Better seed in so many weighs

The Proving Ground™ is our unique, large-scale trialing effort. This year we have planted more than 1000 large-scale trials of canola, corn and soybeans across Western Canada. This is more than any other seed company and continues to grow every year.

Large-scale trials for large-scale farming

Farming is large-scale so why shouldn’t our trials also be to scale. All Proving Ground trials for commercial products are conducted under real world conditions with a grower’s own management practices.

Successful crops take more than great genetics

It takes a whole package of information and advice to maximize yield potential for crops. The Proving Ground trials aim to provide more information and resources to make growers more successful.

Valuable learning opportunity

Our Proving Ground trials also provide a valuable learning opportunity for our co-operators. To participate in a trial, talk with your local Pioneer Hi-Bred sales representative.
Welcome to the 2012 growing season!

DuPont Pioneer is one of the world’s largest seed companies. For more than 80 years, Pioneer Hi-Bred has been developing and supplying advanced plant genetics to growers around the globe. Our business is continuing to grow as global demand for food, feed, fuel and biomaterials increases.

In Western Canada, our business is also aggressively growing. To support this growth, we recently announced the establishment of a new organizational structure that puts increased focus on Western Canada.

We’re excited about what this announcement means. It will allow us to provide our customers with more interaction with front line field staff like agronomists, account managers and sales reps. And it will increase our ability to provide more personalized agronomic service and products that much quicker to growers.

It also means more research and development opportunities focused on Western Canada. We’re increasing the scale of our research and development programs with more testing, more locations, more data points, more equipment and most importantly, more people.

Our investments in research are already paying off. This is demonstrated with new high performing products like those featured in our plots across the west and the new products and technologies detailed in this tour book. Our future is even brighter. Western Canada growers can expect even more exciting new products and traits to come to market – products that have been developed to meet their specific needs.

On behalf of the Pioneer Hi-Bred team, thank you for your business. We look forward to continuing to earn your seed business every year. Best wishes for a safe and successful growing season and harvest.

Greg Stokke
Business Director, Western Canada Commercial Unit
Pioneer Hi-Bred Limited

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Guided by The Long Look

For more than 80 years, DuPont Pioneer has been developing and supplying advanced plant genetics to growers around the world. Our commitment goes beyond seed supply. We are the leading source of customized solutions for farmers, livestock producers and grain and oilseed processors. With headquarters in Des Moines, Iowa, Pioneer provides access to advanced plant genetics in more than 90 countries.

In Canada, Pioneer Hi-Bred Limited produces and markets a full lineup of seed products including canola, corn, soybeans, alfalfa, sunflowers, winter wheat and Sila-Bac® brand forage inoculants.

In everything we do at Pioneer Hi-Bred, we are guided by our Long Look business philosophy, written in 1952, which remain our guiding principles.

The Long Look

1. We strive to produce the best products on the market.
2. We deal honestly and fairly with our customers, seed growers, employees, sales force, business associates and shareholders.
3. We advertise and sell our products vigorously, but without misrepresentation.
4. We give helpful management suggestions to our customers to assist them in making the greatest possible profit from our products.

DuPont Pioneer – Quick Facts

• Due to DuPont Pioneer’s aggressive expansion in Western Canada, a new head office located in Saskatoon, SK, has recently been established.
• Across all business functions, there are currently more than 90 employees working for Pioneer Hi-Bred in Western Canada. Additional growth of our employee base, with a focus on research and development, is planned over the next few years.
• Our unique Pioneer Hi-Bred sales representative network is now more than 130 strong and continues to grow.
• Pioneer Hi-Bred operates three research stations in Western Canada – Edmonton, AB, Saskatoon, SK, and Carman, MB. To support a growing research and development effort focused on Western Canada, expansions and upgrades will happen at all of these facilities in the short term.
• The global headquarters for Pioneer Hi-Bred’s canola breeding program is located in Georgetown, ON.

• Pioneer Hi-Bred has the first and only grain and silage corn breeding program in Western Canada. It is located in Carman, MB.
• Pioneer Hi-Bred operates the largest seed plant in Canada. Located in Chatham, ON, it conditions and packages corn, soybeans and winter wheat.
• Pioneer Hi-Bred is working to provide our canola customers with access to all of the herbicide tolerant traits. This includes the LibertyLink® trait thanks to a licensing agreement signed in 2011.
New Pioneer® brand products for 2012

Canola

Pioneer® brand **45S54**

Pioneer® brand 45S54 is a new hybrid with the Roundup Ready® trait and the Pioneer Protector® Sclerotinia Resistance trait. This hybrid offers an improved level of sclerotinia resistance. Strong disease package: R for blackleg, R for Fusarium wilt and MR for sclerotinia. Excellent early growth and very good standability. In WCC/RRC registration trials, 45S54 yielded 126% of checks (46A65 & Q2).

