SEED- AND SOIL-BORNE
SOYBEAN DISEASE
& INSECT GUIDE
GOT WHAT IT TAKES TO JOIN THE RANKS?
MEET THE NEW BREED OF SOYBEAN GROWERS

HAS A CURIOUS MIND
SEES THE VALUE OF INTENSIVELY MANAGED CROPS
HUNGERS FOR NEW INFORMATION
IS PASSIONATE AND DRIVEN
ROLLS UP HIS SLEEVES TO GET THE JOB DONE
PRACTICES PATIENCE AND PERSISTENCE
FOLLOWS HIS GUT AND SHIRKS THE STATUS QUO
WALKS THE TALK
DIGS INTO THE DETAILS

There’s a new breed of grower who’s unlocking the genetic potential of their soybean crop. Innately curious and unwilling to settle for average returns, the New Bean Counter intensively manages their soybeans for a comprehensive, systematic approach to maximizing crop production. If you’re ready to up your soybean game, it’s time to join the ranks of the New Bean Counters.
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Introduction

Want to be part of the new breed?

The new breed of grower is passionate, driven and curious. They’re unwilling to settle for average returns and the status quo. Instead, they roll up their sleeves, sweat the small details and intensively manage their soybeans to wring every drop of yield out of their fields.

We call this grower the New Bean Counter. To them, it’s not just the bottom line that matters; it’s about upping their soybean game full stop, about following their instincts and hunting down the latest information that will help them unlock the full genetic potential of their crops.

Set the stage for a strong stand

Establishing a strong, healthy soybean stand right from the start makes it that much easier for your crop to deal with weather and pest-related pressure throughout the rest of the growing season, and reach its maximum yield potential.

We know that early-season seedling and soil-borne diseases and insects are always top-of-mind in your planting decisions. Common management practices – such as using cover crops and no-till – have their benefits but can potentially increase your early-season disease and insect pressure.

Regardless of what management approach you take, remember that all soils contain different levels of disease pathogens, such as Pythium, Rhizoctonia, Phytophthora and Fusarium. These pathogens cause a variety of seedling diseases that can strike depending on several factors, such as early-season temperatures and rainfall.

Insect pressure can also vary from season to season, since insect populations are heavily influenced by environmental and cropping conditions.

We know how important it is to understand the diseases and insects your soybeans are up against during the critical first few weeks after planting. At the end of the day, the more you know the better you’ll manage. That’s why Syngenta is committed to helping you grow the best soybean crop possible. We’ve put together this guide to help you build the best integrated management plan for your farm.
Set the tone for a successful season

Start with rotations

Many pathogens can survive and thrive in your soil for years. And the only way to stay ahead is through long-term scouting, observation and careful planning. Introducing non-host crops into your rotation is one of the best things you can do to interrupt disease cycles, as they’ll help reduce the opportunity for disease pathogens to continue their life cycle. On the flip side, shortening or even ignoring proper crop rotations can cause disease to build up in your soil to levels where even the most powerful seed treatments won’t be able to fend off the pressure.

What role do seed treatments play?

We know you want to do everything you can to ensure your crop gets off to the best start possible in the days and weeks after planting. That’s where seed treatments become an important part of your early-season strategy. They’re the only effective defence against early-season seed- and soil-borne diseases and insect feeding in soybeans and edible bean crops. Along with the pest protection seed treatments offer, they can also deliver several key side-benefits, such as improved germination, emergence and stand establishment when planting into cool, wet soils.
EARLY-SEASON FUNGAL DISEASES OF BEAN SEED AND SEEDLINGS

Pythium

Conditions

• The impact and severity of Pythium depends on the species present in your soil, as well as the environmental conditions and plant growth stage

• Most Pythium species tend to prefer cool soils between 10–16 °C but there are some species that prefer warmer soil above 18 °C

• Pythium infections require wet, saturated soils – particularly after a heavy rainfall – or on heavy soil types and in low-lying areas of a field

Diseases

• Seedling blight, root rot, and damping-off

Identification

• Stand establishment will be patchy

• Infected seedlings have water soak lesions, which develop into brown soft rot

• Roots will be short and discoloured

Management

• Planting later into warmer, drier soils rather than wetter, cooler soils early in the season can help reduce disease severity

• While there are many proven soil health benefits to no-till planting, know that higher levels of crop residues in your fields, combined with cold, wet soils, can lead to an increase in disease pressure

