Pulse Stand Establishment
A Guide to Best Management Practices
Update on the Basics

CONSTANT PROGRESS MEANS TWEAKING THE RULES

Lentils, chickpeas and field peas have tremendous agronomic advantages as broadleaf rotation crops on the Prairies. The benefits from pulse crops, such as nitrogen management, soil structure improvement, water use efficiency and crop diversification keep the interest in pulse crops high. But pulse crops also bring their own set of agronomic challenges – among other things, they can be tough to establish, they tend to be highly susceptible to disease and their indeterminate growth habit can make harvest timing difficult.

As with any crop, achieving good stand establishment is key to growing a successful pulse crop. Getting the crop off to a strong, healthy start helps make other growing season challenges a little bit easier to deal with. Still, best practices for pulse crop stand establishment seem to be a constantly moving target. That’s because times are changing – we now have a much better understanding of the major diseases that attack pulses and how to control them, newer varieties and newer crop protection products continue to come on line, and even equipment and storage modifications continue to be introduced. The good news is that best practices are still very much rooted in the basics of proper agronomic principles, so making tweaks to adjust to changing conditions doesn’t have to be that difficult a task.

This Pulse Stand Establishment Guide is designed to help examine pulse production practices for the major pulse crops grown on the Prairies. At the back, you’ll also find a list of references where you can get further information on pulse crop production, a field scouting guide to help you more accurately assess early season disease risk, and an at-a-glance risk assessment guide to help you make seed treatment and seeding decisions.

At Syngenta, we’re committed to helping you grow the best pulse crops. Use this guide to help build an integrated pulse crop management plan that works best for your farm.
Facets That Affect Pulse Stand Establishment

Achieving strong stand establishment is the result of an integrated crop management plan that focuses on maximizing those agronomic practices that help crops overcome early season challenges and minimizing those that don’t.

Best management practices for pulse crop stand establishment centre around three main themes: seeding practices, disease management and insect management. Within these areas there are many factors that can affect pulse stand establishment:

1. Crop and variety choice
2. Seed quality
3. Inoculation
4. Seedbed quality
5. Seeding date
6. Seeding rate and depth
7. Fertility
8. Weather
9. Herbicide carryover
10. Seed and soil-borne diseases
11. Early season insects
12. Weed competition

Naturally, growers have no control over the weather. But when they exercise their full influence over the remaining factors, they do much to buffer the effects of weather on their young pulse crop.

None of these factors work in isolation. A truly integrated stand establishment plan recognizes that when seedlings are weakened by one problem, the effects of other problems are often magnified. For example, a seed planted with a cracked seed coat will (if it survives at all) have greater exposure to seed and soil-borne diseases, take longer to emerge and will likely grow less vigorously throughout its life. The effects of weed competition, foliar disease or frost on a struggling plant like this are much more severe than on a healthy, strong seedling. So be sure to take all factors affecting stand establishment into account when planning your pulse crop management strategy.
Seeding Practices
Pulse crop seeding practices can determine, to a large extent, whether or not a healthy, competitive crop emerges and is able to become well established in the field.

**Crop choice.** Unlike canola or most cereals, which can be grown almost anywhere on the Prairies, pulse crops have fairly well-defined geographic suitabilities. It means the first seeding decision to make is: which pulse crop will grow best in my area and under my expected moisture conditions? The chart below outlines general soil zone adaptabilities of the three main pulses grown on the Prairies. If your land is in a blended zone, check with your local agronomist to find out which pulse crops may work best for you.

<table>
<thead>
<tr>
<th>Soil zone</th>
<th>Lentil</th>
<th>Pea</th>
<th>Chickpea</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brown</td>
<td>Suitable on fallow</td>
<td>Fair on fallow, irrigated</td>
<td>Excellent on fallow</td>
</tr>
<tr>
<td>Dark Brown</td>
<td>Excellent on stubble</td>
<td>Fair to good on moist soil, irrigated</td>
<td>Excellent on fallow</td>
</tr>
<tr>
<td>Moist Dark Brown</td>
<td>Good on stubble</td>
<td>Good</td>
<td>Fair on stubble, light soil</td>
</tr>
<tr>
<td>Black</td>
<td>Not suitable: too wet</td>
<td>Excellent</td>
<td>Not suitable: too wet, season too short</td>
</tr>
<tr>
<td>Moist Black</td>
<td>Not suitable: too wet</td>
<td>Excellent</td>
<td>Not suitable: too wet, season too short</td>
</tr>
<tr>
<td>Gray</td>
<td>Not suitable: too wet</td>
<td>Excellent</td>
<td>Not suitable: too wet, season too short</td>
</tr>
</tbody>
</table>

Once your crop choice is made, you can turn your attention to variety. Choose those that have resistance to diseases known to be a problem in your region.