Pioneer® brand **43E02**

Pioneer® brand 43E02 is a new very early canola hybrid. It offers good early growth and average standability. Rated MR for blackleg and R for Fusarium wilt. An excellent option for early harvest opportunities to help spread your harvest timing. Also suitable for late replant situations. In WCC/RRC registration trials, 43E02 yielded 117% of checks (46A65 & Q2).

Soybeans

Pioneer® brand **90Y01**

Pioneer® brand 90Y01 is a new early soybean variety. It offers excellent emergence and aggressive early growth making it highly suitable for Manitoba. Moderately wide canopy width. Very good harvest standability and a solid disease resistance package.

Corn

Pioneer® brand **P8193HR**

2400 heat units

Pioneer® brand P8193HR is a new double-stack hybrid. It is a taller plant with average root and stalk strength. P8193HR is early flowering with good test weight. Predicts above average for drought tolerance.

Pioneer® brand **P8210HR**

2475 heat units

Pioneer® brand P8210HR is a new double-stack hybrid. It offers superior yield potential with very good root and stalk lodging resistance. P8210HR has moderate plant height and ear insertion. Predicts above average for drought tolerance.

Pioneer® brand **P8651HR**

2550 heat units

Pioneer® brand P8651HR is a new double-stack hybrid with excellent performance. Taller hybrid with excellent silage characteristics. Predicts above average for stalk lodging resistance.

R = Resistant; MR = Moderately Resistant

Product information is based upon historical field observations and analysis of trait scores by Pioneer Research Managers and may not predict future results. Product responses are variable and subject to any number of environmental, disease and pest pressures. Please use this information as only one component of your product positioning decision. Refer to www.pioneer.com or contact a Pioneer Hi-Bred sales representative for the latest and most complete listing of traits and scores for each Pioneer brand product.
Where research meets reality.

Better seed in so many weighs

The Proving Ground™ is our unique, large-scale trialing effort. This year we have planted more than 1000 large-scale trials of canola, corn and soybeans across Western Canada. The number of trials we plant is currently more than any other seed company and continues to grow every year. The large amount of data we collect from these trials helps our Pioneer Hi-Bred sales team confidently position the right Pioneer® brand seed product on every acre you grow.

Large-scale trials for large-scale farming

Farming is large-scale so why shouldn’t our trials also be to scale. All Proving Ground trials for commercial products are conducted under real world conditions with a grower’s own management practices. This way they provide data that is local and more relevant to growers in their own area.

Successful crops take more than great genetics

It takes a whole package of information and advice to maximize yield potential for crops. The Proving Ground trials aim to provide more information and resources to make growers more successful. That why we not only test products, we also thoroughly test traits, seed treatments and agronomic practices. This helps us better understand and validate the true value of proprietary traits so we can better position them with our customers.

By testing different agronomic practices – both new and old – it helps us learn more about the factors that impact yield.
The Proving Ground™ trials encompass our complete testing program – from research through to testing both products and agronomic practices that make a difference on the grower’s operation. They truly are where research meets reality.

**Research and Development**
- Five years of field testing in small plots
- We’re expanding our R&D program to include more testing, more locations, more data points and more traits

**Agronomy Research Efforts**
- Testing different agronomic practices – new and old – to help us learn more about the factors that impact yield
- Testing of new proprietary traits and treatments to help us understand the true value to farmers of the trait and how it can best help their operation
- Providing growers with access to unbiased, scientifically based agronomic

**Product Advancement Trials**
- Field-scale program that generates yield performance data to make product advancement decisions
- Replicated trials conducted under a wide range of environments and management practices

**Side-by-Sides**
- Field-scale demonstration of commercial products that are managed with farm-scale equipment
- Customers can “test-drive” Pioneer genetics against other products on their farm
- Allows “system comparisons” to measure overall performance of hybrid and weed control

**Product Knowledge Plot**
- Allow farmers to be the first to test and trial new products
- Test new commercial products under many environmental and management conditions
- Gain experience with new products before wide-scale launch
DuPont Pioneer has always been at the forefront in providing genetics with high yield potential and solid agronomics that anticipate grower needs.