• Use a fungicide seed treatment that’s registered for Pythium control

EARLY-SEASON FUNGAL DISEASES
OF BEAN SEED AND SEEDLINGS

Fusarium

Conditions
• Infection generally occurs in wet, cool soil below 16 °C
• Wilt symptoms don’t appear until it becomes hot and dry
• Infection is more severe when plants are under stress by elements such as nematode feeding, herbicide injury, iron chlorosis and high soil pH

Diseases
• Root rot, damping-off, sudden death syndrome

Identification
• Slow and poor stand establishment
• Stunted and weak seedlings
• Root rots can cause the outside of the root to turn reddish to dark brown and the vascular tissue inside to turn brown
• Poorly developed root systems and poor nodulation
• Seedling and plants may wilt and die
• Stem lesions and decay occur below the soil
• Symptoms of sudden death syndrome (SDS) begin to appear mid-July after heavy rains
• Plant leaves develop interveinal chlorosis, and eventually die, and fall off while leaving the petiole attached

Management
• While there are no soybean varieties resistant to Fusarium, they do have varying tolerance levels
• Reducing stress on the plant can help to reduce root rot. For example, avoid herbicide injury and grow a Fusarium-tolerant variety
• Use a fungicide seed treatment registered for Fusarium control
• Fields with a history of Fusarium pressure or infections should be planted later when soil is warmer and drier
Rhizoctonia

Conditions
- Different strains of *Rhizoctonia* fungus can thrive in a variety of conditions. This means the disease can be found in a wide range of soil conditions.
- Symptoms are generally more severe in sandy soils or in drought conditions
- The fungus prefers warmer soils from 16–32 °C

Diseases
- Seedling blight, root rot, damping-off

Identification
- *Rhizoctonia* is identifiable by firm, dry reddish-brown sunken lesions on the hypocotyl (the stem of the germinating seed)
- The disease can spread and cause root rot into the plant’s early reproductive phases
- Plants may appear stunted after symptoms fade

Management
- Reducing stress factors, such as compacted soils, drought and herbicide injury to the roots, can help reduce the infection and severity
- Use fungicide seed treatments registered for *Rhizoctonia* control
**EARLY-SEASON FUNGAL DISEASES OF BEAN SEED AND SEEDLINGS**

*Phytophthora*

**Conditions**

- Infection can occur at any growth stage
- Disease symptoms can appear on a single plant or in patches
- *Phytophthora* favours poorly drained soils and high organic matter generally found in lower-lying areas
- The fungus can survive in winter soybean residue as small structures called oospores, which then germinate when soil temperature rises above 16 °C

**Diseases**

- Root and stem rot, seedling blight, damping-off

**Identification**

- Symptoms will vary by soybean variety
- Stems may appear water soaked and the leaves may become chlorotic – or pale – between the veins
- Once infected, susceptible varieties may wilt and die
- Varieties with some field tolerance don’t usually die from infection
- One unique symptom is a dark brown lesion that extends from the taproot up to several nodes on the stem. This lesion girdles the stem and causes the plant to be stunted and wilt

**Management** *(Specifically for a field with history of issues)*

- Varieties with the Rps genes offer complete resistance to certain *Phytophthora* pathotypes
- *Phytophthora* populations are so diverse, making it unlikely that a variety will be resistant to every pathotype. Also – many *Phytophthora* populations have evolved over the years to overcome Rps resistance genes
- Some soybean varieties have partial resistance that’s effective on all pathotypes, but is only expressed after the first true leaves
- Use a fungicide seed treatment registered to control *Phytophthora*
Insect Management

Early-season insect feeding on your plants’ roots and shoots can set your crops yield potential back in a big way. You need to be proactive not only in scouting and identifying the first signs of insect damage, but also in knowing how to best manage those pests. But the tricky thing about insect pests is that insect pressure can vary from season to season, since they are heavily influenced by environmental and cropping conditions.

Successful insect management is based on several factors:

1. **Proper identification of the insect at various parts of the life cycle.** For example, large numbers of click beetles – the adult stage of the wireworm – can be an early warning sign for damaging levels of wireworms in following years.

2. **Accurate diagnosis of damage.** Slug feeding can resemble hail damage. Seedcorn maggot damage – usually seen as patchy stands – is sometimes mistaken for a seed quality issues or damping-off.