**Seed quality.** Pulse seed is well known for its fragility – it doesn’t take much to split a seed coat, or cause moisture damage in the bin. That’s why best management practices start with taking full ownership in seed quality and the choices available to you. Buying Certified pulse seed is an excellent start, especially for newer varieties, because certification guarantees seed quality in terms of germination and varietal purity.

However, many growers buy or use their own common seed. If so, they should always test it at an accredited lab to verify seed quality and check for the presence of seed-borne diseases – include it as an input cost. Home germination tests simply do not
tell you enough about a seed lot to be a reliable measure of quality. Sprouting well in a germination test does not necessarily mean the seed has sufficient vigour to perform well in the field, especially when seeded under difficult conditions such as cold soils, soils with heavy soil-borne disease pressure, or insects such as wireworms.

The 2005 season provides a concrete lesson in the matter of seed testing. The fall of 2004 was fraught with poor weather, including early frosts, in many areas of the Prairies. In many cases, the rushed harvest meant crops were binned before they were completely stable, and the “sweat” that pulse crop seed undergoes in the bin wasn’t always well managed. Seed samples from the 2004 crop sent into labs for testing over the winter have shown high levels of seed-borne diseases, plus extensive damage from a variety of other factors relating to a late harvest in difficult weather conditions. It’s likely this seed will do well in a germination test conducted in the fall, but the inherent damage may result in a significant decrease in germination and vigour come spring.

Careful records of pre-harvest glyphosate treatments are also essential to evaluating seed quality. If your pulse crop received a pre-harvest glyphosate treatment, or if you’re buying common seed from someone else and you don’t know the production history, it becomes even more important to test the quality of the seed to ensure there has been no impact on germination.

Always obtain reliable assurances of seed quality by having seed tested at an accredited seed lab, or by buying quality tested and quality assured Certified seed.

**Inoculation.** Field peas, lentils and chickpeas are legumes that can capture atmospheric nitrogen then transform it into plant-available nitrogen in root nodules. To optimize N-fixing activity, sufficient numbers of bacterial (rhizobial) cells must be close to the developing root zone. Inoculation accomplishes this by adding appropriate types and amounts of rhizobia to the seed and the soil. Each pulse crop has specific inoculant needs, so ensure that the inoculant product applied is right for the crop you are seeding.

Commercial inoculants are available in granular, liquid or peat-based formulations. Granular inoculants are placed with the seed, much like fertilizer, and are the best choice for new pulse ground or challenging growing conditions, such as high soil moisture content.
Liquid and peat-based inoculants are applied to the seed itself, so if you are using a seed treatment as well, be sure that it is compatible – rhizobia are living bacteria and can be adversely affected by some seed treatments. Too much heat, cold or light can also kill rhizobia, so always read and follow inoculant label directions to the letter.

**Seedbed quality.** A common cause of seed failing to germinate properly is poor seed-to-soil contact, which comes down to seedbed preparation. Preparing the seedbed properly is a challenge, particularly with minimum or zero-till systems. Minimum till does help preserve moisture, but high levels of crop residue can interfere with seed-to-soil contact and reduce germination. As much as possible, the seedbed should be level, uniform, well packed and at the right temperature for the crop, with the previous crop’s residue well spread out at harvest, or by harrowing if required. Clumps of chaff or straw will reduce seed-to-soil contact and quite often delay stand establishment.

Today’s larger seeding equipment means more acres can be seeded in less time. But since most farms are now also much larger, and often involve widely separated parcels of land, there can be just as much, if not more, pressure than ever to finish seeding in time. Other considerations are using less skilled equipment operators or seeding operations that extend into the night, when it’s much harder to monitor conditions and check rows for proper seed placement.

