
</tr>
<tr>
<td>45%</td>
<td>2.7</td>
<td>5.4</td>
<td>8.1</td>
<td>10.8</td>
<td>13.5</td>
</tr>
<tr>
<td>60%</td>
<td>3.6</td>
<td>7.2</td>
<td>10.8</td>
<td>14.4</td>
<td>18</td>
</tr>
<tr>
<td>75%</td>
<td>4.5</td>
<td>9</td>
<td>13.6</td>
<td>18</td>
<td>22.5</td>
</tr>
<tr>
<td>90%</td>
<td>5.4</td>
<td>10.8</td>
<td>16.2</td>
<td>21</td>
<td>27</td>
</tr>
</tbody>
</table>

Source: Streikov, S.E., Hwang, S.F., Lange, R., Peng, G. Development of a blackleg yield loss model and assessment of fungicide resistance in Western Canadian populations of *Leptosphaeria maculans*.
Measuring blackleg.
Severity is rated from 0 to 5 – from no infection to 100% infection of the stem.

<table>
<thead>
<tr>
<th>Image</th>
<th>Disease Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Image" /></td>
<td>0</td>
<td>No diseased tissue viable in the cross section.</td>
</tr>
<tr>
<td><img src="image2.png" alt="Image" /></td>
<td>1</td>
<td>Diseased tissue occupies 25% or less of cross section.</td>
</tr>
<tr>
<td><img src="image3.png" alt="Image" /></td>
<td>2</td>
<td>Diseased tissue occupies 26%-50% of cross section.</td>
</tr>
<tr>
<td><img src="image4.png" alt="Image" /></td>
<td>3</td>
<td>Diseased tissue occupies 51%-75% of cross section.</td>
</tr>
<tr>
<td><img src="image5.png" alt="Image" /></td>
<td>4</td>
<td>Disease tissue occupies &gt;75% of cross section with little or no constriction of affected tissue.</td>
</tr>
<tr>
<td><img src="image6.png" alt="Image" /></td>
<td>5</td>
<td>Diseased tissue occupies 100% of cross section with significant constriction of affected tissue; tissue dry and brittle, plant dead.</td>
</tr>
</tbody>
</table>

Source: Canola Council of Canada. Photo Credit: Peng, G., Agriculture and Agri-Food Canada, Saskatoon

A score of 5 indicates the plant has essentially died as a result of nutrients being blocked from travelling up the stem. If crops seeded with a blackleg-resistant variety show ratings of 1 or more, a fungicide application should be planned to help reduce yield loss from disease. You can also scout at other stages although identification may be more difficult.
Strategies for controlling blackleg.

1. **Scout for blackleg.**
   Understand what you have. If blackleg has not been an issue on your farm, continue to use the hybrid that has the best agronomic fit for your field.

2. **Lengthen rotations.**
   Maintain a break between canola crops to allow time for crop residue to decompose. If blackleg becomes established in the field, a minimum break of two to three years is recommended in addition to other management strategies.

3. **Adopt newest R-rated hybrids.**
   If blackleg becomes established in the field, grow hybrids that have been tested against the latest blackleg populations for robust protection.

4. **Use a fungicide for blackleg.**
   Apply a blackleg fungicide in the spring if blackleg is a concern. Chemistry can be an excellent resistance management tool to support genetics.

**Blackleg disease cycle.**

Source: Canola Council of Canada
At risk for blackleg? Add Nexicor into the mix.

Applied from the 2- to 6-leaf stage, with the option to tank mix with your herbicide, Nexicor™ fungicide combines three powerful modes of action to deliver a new level of blackleg management. It builds on the proven benefits* of AgCelence® to increase growth efficiency and to help better manage minor stress, leading to greater yield potential and improved profitability.** It’s the ideal addition to any integrated disease management plan when necessary.

See the difference Nexicor can make.

**Active ingredients**
- Pyraclostrobin – Group 11
- Fluxapyroxad – Group 7
- Propiconazole – Group 3

**Formulation**
Emulsifiable concentrate

**One case contains**
- 2 x 8.0 L jugs

**Storage**
- Store above 0°C.

Source: AgSolutions® Performance Trials, 2016

Once infected, fungicides cannot completely eradicate disease. An early, preventative blackleg fungicide application has been shown to reduce the incidence and severity of infection.

**Nexicor return on investment.**

<table>
<thead>
<tr>
<th></th>
<th>Untreated</th>
<th>Treated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incidence</td>
<td>81%</td>
<td>56%</td>
</tr>
<tr>
<td>Average severity</td>
<td>2</td>
<td>1.7</td>
</tr>
<tr>
<td>Potential yield loss</td>
<td>Loss of 9.8 bu/ac†</td>
<td>Loss of 5.7 bu/ac‡</td>
</tr>
<tr>
<td></td>
<td>Saved 4.1 bu/ac with fungicide.</td>
<td></td>
</tr>
</tbody>
</table>

† Based on 35 bu/ac yield, from a Southern Saskatchewan operation. Source: AgSolutions Performance Trials, SK, 2016

‡AgCelence benefits refer to the active ingredient pyraclostrobin. ** All comparisons are to untreated, unless otherwise stated.
Don’t let sclerotinia run wild. Stay in control.