As example of this leadership position is the introduction of the Pioneer Protector® canola seed traits. They’re the market-leading traits for protecting canola from damaging diseases like clubroot or sclerotinia.

- Pioneer Hi-Bred was the first company to introduce sclerotinia resistant canola hybrids to the market. Today, four years later, we remain the only company offering sclerotinia resistant hybrids.

- Pioneer Hi-Bred was the first company to introduce a clubroot resistant hybrid to Western Canada.

Look for the new Pioneer Protector® logo on high-performing canola hybrids this season. It’s a symbol of canola seed traits that serve to protect your productivity, yields and profits.
Pioneer Protector® Sclerotinia Resistance

Sclerotinia stem rot, also known as white mould, is one of the most devastating diseases in canola production.

- From the 2011 Provincial Disease Surveys,
  - Alberta – 67% of fields surveyed had sclerotinia
  - Manitoba – 43% of fields surveyed were impacted by sclerotinia
  - Saskatchewan – 81% of field surveyed showed the presence of sclerotinia

The Pioneer Protector® Sclerotinia trait in high performing canola hybrids provides these benefits to growers:

**Reduction in incidence**
- More than 50% reduction in sclerotinia incidence.

Field results show that Pioneer Protector® Sclerotinia resistance can reduce the incidence of sclerotinia in a canola crop by over 50%. Individual results may vary. Depending on environmental and agronomic conditions, growers planting Pioneer Protector Sclerotinia resistant hybrids may still require a fungicide application to manage sclerotinia in their crop.

**Peace of mind**
- Provides increased flexibility and insurance when timing fungicide applications.

**Convenience**
- Sclerotinia protection is planted with the seed.

**Season-long control**
- An in-plant trait that provides coverage regardless of weather patterns throughout the entire growing season.

High yielding Pioneer® brand canola hybrids with the Pioneer Protector Sclerotinia resistance trait that are exclusively available from your local Pioneer Hi-Bred sales representative:

<table>
<thead>
<tr>
<th>45S54</th>
<th>57.9 bu/ac</th>
</tr>
</thead>
<tbody>
<tr>
<td>45S52</td>
<td>58.6 bu/ac</td>
</tr>
<tr>
<td>46S53</td>
<td>57.9 bu/ac</td>
</tr>
<tr>
<td>45S51</td>
<td>57.9 bu/ac</td>
</tr>
</tbody>
</table>

Sclerotinia resistant hybrid (45S52) shows a 1.2% yield advantage versus a non sclerotinia resistant hybrid (45H29).

2011 On-Farm Sclerotinia Trials, 14 locations, Pioneer Agronomy Sciences.
Pioneer Protector® Clubroot Resistance

Clubroot is a serious disease threat in parts of Alberta and can cause up to an 80% yield loss in infected fields. The Pioneer Protector® Clubroot resistance trait in high performing canola hybrids provides several benefits to growers:

**Multi-race resistance**
- High level of resistance to the most prevalent race – race 3.
- Also resistant to races 2, 5, 6 and 8.

**Resistance is controlled**
- Clubroot is a soil-borne disease so growing a canola hybrid with the Pioneer Protector Clubroot resistance trait will not increase the risk of clubroot resistance development.
- Proper agronomic and sanitation practices are key to preventing and minimizing the spread of clubroot.

**Keeps land infection to a minimum**
- Planting protected canola hybrids keeps clubroot infection from building – and it is important to maintain a one-in-four year rotation in clubroot confirmed areas.

The roots and stalk of clubroot resistant hybrid (left) are healthy and unaffected compared to the clubroot susceptible hybrid which exhibits the characteristic galls (right).

High yielding Pioneer® brand canola hybrid with the Pioneer Protector Clubroot resistance trait that is exclusively available from your local Pioneer Hi-Bred sales representative: 45H29

Blackleg Resistance

Blackleg continues to be a major disease threat for canola. While genetic resistance is available, products differ in the level of resistance and type of resistance (seeding or adult plant resistance).

- All products on the market are classified for the level of blackleg resistance.
- Evaluation of blackleg is part of the overall recommendation and registration process for canola products.

Pioneer Hi-Bred canola research evaluates blackleg resistance through the entire breeding process.