Operating in pressures like these can sometimes lead to increased speed during seeding, and seeding at too high a speed can result in uneven seed and fertilizer placement, which can lead to inadequate seed-to-soil contact. Making a conscientious effort during seeding operations will result in improved, even germination and contribute to optimal stand establishment.

**Seeding date.** There’s always a rush to get everything in early to make the most of our short growing season. But be cautious of seeding too early, as this can lead to delayed or reduced emergence due to cold weather and soils. Such a delay leaves crops vulnerable to early season disease and insect attack for a longer time than need be. Picking the right date is always difficult, but employing disease limiting practices, like proper rotations, seedbed preparation and using a seed treatment, can give early-seeded crops a better chance at becoming established, even if the weather is unfavourable.
Seeding rate. Optimal seeding rates will vary with crop type, soils, fertilizer use and target yields. This is especially true of unfamiliar soils encountered on large, expanded land bases. The large and varied seed size of pulse crops, plus their generally high seed cost, makes using appropriate seeding rates critical.

The primary purpose of optimizing your seeding rate is to establish the optimum number of viable plants per unit of area, e.g. per square foot or per foot of row. Along with optimizing plant growth, this promotes crop competition against weeds. This is an area where pulse crops need all the help they can get because in terms of weed competition, pulse crops are not nearly as competitive as cereals or canola.

To develop a seeding rate that will achieve the optimum plant population, you need to know the following information:

1. Seed size/weight. This may be available from the seed seller, or from the lab where you have your seed tested. Seed weight can vary widely for any crop type. Lentils, for example, can weigh 30 to 80 grams per 1,000 seeds, or 5,600 to 15,000 seeds per pound.

2. Expected seedling survival rate. Take the germination rate, then reduce it by a factor that accounts for the number of germinated seeds that may not survive to produce a plant. Seedling survival is typically 80% to 90%; under adverse conditions, it may fall to 40% to 50%.

Using your target plant population figure (from the chart above), seed weight and expected seedling survival, your optimal seeding rate can be determined as:

$$\text{Seeding rate (lb./ac.)} = 10 \times (\text{population per square foot}) \times \text{seed weight (grams/1,000)} \times \frac{\% \text{ seedling survival}}{100}$$
Here’s an example: Eston lentil with a seed weight of 33 grams/1,000 seeds, a desired population 12 plants/square foot, and an expected seedling survival rate of 70% due to anticipated disease pressure.

\[
\text{Seeding rate} = \frac{10 \times 12 \times 33}{70} = 57 \text{ lb./ac.}
\]

**Seeding depth.** The goal at seeding is always to place seed into moisture. But the deeper you plant, the colder the soil, which slows germination. And for many pulse crops, germination already takes a relatively long time, even in ideal conditions, because the seed must first imbibe enough moisture to swell to two or three times its size when dry. Seeding too deep also adds unnecessary time for emergence, and that gives seed- and soil-borne diseases more time to attack the seed and young shoot.

So be cautious of your seeding depth, and use the following industry recommendations.

<table>
<thead>
<tr>
<th>Crop</th>
<th>Seeding depth recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lentil</td>
<td>1½ inch to 3 inches. Seed should ideally be covered with 1½ inches of moist, packed soil.</td>
</tr>
<tr>
<td>Chickpea</td>
<td>1½ to 2½ inches. Chickpea seeds are large and imbibe their own weight in water during germination, so seeding into moisture is important.</td>
</tr>
<tr>
<td>Field pea</td>
<td>2½ inches. Place seed 1½ inches into moisture. Pea seedlings can emerge from 3 inches – do not plant too shallow.</td>
</tr>
</tbody>
</table>

Best practices for controlling seeding depth include:

- Before the seeding operation, verify that the drill achieves the desired depth across its full width.
- In the field, make frequent checks on actual depth achieved, especially if equipment is operated by others.
- Slow down! Large seeds are prone to bouncing out of the trench when seeding at excessive speed.
- Use field speeds that don’t allow the drill to throw soil onto rows from adjacent shanks.
- If very deep seeding into moisture appears necessary, investigate special openers available to place seed in a deep trench and cover it lightly.
Fertility. Each pulse crop has its own specific fertility requirements. Consult up-to-date research guidelines, seed/fertilizer supplier recommendations and local growers when developing your fertility program. Best practice recommendations for pulse crop fertility are continually evolving, so stay current with the latest advice on nutrient management, including rates of application. For optimum stand establishment, ensure that any fertilizer going down with the seed or at seeding has a safe separation (at least one inch) from the seed. Pulse crop seedlings can very sensitive to seed row nutrients.

