VITERRA THE AGRICULTURE NETWORK

Tips for Dry Bean Production in **Alberta | 2021**

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Introduction

The common bean or dry bean (Phaseolus vularis) that is grown in southern Alberta is an ancient American food source. Indigenous peoples of South and Central America were the first to collect wild samples of beans and select varieties for seed size, color, and plant growth habit. Wild beans were common in these areas and a large variety of sizes and colors developed. Varietal selection and breeding programs have since extended the growing range of the bean to the temperate regions of the world, such as the warmer areas of the Canadian prairies.

Canada is a small producer of dry beans as compared to other areas of the world, with most of the production concentrated in Ontario, Manitoba, and southern Alberta. Dry bean production in southern Alberta has climbed steadily since its introduction in the early 1950s. The Canadian domestic market is very small. Almost all the beans produced in southern Alberta are exported. Dry beans have become an excellent crop option for irrigated growers providing a legume in the rotation while also generating high value returns to the producer.

Requirements

Climate

Beans cannot tolerate frost at any time during their growth cycle. Hence, a long frost-free growing period is essential. Along with a long frost-free period is the need for heat. One of the standards for measuring heat in Canada is the Corn Heat Units (CHU). This measures the amount of heat between the first and last frost. To profitably grow beans at least 2100 CHU are required (see Figure 1: CHU Map of Alberta). The risks associated with bean production rise significantly with less than 2100 CHU.

The amount of sunshine and air movement is also important to bean production. Cloudy, humid, very still days promote the growth of pathogens, causing disease. Sunshine and a slight breeze tend to keep the humidity lower in the canopy, helping to prevent the growth of pathogens.

Beans do not require as much water as most other irrigated crops in southern Alberta, but they do require precipitation at specific stages in their growth cycle. **The critical period is between flowering and cutting.** Usually this period is between July 15 and August 15 when the region normally receives very little rainfall. Irrigation is essential to optimize yields while not over watering the crop. Beans cannot tolerate saturated soils. Irrigation must be timed and controlled to prevent puddling and soil saturation for prolonged periods and to aid in disease control.

Soils

Most soils in southern Alberta are suitable for dry bean production. Soils that are intolerable for bean growth are salty, alkaline, or sodic soils. These soils are often found along canal banks and seep areas and should be avoided. Soils with an electrical conductivity (EC) of 2.0dS/m should be avoided, and soils at 1.5dS/m may still stress the plant.

Air movement into the root zone is important, therefore poorly structured soils with inadequate drainage, such as heavy clay/gumbo soils should be avoided. Light sandy soils work well but can be prone to wind erosion. When using a pre-plant incorporated herbicide, erosion can become a greater issue if not well managed. Retaining trash cover or the use of cover crops are both useful strategies. Refer to Land Preparation on page 12 and Soil Conservation on page 63.

If you are not sure of your field's soil properties, it is advisable to have a soil textural analysis done. Hand texturing is an easy practice to identify soil textures such as heavy clay or loamy sand. Choose fields that have good surface drainage, so that water is not allowed to puddle after heavy rains or irrigating.

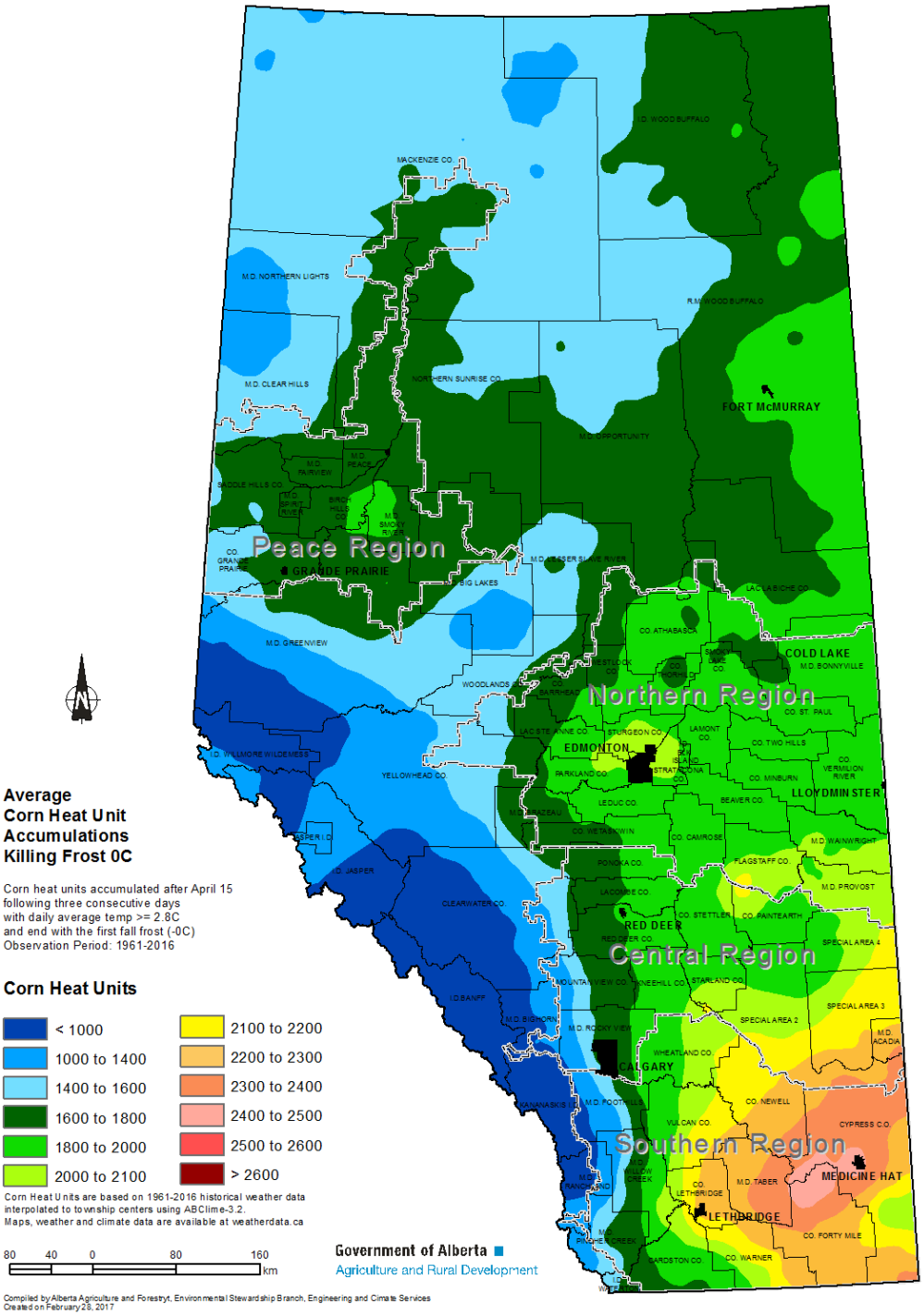


Figure 1: CHU Map of Alberta

Crop Rotation

Crop rotation is very important in bean production. Care needs to be taken to ensure the bean industry stays viable for future generations.

Disease

Without adequate rotation the risk of fungal and bacterial infections increases as spores persist in a soil for years, potentially causing long-term damage to the bean growing potential. A cereal crop prior to beans is a good option to provide a clear break in disease cycles. A four-year rotation is recommended. Sclerotinia (White Mold) is the key economic disease of beans and crop rotation is an important means of limiting it's spread. Other crops that share the fungal pathogen for Sclerotinia are canola, mustard, potato, hemp, and sunflower Bacterial wilt is also enhanced by close bean rotations and one of the main means of control is by a proper four-year rotation.

Admix

Be careful with your rotation that you do not grow beans after a crop of similar seed size. Seeds of the same general size and weight, such as corn, peas, fababeans or soybeans are difficult to remove and typically will downgrade the product. There are pesticides that will control volunteer corn, if caught at an early stage, but there are no chemical options to control pulses such as volunteer peas and soybeans in a bean crop. Fababeans are very difficult to control and volunteer for many years. GMO corn and soybeans can also threaten our exports to foreign countries where GMO crops are not tolerated. **We have a zero tolerance for soybeans found in deliveries.**

Volunteers

Flax, alfalfa, and canola pose different problems. Flax and alfalfa are difficult to control in crop and can cause major crop loss due to competition and mechanical losses at time of cutting.

Old alfalfa crowns from the previous crop can potentially cause problems with inter-row cultivation. Chemically, they are nearly impossible to control in a bean field. For best results, alfalfa should be chemically controlled the previous fall, or in spring before tillage. Check growth stage of alfalfa before applying herbicide.