Sclerotinia is another important disease that affects canola. It can be very destructive, causing yield reductions of up to 50% or more. The disease can live in the soil for five years or more, building up year after year, and waiting to germinate in ideal conditions. Even in drier weather it can be a problem, as improved canola genetics have led to thicker canopies, which create the ideal environment for the fungus to germinate.

Expected yield losses due to sclerotinia.

The sclerotinia fungus spreads inside the stem, causing girdling and wilting. This results in premature ripening, leading to smaller and fewer seeds, pod shatter and loss of lighter seed during combining. That’s a hit to both yield and quality. Plus, excessive lodging can spread infection through stems that contact one another and hamper straight cutting, reducing both productivity and efficiency at harvest.

A sclerotinia fungicide protects yield potential in canola under all weather conditions, with its most pronounced benefits being in above average precipitation environments—when disease development is at its highest risk.
The basics of sclerotinia.

Sclerotinia stem rot in canola is caused by the fungus *Sclerotinia sclerotiorum*. It overwinters as small black bodies called sclerotia in soil and field stubble, and they can also be found mixed with seed. It can remain in the field for up to 5 years, germinating when conditions are right to form spore-bearing structures called apothecia.

Apothecia are small golf-tee shaped mushrooms about 5 to 15 mm in diameter, usually clumped in groups just above the soil. They can release millions of tiny ascospores, which are carried several kilometres by wind to nearby plants. Apothecia, the main source of sclerotinia infection in canola, typically appear in June, coinciding with the ideal infection time – at canola flowering. However, apothecia are difficult to see in the field and even if they aren’t identified while scouting, it’s still possible to have high disease pressure.

**Sclerotinia disease cycle.**

Source: Canola Council of Canada

**Apothecia are golf-tee shaped structures of sclerotinia.**

Source: Canola Council of Canada
Tracking down sclerotinia.

Assess your risk and determine your need for a preventative fungicide:

High-yielding crops.
Even in drier years, a vigorous crop with an expected yield potential of over 35 bu/ac can form a thick, luscious canopy with the perfect microclimate for disease. Moisture is trapped inside the canopy and in the soil, along with the inoculum.

Tight rotations in broadleaf crops.
Sclerotinia infects over 400 other broadleaf plants, including crops such as beans, lentils, peas and flax, as well as common broadleaf weeds such as chickweed, stinkweed, shepherd’s purse, hempnettle and thistles.17 Shorter rotations can lead to greater sclerotia levels in the soil.

Early-season moisture.
Precipitation timing is important. Light rains, heavy dews and other humid weather patterns that occur just prior to canola flowering can all increase the risk of sclerotinia. A total of 10 days of moist soil around this time can initiate production of apothecia (doesn’t need to be consecutive).

Sclerotinia on canola stems.
Strategies for controlling sclerotinia.

Scout for sclerotinia-friendly conditions.
Walk your fields at first flower around mid-day. Wet fields at that time are a sure sign that there was enough moisture for sclerotinia spores to germinate and spread. The better your canopy looks, the higher the risk.

Use recommended seeding rates.
Seed at rates that produce an optimal targeted plant population of 5 to 7 plant/ft². Seeding at higher rates can result in a denser canopy, which can increase sclerotinia risk and infection, and can also lead to increased lodging.

Rotate to non-susceptible crops.
Avoid planting consecutive crops susceptible to sclerotinia (canola, pulses, soybeans). Cereals and grasses are not susceptible to sclerotinia and should be used in rotation.

Assess disease risk and crop potential.
Scout your fields several times during the season to assess the potential for disease. Look also for apothecia beneath the canopy around mid-June and sclerotia bodies in the fall.

Keep detailed records of moisture and disease.
Keep records that include moisture during the season and the disease incidence in previous host crops.

Use a foliar fungicide preventatively.
Plan to spray preventatively at 20% to 30% flowering. Fungicides applied up to 50% flowering can still be beneficial.

"One of the best management techniques for managing this disease [sclerotinia] is a preventative fungicide application. For growers battling sclerotinia, it is good to use multiple modes of action and to rotate chemistries." Cornelsen also notes that almost all canola fields are affected by sclerotinia to some degree.

Justine Cornelsen, Agronomy Specialist, Canola Council of Canada.
When it comes to prevention, timing is everything.