Seed handling. Pulse seed needs extra care in handling to prevent seed coat breakage and reduced germination. Seed may need to be moisturized before seeding to maximize seed coat flexibility. Meter rollers or seed cups on drills must have enough clearance to allow accurate metering of large seeds without damage. With air seeders, excessive fan speed and high seed velocity in the air stream will result in seed damage and reduced germination. Observe manufacturers’ recommendations and run fans no faster than necessary to prevent plugging. Inoculants and seed treatments can affect seed metering and flow, so equipment should be calibrated using inoculated and/or treated seed.

Be sure to keep pulse seed from excessive drying while preparing to seed, as over-dry seed is much more prone to cracking and mechanical damage. In addition, dryness or high heat will kill many or all of the crucial bacteria in any inoculant on the seed.

Post-planting operations. For certain pulse crops, rolling after seeding smooths the soil, thereby reducing the difficulty of harvesting a low-growing crop. A tine harrow pass between seeding and emergence may also be possible to control weeds while leveling the soil.

<table>
<thead>
<tr>
<th>Crop</th>
<th>Rolling</th>
<th>Harrowing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lentil</td>
<td>Can be rolled from before emergence up to the 5-node stage. Best done on hot days when plants are partially wilted and more flexible. Rolling damp crops can spread disease over the entire field.</td>
<td>Can be tine harrowed from after seeding to the seedling stage (max. 4 inches). Some plant damage may occur. Use higher seeding rates if you plan to harrow.</td>
</tr>
<tr>
<td>Chickpea</td>
<td>Rolling is generally not necessary, may damage plants and spread disease.</td>
<td>Post-plant harrowing is not recommended – may damage crop.</td>
</tr>
<tr>
<td>Field pea</td>
<td>Can be rolled from before emergence (preferred) up to the 5-leaf stage. Best done on hot days when plants are partially wilted and more flexible. Rolling damp crops can spread disease over the entire field.</td>
<td>Can be harrowed from after seeding to emergence.</td>
</tr>
</tbody>
</table>
Disease Management
Achieving a strong, uniform crop stand lays the foundation for higher yields. Healthy, dense stands also maximize the competitive ability of the crop against weeds. Working against this are seed- and soil-borne diseases, such as seed rot and seedling blight, which can severely reduce pulse plant establishment, nodulation, plant growth and ultimately yield. The good news is that seed- and soil-borne diseases can be managed through the use of agronomic practices that are known to help reduce the impact of the disease on the crop.

**Start with rotations.** Many disease pathogens survive in the soil for years, so it takes long-term observation and good planning to defend against them, and that starts with maintaining proper crop rotations. A proper rotation breaks disease life cycles and reduces pathogens’ opportunities for success – it is one of your most powerful disease management tools. Shortening or ignoring rotations usually encourages disease inoculum to build up in the soil to levels where even treated seed can succumb to the pressure.

In pulse crops, rotations of no less than four years are recommended to keep soil- and residue-borne diseases in check. It can be difficult some years, but maintaining a proper cereal-oilseed-cereal-pulse rotation takes the advantage away from diseases, because what affects one crop type is, typically, less harmful to others. Pathogens are tenacious survivors, both in the soil and on pulse residue, and rotating out of host crops just makes good sense.

Rotations are also important in managing herbicide carryover. If they are too short, particularly in dry years when herbicide breakdown tends to be slower, you run the risk of damaging your pulse crop with residual herbicides from previous years.

**The role of seed treatments.** Seed treatments are a valuable weapon in the fight against early season diseases in pulse crops. Their primary role is to improve germination, emergence and stand establishment – getting plants safely through the early-season disease threats and off to a good start. Always remember that today’s seed treatments will only do their job for the first few weeks of plant growth, and that extended periods between seeding and emergence (due to cold weather or soils, for example) will reduce a seed treatment’s ability to do its job properly. It’s one reason why seeding dates are so important when it comes to seed treatment performance.