3. **Understand what control measures are possible, and when they can be applied.** The best defense against soil-borne insects is a seed treatment insecticide that contains an active ingredient against the target pest. Some early-season foliar insects, such as bean leaf beetles and soybean aphids, can also be controlled with seed treatments.
Seedcorn Maggot

Identification
The seedcorn maggot is a small, yellowish-white larva. Its body tapers to the front with two small protracting mouth hooks. Seedcorn maggots burrow into germinating seeds and the belowground parts of emerging seedlings. Adults resemble a small housefly that is slender, light grey and approximately 5 mm in length.

Life cycle
You can expect three or four generations a year, as the seedcorn maggot’s life cycle is completed in about three weeks. Maggots overwinter in the pupal stage, with adults emerging early in the spring. Eggs are laid in the soil near germinating seeds, or where there is an abundance of decaying vegetative matter, and hatch at temperatures as low as 10 °C.

Feeding damage
Larvae or maggots burrow into planted seeds. This prevents proper germination, causes abnormal leaf and root development and creates openings for other fungi and bacteria to enter the maggot-damaged seed.

Geography
Seedcorn maggot infestation can occur in all bean-growing areas, but is most severe in wet, cold seasons and when delays in germination and emergence occur. While manure and cover crops can be beneficial in contributing nutrients and organic matter to your soil, they also attract seedcorn maggot flies to lay their eggs.

Control
These pests feed underground, which makes your only option for protection a seed treatment containing an insecticide for seedcorn maggot control.
Bean Leaf Beetle

Identification
The adult bean leaf beetle is about 10 mm long, and usually has four square-ish black spots on its wing covers. Bean leaf beetles can vary in colour – red, orange, tan or even yellow – but all have a small, black triangle marking behind their heads.

Life cycle
Bean leaf beetles produce one generation a season, but have recently been found to overwinter in Ontario in mild weather. The beetles overwinter in the adult stage by taking shelter in leaf litter and woodlots and become active again in the spring. Overwintering adults will begin to feed on soybeans as early as the cotyledon stage and can cause considerable damage. Adult females lay eggs until late-June, depositing them in the soil at the base of soybean plants. Once hatched, the larvae remain underground for about a month, feeding on the roots. The beetles emerge as adults in July and begin to feed on the plant itself, chewing into foliage and pods until harvest. Excessive pod feeding may increase the incidence of some seed-borne diseases.

Feeding damage
The adult bean leaf beetle will start feeding as soon as soybeans begin to emerge. Heavy foliar feeding and damage at the cotyledon stage by larger bean leaf beetle populations can set the plant back in maturity. The insects can also transmit bean pod mottle virus, which causes a mottling or purpling effect on the seed, and degrades quality.

Geography
Areas of southwestern Ontario, where soybeans are planted earlier and bean leaf beetles are more successful at overwintering.

Control
Early-season protection against overwintering bean leaf beetle adults can be achieved with a dual-purpose seed treatment that includes a systemic insecticide recommended for their control. By reducing the number of adults early in the spring, you may cut down the next generation of beetles emerging in July and see less foliage and pod feeding.
**Soybean Aphid**

### Identification
Adult soybean aphids are quite small (compared to other aphid species), lime-green in colour when fully mature and may be either winged or wingless. Because of their small size, soybean aphids can be difficult to see without magnification. Adult aphids are usually found on stems and the underside of soybean leaves. Young soybean aphids, called nymphs, look the same as adults, but are much smaller and appear as very light green dots on leaves.

### Life cycle
Soybean aphids need two host plants to complete their life cycle. First, the aphids survive as eggs on the twigs of buckthorn species. Then, in the spring, the eggs hatch into nymphs and undergo two generations as wingless females on the buckthorn. The third generation develops into wingless adults that migrate onto soybean plants, where they feed and produce further wingless generations. Over an entire year, there could be as many as 18 aphid generations within your soybean crop.

### Feeding damage
Soybean aphids feed by using their sucking, needle-like mouthparts to extract juices from soybean plants. The insects excrete a sticky substance called honeydew, which can help feed grey sooty mould development and reduce the plant’s photosynthesis by blocking sunlight. Aphids can also carry soybean mosaic virus. If aphids are present in high numbers, their feeding can lead to reduced plant vigor and growth rates, as well as leaf puckering, reduced pod and seed counts and overall reduced yield. Serious aphid outbreaks from the R1 to R4 growth stages will have a greater impact on your yields than aphid outbreaks at the R5 or R6 stages.