Timing is critical to a fungicide application. Sclerotinia spores feed on weak, dying tissue such as petals. Once the infected petals fall, the fungus begins to grow actively into the stem. The ideal timing is between 20% to 30% flowering or prior to significant petal drop because the largest number of flowers will be open and the greatest number of petals will be covered by the fungicide application. Part of the fungicide will penetrate the canopy to help protect other infection sites, including leaf axils and bases.

At 50% flowering, more petals will have likely dropped onto lower parts of the plant, therefore it’s more likely that infection has already occurred. However, fungicide applications at this stage can still reduce disease and provide an economic benefit, particularly if conditions are wet, the canopy is dense, or there is a high yield potential.

To determine what stage the canola crop is at, count the number of flowers and pods on the main stem. The main stem is where the majority of yield potential is coming from and is the most important to protect.

If the number of open flowers and pods on the main stem is approximately 15, the plant is at 20% flowering and fungicide applications should begin. 50% bloom is when the number on the main stem exceeds 20. In general, a canola field will be its most yellow at 50% flower meaning the application window is closing.
It’s more than another fungicide. It’s a new era.

Cotegra® fungicide delivers sclerotinia management to help preserve yield potential and quality in canola.

- Combines two leading sclerotinia actives, in a convenient liquid premix
- Delivers the best management of sclerotinia, compared to other fungicides on the market
- Provides the best opportunity to protect your investment and yield potential when there is potential for sclerotinia development
Outperform the competition with Cotegra.

Cotegra shows higher performance against sclerotinia compared to competitive products in field trials – regardless of moisture. Cotegra adds bushels compared to untreated acres and against popular competitors.

### Increased sclerotinia management in canola – moderate disease pressure.

- **Untreated**: 24.3
- **Competitor 1**: 15
- **Competitor 2**: 15.9
- **Cotegra**: 14.2

Source: RCD trials, Western Canada, 2015, n=12

### Increased sclerotinia management in canola – high disease pressure.

- **Untreated**: 60.5
- **Competitor 1**: 21.2
- **Competitor 2**: 13.9
- **Cotegra**: 11.1

Source: RCD trials, Western Canada, 2016, n=5

Two modes of action designed for the best results in managing sclerotinia.

### Increased yield with Cotegra vs. untreated.

- **Cotegra**: 51
- **Untreated**: 46.6

Source: AgSolutions Performance Trials, Western Canada, 2017, n=11

### Increased yield with Cotegra vs. competitor.

- **Cotegra**: 52.9
- **Competitor**: 51.4

Source: AgSolutions Performance Trials, Western Canada, 2017, n=11
Getting to the root of clubroot.

Clubroot is a serious soil-borne disease of canola. Infected roots develop galls that impede water and nutrient uptake. This slows or halts crop growth and development, leading to lower yields. Research has shown that yield loss can be estimated by dividing the percentage of infected stems by half – similar to sclerotinia.18

To spot the disease, grab canola by the roots.

The best way to confirm the presence of clubroot is to dig up plants that appear to be dying or prematurely ripening. Infection leads to galls on the roots, ranging from tiny nodules to large club-shaped outgrowths. Galls are firm and white, but become soft and greyish-brown as they mature and decay. Infected plants show signs of wilting, stunting and yellowing, but considerable damage can be done below ground before symptoms aboveground begin to appear. The crop may also ripen pre-maturely and lead to shriveled seeds.18

GALLS ON INFECTED ROOTS

Source: Turkington, K., 2015. Found in Clubroot disease of canola and mustard, Agri-Facts, Alberta Agriculture and Rural Development

PATCHES OF PREMATURELY RIPENED CANOLA COULD BE A SIGN OF CLUBROOT

Source: Strelkov, S., 2015. Found in Clubroot disease of canola and mustard, Agri-Facts, Alberta Agriculture and Rural Development
A year in the life of *P. brassicae*.

Caused by the fungus *Plasmodiophora brassicae*, clubroot infection involves two generations of spores. In the spring, resting spores in the soil germinate into first generation zoospores that are carried by water in the soil to the roots of susceptible plants. They enter and infect canola through root hairs or wounds, forming unicellular organisms (similar to amoebas) that later join to form a larger plasmodium, becoming the source for a second generation of zoospores. This set of zoospores reinfects the host plant, getting deeper and reaching the cortex of the roots. Once again, they form amoeba-like cells that become a larger plasmodium. This disrupts plant hormones and leads to swelling of infected root cells, forming galls characteristic of this disease.\(^{18}\)
Managing clubroot.

Resting spores can last in the soil for up to 20 years. While there is no way to completely eradicate the disease, it’s possible to slow down the spread and reduce the severity of infection.

**Practise good sanitation.**
This helps reduce the transfer of diseases through contaminated soil and crop debris. Be sure to clean equipment prior to moving to another canola field. Limit or eliminate external traffic on fields.

**Pull infected plants.**
If you catch the disease early and there is a relatively small patch of incidence, consider pulling the infected plants and either burn them or bury them in a landfill.