- Inbreds are evaluated before they are combined to produce a hybrid.
- As a canola hybrid advances through the testing program, the intensity of blackleg testing increases (both number of replications and testing locations).
- Evaluation continues even after registration of new hybrids.

And our efforts have paid off. Pioneer® brand canola hybrids offer built-in industry-leading blackleg resistance.

Typical symptoms of blackleg include leaf lesions that are greyish white, round to irregular in shape that are often dotted with black fruiting bodies (left). As the disease develops, stem cankers appear as dry sunken lesions with black borders that girdle the base of the stem. Inoculum produced on the stubble causes infection in subsequent years (right).
How a corn plant develops: Growth and development through the vegetative stages

All corn follows a similar pattern of development with variations based on hybrids, seasons, planting dates and locations. This illustration shows the key phases of corn development through the vegetative (V) stages.

Germination and emergence (VE)

Once planted, corn seeds absorb water from the soil and begin to grow. VE (emergence) comes when the coleoptile (spike) pushes through the soil surface. Corn plants can emerge within five days in ideal heat and moisture conditions. But under cool and wet – or even under very dry conditions – they can take more than two weeks to emerge. The growing point (stem apex) is 1 to 1.5 inches below the surface. The seminal root system is growing from the seed. The seminal roots do much of the early work, but growth slows after VE as nodal roots begin to grow.

V3 Stage
At V3, the growing point is still below the surface. The stalk (stem) hasn’t elongated much. Root hairs are growing from the nodal roots as seminal roots cease growing. All leaves and ear shoots the plant will ever produce form from V3 to about V5. A tiny tassel forms at the tip of the growing point. Above-ground plant height typically is about 8 inches.

V6 Stage
The growing point and tassel rise above the soil surface at about the V6 stage. The stalk begins to elongate. The nodal root system grows from the three to four lowest stalk nodes. Some ear shoots or tillers are visible. Tiller (or sucker) development depends on the specific hybrid, plant density, fertility and other conditions.

V9 Stage
Dissection of a V9 plant shows many ear shoots (potential ears). These develop from every aboveground node except the last six to eight nodes below the tassel. Lower ear shoots grow fast at first, but only the upper one or two develop a harvestable ear. The tassel begins to develop rapidly. Stalks lengthen as the internodes grow. By V10, the time between new leaf stages shortens to about every two to three days.

V12 Stage
The number of ovules (potential kernels) on each ear and the size of the ear are determined at the V12 stage. The number of kernels per row isn’t determined until about a week before silking, at about V17. The top ear shoot is still smaller than the lower ear shoots, but many of the upper ears are close to the same size.

V15 Stage
This is the start of the most crucial period for determining grain yield. Upper ear shoot development overshadows lower ear shoot development. Every one to two days, a new leaf stage occurs. Silks begin to grow from the upper ears. By V17, the tips of upper ear shoots may be visible atop the leaf sheaths. The tip of the tassel also may be visible.

V18 Stage
Silks from the basal ear ovules elongate first. Silks from the ear tip ovules follow. This illustration represents about eight to nine days of reproductive organ development. Brace roots (aerial nodal roots) grow from the nodes above the soil surface to help support the plant and take in water and nutrients during the reproductive stages.

VT Stage
The VT stage arrives when the last branch of the tassel is completely visible. VT begins about two to three days before silk emergence. The plant is nearly at its full height. Pollen shed begins, lasting one to two weeks. The time between VT and R1 can fluctuate considerably depending on the hybrid and the environment.
How a corn plant develops: Reproduction through maturity

R1 stage: Silking
The R1 stage begins when silk is visible outside the husks. Pollination occurs when these moist silks catch falling pollen grains. Pollen takes about 24 hours to move down the silk to the ovule where fertilization occurs. The ovule becomes a kernel. Generally, all silks on an ear are pollinated in two to three days. The silks grow 1.0 to 1.5 inches each day until fertilized. The R1 kernel is almost engulfed in cob materials and is white on the outside. The inner material is clear with little fluid present.

R2 stage: Blister (10-14 days after silking)
R2 kernels are white on the outside and resemble a blister. The endosperm and its now-abundant inner fluid are clear. The embryo is still developing, but it now contains a developing miniature corn plant. Much of the kernel has grown out from the surrounding cob materials. The cob is close to full size. Silks are brown and dry or becoming dry.