### Geography
Ontario and Quebec.

### Control
Seed treatments containing an insecticide may provide early-season protection from early soybean aphid infestations. It’s also important to scout your fields frequently. The Ontario Ministry of Agriculture Food and Rural Affairs (OMAFRA) recommends that you apply a foliar insecticide from the R1 to R5 growth stage when a threshold of 250 aphids per plant with 80 per cent of the plants infested and populations increasing. OMAFRA also advises against using an insecticide if aphid populations are not actively increasing above 250 aphids per plant, as there is a risk of killing off beneficial insects that are keeping the aphid population in check.

*OMAFRA Publication 811: Agronomy Guide for Field Crops*
European Chafer
(White Grub)

Identification
Mature European chafer larvae have a C-shaped body, are white with a brown head, and distinguishable from other grub species by the Y-shaped pattern of bristles on the underside of their last abdominal segment. At the adult stage, European chafers are light brown or tan and resemble June beetles.

Life cycle
European chafers produce one generation per season. Adult female beetles mate and lay eggs in the soil in June and July. Hatched larvae feed on roots in late-July and migrate down to below the frost line to overwinter. The larvae migrate up above the frost line the following spring (April and May), feeding on roots just below the soil surface. Chafer larvae pupate in mid-May to late-June and the cycle begins again.

Feeding damage
European chafers tend to start feeding earlier and finish later than other grubs. The insects do the most damage in the spring as larvae and feed on many crops, including cereals, corn, forages and even residential lawns. European chafers feed 1.5 to 5 cm below the soil surface, pruning roots and causing plant stunting and wilting.

Geography
European chafer is commonly found in all soybean growing areas, but is rarely a severe pest.

Control
Get a handle on early-season larval feeding with a dual-purpose seed treatment that includes a systemic insecticide recommended for European chafer control.
Wireworm

Identification
Wireworm larvae have hard, smooth, slender, jointed bodies and are usually dark coloured, though some can be yellow or white. The larvae have three pairs of legs behind the head and the last abdominal segment is flat with a keyhole-shaped notch. Fully-grown larvae range from 3 to 4 cm in length. Adult wireworms are also known as click beetles because of the distinct clicking sound they make as they flip into the air after being overturned.

Life cycle
Wireworm can overwinter as larvae or in the pupal cell. Adult beetles emerge from the pupal stage in the spring. From late-May through June, the female beetles lay 200 to 400 eggs in loose or cracked soil and under lumps of soil. Larvae hatch in three to ten days, then spend the next two to six years feeding on the roots of host species. When fully grown, wireworm larvae pupate in the soil. Elevated wireworm populations are generally seen in rotations with turf as well as in areas with sandier soil types.

Feeding damage
Seeds are often hollowed out, which causes the seed to die due to direct feeding on the seed or indirectly from a disease organism entering through the wound. Stems of young seedlings are shredded, which can cause the central leaves to die. Damaged plants usually wilt and die, resulting in thin and weaker stands.

Geography
Wireworm infestation levels may vary considerably – even across a single field or farm – since larvae tend to remain close to where they hatch. In an infested field, wireworms can be found in all stages of development, as the larval stage can take several years to complete. Multiple wireworm species can be found in the same field, with five known species across Ontario.

Control
Wireworms may affect emergence and crop vigor. An action threshold of about 32 wireworms per square metre is often recommended. If you’re finding wireworms at this density or higher, you may want to consider a seed treatment for the subsequent seasons.
Soybean Cyst Nematode

Identification
The soybean cyst nematode (SCN) is a small (about 0.5 mm) roundworm that feeds on the roots of soybeans and edible beans. Female nematodes eventually become white cysts about the size of a pinhead that break through the surface of the root. These white female cysts turn brown as they mature.

Life cycle
Eggs hatch to release worm-shaped larvae in the soil. This is the only stage when SCN can infect soybean roots. Once SCN have penetrated the roots, larvae migrate to the water and nutrient-conducting tissue. Female larvae inject secretions into the root cells, modifying and transforming them into specialized feeding cells. At this stage, the female nematode begins to swell and eventually breaks through the root surface. Adult females that remain attached to the root feed and produce eggs in a mass or egg sac outside of the body. Towards the end of the SCN life cycle, eggs also develop within the female’s body cavity. These egg-filled bodies of the adult females are called “cysts”. Eventually the cysts dislodge from the root surface and are able to move freely within the soil.