All prairie soils contain naturally occurring levels of disease pathogens, particularly *Fusarium*, *Pythium* and *Rhizoctonia*, which are responsible for a variety of seedling...
diseases, so it’s a good idea to use a broad spectrum seed treatment, even on clean seed, to protect your crop from early season disease attack. As well, keeping some of these early season diseases in check can help reduce the severity of later mid-season foliar diseases, such as ascochyta blight and anthracnose (see chart below).

**Accurate diagnosis is key.** Correct diagnosis of plant disease is a complex activity and can’t always be done with the naked eye. It’s easy, for example, to mistake herbicide carryover damage for disease because some of the early physical symptoms are similar, like stunting, yellowing and rotting at the base of the stem. Conversely, many disease symptoms are often misdiagnosed as frost damage.

If you suspect disease in your crop, send seed samples to an accredited lab for an accurate diagnosis. If the test results come back positive for disease, you will have a heads up on what you need to protect against in your seed stock or what to watch out for in the field next season. If results come back negative for disease, you’ll know that you need to look back at other agronomic practices to correctly identify what happened and how to rectify it next year.

**EARLY SEASON FUNGAL DISEASES OF PULSE CROPS**

<table>
<thead>
<tr>
<th>Crop</th>
<th>Diseases</th>
<th>Description</th>
<th>Conditions</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lentil</td>
<td>Seed rot, damping-off or seedling blight caused by <em>Fusarium</em> spp., <em>Pythium</em> spp., <em>Rhizoctonia</em> spp. and seed-borne ascochyta, anthracnose and Botrytis.</td>
<td>Failed emergence or collapsed seedlings.</td>
<td>Usually only occurs on scattered plants.</td>
<td>Thin stand, reduced nodulation, slowing growth. Higher risk of ascochyta infection as the crop grows.</td>
</tr>
<tr>
<td>Field Pea</td>
<td>Seedling blight, root rot and wilt caused by <em>Pythium</em> spp., <em>Fusarium</em> spp., <em>Rhizoctonia</em> solani. and Aphanomyces euteiches occasionally reported. Seed-borne ascochyta.</td>
<td>Failed emergence or collapsed seedlings as root base decays and turns brown.</td>
<td>Pythium is more severe when soils are cool and wet. Rhizoctonia seedling blight can be severe under drier soil conditions.</td>
<td>Patchy stands, missing seedlings. Higher risk of ascochyta infection as the crop grows.</td>
</tr>
</tbody>
</table>
Compared to the damage potential of disease, the potential for insect damage in emerging pulse crops is much lower. Cutworm damage is occasionally reported in field peas and lentils. Crops such as field peas, where the cotyledons remain below the soil surface, can often recover from cutworm damage if good growing conditions occur. However, the plants may be set back by up to a week, a potential concern for crops that need a long growing season to maximize yield.

As with most insect pests, infestations are hard to predict because of the influence of changing weather and cropping conditions. Sometimes, insects that have been insignificant for years may suddenly boom, so it’s worth knowing what can be done if necessary.

1. **Proper identification of the pest at various stages of its life cycle.** For example, click beetles are the adult stage of the wireworm, and large numbers of them were observed in the western Prairies in 2004. This indicates a potential for increased risk of damaging levels of wireworm larvae.

2. **Accurate diagnosis of damage.** For example, where cutworm or wireworm damage occurs at a low level, the resulting reduction in emergence and plant vigour may be mistaken for poor seed quality or environmental factors.

3. **Understand what control measures are possible.** Cutworms, for example, can be controlled with an insecticide application once damage becomes visible. But the only defence against wireworms is seed treatment. By the time wireworms are found in an emerging crop, there is no “quick fix”, only the need to consider management options in following years.

4. **Stay current with new information.** New research from Agriculture and Agri-Food Canada is providing a better understanding of wireworms, including their reaction to the newer seed treatments. And it’s a good idea to regularly check government and research institution websites for possible updates on insect outbreaks, their feeding behaviour and potential control methods.
CUTWORMS

Identification. Pulse crops are not the first choice for cutworms, but legumes are an alternate host plant for three species of cutworm, so know what to look for.

Pale western cutworm larvae are about 1¼-inches long, greenish or slate-grey, with a brown head. Red-backed cutworm larvae are about 1½-inches long, dark grey with two broad, dull red stripes down the back. Army cutworm larvae start out pale green in colour and grow to about 1½ to 2 inches in length. When full grown, army cutworms are very smooth, almost hairless and have a number of stripes (white in the centre, then mottled, orange and brown stripes) running lengthwise down their backs. Cutworm larvae curl up when disturbed.