Flax fields should be worked and watered after harvest to encourage growth of volunteers. Follow irrigation with a combination of tillage and application of appropriate herbicides before planting or emergence.

Canola poses a couple of problems when grown prior to beans. First, the density of volunteers can be very difficult and costly to control. Canola leaf canopy can be thick, shading neighboring plants during spraying operations, causing some plants to be missed by herbicide control. Secondly, canola volunteers can emerge later in the season and spraying is not an option due to pre harvest intervals. Lastly, canola has allelopathic properties, meaning the plant releases chemicals into the soil that restrict the growth of other plants. To mitigate these problems, canola

fields should be worked as soon as possible after harvest, and watered to promote growth. Follow irrigation with a combination of tillage and application of appropriate herbicides before planting or emergence. Permit is another pre-plant/pre-emerge chemical that controls canola and offers residual control midway into the season (check label for re-cropping restrictions). Canola fields with high harvest losses and/or losses due to hail or wind damage should be avoided, as the high level of volunteers will cause economic losses in beans.

Chemical Residues

Prevent situations where growth of bean plants is harmed by residues of commonly used pesticides from previous crops.

Field Records

With the great diversity in pesticides and their chemical properties it is critical to keep detailed field records and obtain field records when leasing land. Some pesticides leave a harmful residue in the soil many years after their use. When considering a piece of land for growing beans, check to see if the following chemicals were used.

Do not plant beans within the re-cropping interval after the application of the following herbicides:

Active	Product Name	Interval
Atrazine	Aatrex	12 months
Clopyralid	Lontrel, Curtail M, Eclipse and others**	12 months
Ethametsulfuron	Muster Toss-N-Go	22 months
Imazamethabenz	Assert	24 months

***Clopyralid is an active ingredient is in many herbicides. See the blue book for complete list.**

If you suspect there could be a harmful residue, have a field bioassay done prior to planting. There are local companies who can perform this task. Call your local field staff if you need more information.

Banvel II used for fall perennial weed control may pose a problem for beans in the following year if sprayed after September 1st.

Market Classes

Viterra primarily uses Alberta bred adapted varieties of five different market classes of dry beans for the contracting program in southern Alberta. The varieties contracted are well suited to this area in both yield and quality. Although other varieties can grow here, they do not perform consistently, making them economically risky to produce and market. The five market classes and the varieties Viterra presently contracts and markets are:

Pinto

A large, light tan bean with brown mottling and flat-oval shape. Pintos are one of the most widely consumed beans in the world. They are easy to grow and can yield very well. They are easier to harvest than other varieties because they do not split as easily and will also hold their grade a better if inclement weather occurs at harvest.

Slow Darkening Pinto

These varieties pintos that have been bred to hold their color for longer periods of time. Regular pintos will darken substantially after 6 months, or sooner if weathered in the field due to poor harvest conditions. Slow darkening will hold their color longer in the field.

Great Northern

A long round shaped bean, which is white to ivory in color, and preferably a large seed size. There is a large world market for high quality Great Northerns. Care should be taken at harvest to prevent splits and seed coat cracks, as the seed coat is thin. Harvest management is key to reduce staining, wrinkling and earth tag.

Red

Small Mexican Red beans are mid-sized, flat, oval, and dark red skinned Because of the fragile seed coat they are a little harder to harvest without cracking. Good quality Reds are even in size, and a dark red shiny color.

Black

There is a significant market for black beans.

Yellow (AKA Mayocoba)

Yellows are a plump mid-sized bean, with a yellow seed coat. They are the only market class that is derived from the Andean Strain; meaning they are more tolerant to white mold, but prone to bacterial diseases especially with damage from hail or wind.

Crop Insurance

It is highly advised to insure your bean crop.

Last day to apply for crop insurance	April 30
Last day for seeding dry beans	June 10
Last day for reseeding dry beans	June 10
Insurance Levels	50, 60, 70, & 80%

- Separate insurance plans for different types of dry beans: small red, pinto, great northern, yellow, black/other dry beans.
- Separate insurance prices for each type of dry bean.
- Hail rider is available with all risk crop insurance at 60 % of the basic straight hail rate.
- Hail insurance is available to a max. of $400.00/ acre.
- Dry Beans are insurable on Irrigated land.

For more information, contact your local AFSC office.

Land Preparation

Fall Preparations

Preparations for growing beans should start in the fall after the previous crop has been harvested. The first step is to work the soil lightly and apply water to encourage as much of the weed seeds of the previous crop to germinate. The more seeds that can be motivated to grow at this time will cause less competition for the beans to grow in the following spring. Once a good growth has been established, lightly work the field again or apply a suitable herbicide to destroy all the new growth.

Soil Testing

It is always advisable to soil test for essential nutrients prior to growing beans. Fall sampling is preferred, as this will give you more time to discuss the results with your field representative, and your fertilizer supplier, but early spring sampling will also work. **Sampling to a depth of 12”** is sufficient, as most of the feeder roots will be in this zone. The soil should be tested for all the major nutrients, soil pH, organic matter, salt content, and micronutrients. It is also be helpful to have a soil texture analysis done at this same time as this will help you plan your water management during the irrigation season. **Soil testing should be carried out before subsoiling operations are performed for best results.**

Subsoiling

Beans tend to have very lazy, non-aggressive roots, and will not penetrate hard soils well, reducing yields substantially. For top yields it is strongly recommended that you subsoil, para-plow, or disk-rip to a depth of 16 – 18 inches in the fall prior to planting. Best soil fracture is achieved when soils are dry, while wet soils can smear, increasing soil compaction. To prevent soils from drying too much a light disc, or vibra-shank operation should be carried out to seal the top of the soil.

In Row Deep Ripping

Many growers have gone away from cultivating, replacing this operation with a paddle-ripper operation instead. Results from previous years show a definite yield advantage when the soil is tilled in a narrow band between the bean rows. These rippers should be as narrow as possible, so they do not throw dirt, but cut the soil 6 - 8" deep. This aerates and allows the water to penetrate the soil faster. The addition of paddles is beneficial in controlling water flow during periods of irrigation or heavy rains. **This ripping should be done early in the year, when the beans are small to prevent excess pruning of the roots of the plants and reducing yields.**

Ridging (Fall or Spring)

Ridges prepared before planting have many advantages for the growth of the beans.

1. The hills warm up quickly in the spring allowing for **faster emergence** of the bean plant. Faster emergence prevents stand losses from soil insects such as corn seed root maggot and wireworms. This warmer hill also allows for better root penetration and better drainage of water from the root zone. Diseases such as damping off are reduced with warmer, better drained soils and faster emergence.
2. When a hill has been established prior to planting there **is no reason for further tillage**, and the root zone is left undisturbed.
3. The ridges also seem to affect plant growth, producing **plants which stay erect slightly longer** than normal. When the rows do cover over, they seem to prop themselves up off the ground, leaving a tunnel effect under the rows. When the vines are not in direct contact with the soil surface there can be less white mold problems.
4. Ridges also **help at harvest time** if using a Pickett One Step as it reduces the drag on the rods allowing them to maintain a consistent depth and smooth operation.

Nutrient Requirements for Dry Beans

Soil Testing

Soil sampling and testing on individual fields will provide a picture of plant available nutrients. This will help to provide the basis for the fertilizer blend that should be applied.

Inoculation

In general, for fields that have had a history of dry beans grown on them in the past, inoculation is not required. However, if a field has not had beans grown on it recently or at all in the past, inoculation with the proper strain is advisable.

Placement

Dry beans are sensitive to salts and ammonium containing fertilizers when placed too close to the seed. Fertilizer should never be placed with the seed. Broadcast/incorporation is the most common method of fertilizer application. Most fertilizer is applied with preplant herbicides.

Fertility recommendations below as based on dry bean fertility research conducted by Dr Ross McKenzie with Alberta Agriculture that was most recently revised in 2013.

Nitrogen

Beans are not considered to be a good nitrogen fixing crop. They are only capable of fixing 30 to 40% of their total nitrogen requirements. The remaining N must come from mineralization of soil N or from applied nitrogen.

The following table provides a basis for making nitrogen recommendations in southern Alberta:

Soil test N level (lb./ac: 0-12”)	Recommended N fertilizer rate applied	
	Row cropped (lb./ac)	Solid seeded (lb./ac)
0-10	90	110
10-20	80	100
20-30	70	90
30-40	60	80
40-50	50	70
50-60	40	60
60-70	30	50
70-80	20	40
80-90	10	30
90-100	10	20
100-110	0	10
110-120	0	10
>120	0	0

Phosphorus

The table below provides phosphate recommendations based on soil test analysis using the modified Kelowna method. These rates are based on banded phosphate. On low P soils, broadcast and incorporated rates should be 1.5 to 2 times higher.