R3 stage: Milk (18-22 days after silking)
The R3 kernel is yellow outside, while the inner fluid is now milky white due to accumulating starch. The embryo is growing rapidly. Most of the R3 kernel has grown out from the surrounding cob. Silks are brown and dry or becoming dry.

R4 stage: Dough (24-28 days after silking)
Continued starch accumulation in the endosperm causes the milky inner fluid to thicken to a pasty consistency. Usually four embryonic leaves have formed as the embryo has grown dramatically from the R3 stage. The shelled cob is a light red to pink. Toward the middle of R4, the embryo will stretch across more than half of the width of the kernel side. Just before R5, kernels along the length of the ear begin to dent or dry. The fifth (last) embryonic leaf and the lateral seminal roots have formed. If this seed is planted, these five embryonic leaves will appear the following season after germination and VE.

R5 stage: Dent (35-42 days after silking)
At R5, all or nearly all kernels are dented or denting. The shelled cob is dark red. The kernels are drying down from the top, where a small hard layer of starch is forming. This starch layer appears shortly after denting as a line across the back of the kernel (the non-embryo side). With maturity, the hard starch layer and line will advance toward the cob. Accumulated starch is hard above the line but still soft below the line.

R6 stage: Physiological maturity (55-65 days after silking)
By the R6 stage, kernels have attained their maximum dry weight or dry matter accumulation. The hard starch layer has advanced completely to the cob. A black or brown abscission layer forms, moving progressively from the tip ear kernels to the basal kernels of the ear. It’s a good indication of physiological maturity and signals the end of kernel growth. The husks and many leaves are no longer green, although the stalk may be.
Match Hybrid Maturity to Available CHUs

In Western Canada, especially in areas new to growing corn, it is very important that the maturity of your selected hybrid matches the available growing period. Growers should make hybrid selections that correspond to the corn heat unit (CHU) rating of their local area.

The CHU rating of a hybrid is the number of CHUs required to achieve physiological maturity.

The good news is that new early maturity corn hybrids from Pioneer Hi-Bred are very early—giving growers in non-traditional corn growing areas opportunity to grow a successful corn crop. For example, the CHU’s rating of our earliest hybrids are 2100 CHUs—this would match the average CHU ratings for Saskatoon or Edmonton.

Using the cob to determine crop stage, quality and yield potential

One way to track the corn plant’s development from reproduction through maturity is to establish the silking date (time of flowering) and then add:

- Corn silage—add 45 to 50 days to reach silage quality (approximately 65% moisture)
- Grain corn—add 55 to 60 days to reach grain quality

Silking / Tasseling

<table>
<thead>
<tr>
<th>Stage</th>
<th>% of Maximum Yield</th>
<th>Whole plant moisture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn silage</td>
<td>0%</td>
<td>80-85%</td>
</tr>
<tr>
<td>Grain</td>
<td>50-55%</td>
<td>80-85%</td>
</tr>
</tbody>
</table>

Blister

+13-14 days after silking

<table>
<thead>
<tr>
<th>% of Maximum Yield</th>
<th>Whole plant moisture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grain</td>
<td>0-10%</td>
</tr>
<tr>
<td>Whole Plant</td>
<td>55-60%</td>
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</tbody>
</table>

Milk

+7-8 days after blister stage

<table>
<thead>
<tr>
<th>% of Maximum Yield</th>
<th>Whole plant moisture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grain</td>
<td>30-50%</td>
</tr>
<tr>
<td>Whole Plant</td>
<td>65-70%</td>
</tr>
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</table>

Dough

+5-6 days after milk stage

<table>
<thead>
<tr>
<th>% of Maximum Yield</th>
<th>Whole plant moisture</th>
</tr>
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<td>Grain</td>
<td>60-75%</td>
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<td>Whole Plant</td>
<td>75-80%</td>
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</table>

Dent

+13-14 days after dough stage

<table>
<thead>
<tr>
<th>% of Maximum Yield</th>
<th>Whole plant moisture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grain</td>
<td>60-75%</td>
</tr>
<tr>
<td>Whole Plant</td>
<td>70-75%</td>
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</table>

1/2 Kernal Milk Line

+7-8 days after dent stage

<table>
<thead>
<tr>
<th>% of Maximum Yield</th>
<th>Whole plant moisture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grain</td>
<td>80-95%</td>
</tr>
<tr>
<td>Whole Plant</td>
<td>100%</td>
</tr>
</tbody>
</table>
Guide to corn nutrient deficiency symptoms

**HEALTHY** leaves shine with a rich dark green color when adequately fed.

**PHOSPHATE** shortage marks leaves with reddish-purple, particularly on young plants.

**POTASH** deficiency appears as a firing or drying along the tips and edges of lowest leaves.

**NITROGEN** hunger sign is yellowing that starts at tip and moves along middle of leaf.

**MAGNESIUM** deficiency causes whitish strips along the veins and a purplish color on the underside of the lower leaves.