**Use resistant varieties.**
Grow first generation clubroot-resistant varieties at the first sign of clubroot in the field or if clubroot is present in the farming community that includes the area where you or others conduct your farming activities. This community can include equipment or contractors that have travelled from other fields. If growers are still (or start) seeing issues in their first generation clubroot-resistant hybrid while still following a one-in-three-year canola rotation, a second generation hybrid should be deployed.

**Control weeds and volunteers.**
Cruciferous weeds, such as wild mustard and shepherd’s-purse, can serve as hosts for clubroot in non-canola years.

**Limit tillage.**
Use soil conservation practices to reduce spread of resting spores.

**Monitor moisture levels.**
Frequently monitor your fields for high moisture levels. Well-drained soils can help prevent the movement and may help minimize the development of the disease.

**Rotate crops.**
A one-in-three-year or greater rotation is recommended. Note that cruciferous crops can also act as hosts to clubroot.

**Scout crops regularly and carefully.**
Assess the field as a whole and look for patches of crop showing wilting, premature ripening or stress symptoms. Pay particular attention to field entrances and areas of high traffic. Dig up plants at or after swathing to check for galls on the roots.
First generation versus second generation clubroot-resistant hybrids.

First generation hybrids: contain resistance genetics that were designed to control the predominant pathotypes of clubroot at the time of their registration.

Second generation hybrids: contain additional sources of resistance designed with multiple genes so that they are effective against a wider range of pathotypes.

Resistance doesn’t last forever.

A hybrid that once showed resistance to clubroot in your field might not always show that same resistance. If characteristic galls are found on canola in areas of thin and early-ripening patches, it is likely the clubroot population in the field has shifted.

Fields that have clubroot have more than one pathotype in the soil. With the use of resistance genetics, you will control the pathotypes that your hybrid has resistance to, but over time, because there are spores from other pathotypes that are not being controlled, you could see the predominant pathotype shift in your field. Also, selection pressure on the pathotypes being controlled can cause genetic changes in the virulence of the pathogen to overcome resistance.

The shifted or newly-introduced population should be pathotyped and a second generation clubroot-resistant canola hybrid should be grown on that field.
END THE SEASON THE WAY YOU STARTED. STRONG.

You’re about to reap the rewards of your season’s work, but there’s one last step – harvest management. At this stage, any loss to yield or quality can be attributed to harvest timing, harvest techniques and/or storage issues.
Growers are straight cutting across Canada. Here’s why.

By 2020 it’s predicted that 50% of canola acres in Western Canada will be straight cut. There are many advantages to straight cutting. The main reason? Greater efficiency at harvest.

**Percentage of market straight cutting.**

![Graph showing percentage of market straight cutting from 2014 to 2020.](image)

Source: BASF Five-Year Forecast Model. *Stratus Market Research

**Top reasons why growers straight cut canola.**

<table>
<thead>
<tr>
<th>Reason</th>
<th>2016</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Better use of manpower / more efficient operations</td>
<td>65.9</td>
<td>42.9</td>
</tr>
<tr>
<td>Potential yield benefits / higher yield</td>
<td>34.1</td>
<td>32.7</td>
</tr>
<tr>
<td>Weather / too wet to swath</td>
<td>7.3</td>
<td>20.4</td>
</tr>
<tr>
<td>Wanted to try it as an experiment</td>
<td>7.3</td>
<td>12.2</td>
</tr>
<tr>
<td>Reduce green seed count</td>
<td>4.9</td>
<td>2.0</td>
</tr>
<tr>
<td>Uneven maturity</td>
<td>2.4</td>
<td>8.2</td>
</tr>
<tr>
<td>Other</td>
<td>0</td>
<td>2.0</td>
</tr>
</tbody>
</table>

Source: AgData, 2016 (n=141 growers who straight cut canola)

It’s important to recognize that straight cutting isn’t “all or nothing”. It’s a tool that can help manage your time and mitigate some of the risks associated with swathing your entire canola crop. By eliminating the swath step, you’re reducing manpower, fuel and extra equipment use. Plus, later timing gives your crop more time to mature, upping the potential for larger seeds and higher yields.
Eight steps to a better straight cut.

Many growers are now making decisions to straight cut certain acres at the beginning of the season, before seeding. Here are some factors to consider:

1. **Consider a straight cutting suitable hybrid.**
   While all hybrids can be straight cut, there are some that are better suited to straight cutting. InVigor Pod Shatter Reduction hybrids have been bred to select for excellent pod drop characteristics while also containing the patented pod shatter reduction technology. These hybrids deliver high yield potential even when left standing in the field during inclement weather.

2. **Seed early and at optimal rates.**
   Seed at a rate that will produce an optimal targeted plant population of 5 to 7 plants/ft². Attaining a targeted plant population promotes good seedbed utilization, efficient use of available resources, improved stress tolerance, reduced sclerotinia incidence, reduced lodging and maturity with uniform plant structure.