Lifecycle. The pale western and red-backed cutworm species overwinter as eggs, which hatch in April and early May. The larvae feed on seedlings until June, then burrow into the soil to pupate. Adult moths emerge from August to September and lay eggs either in the soil (pale western) or in stubble (red-backed).

In the case of army cutworms, female moths lay eggs in the soil from August to October. The larvae feed until winter when the ground freezes and they remain inactive, half grown, throughout the winter. They begin to feed the following April and continue to feed until they pupate in May and June. They have a brief life as moths, then the egg laying cycle begins again.

Feeding damage. Pale western and red-backed cutworms go through about six growth stages in the larval period from April to June. Holes and notches eaten into plant leaves are typical of feeding damage caused by small, young larvae; older cutworms eat into plant stems, literally cutting seedlings off at the soil level.

Pale western cutworms tend to eat along rows and, when their food supply is diminished, army cutworms will move en masse to find new sources. Bare patches in the field, particularly on hills and south-facing slopes, are a key indicator of cutworm damage and can be easily mistaken for poor germination. If you suspect cutworms, dig around the roots of plants on the edge of a bare patch, and look for larvae in the first two inches of soil.

Cutworm damage vs. wireworm damage
Cutworms: plants are usually cut off completely at or near the soil surface.
Wireworm: plant is wilted and discoloured but remains attached to the root.
Geography. Pale western and army cutworm are mainly a concern in southern growing regions, while the red-backed species are more prevalent in northern areas.

Control. Pesticide sprays can be used locally in those areas of the field where cutworms are still actively feeding. Spraying is most effective when done in the evening as cutworms feed most actively at night. Today’s seed treatments will not control cutworms.

WIREWORM

Identification. Wireworm larvae have hard, smooth, slender jointed bodies. They are usually dark coloured, though some are yellow or white. They have three pairs of legs behind the head, and the last abdominal segment is flattened with a keyhole-shaped notch. Full-grown larvae range from 1 to 1 1/2 inches in length. Adult wireworm are 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 soil pupae in the spring. From late May through June, the female beetles lay 200 to 1,400 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 full-grown, the larvae pupate in the soil.

Feeding damage. Seeds are often hollowed out and seedlings killed. Stems of young seedlings are shredded, usually causing the central leaves to die. Damaged plants soon wilt and die, resulting in thin stands. Disease organisms often enter plants damaged by wireworm.

Wireworm damage vs. cutworm damage

Wireworm: plant is wilted and discoloured but remains attached to the root.
Cutworms: plants are usually cut off completely at or near the soil surface.

Geography. Wireworm pest species can be found across the Prairies. However, infestation may vary considerably even over a single field or farm, since larvae tend to remain where they hatch. There are usually wireworms in all stages of development in an infested field, since the larval stage can take several years to fully develop.

Control. An action threshold of about 32 wireworms per square metre is often recommended. If wireworms are found at this or a higher density, a dual-purpose seed treatment is usually warranted in following years.
APPENDIX I – SEED TREATMENT CHOICE

The primary factor to consider when choosing which pulse crop seed treatment to use is seed- and soil-borne disease control. Since the major soil-borne disease pathogens (Fusarium, Rhizoctonia and Pythium) are almost always present, choosing a seed treatment with broad spectrum protection is a basic step in managing for strong stand establishment.

For a class of crops that tend to struggle at emergence, it’s interesting to note that seed treatment use intensity is quite low among pulse growers. Part of this is driven by crop kind. Industry estimates indicate that only 20% to 30% of the peas that are seeded each year are treated, which is likely due to their competitive nature against disease; chickpeas on the other hand, which are notoriously poor disease competitors, are 100% treated.

Another factor is treatment location – on-farm or in a commercial treatment facility. Again, this is primarily dictated by the crop kind itself – what a grower chooses to do often depends on the seed’s ability to withstand a certain amount of handling. Here are some industry statistics on pulse seed treatment use patterns.