**DROUGHT** causes the corn to have a grayish-green color and the leaves roll up nearly in the size of a pencil.

**DISEASE**. *Hemimphilaerum bight*. starts in small spots, gradually spreads across leaf.

**CHEMICALS** may sometimes burn tips, edges of leaves and at other contacts. Tissue dies, leaf becomes whitensap.

**DEEP, SPREADING** roots of healthy, high-yielding plant will spread a half-bushel basket.

**PHOSPHATE** shortage during early weeks causes a shallow root system with little spread.

**ROOTNORMS** pruned heavily as they eat small roots, tunnel in larger ones.

**POOR DRAINAGE** and hardpan are causes of a flat, shallow root system. Corn with poor roots can’t stand drought and is easily blown over by high winds.

**ACID SOIL** is indicated when the lower part of the root is discolored and decayed, particularly when brace roots shoot from third or fourth node.

**PRUNED ROOTS** are work of a cultivator. Shovels were too deep and too close. CHEMICAL damage makes roots rotte and twist. Joined brace roots are another symptom.

**NORMAL EAR** on well fertilized high-producing corn weighs about 2-3 lb. It has well filled tips.

**BIG EARS** weighing up to 1 lb. indicate that plant population was too small for most profitable yields.

**SMALL EARS** usually are a sign of low fertility. For better yields, boost fertilizer application.

**POTASH** shortage shows up in ears with poorly filled tips and loose, chalky kernels.

**PHOSPHATE** shortages interfere with pollination and kernel fill. Ears are small, often are twisted and with undeveloped kernels.

**NITROGEN** is essential throughout the growing season. If plant runs out of nitrates at critical times, ears are small and protein content is low. Kernels at tip do not fill.

**GREEN SILKS** at maturity may be caused by too much nitrogen in relation to other elements.

**DRY WEATHER** slows silking behind tassel; kernels aren’t pollinated.
Goss’s Wilt in corn

**Facts**
- Disease is caused by a bacterial pathogen.
- Overwinters in infected residue of corn and several grasses.
- Depending on conditions, may cause only minor problems or devastating damage with grain yield losses approaching 50%.

**Distinguishing features of Goss’s Wilt lesions**
- Freckles – dark green to black water soaked spots, often near lesion edges.
- Shiny exudate – bacteria ooze to leaf surface and may appear shiny after drying.

**Development of Goss’s Wilt**
- Disease has been found in parts of Manitoba, the Dakota’s, Minnesota, Wisconsin, Nebraska, Colorado, Iowa, Illinois and Indiana.
- Plant wounding from wind, sandblasting and especially hail provide openings for bacteria.
- Insects are not known to be a factor in spread or development of this disease.
- Wet weather and high humidity encourage disease development.

**Management tips**

**Genetic resistance**
- Primary management method.
- DuPont Pioneer researchers inoculate, screen and rate hybrids for resistance.
- Hybrids are also rated under natural infestations in affected states.
- Pioneer Hi-Bred screens material and breeds hybrids with genetic resistance to this disease at our Carman, MB research centre.
- See your local Pioneer Hi-Bred sales representative for help in selecting appropriate hybrids for your field.

**Reduce corn residue**
- Disease can become problematic in corn on corn, high-residue fields.
- Crop rotation is effective in reducing residue.
- Tillage encourages residue breakdown.
- Control grassy weeds that are hosts for the bacteria such as green foxtail and barnyard grass, and others.

**Prevention/Avoidance**
- Harvest and till affected fields last and clean equipment to avoid spreading the pathogen to uninfected fields.
- Fungicide application is NOT effective, as this is a bacterial disease.

*Goss’s wilt lesions may expand to eventually encompass entire corn leaf.*
Soybean production in Western Canada

Soybean acres in Manitoba have been rapidly expanding. DuPont Pioneer is developing new early soybean varieties for this market.