Soil test P level (lb./ac – 0-6") Kelowna P soil test method	Recommended P fertilizer applied (lb./ac)
0-10	60
10-20	50
20-30	40
30-40	35
40-50	30
50-60	25
60-70	20
70-80	15
>80	0

Potassium

Fortunately, many soils in southern Alberta are medium to high in available potassium. If soils test greater than 350 lb./ac of K, a potassium application is not likely required. In general, K deficiencies are most likely to occur on intensively cropped sandy soils. If potassium is required, banding K is the most efficient method of application. Broadcast and incorporated K should be increased by 1.5 times.

The following table provides a basis to go by regarding K applications:

Soil test K level (lb./ac – 0-6")	Recommended K fertilizer applied (lb./ac)
0-50	140
50-100	120
100-150	100
150-200	80
200-250	60
250-300	40
300-350	20
>350	0

Sulphur

Sulphur deficiencies are not common on irrigated soils in southern Alberta with irrigation water often containing enough sulphate to meet bean requirements. However, sulphate deficiencies may occur on sandy soils or after heavy precipitation that can leech the sulphate further into the subsoil.

The table below will provide a basis to go by for S recommendations:

Soil test S level (lb./ac – 0-12”)	Recommended S Fertilizer applied (lb./ac)
0-5	25
5-10	20
10-15	15
15-20	10
>20	0

Micronutrients

Zinc

Beans require all essential micronutrients. However, only Zinc has been identified as being deficient at times. Zinc deficiency can be induced by cool wet soil conditions in the spring.

From research, Zn recommendations have been developed and provided in the tables below:

Soil texture	Zinc soil test level in ppm (0-6 inches)	Zinc recommended
Medium – fine texture (loam-clay loam)	>1.5	0 lb./ac
	1.0-1.5	3 lb./ac
	<1.0	5 lb./ac
Coarse texture (sandy loam – loamy sand)	>2.0	0 lb./ac
	1.0-2.0	3 lb./ac
	<1.0	5 lb./ac

In addition to the above table, previous crops such as sugar beets or canola can inhibit the growth of microorganisms essential in the uptake of zinc, so higher rates are recommended. Following sugar beets or canola, 5 lb./ac of zinc should be applied. For soils with sufficient levels, a maintenance application of 3 lb./ac Zn is recommended.

Boron

Previous work with boron and beans in southern Alberta has not resulted in improved crop growth or yield. In fact, several locations resulted in a reduction of yield by 5 – 15% with a 3 lb./ac banded application. Even small applications of boron can be potentially toxic to beans.

Pre-Plant Herbicides

Weed control is greatly aided using a pre-emerge herbicide. There are several options that should be considered.

Aim

Can be mixed with Glyphosate and Express SG.

Rate	14.8-47.3 ml/ac

Dual II Magnum

Pre-plant incorporated or can be Pre-Emerge if irrigated in 10 days.

Rate	0.51-0.71 L/ac

Edge

The most popular pre-emergent herbicide is Edge (ethalfluralin). Edge is applied in a granular form and requires time to become active in the soil. Edge needs to be incorporated into the soil zone where germination takes place as the activity is on the new root growth. For best results, follow these instructions:

1. Apply evenly to a relatively level surface, free of lumps and clods. Trash must be evenly spread and broken down enough to be incorporated evenly.
2. Apply in either fall or early spring. Incorporate with a light disk or narrow spaced cultivator to a depth of 4”. (Implement must be set deeper to achieve a 4” mixing depth.)
3. Delay second incorporation for 7-10 days under normal spring temperatures. Work cross-angle to first application at ½”-1” above first incorporation. If the Edge has been applied in the fall, only 1 tillage pass will be required in the spring. Ridging for the second incorporation is acceptable.
4. Seal the seedbed with harrows and packers.

Rate	
Spring	7.5-12.5 lbs./ac
Fall	12.5 lbs./ac

Eptam (EPTC)

works well on Nightshade. Eptam is sold as a liquid and must be applied with water or liquid fertilizer as a carrier. Its limitations are that it is very volatile, meaning it must be incorporated into the soil immediately.

1. Apply to a relatively trash free and smooth dry surface. Trash will absorb the chemical, resulting in poor control. Soil should have 30 % or less trash cover.
2. Apply with plenty of carrier (water or liquid fertilizer). Use a large droplet nozzle for less drift. Do not allow mix to stand for long periods of time. Adequate agitation is essential.
3. Use a light disk or narrow spaced cultivator to incorporate to a 4" depth. (Implement must be set deeper to get a 4" mixing depth.) Seal with harrows and/or harrow packer combo.
4. Raise your cultivator/disk ½ -1" before second incorporation. Be sure to work second time at as large an angle as possible. Seal as above.

OR

Apply with irrigation equipment and adequate water to move herbicide into soil.

Rate	1.7–2.2 L/ac.

Express SG

Must be mixed with Glyphosate and applied 1 day prior to seeding.

Rate	6g/ac plus 180g ae/ac Glyphosate

Permit

Is sprayed on as a pre-plant or a pre-emerge. It can be tank mixed with glyphosate or Eptam. It offers excellent efficacy on Mustards and Canola as well as other broadleaf weeds season long.

Rate	
Pre-Plant	19 g/ac
Pre-emergent	19 g/ac

Pre-Emerge Herbicides

Dual II Magnum

Pre-plant incorporated or can be Pre-Emerge if irrigated in 10 days.

Rate	0.51-0.71 L/ac

Goldwing

Can be tank mixed with Glyphosate and must be applied prior to emergence.

Rate	133-266ml/ac

Permit

Is sprayed on as a pre-plant or a pre-emerge. It can be tank mixed with glyphosate or Eptam. It offers excellent efficacy on Mustards and Canola as well as other broadleaf weeds season long.

Rate	
Pre-Plant	19 g/ac
Pre-emergent	19 g/ac

Planting

Equipment

There are three types of planters commonly used in our area.

Conventional

John Deer 71, I-H 185, etc. These use a plate, or peanut bottom to distribute the seed. Plates must match the seed size and can be hard to find at times. Some of these planters have "peanut bottoms" for seed distribution. These must be set by a gate at the bottom of the seed box, which can be a problem to set accurately. Watch for wear on the bottom wear tabs of the cone. These planters work very well, but must be operated at, or below recommended speeds. Consult your operator's manual. Be sure to use dry graphite with the seed for planter lubrication. Do not use graphite and liq. inoculant.

Mechanical Precision

John Deere Maxi-Merge (finger type), etc. They can change between different seed sizes easier than plate planters. They can be operated slightly faster than plate planters, but care must be taken to avoid planter bounce, and seed bounce in the seed trench from the extra speed, which will disrupt seed spacing. Maxi-Merge planters require dry graphite for lubrication, and if not equipped, will need a high-speed gear installed below the planter box.

Precision Air

Monosem, JD Maxi-Merge (new style), Case, etc. These planters use vacuum and plate system for precision seed pickup and drop. Work well with different seed sizes and speeds, however excess speed can cause planter row bounce, or seed bounce in the seed trench. Read manual for proper Vacuum Setting!

Traveling the recommended speed with a planter in good mechanical condition will give the best seed placement and population results.

Pre-Planting checklist
Be sure the planter is running level.
Be sure that markers are adjusted properly
Be sure planting plates are the proper size and are not worn. Check that the cutoff brushes are the correct ones, and the vacuum seals are not worn or damaged.
Check condition of all hoppers, drives, chains sprockets and bearings.
Be sure fans are running proper speeds, and air-vacuum lines are clean with no holes, and adequate vacuum is achieved.
Check drop tubes for damage or obstructions
Check shoe openers for wear, and disk openers run freely, and are not worn. They must cut a nice clean V in the soil.
Check packer wheels for wear and adjustment.
Lubricate planter properly before operating
Use Fluency Agent with the seed for additional lubrication

Be sure to lubricate the planter as required. See your owner's manual for lubrication recommendations.

When preparing to plant beans, remember that fast emergence of the seedlings is very important. Fast emergence means less time for soil borne diseases such as Damping off, Fusarium and Rhizoctonia to affect the seedling. As well, insects such as seed corn root maggot and wireworms rarely attack a healthy emerged seedling. A poor job of planting greatly reduces the potential of your crop. **Always plant for the fastest emergence possible.**

Row Spacing

All varieties currently used in Alberta are from the AAFC breeding program at Lethbridge where varieties are developed using a 22” row spacing. So, if you are buying equipment for the first time, purchase 22” equipment. This will give you the option of growing other crops, such as sugar beets. If you have 30” equipment in good condition, it is normal to stay with this equipment even though there could be a slight yield penalty often offset by reduced disease pressure. For solid seeding, plug off every other one to achieve something close to 15” row spacing. 7.5” spacing requires excess seed and promotes White Mold.