<table>
<thead>
<tr>
<th>Crop</th>
<th>% Seed treated against disease</th>
<th>Where treated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lentil</td>
<td>30</td>
<td>100% on-farm</td>
</tr>
<tr>
<td>Chickpea</td>
<td>100</td>
<td>50% on-farm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>50% commercial</td>
</tr>
<tr>
<td>Field pea</td>
<td>20–30</td>
<td>75% treated on-farm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>25% commercial</td>
</tr>
</tbody>
</table>

Source: Stratus Agri-Marketing.
Flexibility in a broad spectrum option

Syngenta’s seed treatment for pulses, Apron Maxx RTA®, provides tremendous flexibility for pulse growers. It’s registered for control of the major seed- and soil-borne diseases affecting peas, lentils and chickpeas. Growers have the choice of applying it on-farm or through a commercial treater. As well, it’s inoculant-friendly, so growers can treat their seed for protection against early season disease attack and inoculate all in one operation.

<table>
<thead>
<tr>
<th>Crop</th>
<th>Diseases controlled</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lentil</td>
<td>Seedling blight caused by <em>Fusarium</em> spp., <em>Rhizoctonia</em> spp. and <em>Pythium</em> spp.</td>
</tr>
<tr>
<td></td>
<td>Seed-borne ascochyta caused by <em>Ascochyta lentis</em>.</td>
</tr>
<tr>
<td></td>
<td>Seed rot and seedling blight caused by seed-borne <em>Botrytis</em> spp.</td>
</tr>
<tr>
<td>Chickpea</td>
<td>Damping-off caused by <em>Fusarium</em> spp., <em>Rhizoctonia</em> spp. and <em>Pythium</em> spp.</td>
</tr>
<tr>
<td></td>
<td>Seed-borne ascochyta blight caused by <em>Ascochyta rabiei</em>.</td>
</tr>
<tr>
<td></td>
<td>Seed rot and seedling blight caused by seed-borne <em>Botrytis</em> spp.</td>
</tr>
<tr>
<td>Field pea</td>
<td>Seedling blight caused by <em>Fusarium</em> spp., <em>Rhizoctonia</em> spp. and <em>Pythium</em> spp.</td>
</tr>
</tbody>
</table>

APPENDIX II – APPLICATION CHOICES FOR SEED TREATMENTS

For those treating pulse crops on-farm, treatment methods and equipment have significantly improved over the old system of dripping treatment into an auger, which often resulted in spotty coverage, significant waste of product and seed damage. However, even with improved equipment, operator skill remains by far the single largest factor in achieving optimal seed loading and coverage during on-farm treatment.

Initial application may typically coat only some of the seeds. Coverage of the remaining seed is the result of mixing the seed as it travels from the treater to the seeder. Better mixing by aggressive augering is not an option in pulse crops due to the increased risk of mechanical damage to the seed. Instead, focus on ways to increase the initial coverage by using new application techniques and/or equipment that provides increased initial coverage.

On-the-go seed treaters are another option. By applying seed treatment on the seeds as it makes its way through the air drill, only as much seed is treated as is actually needed for that crop, so there are no “leftovers”. The coverage achieved by these units is typically very good, but again, operator skill becomes a factor in effective coverage. The peristaltic pumps used in these units operate best when kept free of product residue, so units should be drained and flushed every night to ensure effective seed coverage.
Achieving strong stand establishment is key to helping your pulse crops outgrow early season challenges, such as frost or cold and wet seedbeds, and move into the summer growing season strong and healthy. The slower young seedlings grow, the more vulnerable they are to environmental stresses as well as disease attack. The seeding decisions you make in the spring can determine whether or not your crop gets out of the ground quickly and off to a great start. What are you doing to minimize your pulse crop stand establishment risk factors?