There are many factors to consider when producing a successful soybean crop.

**Variety selection:**
- Maturity should be the first consideration.
- Select a variety that has the appropriate maturity for your growing area.
- Throughout most of southern Manitoba, varieties in the 00 maturity group are ideal. Such varieties are adapted to 2400 crop heat unit areas. Pioneer Hi-Bred offers several varieties in this maturity.

**Inoculate prior to planting:**
- Soybeans require the presence of N-fixing rhizobia bacteria to convert gaseous nitrogen into a form the plant can use.
- With new soybean fields, seed should be inoculated prior to planting to ensure the field has the right bacteria strains present.
- Use proven soybean inoculants (note expiration date on package).
- Keep inoculants out of direct sunlight and avoid high temperatures.
- Plant seed soon after inoculation.

**Planting:**
- Can be planted in rows ranging from 15 to 36 inches or solid seeded through air-seeders or press-drill.
- Seed at a depth of 1-1 ½ inches into warm soil (10°C).
- Planting in rows offers several advantages:
  - Less seed is required to establish a crop. In 30 to 36” rows, target 120,000 to 150,000 plants per acre.
  - Allows for post emergent weed control through over spraying, chemical banding or inter-row cultivation.
  - Ensures more accurate seed placement and spacing, resulting in more uniform emergence.
- Solid seeded soybeans should be planted at a population of 200,000 to 220,000 plants per acre.

**Fertilization:**
- Soybean plants require phosphorus (P), potassium (K), sulfur (S), calcium (Ca), magnesium (Mg), iron (Fe), boron (B), manganese (Mn), zinc (Zn), copper (Cu) and molybdenum (Mo).
- Amounts of nutrients available vary with soil type, soil test, depth of soil and tillage practices, and are influenced by soil temperature and moisture conditions.
- A 50 bu/ac soybean crop will remove 42 lbs of phosphorus and 65 lbs of potassium from the soil.
- Soil test to determine your fertility requirement is essential to having a health soybean crop.

**Early weed control:**
- Soybeans are poor competitors with weeds so early weed control is essential to achieving your maximum yield potential.
- Consult your Crop Production guide for herbicide options available in your area.

**Harvest:**
- Harvest when bean moisture level reaches 15%.
- Harvest losses increase if beans reach this moisture level and then are subjected to alternating wet and dry periods.
- Splitting and kernel damage increases dramatically as seed moisture falls below 13%.
- Seed moisture can rapidly fall, so careful attention is required to harvest your beans during the optimal harvest moisture window of 14-16% moisture.
- Equipment options for soybean harvest:
  - Flex head, All-Crop Header (rows only) Love bar on a grain head, Macdon Harvest Head, Honey Bee draper head, and swather then combine pickup header are all options to harvest soybeans.
  - Flex head and love bar set-ups seem to reduce harvest losses.
Controlling volunteer Roundup Ready® canola in Roundup Ready®
corn and soybean systems

Controlling volunteer glyphosate tolerant canola (i.e. Roundup Ready® canola) in corn and soybeans is economically important. In Western Canada there are some herbicide options available to producers that can be applied either pre-seed or in-crop to combat this weed. It is important that growers follow herbicide labels and best practices when applying herbicides.

1. Best practices

- Refer to herbicide labels for complete information on rates, crop/weed staging and directions for use prior to any application.
- Control weeds when they are small – you can’t expect miracles from herbicides. Whatever your product of choice, know the maximum weed size for those species that are the primary targets and monitor weed growth closely.
- If weeds emerge after early post-emergence applications, effective weed control can be maintained and corn yields can be protected by a timely cultivation.
- A good “rule of thumb” is to apply herbicides when the tallest weeds are about 4 inches in height. This will insure both good weed control and help minimize yield losses.
- Remember to continue to scout your corn and soybean fields for subsequent weed flushes and spray as necessary.

2. Avoid crop injury

- Correctly staging the corn or soybean crop is important to avoid crop injury. In general, corn is more tolerant as a small seedling and the risk for crop injury increases as the plant becomes larger.
- Check your provincial herbicide book for the range of corn stages that can be treated with different herbicide options. If the corn exceeds the size listed on the label, switch to a herbicide that allows application at a larger stage of growth or use drop nozzles if permitted.
- In corn, this is especially important if using growth regulator (e.g. dicamba, MCPA, 2,4-D) herbicides. If the crop is too far along, severe damage can occur.