Timing

Beans cannot tolerate any frost, at any time during their lifespan. Planting should be timed so that emergence will occur after any threat of frost has passed. Optimum seeding date is between May 20 and May 25, however any time between May 15 and June 1 seems to be the period of least risk, and overall best results. The risks associated with early, or late planting, can outweigh any yield advantages. Remember, dry, trashy, or freshly cultivated soils are more prone to spring frosts. The latest date beans can be planted, and still be covered under Alberta Hail and Crop Insurance is June 10.

Soil Temperature

The ideal soil temperature for germination of beans is +18C or 65F. Seeding into colder soils will delay emergence, giving fungi, insects, and bacteria more time to attack germinating seeds, resulting in potential seedling losses, or weakened plants. If the soil is slow to warm up, consider planting at a shallower depth. **Always plant for the fastest emergence possible.**

Depth

Best results are obtained when beans are planted into a firm, warm, moist seedbed at a depth of 0.75” to 1.5” (1.9 cm to 3.8 cm). If soils are cold plant shallower. If the soil is dry, plant shallow and then irrigate enough so that the new moisture is adequate to meet the existing soil moisture. Be careful, often the depth of beans planted into dry soil seems shallow, only to find after irrigation they are too deep. If you are planting into dry soil, plant as shallow as possible, as the irrigation water will cool off the soil. Do not seed deep if soils are cold. **Plant for the fastest emergence possible.**

****Irrigating when the beans are emerging can/will cause a stand reduction. Water before they are cracking the soil.****

Handling Seed

Mechanically damaged seed will often not germinate or is prone to fungal diseases during germination, and young seedlings are less vigorous and more susceptible to fungal diseases. Baldhead is also a symptom of mechanically damaged seed. For bulk seed transfer, use a brush flighting in your drill fill auger.

Population

Plant population and spacing are very important in establishing a good field of beans. The more accurate you can be at spacing the beans the better the crop will perform. A population of 96,000 plants per acre should be targeted; therefore, some quick calculations must first be made. Use the following charts and instructions to calibrate your planter. **If you are using an inoculant, always use inoculated seed when calibrating the planter.**

Estimating plant population according to seed spacing					
22" Rows	**24" Rows**	**26" Rows**	**28" Rows**	**30" Rows**	**Plants / ac.**
3.4"	3.1"	2.8"	2.6"	2.5"	84,000
3.3"	3.0"	2.7"	2.5"	2.4"	87,000
3.2"	2.9"	2.7"	2.5"	2.3"	90,000
3.1"	2.8"	2.5"	2.4"	2.2"	93,000
3.0"	2.7"	2.5"	2.3"	2.2"	96,000
2.9"	2.6"	2.4"	2.3"	2.1"	99,000
2.8"	2.6"	2.4"	2.2"	2.0"	102,000
2.7"	2.5"	2.3"	2.1"	2.0"	105,000
2.6"	2.4"	2.2"	2.1"	1.9"	108,000
2.5"	2.3"	2.1"	2.0"	1.8"	111,000

1. Lower planter and drive on a hard surface over a short distance.
2. Count out 11 seeds, measure the distance and divide by 10 to calculate average distance between seeds.
3. Use table to determine plant population
4. Adjust planter settings, and repeat process to achieve approx. 96,000 plants/acre

To get a more accurate estimate, use the following chart to determine plant population over a longer distance.

Row Spacing (in)	Distance traveled to equal 1/1000 ac
22”	23ft. - 9in
24”	22ft. - 5.25in
26”	20 ft. 1.5in
28”	18ft. – 8in
30”	17ft. – 5in

1. Pick row spacing according to planter
2. Operate planter over ~25 feet.
3. Measure the required distance.
4. Count seeds dropped in measured distance.
5. Multiply count by 1000 to get plant population per acre
6. Adjust planter settings to achieve ~96,000 plants/acre

For conversions, measurements, and charts see page 43.

Seed Treatments

All seed supplied by Viterra will be treated at the source.

Standard Treatment: ApronMax Cruiser & Heads-up.

Some companies due to bulk buying strategies offer Vibrance, Dynasty or Rancona as well at no extra cost to us. We have not seen any field benefits or adverse effects from these additional products. These seed treatments are designed to protect the germinating seed from fungal diseases such as Fusarium, Rhizoctonia and Pythium.

Inoculating the beans with beneficial rhizobia to boost nitrogen fixation is also an option for the producers. This needs to be applied just prior to planting. Be sure to use the right strain of inoculant if you intend to treat your seed. Viterra does sell inoculants, but you must order it at the time of contracting. Contact your field representative for more information.

Weed Control

Beans are not a competitive crop. Usually it will be well into July before they form a canopy if they do at all. So, controlling weeds in-crop and in the previous year's crop is very important. Weeds will reduce yields through competition and through harvest loss at cutting time. An example of yield losses due to weeds is as follows:

2 Weeds per 2 meters of Row	Yield Loss
Wild Sunflower	40%
Cocklebur	30%
Redroot Pigweed	22%
Nightshade	18%

Without a full canopy, dry beans are poor competitors for persistent, hard to control weeds such as Canada thistle, Perennial Sow thistle and Quackgrass. The presence of these weeds will cause yield losses. Controlling these weeds in crop can be difficult and expensive. Avoid fields where these weeds are a major problem or control them before planting beans is the best strategy.

Nightshade is a very serious weed issue that can cause serious earth tagging, harvest problems and high losses. Care should be taken in previous seasons to rid the field of nightshade. It likes to grow in areas where there is little competition, such as along roadways, pivot points and field approaches and likes potato rotations. **Be careful when disposing of tare soils from beans, sugar beets and potatoes, as the seeds can be spread quickly from farm to farm by this means.** Hand picking and disposal of plants in the fall can save many years of problems in the future.

These are some of the weeds which you should pay close attention to controlling.

Perennials

Canada Thistle

Can grow in patches so thick it crowds out all other plants. Don't be deceived, patches may look small and insignificant, but, add up to huge losses. It is hard to control in-crop.

Sow Thistle

Usually spread throughout the field they are very aggressive feeders, cutting yields. They also make cutting difficult. They are also very hard to control in-crop.

Quack grass

Very competitive and aggressive. It is hard to control in-crop. It makes cultivation and cutting very difficult.

The best way to control perennial sow thistle, Canadian thistle, and quack grass is by an application of a Glyphosate product on the previous crop as a pre-harvest aid. Do not rely on post-harvest application, or on post emergence applications in the bean crop to control these weeds.

Annuals

Nightshade

Related to the potato and tomato, this low growing plant germinates throughout the season and grows prolifically at late season. Has an abundant supply of pea size green berries which are hard to separate from the beans and can cause high losses at harvest due to downgraded product. It likes to grow along roadways, pivot points, headlands, and approaches. Hand removal in these areas can prevent future problems. Tare soil from sugar beets and beans can spread it throughout the area. Because of the late germination is one of the hardest to control and the most potential to downgrade your sample.

Volunteer Canola

Can grow very fast, quickly passing the ideal spraying size. Volunteers left uncontrolled can limit cropping prospects in following years. Canola may be tolerant to Glyphosate or Clearfield, so appropriate herbicide selection is important.

Kochia, Lamb's-quarters & Redroot Pigweed

Must be sprayed quite small or can be missed altogether. The thick woody stems and roots can make cutting a problem. Caution should be taken as group 2 & 9 resistant kochia is present in the area.

Wild oats

They are very competitive and can cause problems during cutting. They can be deceiving, as what may look like a light infestation, can turn into a big problem. Many fields have group 1 resistant wild oats which limits herbicides available for control. Group 2 resistant wild oats have also been found and are a growing concern.

Wild Sunflower

If left uncontrolled will make harvest very difficult because the large root ball will prevent smooth cutting or lifting resulting in large harvest losses. In a sugar beet rotation where Permit is not advised it must be controlled very early before it reaches 4-6" height.

Wild Buckwheat

"Glyphosate" tolerant crops such as corn and canola have allowed wild buckwheat populations to increase rapidly. There is no single herbicide for controlling wild buckwheat in dry beans. The best approach is to use a combination of herbicides for control. Edge as a pre-plant herbicide plus post emergent herbicides while the buckwheat is very small is the best approach.