3. **Manage disease preventatively.**
   Diseases (e.g. blackleg, clubroot, sclerotinia) can cause uneven maturity, premature ripening, pod drop and shatter loss. Lodging reduces standability, hindering the straight cutting process. Take a preventative approach that includes crop rotations, seed treatments, hybrid selection and foliar fungicides.

4. **In-crop weed control.**
   Choose a systemic herbicide for optimal control of troublesome weeds to set up fields for a successful harvest by raising yield potential, improving harvestability and lowering dockage.

5. **Assess your field.**
   Pod shatter reduction hybrids offer improved harvest flexibility. Choosing a field with uniform stand, a well-knit crop and where you’ve seen canola mature most evenly offers the greatest harvestability. Avoid extreme variability and pick a fairly flat, even field with minimal low spots.

6. **Apply a pre-harvest herbicide.**
   Preliminary research suggests that a pre-harvest herbicide can save you time and fuel at harvest.¹⁹ It also promotes crop dry down and improves harvestability.²⁰

7. **Equipment setup.**
   Minimize yield losses at harvest and improve efficiency by maintaining appropriate combine and reel speeds, while using the proper header and header modifications. Be sure to review and discuss your options with your equipment dealer.

8. **Storage.**
   Canola seed over 10% moisture should be dried within one to two weeks to avoid spoilage and stored below 15°C. Green tissue in a sample also adds to the overall moisture of the sample, which can also cause spoilage. Dryers, rather than heating, should be used to reduce the green tissue moisture.
Staying ahead of straight cutting obstacles.

While straight cutting can save time, harvesting a naturally ripened crop can mean longer wait times and more time spent unplugging the combine – not to mention the stress that comes with it from:

**Greener stems.**

When canola is ripened naturally, stems can be greener, more moist and harder to combine, slowing down harvest. This can also limit operations to periods between late morning and early evening when conditions are conducive to the crop getting tough.

**Time standing in the field.**

Under ideal conditions, straight cut fields typically stand for another 21 to 28 days after the optimal stage for swathing. This can take longer under wet, fall conditions.

Using a pre-harvest application can help you overcome these challenges. It facilitates straight cutting by providing faster crop and weed dry down, leading to improved field uniformity, fewer green stems, a cleaner sample and reduced seed moisture content. Research suggests that it can increase both harvest productivity and efficiency. All it takes is good technique, including sufficient coverage and correct application timing.

---

Source: Data from PAMI, 2017, Research Report. Straight cutting canola in Manitoba: Comparison of pre-harvest aids
Heat LQ works.  
And we’ve got the results to prove it.

Applied pre-harvest, Heat® LQ herbicide tank mixed with glyphosate delivers:

- Fast, complete crop and weed dry down for improved uniformity and harvestability
- Rapid, broad-spectrum control of key weeds for improved storability and cleaner fields next season
- Tank mix with glyphosate, for fast broadleaf weed dry down and cleaner fields next season
- An innovative Group 14 active that works on all types of canola, including Roundup Ready®, Clearfield® and InVigor hybrid canola

With both contact and systemic activity, Heat LQ speeds up the rate of crop and weed dry down compared to using glyphosate alone. In return, glyphosate brings control of key grasses and perennials, complementing the broadleaf weed spectrum of Heat LQ.

Lower canopy in glyphosate-treated crop is greener, less dried down compared to Heat LQ + glyphosate

Source: AgSolutions Performance Trials, Swan River, MB, 2015

Canola dry down, 1 and 2 weeks after application.

<table>
<thead>
<tr>
<th></th>
<th>% DRY DOWN</th>
</tr>
</thead>
<tbody>
<tr>
<td>HEAT LQ + GLYPHOSATE</td>
<td>80.8</td>
</tr>
<tr>
<td>GLYPHOSATE ONLY</td>
<td>75.1</td>
</tr>
</tbody>
</table>

Source: AgSolutions Performance Trials, Western Canada, 2016

Canola, 16 days after application.
Grain moisture at harvest.

<p>| Source: AgSolutions Performance Trials, Western Canada, 2016 |</p>
<table>
<thead>
<tr>
<th>HEAT LQ+GLYPHOSATE</th>
<th>Glyphosate</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.7</td>
<td>9.3</td>
</tr>
</tbody>
</table>

Remaining green in canola at harvest.

<p>| Source: AgSolutions Performance Trials, Western Canada, 2015 (n=11) |</p>
<table>
<thead>
<tr>
<th>HEAT LQ+GLYPHOSATE</th>
<th>Glyphosate</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.5</td>
<td>16.8</td>
</tr>
</tbody>
</table>

Weed dry down, 4 to 22 days after application.