<table>
<thead>
<tr>
<th><strong>Low Risk</strong></th>
<th><strong>High Risk</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>- Long rotations (pulse crop every four years)</td>
<td>- Short rotations (pulse crop every two years or less)</td>
</tr>
<tr>
<td>- Within rotation, pulse crop is grown only where the prior crop does not have diseases in common with pulse crops</td>
<td>- Pulse crops grown on land where another broadleaf crop may have had diseases in common e.g. sclerotinia</td>
</tr>
<tr>
<td>- Test seed for germination, vigour and seed borne disease</td>
<td>- Test seed for germination only, or not at all</td>
</tr>
<tr>
<td>- Soil temperature 10 C or higher</td>
<td>- Soil temperature less than 10 C</td>
</tr>
<tr>
<td>- Seed early (mid-May)</td>
<td>- Seed too early (late April, early May)</td>
</tr>
<tr>
<td>- Seeding rate set according to seed size and quality</td>
<td>- Seeding rate assumed from broad guidelines</td>
</tr>
<tr>
<td>- Handling seed with conveyors to minimize breakage</td>
<td>- Handling seed with steel augers partially full</td>
</tr>
<tr>
<td>- Uniform seed/fertilizer placement</td>
<td>- Variable seed/fertilizer placement</td>
</tr>
<tr>
<td>- Balanced fertility</td>
<td>- Unbalanced or poor fertility</td>
</tr>
<tr>
<td>- Herbicide rotation practices that minimize risk of carryover</td>
<td>- Herbicide rotation practices that increase potential for carryover</td>
</tr>
<tr>
<td>- Appropriate seed treatment based on risk assessment</td>
<td>- No seed treatment, or inappropriate seed treatment</td>
</tr>
<tr>
<td>- Good knowledge of field history</td>
<td>- Incomplete knowledge of field history</td>
</tr>
<tr>
<td>- Careful diagnosis of emergence</td>
<td>- “Drive-by” diagnosis of emergence</td>
</tr>
</tbody>
</table>
IMPORTANT NOTE: Achieving strong stand establishment is the result of an integrated crop management plan that focuses equally on managing disease and insect cycles, minimizing herbicide carryover through proper rotations, managing for optimum plant population through proper seeding practices, optimizing fertility and knowing the long-term history of the field. The more low-risk practices you use, the better your chances of achieving strong stand establishment and, ultimately, a high-quality, high-yielding pulse crop.
References

There are many resources for pulse crop growers in Western Canada to draw on for valuable, accurate pulse crop production information. Our sincere thanks to those who provided information in the preparation of this Guide. If you have questions or concerns about your pulse crop, contact your local agronomic advisers or any one of these resources for help.

Saskatchewan Pulse Growers
104, 411 Downey Road
Saskatoon, SK  S7N 4L8
Ph: (306) 668-5556
Fax: (306) 668-5557
e-mail: pulse@saskpulse.com
web: www.saskpulse.com

Manitoba Pulse Growers Association Inc.
PO. Box 1760
Carman, MB  R0G 0J0
Ph: (204) 745-6488
Fax: (204) 745-6213
e-mail: mpga@cici.mb.ca
web: www.manitobapulse.ca

Alberta Pulse Growers
4301 - 50 Street
Leduc, AB  T9E 7H3
Ph: (780) 986-9398
Toll-free: 1-877-550-9398
Fax: (780) 980-2570
e-mail: office@pulse.ab.ca

Penny Pearse
Provincial Specialist, Plant Disease
Saskatchewan Agriculture, Food & Rural Revitalization
Room 125, 3085 Albert Street
Regina, SK  S4S 0B1
Ph: (306) 787-4671
Fax: (306) 787-0428
e-mail: ppearse@agr.gov.sk.ca

Ron Howard
Plant Pathology Scientist
Alberta Agriculture, Food & Rural Development
Crop Diversification Centre South
101 P. Duncan Hargrave Building
Brooks, AB  T1R 1E6
Ph: (403) 362-1328
Fax: (403) 362-1326
e-mail: ron.howard@gov.ab.ca

Syngenta Crop Protection Canada, Inc.
300, 6700 Macleod Trail South
Calgary, AB  T2H 0L3
Ph: (403) 219-5400
Fax: (403) 219-5401
Customer Resource Centre:
1-87-SYNGENTA (1-877-964-3682)
web: www.FarmAssist.ca

Photo Credits:
Photo on page 4 courtesy of 20/20 Seed Labs Inc.
Middle photo on page 11 courtesy of the Canadian Phytopathological Society, Diseases of Field Crops in Canada, 3rd Edition.
Committed to helping you grow the best pulse crop™

For more information, please contact our Customer Resource Centre at 1-87-SYNGENTA (1-877-964-3682), or visit us at www.FarmAssist.ca

® APRON MAXX, RTA and the Syngenta logo are registered trademarks of a Syngenta group company. TM "Committed to helping you grow the best pulse crop" is a trademark of a Syngenta group company.