For best results it is recommended that for adequate control of annuals **a two-step** approach be taken. First, an application of a pre-emerge soil applied product such as **Edge** followed by a post emerge application needed later in the growing season. This will give early weed control, reduce weed pressure, and will give you a slightly larger application window of post emerge products. A pre-emerge application is also beneficial in controlling early germinated weed seedlings.

Most Used Herbicide Program	
16-20 lbs. Edge	Pre-plant
Goldwing	Pre-emerge
Viper + Basagran	Post-emerge 1-3 trifoliate

Unusually heavy weed populations or the presence of perennial weeds, herbicide resistant or herbicide tolerant weeds may require different combinations.

Herbicide Control Matrix ***Controlled (C)*** ***Suppressed (S)*** ***1,2,3 (See notes)***	**Edge**	**Eptam**	**Basagran**	**Solo**	**Viper**	**Centurion**	**Poast**	**Permit**	**Glyphosate**
Canada thistle			4		4				C
Perennial sow thistle									C
Quack grass						S	S		C
Lambs-quarters	C	C	C		C			1	C
Kochia	C			S	C			C	C
Nightshade	S	C	C		C				C
Redroot pigweed	C	C		C	C			C	C
Round-leaved mallow				S	S			C	
Shepard's purse				C	C			C	C
Smartweed			C	C	C			C	C
Stinkweed			C	C	C				C
Storksbill			C		C				C
Volunteer Canola			C	2	C			C	3
Wild buckwheat	C		C	S	C				
Wild mustard			C	C	C			C	C
Wild sunflower					C			C	C
Green foxtail	S	C		C	C	C	C		C
Volunteer grain	S	C		C	C	C	C		C
Volunteer Clearfield Wheat		C				C	C		C
Wild oats	S	C		C	C	C	C		C
Group 1 resistant wild oats	S	C		C	C				C
Annual sow thistle									C

Legend for Herbicide Matrix

1. Will not control emerged seedlings. Will control as a pre-emerge only.
2. Will not control Clearfield tolerant Canola or Wheat varieties.
3. Will not control Canola varieties which are genetically modified to resist Glyphosate products. A tank mix with Goldwing is recommended to control these varieties.
4. A second application is needed for control of Canada Thistle 7-10 days after first application.

Spraying

Post Emergent Application Tips

The surfactants used with post emergent sprays affect the leaf surface of the weeds and can act as a repellent for other herbicides. It is thus advisable to wait 4 days between applications of herbicides on your fields.

Frost or temperatures near freezing can affect the uptake of herbicide by the plants. It is advisable to wait 3-4 days following a cool temperature event before applying herbicides.

Basagran

Basagran is used to target most broadleaf weeds. It is a contact herbicide; adequate water is required, 20 gallons per acre is the recommended volume rate.

Basagran works best when the temperatures are warm. It is not recommended to spray Basagran under 20 Celsius.

It is recommended to apply Basagran as soon as possible after the emergence of the 1st trifoliate of the bean growth. At this stage the weed seedlings are small enough that good control is achieved.

Solo

Solo is a group 2 systemic herbicide which can be used alone but is best suited as a tank mix with Basagran Forte. When tank mixed all the application tips for Basagran should also be observed. It has a pre-harvest interval of 60 days.

Viper

Viper is a premix of bentazon (active ingredient in Basagran) and imazamox (active ingredient in Solo). It still requires a top up of Basagran Forte, UAN, and Merge for good results. It has a pre-harvest interval of 30 days.

Select, Centurion, Arrow, Equinox and Poast

Select, Centurion, Arrow, Equinox and Poast are Group 1 grassy weed herbicides. Best results are achieved when applied to weeds which are have good growing conditions and are not under stress. Application should be made when temperatures are warm for best results. Growers may be tempted to tank mix these products with Basagran, but this is not recommended. These products behave antagonistically when mixed, resulting in reduced affect in both products. Be aware of the 60-day pre-harvest interval (80 days for Poast)

Assure II

Not to Be Used Due to Prop65!

Permit

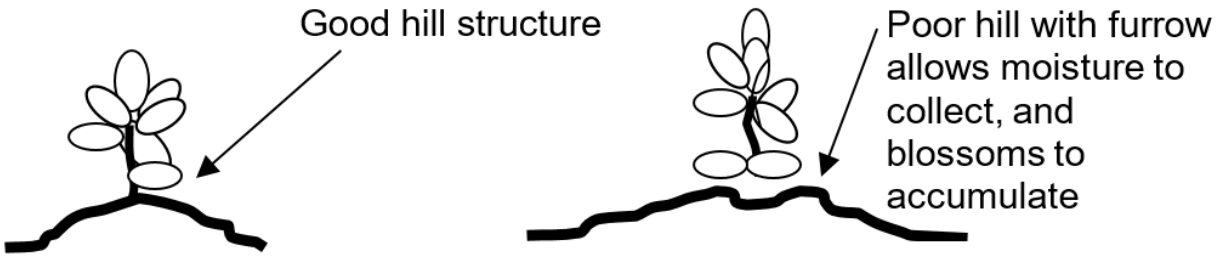
Permit is a group 2 herbicide that can be used pre-emerge or post-emerge. The largest variety of weeds are controlled when used pre-emerge with the addition of glyphosate. It is extremely effective on canola and the residue will control flushes for up to 4 weeks. It has a 30-day pre-harvest interval.

Pesticide mixes can be found in the annual "Bean Pesticide Program"

Row Cultivation

Row cultivation is not a necessary operation if weed control and a ridge are already present.

Besides controlling weed growth between the rows, cultivation is useful for aerating the soil, better drainage, and preparation for cutting. Most producers who row cultivate use a tine type cultivator, with small sweeps. It is recommended that you throw a small hill around the base of the plant at least 3-4" in height. Try not to throw the soil hard enough that it buries the plant but forms a nice conical ridge along the row. This operation should be performed prior to flowering to prevent the young bean pods from growing into, or being covered by the soil, and creating a perfect habitat for white mold to grow. This ridge is necessary for harvest, to let the cutter penetrate the ground, as well as stimulating the young bean plant into developing secondary roots.



A hollow top ridge as shown above-right is undesirable, as it allows water to collect around the stem, as well as dropped blossoms, leaves and other plant material to collect. This material along with the humidity from water collected in the furrow will give white mold an excellent place to grow.

Insects

Corn Root Maggot

A soil borne insect this ¼" maggot is a larva of a small gray fly. The fly is attracted to the odor of freshly worked soil or decomposing organic matter such as manure or beet tops from the previous fall. The flies lay eggs into the freshly worked soil and the eggs hatch in 2 to 4 days in 10-degree soils. The maggots are attracted to carbon dioxide from decomposing organic matter or germinating seeds. If soil temperatures are adequate for fast emergence the seed will germinate and emerge before the maggot can do much damage. Cool and wet soils can slow emergence,

and severe damage can occur. A fungal infection of the sub-soil stem due to Fusarium, Pythium of Rhizoctonia can cause decayed material, and attracts the maggot, eventually killing the seedling. This activity can severely affect plant populations, or affect the vigor of young seedlings, especially if they are under stress. There are ways to lessen the damage done by these insects. One method is to prepare the soil early in the spring, giving incentive for the flies to lay their eggs and then planting 2-3 weeks later into this un-worked soil where the maggot population is finished its feeding cycle. Another is to plant shallow enough for fast emergence, as the quicker the seedling emerges the less chance of damage. All dry bean seed supplied by Alberta Bean have Cruiser applied to deter feeding.

Wireworms

Larvae of the "click beetle" these ¾ - 1-inch reddish-brown larvae live in the soil and can damage seeds or seedlings before emerging. These larvae are quite common and can appear at high levels in the spring and cause severe reductions in plant population. Feeding on the seed during germination can kill or severely weaken the seedling. It is especially prevalent in freshly broken sod, or forage cropland and on years with cool wet soils and delayed emergence. All Alberta Bean supplied dry bean seed has Cruiser applied to provide control of wireworms.

Red Backed and Western Cutworm

A 1 – 1.5-inch worm which hatches in early spring and feeds on young plants either on the surface, or just under the soil surface. When disturbed they will curl up in a ball, making them easy to identify. Red Backed differs from western by the color of their upper surface, which reddens as the worm matures. Both species are usually found in the drier, higher parts of fields. Plants will wilt and die. Close inspection will reveal where the plant has been chewed off, usually right below the surface. Digging around the area will usually reveal the worm. Damage is often noticed on hilltops and is quite often confused from a distance with poor germination. The economic threshold for Western cutworms is 3-4 per square meter, while Redback cutworm it is 5-6 per square meter. For control contact your field representative as it is important applied insecticides conform to Canadian registrations and export standards.