<p>| Source: AgSolutions Performance Trials, Western Canada, 2013-2014 |</p>
<table>
<thead>
<tr>
<th>STINKWEED</th>
<th>WILD BUCKWHEAT</th>
<th>ANNUAL SOW THISTLE</th>
<th>ROUND-LEAVED MALLOW</th>
<th>REDROOT PIGWEED</th>
<th>CANADA THISTLE</th>
<th>NARROW LEAVED HAWKSBEARD</th>
<th>PRICKLY LETTUCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>% DRY DOWN</td>
<td>HEAT LQ + GLYPHOSATE</td>
<td>Glyphosate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>100</td>
<td>90</td>
<td>80</td>
<td>70</td>
<td>60</td>
<td>50</td>
<td>40</td>
<td>30</td>
</tr>
</tbody>
</table>
How to ensure first-rate results.

There are four key steps to optimizing your pre-harvest application of Heat LQ.

1. **Use the right rates.**

   Always tank mix Heat LQ with glyphosate for pre-harvest on canola, even on Roundup Ready hybrids. One case of Heat LQ will treat 40 acres.
   
   - Heat LQ tank mixed with glyphosate: 43 ml/ac (106 ml/ha)
   - Merge® adjuvant: 400 ml/ac (1 L/ha)

   Include all the Merge within the case and tote of Heat LQ.

2. **Water volume.**

   One of the most important factors of a successful dry down, use more water to penetrate the dense canola canopy, reaching the stems and weeds in the lower part.
   
   - Ground application tank mixed with glyphosate: 40 L/ac (10 gal/ac) minimum
   - Aerial application: 20 L/ac (5 gal/ac)

   The rate of dry down increases with water, so consider using different volumes to stagger your straight cutting.

3. **Spray quality.**

   To optimize your spray, use finer droplets that can better maneuver through the canopy to reach stems and petioles. Slow your travel speed and point nozzles backward for more vertical movement of the droplets. Refer to product labels for optimal spray settings of the product.

![Graph showing dockage reduction with higher water volumes](source: Enns Bros trial, MB, 2016 (n=6))

Higher water volumes increase dry down and reduce dockage.
4. **Apply when the time is right.**

Apply Heat LQ when 75% of seeds within the pod have changed colour. Pods must be opened to determine seed colour. Applying too early can potentially reduce yield and/or impact quality.

**Optimal timing.**

Seeds on the bottom 3/4 or more of the main raceme will have initiated colour change from green to dark brown or black.

**Too early for application.**

External pod colour has started to change but the majority of seeds inside are still green and have not started to change colour.

**Recognize when it’s harvest time.**

Aim for seed moisture content of 10% or less to avoid heating. Because dry down works best under sunny, warm, low moisture conditions, this process can be slowed down by cold, overcast or wet conditions, leading to delayed harvest.

If shatter loss is a concern, combine during cooler and more humid parts of the day or during damp nights when pods gather dew. Keep checking seed moisture levels as they can change throughout the day, adjusting your cylinder speed as necessary to avoid seed cracking or splitting. Start with a cylinder speed of 650 to 700 rpm for small cylinders or adjust to 450 to 600 rpm for large cylinders.
Check out your options.

No pre-harvest herbicide is created equal. Consider the strengths and weaknesses of each to find one that works for you.

<table>
<thead>
<tr>
<th>Overview</th>
<th>HEAT LQ + GLYPHOSATE*</th>
<th>REGLONE®/REGLONE ION</th>
<th>GLYPHOSATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Contact and systemic activity</td>
<td>• Contact activity causes rapid dry down of plant tissue</td>
<td>• Systemic activity</td>
<td></td>
</tr>
<tr>
<td>• Speeds up crop and weed dry down</td>
<td>• May not result in complete plant death, leading to regrowth</td>
<td>• Helps improve uniform maturity but is the slowest herbicide option</td>
<td></td>
</tr>
<tr>
<td>• Translocates to growing points of plant for complete plant death/reduced risk of regrowth</td>
<td>• No perennial weed control</td>
<td>• Use for perennial weed-control benefits</td>
<td></td>
</tr>
<tr>
<td>• Perennial weed control</td>
<td>• Minimum water volume – 20 gal/ac</td>
<td>• Key weeds controlled: Canada thistle, quackgrass, perennial sow thistle, dandelion, narrow-leaved hawk’s beard, foxtail barley, cleavers, volunteer canola, and wild buckwheat</td>
<td></td>
</tr>
<tr>
<td>• Minimum water volume – 10 gal/ac</td>
<td>• Treatment is often more effective when application is made on cloudy days or prior to periods of darkness</td>
<td></td>
<td></td>
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<tr>
<td>• 1-pass for both crop and weed dry down – including the following season</td>
<td>• A post-harvest application is often required after a diquat application, due to lack of weed control and regrowth</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Key weeds controlled: Canada thistle, quackgrass, perennial sow thistle, dandelion, narrow-leaved hawk’s beard, foxtail barley, cleavers, volunteer canola, and wild buckwheat</td>
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<table>
<thead>
<tr>
<th>Canola</th>
<th>HEAT LQ + GLYPHOSATE*</th>
<th>REGLONE®/REGLONE ION</th>
<th>GLYPHOSATE</th>
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<tbody>
<tr>
<td>• Effectively dries down all types of canola (Clearfield canola (CLC), InVigor hybrid canola and Roundup Ready (RR))</td>
<td>• Stem dry down varies</td>
<td>• No activity on RR canola dry down</td>
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<tr>
<td></td>
<td>• Increased risk of shatter</td>
<td>• Will not control RR volunteer canola or Group 9-resistant weeds</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Risk of locking in green seed</td>
<td></td>
<td></td>
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</table>