Feeding damage
Nematodes damage the root system, preventing water and nutrient uptake. A typical early symptom of SCN infection is a stand that appears uneven. As SCN populations increase, symptoms can include stunting and yellowing of plants, uneven plant growth and poor overall growth and appearance. Infected plants also display reduced nodulation and root rot infection. Nematode injury symptoms are most obvious under stressful growing conditions, especially when it’s hot and dry. Under good growing conditions with little stress, the visual damage from SCN may even go unnoticed. SCN feeding damage can sometimes be confused with soil compaction, herbicide injury, nutrient deficiency and other factors. Feeding damage can also create entry points for other diseases – such as brown stem rot or sudden death syndrome – to enter the root system.

Geography
Currently found in most Southern Ontario Counties and spreading into Bruce County.

Control
Once a field has SCN, eradication is impossible, but effective management is possible by rotating to non-host crops (corn, wheat) and the use of resistant varieties and seed treatments.

For more detailed information about soybean cyst nematode, download the Soybean Cyst Nematode Agronomic Guide from Syngenta available at Syngenta.ca/SCN
Seed Treatment Choice

Seed treatments have a crucial role to play in protecting your crops against early-season insect damage and providing early season disease control. Below are three strong products from our Seedcare™ lineup that can form a strong foundation for your soybean management strategy this season.

<table>
<thead>
<tr>
<th>Product</th>
<th>DISEASES CONTROLLED</th>
<th>INSECTS/PESTS CONTROLLED</th>
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<tbody>
<tr>
<td><strong>CruiserMaxx® Vibrance®</strong></td>
<td>Controls the most significant seed- and soil-borne diseases, including:</td>
<td>• Bean leaf beetle</td>
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<tr>
<td></td>
<td>• Pre and post-emergence damping-off</td>
<td>• European chafer</td>
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<td></td>
<td>• Seed rot</td>
<td>• Seedcorn maggot</td>
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<tr>
<td></td>
<td>• Seedling blight caused by <em>Rhizoctonia</em>, <em>Fusarium</em> and <em>Pythium</em> species</td>
<td>• Wireworm</td>
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<td></td>
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<td>• Soybean aphid</td>
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<tr>
<td><strong>Vibrance® Maxx</strong></td>
<td>• Pre and post-emergent damping-off caused by <em>Fusarium</em> spp., <em>Pythium</em> spp., and <em>Rhizoctonia</em> spp.</td>
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</tr>
<tr>
<td></td>
<td>• Seedling blight – caused by <em>Fusarium</em> spp., <em>Pythium</em> spp. and <em>Rhizoctonia</em> spp.</td>
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<tr>
<td></td>
<td>• Seed rot – caused by Phomopsis-infected seed</td>
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<td></td>
<td>• Early-season root rot caused by <em>Phytophthora sojae</em></td>
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<tr>
<td><strong>Clariva™ pn</strong></td>
<td>N/A</td>
<td>• Supresses soybean cyst nematode</td>
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<tr>
<td></td>
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<td>• Complements SCN-resistant varieties</td>
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This document combines the understanding of our chemists, biologists and field experts. Please note that the information provided here is only a guideline and not a comprehensive or definitive view of all of the elements of seed- and soil-borne soybean diseases and their management.

For more information, visit Syngenta.ca, contact our Customer Interaction Centre at 1-877-SYNGENTA (1-877-964-3682) or follow @SyngentaCanada on Twitter.

Always read and follow label directions. Cruiser Maxx Vibrance Beans is an on-seed application of Cruiser Maxx Beans Seed Treatment insecticide/fungicide and Vibrance 500 FS Seed Treatment fungicide. Vibrance Maxx is an on-seed application of: (i) Vibrance 500 FS Seed Treatment fungicide; and (ii) Apron Maxx RTA Seed Treatment fungicide. Soybean seeds treated with thiamethoxam are classified as a Class 12 pesticide in Ontario. Soybean seeds which are not Class 12 pesticides are also available for sale from Syngenta. Clariva®, Cruiser®, Rooting Power®, RTA® Seedcare®, Vibrance®, Vigor Trigger®, the Alliance Frame, the Purpose Icon and the Syngenta logo are trademarks of a Syngenta Group Company. Other trademarks are property of their respective owners. © 2017 Syngenta.