Grasshoppers

Although they prefer other plant material to beans, they will occasionally chew holes in the leaves. If populations are high, and other plant material is depleted they could pose a problem. Watch for them along grass ditches, headlands, fence rows and pastures where they hatch. No control has been needed to this point. For control contact your field representative as it is important applied insecticides conform to Canadian registrations and export standards.

Pea Leaf Weevil

Some notched leaf damage to dry beans may occur close to field corners where peas have been planted. Usually occurs later in the growing season.

Potato Leafhopper

Adult potato leafhoppers are slender, 2.5 mm (1/10 in.) long, light green, and have short, bristle-like antennae. The female lays eggs on plants and the nymphs hatch in about 10 days. Both adults and nymphs suck sap from the vascular tissue of the plant. By July, a sufficient population of leafhoppers can be present to cause stunted plants that may eventually die. The economic threshold for insecticide application is one leafhopper per trifoliate leaf.

Lygus Bug (Tarnished plant bug)

Hot, dry weather favors an increase in the population of lygus bug and increases the possibility of damage to bean pods. Lygus bugs have piercing mouth parts that suck sap from the plant, especially the seed inside green pods. Several insecticides are registered for the control of lygus bug on bean. Some seed damage has been noted at harvest time.

Irrigation Management

Beans are not a large user of water but require it at specific times. Irrigation not only allows us to provide adequate water when needed but is also one of our best tools for disease control.

Planting and emergence

(May 15 – June 7) Conditions at planting can be very dry as hot days and warm soils increase evaporation. Unless you have extraordinarily dry soils you should plant first and then irrigate as required. Remember they do not need a lot of water at this point, just enough to germinate. If the beans and roots are in moisture, they are fine. Crusting is not usually a problem; they are strong and can push a crust out of the way. Irrigating can cool off your soil and slow emergence.

Post emergence to 3rd trifoliate

(June 7-July 20) Water use is very low from emergence until the third trifoliate. Water only if the weather is hot, applying lower amounts, ½ -3/4 at the most. It is better to let the beans root down at this point and warmer soils will promote this.

3rd trifoliate to bud stage

(June 20 – July 15) Once the weather is warmer it is time to "build" a plant structure by irrigating adequately for growth. Be careful, your goal is to have a plant large enough to fill in the rows, not to canopy over the rows. If you feel your plants are getting too tall and viny you may have to cut your irrigation and dry the soil a little to retrain growth and promote flowering. Once the plants have 1-3 full flowers open the plant will not grow much taller.

Early blossom to Row closure

(July 15-July 25) Once you have 1-3 blossoms on the plants and still can see down between the rows it is time to water heavily. This will help you fill your water profile

without risk of disease and will bank water for when disease pressure is higher. Up until this point the beans are only using water from the top 12" of the profile. Once the rows fill in, they will start pulling water from deeper in the soil, so apply as much water as you can at this point to fill the profile to the 24" level for later use.

Row closure to pod setting

(July 25 – Aug 2) Once the rows have closed over the conditions for white mold infection increase and care must be taken not to over irrigate. It is not the amount of water that promotes mold, but the amount of time the beans remain wet. During this period, apply your fungicide and then water. Irrigating at this point should be cyclical. In other words, water, then dry. Try to keep your water cycles to 5 days or less. If possible, let the top ½-1 of the soil dry to where you cannot make a ball. This will help break the disease cycle.

Pod filling

(Aug 2 – Aug 12) The bean plants are now drawing water from as deep as 2 feet, but they are also very vulnerable to white mold currently. Plants are heavy and slumping under the increased weight of the pods with more branches, leaves and pods are touching the soil. Fallen flower petals litter the ground and stick in the plant structure. Heavy with leaves very little sunlight and air reaches down into the center of the plant. If the humidity stays high for too long this is a perfect environment for white mold. Probe your soils often to the 2-foot level for moisture and wait until you must water before applying a fungicide. Again, keep your water cycle to 5 days and then give the plants time to dry. This should help reduce mold.

Pod filling to Harvest

(Aug 12-Aug-20) Water use is lower now and a few yellow leaves are showing especially on the bottom branches. Beans in the pods are starting to show some colors. Water is still necessary, but not in huge amounts. Watch your soil levels to the 2-foot mark and water when needed. Shorter water cycles work well at this point, 2.5 days of water then dry down again. Do not stop watering when the field turns yellow as the beans still need to fill completely. Continue watering this way until most of the pods are buckskin colored.

Summary

Water sparingly until past the 3rd leaf stage (late June) Water hard until the rows close in (late July). Apply your fungicides and water only as needed in the 4 weeks from row closure until pods have full sized beans in them. Continue to water as needed until most of the pods are buckskin in color.

Diseases

Dry bean is very susceptible to several diseases and few chemical control measures are available. It is therefore important to use an integrated program that include cultural controls in dry bean productions.

Proper Rotation

Four-year rotations with non-susceptible crops is recommended to reduce disease pressure. For soil health, cereals must be an integral part of your rotation.

Prepare a Well-Drained Seedbed

Compaction and poor drainage will promote root rots and premature ripening.

Plant Certified Seed

Planting certified seed, which has been produced in arid regions, is an effective technique for limiting bacterial blight.

Use Care When Handling Seed

Mechanically damaged seed is prone to fungal diseases during germination, and young seedlings are less vigorous and more susceptible to fungal diseases. Baldhead is also symptom of mechanically damaged seed.

White Mold

White mold occurs in all dry bean-growing areas of western Canada. Losses from this disease can be severe. Peak infections in our area usually happen well into flowering when lots of dropped flower petals are present. This coincides with rows starting to grow together which form a canopy, shading the ground and keeping humidity high. First signs of infection can usually be found on petals on the ground beneath the plant with a cottony white appearance. If conditions remain favorable, petals which are caught on pods or in branches of the plant will become infected. As the food source in the petal is depleted the fungus looks for other sources, infecting the adjacent stems.

Life Cycle

Black resting bodies (sclerotia) of varying sizes are formed outside or within dead plant parts and fall to the soil, particularly at harvest. These sclerotia bodies can survive in the soil for 5 years or more. These sclerotia require a preconditioning period of several weeks at 4 degrees or lower before they will germinate. To produce the apothecia (mushrooms) the preconditioned sclerotia require moist soil for 1 or more weeks at temperatures of 11-20 Celsius; a spring rain event can trigger apothecia germination. Apothecia release ascospores into the air, which infect ideal hosts. These ascospores can be viable on plant tissue for up to 2 weeks, with crop canopy increasing the lifespan. Ideal temperature for the development of white mold is between 20 and 25 degrees. Ascospores require a medium on which to grow and the fallen bean flower petals are an ideal source of protein and energy for the ascospores to germinate. Once germinated the ascospores produce fine filamentous mycelium, which, once the energy from the flower petal is depleted, punctures the cell walls of the bean stem, and infects the plant. The infection sites become watery and a cottony white fungus usually forms at the site. As the plant slowly dies the fungus forms hard black or grey fruiting bodies called sclerotia which eventually fall to the ground, to start the entire cycle over again. A great number of other broad leaf crops and weeds serve as natural hosts for Sclerotinia.

Cultural Control

- Rotate with cereals and grasses. Allow at least four years between susceptible crops such as legumes, canola, mustard, potatoes, and sunflower.
- Care should be taken to dispose of "tare" soil from bean deliveries in a non-crop area, as this tare soil can contain large amounts of sclerotia.
- Avoid constant irrigating after the rows close over. Constant humidity in the canopy or soil surface promotes infection.
- Plant rows in the direction of the prevailing wind to enhance air circulation between rows.
- An application of a bacteria, the trade name is Contans, will break down and destroy a high percentage of the sclerotia in the soil.

Fungicides registered for white mold in dry beans			
Product	**Rate**	**PHI (Days)**	**Active Time**
Acapela	350 ml/ac	14	7-10 Days
Allegro	400 ml/ac	30	7-10 Days
Cotegra	400 ml/ac	21	7-14 Days
Elatus	200ml/ac	15	7-10 Days
Lance	227-312 g/ac	21	7-14 Days
Proline Gold	300ml/ac	14	7-14 Days

***Consult the label before applying*

Tips

- Fungicide applications are most critical when target yields are high, vine growth is heavy, and a canopy is formed.
- Complete coverage of plants with fungicide is essential. Fungicides should be applied with adequate water (20 gal.) and pressure to ensure penetration of the canopy, and coverage of the blossoms.
- Fungicides are protectants, so application should be made before the flowers are infected.
- Fungicide applications should be timed with irrigation applications for best performance.
- Chemical control will last 7-10 days, so most year's season long coverage will require 2 applications.
- Fungicide applications should be timed with irrigation applications for best performance.