3. Herbicide recommendations

Listed below are herbicide recommendations for use either pre-seed or in-crop to control volunteer Roundup Ready canola in Roundup Ready corn or soybean systems.

**Pre-seed application**

**Field corn**
- Banvel II, Buctril M, Heat, MCPA Amine.

**Soybeans**
- Express SG, Heat.

**In-crop application**

**Field corn**
- Heat (BASF): Pre-emergent product with excellent residual control when used at the high rate. Must be applied prior to ground crack as contact to young corn plants will cause injury.
- Bromoxynil: Spray under the correct environmental conditions. Apply under warmer temperatures using a high water volume.

**Soybeans**
- Basagran, Basagran Forte, Odyssey, Imazethapyr (Pursuit)**.

**2,4-D (Nu-Farm):** Phenoxy products may cause damage to corn plants, resulting in brittle snap and interrupting normal brace root development. In severe conditions this can result in severe plant stand loss. Pioneer does not recommend the use of 2,4-D or products containing 2,4-D applied to corn. If 2,4-D must be used, apply when corn is very small to minimize the amount of active ingredient entering the corn plant. Avoid spraying when corn is rapidly growing – especially under warm humid conditions.

- Atrazine (Syngenta): Although Atrazine has re-cropping restrictions; under situations of continuous corn it is an excellent method to control volunteer Roundup Ready canola.
- Basagran/Basagran Forte (BASF): Be sure to use higher water volumes (>10gal/ac) to achieve excellent coverage of the weeds.

Pioneer Hi-Bred routinely conducts screening trials to evaluate corn hybrid response to herbicides – especially those with below average tolerance to commonly used herbicides. Please consult your local Pioneer sales representative or our product catalogue for further information.

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## Glyphosate weed resistance

### History
- Glyphosate was on the market for over 20 years before the first resistance case was confirmed in 1996. Since then, glyphosate resistance has been documented in 22 weed species worldwide.
- Glyphosate resistance was first confirmed in North America in 2000 in a population of Canada fleabane (also known as horseweed or marestail in Delaware). Since then there have been a total of 13 confirmed glyphosate resistant weed species in North America (Heap, 2012).
- In 2010, the first glyphosate resistance weed was confirmed on Canadian soil in a population of giant ragweed. In 2011, Canada fleabane was discovered to be glyphosate resistant. Both of these glyphosate resistant weed populations were found in southwestern Ontario.
- In 2012, glyphosate resistant kochia was confirmed in Alberta – the first cases of glyphosate resistance in Western Canada.

### How does herbicide resistance happen?
- Herbicide resistance evolves because of repeated selection pressure of a single herbicide over a period of time. Susceptible weeds are controlled but resistant weeds are unharmed.
- These resistant weeds can then go on to reproduce and spread, making the problem worse.
- Some common characteristics of herbicide resistant weeds are the ability to be abundant in high densities over a widespread area, prolific seed producers, highly competitive, and genetically variable.
- In many cases, weed populations with resistance to glyphosate have already developed resistance to other herbicides as well, which can limit weed control options.

### Herbicide resistance in Canada
- In addition to glyphosate resistance, there are many other documented cases of weed resistance in Canada, especially to group 1 (ACCase) and/or group 2 (ALS) herbicides.

### Management strategies
- The Herbicide Resistance Action Committee (HRAC) outlines the following guidelines in managing herbicide resistant weeds:
  - **Crop Rotation** - allows for the use of different herbicides with various modes of action.
  - **Agronomic Practices** – start off with a clean field, implement tillage if necessary, and use certified seed. Use herbicides appropriately and follow label instructions. Scout fields early and often, especially before and after herbicide applications.
  - **Rotate Herbicide Groups and Mixes** – utilize herbicides with different modes of action or that contain multiple modes of action.
- It is important to remember that unsatisfactory herbicide performance is NOT necessarily due to herbicide resistance. To determine if unsatisfactory weed control is due to resistance:
  - Rule out poor weed control due to adverse environmental factors or application error.

- Determine herbicide use patterns (i.e. is there repeated use of the same herbicide group) for previous years.
- Verify what type of pattern the escapes occur in (regular vs. irregular). Resistant weeds that escape control will likely occur in an irregular patch.

More information on herbicide resistance can be found at:
- [www.weedscience.org](http://www.weedscience.org)

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