* When tank mixed with glyphosate, consult glyphosate label for more information including pre-harvest interval and staging.
TAKE SIMPLIFIED DECISION-MAKING OFF THE SHELVES. (AND INTO THE FIELD.)

Every season brings its share of challenges—from crop establishment to harvest. Having the proper resources on hand can save time and simplify decision-making, providing the information you need when you need it most.
The proof is in the bin.

For over 20 years, InVigor hybrid canola has been trusted to consistently deliver top-performing yields and innovative solutions to farms across the country. InVigor continues to stand at the forefront of innovation by providing the most comprehensive year-over-year trial results program of its kind. The Demonstration Strip Trials (DSTs) offer complete transparency with regards to how InVigor hybrids perform in different localized areas. Compare yield, ease-of-harvest and maturity ratings at InVigorResults.ca.

The InVigor DST results website provides:

- Localized trial results from your area
- The ability to create summaries of various trials
- Comparisons of clubroot-resistant hybrids in areas where clubroot is a concern
- Access via smartphones and all Internet-enabled devices
- The ability to save and/or share trial data
- Access to information on straight cut results for InVigor Pod Shatter Reduction (PSR) canola hybrids
## Conversions.

<table>
<thead>
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<th>MULTIPLY BY</th>
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<td>tons (2,000 lb.)/acre</td>
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<tr>
<td>yards</td>
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</table>
Conversions.

**METRICS IN WEED CONTROL**

**CONVERSION FACTORS COMMON TO WEED CONTROL**

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<thead>
<tr>
<th>(ha) Hectares</th>
<th>Acres × 0.405</th>
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</thead>
<tbody>
<tr>
<td>(kPa) Kilopascals</td>
<td>Pounds per square inch × 6.9</td>
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<tr>
<td>(km/h) Kilometres per hour</td>
<td>Miles per hour × 1.61</td>
</tr>
</tbody>
</table>

**BENCHMARKS**

- 16 hectares = 40 acres
- 64 hectares = 160 acres
- 200 Kilopascals = 29 pounds per square inch
- 250 Kilopascals = 36 pounds per square inch
- 275 Kilopascals = 40 pounds per square inch
- 300 Kilopascals = 43 pounds per square inch
- 4.8 km/h = 3 mph
- 6.4 km/h = 4 mph
- 8.0 km/h = 5 mph
- 9.5 km/h = 6 mph
- 1 gallon per acre = 9.35 litres per hectare
- 1 mile = 5,280 feet = 1,610 metres = 1.61 kilometres

**PRESSURE**

- 1 foot lift of water = 0.433 pound pressure per square inch (psi)
- 1 pound pressure per square inch will lift water 2.31 feet
- 1 atmosphere = 760 millimetres of mercury; 14.7 pounds; 33.9 feet of water

**WEIGHTS AND MEASURES**

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<th>U.S. abbr.</th>
<th>Length Unit</th>
<th>Approx. Metric Equivalent</th>
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<td>mi.</td>
<td>mile</td>
<td>1.609 kilometres</td>
</tr>
<tr>
<td>yd.</td>
<td>yard</td>
<td>0.9144 metres</td>
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<tr>
<td>ft. or 1</td>
<td>foot</td>
<td>30.48 centimetres</td>
</tr>
<tr>
<td>in. or 2</td>
<td>inch</td>
<td>2.54 centimetres</td>
</tr>
</tbody>
</table>

**Area**

- sq. mi. or mi.² | square mile | 2.59 square kilometres |
- acre | acre | 0.4047 hectares or 4,047 square metres |
- sq. ft. or ft.² | square foot | 0.093 square metres |

**Volume/Capacity**

- gal. | gallon | 3.785 litres |
- qt. | quart | 0.946 litres |
- pt. | pint | 0.473 litres |
- fl. oz. | fluid ounce | 29.573 millilitres or 29.573 cubic centimetres |
- bu. | bushel | 35.238 litres |
- cu. ft. or ft.³ | cubic foot | 0.028 cubic metres |

**Mass/Weight**

- ton | ton | 0.907 metric tons |
- lb | pound | 0.453 kilograms |
- oz. | ounce | 28.349 grams |
- gr. | grain | 0.648 grams |

**USEFUL FORMULAS**

\[ \text{GPM} = \frac{\text{GPA} \times \text{MPH} \times W^*}{5,940} \]

\[ \text{GPA} = \frac{5,940 \times \text{GPM}}{\text{MPH} \times W^*} \]

*W = Nozzle spacing (in boom spraying) or spray swath (in boomless spraying), in inches.