Bacterial Diseases

Blight diseases cause leaf lesions, defoliation, pod lesions, and shrunken and/or discolored seed.

Halo Blight

This is the most prevalent blight in Alberta. Ideal temperatures for halo blight are between 18-22 C. Bacteria infect the leaves usually through wounds from wind, driving rain or hail leaving a smaller water-soaked spot which quickly senesces, leaving chocolate brown lesions. These brown spots remain quite small, but the tissue surrounding the spots turns light green to yellow, giving it a halo look. Infected pods develop water soaked appearing spots. Lesions exude white or cream-colored ooze when wet. Yield losses result from defoliation, lack of new leaf growth and pod deformation.

Common Blight

This is less prevalent than halo blight in Alberta. Large irregular shaped lesions are surrounded by a distinct yellow zone. Optimum temperatures for common blight are 28-32 C and humid. The bacteria can cause pod lesions, and these exude yellow ooze. Defoliation and lack of new growth, as well as pod distortion is the main cause of yield loss.

Bacterial brown spot

Bacterial brown spot has not been found to be a huge problem in our area. It favors a warm humid environment and optimum temperature range from 28-30 C. Leaf lesions are generally small, circular, and brown. Water soaking of the tissue is usually nonexistent. A very narrow yellow band surrounds the lesion. Later the dead material falls out, leaving a shot hole appearance. With a bad infection, the lesions run together, and leave a tattered look to the leaves. Lesions on the pods are water soaked, like other bacterial infections, but turn brown. Yield losses are from the lack of leaf health and distortion of the pods.

Bacterial Wilt

While bacterial wilt has been observed in this area, with a couple exceptions, it generally does not become much of a problem in southern Alberta. Foliar symptoms often progress and appear as interveinal chlorosis and necrosis. Infected plants display wilting or flaccid leaves during periods of moisture stress. Wilting results when pathogen cells block movement of water through the vascular system. Damage can be severe when young plants become infected. The development of bacterial wilt can be rapid following hailstorms and at temperatures higher than 32 C. Most of our varieties have resistance to bacterial wilt. For varieties that do not have resistance, if some plants start to display symptoms, an application of copper prior to irrigating or after a hail event may help to minimize its spread.

All the bacterial diseases are spread by wind driven rains, hailstorms and/or irrigation, as the water aids bacterial penetration into leaf pores and wounds. The pathogens are seed-borne but can survive in non-decomposed bean trash for a least one year.

Cultural Control of Blights

- Plant high quality seed that is tested for low numbers of bacteria.
- Bury bean trash and use a three-year or greater crop rotation. Avoid cultivation when bean plants are wet.
- Avoid entering the field with equipment when the foliage is wet.

Chemical Control of Blights

Copper Hydroxide (Kocide, Parasol, Copperside etc.)	2 lbs./ac
Copper Octanoate (Cueva) Solution	2.0%

Leaf coverage is very important. Apply by air or by ground with sufficient water. Recommended 20 gallons/acre by ground.

Copper Hydroxides work best if the first signs of blight are detected in the field. Copper Octanoates work best if you do not have signs of blight but want to protect the beans from oncoming inclement weather.

Timing is very important. Apply as soon as you see signs of blight. If you have had a hail event apply immediately to damaged foliage.

Rhizoctonia

Rhizoctonia solani is a common fungus found in our soils that can cause major yield reductions in many ways.

Seedling root rot

Seedling root rot is the form most people associate with Rhizoctonia. Small reddish brown rusty colored pits on the roots and young shoots are the first visible symptoms. Under favorable conditions the infections grow, either girdling the stem, or eating into the pith, causing the young plant to wilt and die.

Mature pods

Mature pods in contact with moist soil will become infected with symptoms like root rot on young seedlings. Reddish brown pits will form on the pods, eventually entering the interior. Seeds will be stained and be culled as dockage.

Cultural Control

- Plant shallow (3/4 – 11/2”), into a warm seedbed.
- Avoid planting beans after host crops especially sugar beets.
- Plough down beet tops, which provide a perfect medium for the fungi to multiply.
- Ridge planting, and or inter-row ripping to improve soil drainage.
- Avoid stressing plants to water, or nutrients.

Fusarium Root Rot

Another very common fungi in bean fields throughout North America, causing problems and yield reductions through the entire season. Fusarium root rot is very similar to rhizoctonia, with the first symptoms being a reddish-brown streak on the underground shoots of newly emerged beans. The organism then attacks the taproot, destroying the outer layers. Plants will develop adventitious roots, and if growing conditions are favorable yields will not be affected. If the plants are stressed at all, the organism will continue to destroy other roots. Although the organism rarely kills the plant, it can stunt and hinder yields later in the season. First signs are yellowing of the older leaves, like nitrogen deficiency, and premature ripening. Seed size and yields are reduced substantially.

Cultural Control

- Rotate to grassy crops or alfalfa seems to help.
- Plant shallow (3/4-11/2”) into warm soils.
- control soil compaction by subsoiling and not working wet soils
- Plant on ridges.

Pythium (Damping off)

Pythium is not as common, or as damaging as Rhizoctonia or Fusarium, and is usually a result of high soil moisture, for prolonged periods of time. Root rot and seedling blight are common diseases of dry bean. Failure of the plants to emerge from the soil indicates seed decay or seedling damping off. The affected seeds or young plants become mushy and discolored. Young plants may wilt and die after emergence or remain stunted and yellow (seedling blight). Above ground symptoms may not occur unless the degree of root rot is moderate to severe. The casual fungi are all soil-borne. Fields that have grown dry bean for several years are likely to be the most severely affected by root rot and seedling blight diseases.

Cultural Control

Ridging, ploughing, subsoiling, and tilling in previous crop debris so plants can form hardly roots and moisture can move freely through the soil will help to lessen infections.

Aphanomyces

Aphanomyces can infect plants soon after emergence to late in the season. It does not cause seed rot or preemergence damping off. Lesions on roots are initially yellow/brown and firm. They rapidly coalesce to involve most of the roots which become soft as the cortex is destroyed. The infected roots soon darken. Plants may be severely stunted. Typically, the pathogen grows up the hypocotyl to produce a lesion above the soil line. This lesion is slightly water soaked and grey/green in appearance at its leading edge. It will become brown as the necrosis develops. Seedlings may be killed as the lesions extend to the growing point of the plant, especially in mixed infections with Pythium.

Cultural Control

- The most effective management for this disease is to avoid fields that are known to be infested.
- Regular rotation of crops will help in delaying or minimizing an accumulation of aphanomyces populations.

Rust

Rust rarely has occurred in Alberta and is found primarily in pinto beans. It tends to infest late maturing crops. Rust first appears as small, white spots on the lower surface of the leaves. A chlorotic area around the spot gives it a “bulls eye” effect, making it very visible and quick to diagnose. These spots break open within a few days to expose rust-colored fungus spores on both leaf surfaces. Severely infested leaves turn yellow, then brown, and soon die. Pods and stems may also be attacked. Rust fungus can survive on infected bean crop residue and wind-borne spores also spread it. Rust fungus is not transmitted as a seed-borne disease.

Cultural Control

- Follow a crop rotation that allows a minimum of three years between bean crops.
- After harvest, turn under all bean residues as completely as possible.
- Care should be taken to dispose of tare soil from bean deliveries in a non-crop area, as this tare soil may contain spores from other areas where rust is common.

Yellow Bean Mosaic and Bean Common Mosaic Virus

Mosaic viruses have been observed in Alberta but up to this point have never affected yields. Infected plants are often stunted and spindly. Few pods are set, and seeds are off color and small. Infected leaves have irregular areas of yellowish tissue inter-mixed with areas of green. Leaves may be puckered, twisted, and elongated. Plants are seldom prematurely killed, and yield loss depends on time of infection. The disease spreads by plant sap contamination of wounds, insects, and infected seed. Many commercially available varieties have resistance to virus diseases.

Cultural Control

Plant certified seed

Harvesting Dry Beans

Clean, whole, bright colored beans with minimum losses are the result of good harvesting practices.

Timing

The earliest dry beans should be cut is when a minimum of 70% of the pods are a buckskin color, but there is a benefit to leaving them standing until the entire plant is ripe. The best method to determine pod color change is to strip a whole plant, count all the pods and determine percentage of change. **Ask your Field Representative on proper desiccant timing and rates. Desiccants will not ripen a green bean field.**

Methods of Cutting

There are 4 different methods of cutting beans: Pickett One Step, Undercutting and Rodding, Swathing, and Straight Cutting. Due to varieties available, straight cutting is not currently viable. Swathing requires the correct type of swather/reel and will lead to higher harvest losses. Undercutting and rodding was once the main method but is in decline due to advances in equipment. Pickett One-Step has become the most common method used, is simple to set and offers the lowest amount of harvest losses.