**LAND LOCATION MAP**
Mixing order for tank mixes.

Ensure tank-mix compatibility by using the proper mixing order:

- Wettable powders, flowable
- Agitate, Anti-flowing compounds, buffers
- Microcapsule suspension
- Liquid and soluble
- Emulsifiable concentrates
- High load Glyphosates
- Surfactants

Always remember:

**W.A.M.L.E.G.S.**

Always consult the label prior to mixing.
There’s more where this came from.

For product information, agronomic advice and more, explore our resources and see what they have to offer.

**BASF Canola Solutions Website**
Visit [agsolutions.ca/canola](https://agsolutions.ca/canola) for more information on our canola solutions.

**AgSolutions Customer Care**
Reach out to our knowledgeable AgSolutions Customer Care staff with any questions, feedback or advice in the field. Call 1-877-371-BASF (2273).

**AgSolutions Performance Trials**
See how BASF products measure up against the competition in grower-applied, field-scale trials near you. Visit [agsolutions.ca/performancetrials](https://agsolutions.ca/performancetrials).

**DST results page**
Visit [InVigorResults.ca](https://invigorresults.ca) to compare how InVigor hybrids performed in your area.

**The Straight Cutting Experience**
Listen to canola growers as they share straight cutting experiences and advice in this podcast series, hosted by Shaun Haney of Real Agriculture.

**YouTube – BASFAgSolutions Channel**
Check out timelapse videos, grower reviews of our products and expert advice on challenges in the field.

**Twitter – Follow us @BASFAgSolutions**
Stay on top of the latest product information or search #AgSChatter for frequently asked questions.

**xarvio SCOUTING app**
Download the free app from the App Store or Google Play for convenient identification of weeds and leaf disease just by taking a photo.
Solutions for weed management in canola.

<table>
<thead>
<tr>
<th>Weeds</th>
<th>Products</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Heat LQ (pre-harvest)</td>
</tr>
<tr>
<td>Broadleaves</td>
<td></td>
</tr>
<tr>
<td>Canada fleabane</td>
<td>C</td>
</tr>
<tr>
<td>Canada thistle</td>
<td>C</td>
</tr>
<tr>
<td>Chickweed</td>
<td>C</td>
</tr>
<tr>
<td>Cleavers*</td>
<td>C</td>
</tr>
<tr>
<td>Common ragweed</td>
<td>C</td>
</tr>
<tr>
<td>Cow cockle</td>
<td></td>
</tr>
<tr>
<td>Dandelion</td>
<td>C**</td>
</tr>
<tr>
<td>Flixweed</td>
<td>C*</td>
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<tr>
<td>Hemp-nettle</td>
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<tr>
<td>Kochia</td>
<td>C</td>
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<tr>
<td>Lady’s thumb</td>
<td>C</td>
</tr>
<tr>
<td>Lamb’s quarters</td>
<td>C</td>
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<tr>
<td>Pigweed</td>
<td>C</td>
</tr>
<tr>
<td>Redroot pigweed</td>
<td>C</td>
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<tr>
<td>Round-leaved mallow</td>
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<td>Russian thistle</td>
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<td>Shepherd’s-purse</td>
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<td>Smartweed</td>
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<tr>
<td>Sow thistle</td>
<td>C</td>
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<td>Stinkweed</td>
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<td>Stork’s-bill</td>
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<td>Volunteer canola</td>
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<td>Volunteer flax</td>
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<td>Wild buckwheat</td>
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<tr>
<td>Wild mustard</td>
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<td>Grasses</td>
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<td>Green foxtail</td>
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</tr>
<tr>
<td>Japanese brome grass</td>
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<td>Persian darnel</td>
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<tr>
<td>Quackgrass</td>
<td></td>
</tr>
<tr>
<td>Volunteer barley</td>
<td>C</td>
</tr>
<tr>
<td>Volunteer canary seed</td>
<td></td>
</tr>
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<td>Wild millet</td>
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<td>Wild oats</td>
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<tr>
<td>Yellow foxtail</td>
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* Non-Group-2-resistant biotypes only. ** When tank mixed with glyphosate.
Solutions for disease management in canola.

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<th>Diseases</th>
<th>Products</th>
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<td>Nexicor</td>
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<tr>
<td>Sclerotinia stem rot</td>
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</table>

**Legend:** C = Control    S = Suppression
References.

Always read and follow label directions.

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