Undercutting

Bean cutter manufacturers include Kirchner, Orthman and Elmers. Bean cutters are designed to cut the stem about ¾ inch below the soil surface, and windrow 2 rows together. Depth of cutting and vine rods should be adjusted to minimize plant trauma and the amount of dirt in the windrow. Speeds of 5 – 8 mph are often required for optimum performance. Each standard has two settings, narrow for cutting and the wide angle is best used for re-cutting. Soil moisture and proper hill preparation (refer to cultivation section) are both important for good knife penetration. On most of the cutter's producers can change the pitch of the blade with shims. This may enhance soil penetration. Under extremely dry weather

conditions a light irrigation two to three days prior to cutting may be necessary to allow blades to go into the soil profile. Dry soil conditions will increase wear on the knife edge. It is important to often check the performance of the cutting job. Savings soon disappear with poor cutting and harvesting practices. Cut in the same direction and pattern as you intend to harvest, as this will enhance the efficiency of the pickup. **Do not neglect knife quality or sharpness.**

Setting up your Cutter

- Check knives for wear and sharpness.
- Level cutter on a flat surface before going to the field. Then adjust toe ¾ "up from level. For a staggered row cutter, run the machine flat.
- Adjust depth to cut 1" under row. Adjust depth wheels to obtain this constant depth.
- Adjust vine rods so that plants flow evenly, without bunching into a neat teepee shape.
- If ground is hard to penetrate, adjust toe higher, or change pitch on knives for more bite.

Rodding

The use of a power-driven rod after undercutting has become a common practice. This ensures that **all plants are cut or separated from the soil** allowing for even field dry down. Rodding at the same time as cutting will save a trip over the field but will slow cutting slightly (5 – 7 mph). With some of the bigger cutters requiring more horsepower or hydraulic cooling, running both implements may limit speed and efficiency. In this case, a separate operation as soon as possible must be carried out. The wilting process of the leaves and stems helps to anchor plant material to the soil surface which can help reduce movement from high winds but may also slow the drying process. Re-rodding following rain is necessary to help drying and to **retain good color**. Re-rodding prior to the combining operation will decrease the amount of dirt in your sample. **It is very important to ensure that bean pods are free of soil. Pods covered with soil will not dry, causing beans to squash while combining, and tagging other beans with soil.**

Setting the Rod

- Level the rod on flat ground, and then adjust so the rod is lower than the front of the drive shank.
- Adjust the depth in the field so the rod is running just under the soil surface. The front of the shank should just break ground, without moving much soil.
- Adjust the rod speed to match the ground speed, so the soil flows nicely over the rod without building up in front of it.
- Move as little soil as possible laterally.
- Adjust vine turners so they do not bunch, but plants flow through evenly. If you do not have vine turners have some put on to keep plants in a nice

teepee formation. This will make picking up easier, and beans will stand inclement weather better.
- Cut and rod as many rows in the same direction as you are going to pick up with your header.

Pickett One Step

The use of the Pickett One Step allows producers to cut, rod and windrow all in one operation. Its benefits include handling and moving the beans gently which minimizes shelling loss and a clean separation between bean vines and the soil. The ability to place 2 passes side by side increases combining efficiency and quality as there is less splitting and damage when more material is picked up by the combine.

Setting the One step

- Be sure that when the One Step is in the ground the pin in the slide on the top link should rest in the middle.
- When operating in the field the entire weight of the one-step should rest on the 4 wheels. If the machine is hitting the back of the slide on the top link often, then add weights to the back of the machine, or have the back tires filled with fluid.
- Adjust the belt speed to form a nice even swath without lumps. For machines configured for double swaths, be sure to adjust the canvas speed and dividing rods to allow sufficient space between the two swaths for a tractor tire to pass.
- When cutting very ripe beans which have shrunk during dry-down it may be necessary to move the pickup closer to the rod to ensure all the bean plants are picked up.

Thrashing

Machines being used successfully include conventional, rotaries and specialty bean combines, Modifications vary from brand to brand, but the principles are basically the same for all of them. Aim to reduce or eliminate any impact points and areas where striking or grinding of the bean may take place in your combine. Let’s start at the front, and work back.

1. Recommended pickups include Sund and Pickett.
2. Run your pickup slow, slightly less than ground speed (40-50 rpm).
3. Header width should be matched to combine capacity. It is nearly impossible to properly adjust a combine that is operated at 50% of running capacity.
4. Adjust your feeder auger for smooth even feeding.
5. Slow down any power rock traps or front beaters.
6. Case combines should have slots cut in the concave flair in front of the concave, to allow beans to enter the cleaning area without contacting the rotor.
7. Sufficient clearances of 1 – 1.25” must exist between cylinders and concaves to allow beans to pass through freely.

8. Smooth concaves with oblong holes are easier on the beans than wire concaves but work best on dry years.
9. Ensure wire type concaves have sufficient space for the beans to pass freely.
10. Cylinder speed for Case combines should be 240-250 RPM.
11. For John Deere conventional combines cylinder speed should be 150 RPM; for rotary combines 300 RPM.
12. Rub bars work better with wear, new rub bars are sharp, and tend to split beans easier.
13. Use lots of wind, beans are heavy, and hard to blow out.
14. Set your sieves open enough so you do not get beans in your return grain elevator.
15. Bottom screens for the clean grain and return elevators are recommended.
16. A slow down sheave is recommended for the clean grain elevator.
17. When unloading beans from the combine run auger at a slow speed and do not empty out the hopper completely. This allows some protection against seed damage. In damp conditions inspect all augers for soil buildup as this could affect soil stuck to the seed coat.

During hot dry weather it may be necessary to stop at midday, and resume harvest in the evening to reduce cracking. If you experience problems in setting your combine, read the manual for tips and ask your field rep for assistance.

Harvest Losses

There will be some loss through the harvesting process. To determine the amount of loss incurred per acre, count several areas, and determine the average bean count per square foot.

Pinto & Yellow	1150 seeds per lb.
GN	1300 seeds per lb.
Black & Red	1600 seeds per lb.

(# beans per sq. ft. x 43,560) / seeds per lb. = Yield loss in lb./acre)

e.g. 2 Pinto beans per sq. ft x 43,560 sq. ft per acre= 87,120 / 1,150 seeds/lb. = 76 lbs. per acre loss

Delivery

Dry beans are delivered to the plants at harvest. Safe storage moisture level is 16% for beans. If the moisture is testing less, but there are still swollen beans in the sample, it is advisable to delay harvest if possible. These swollen beans will "dirt tag" and will be removed as dockage. The better job you do of combining, the less dockage we will have to remove, the fewer lineups at the dump-sheds, the more efficiently our milling will run, the better the end product will be, the more money that will be returned to you.

Problems Upon Delivery

1. **Fat swollen beans in sample.**
    a. Too soon to combine. Wait until beans cured. Re-rodding before will speed up curing.
2. **Dirt tagged beans in sample.**
    a. Bean pods on or under wet soil. Re-rod beans out of dirt.
    b. Weeds or nightshade still too wet. Wait till weeds dry. May be necessary to rod again.
3. **Machine tag, dark stains on the seed coat.**
    a. Vines are too damp causing "machine tag" Wait until the vines are drier.
4. **Excessive dirt with beans.**
    a. Pickup running too low. Adjust for 1" tine clearance.
    b. Pickup running too fast. Slow to slightly less than ground speed.
    c. Too much dirt on windrow. Re rod beans to shake dirt off.
    d. Not enough wind. Increase as needed.
5. **Excessive trash with beans.**
    a. Sieves too far open. Adjust as needed.
    b. Not enough wind. Adjust as needed.
6. **Excessive cracking and splitting.**
    a. Cylinder speed too high.
    b. Too hot & dry, quit till evening.
7. **ADD Mix: Varieties mixed in load**
    a. ADD MIX is a major Quality Issue
    b. Clean planting equipment between varieties
    c. Clean harvesting equipment between varieties
    d. Control volunteer beans in previous crop
    e. Notify office staff/field staff on any Add Mix loads before delivery
8. **Nightshade.**
    a. Inform Scale Personnel and Dump Shed Operator so beans can be segregated for cleaning.
    b. Pickett Bean Combines can harvest these fields without squishing the nightshade berries and should be considered for fields with excessive nightshade.

Soil Conservation

Soils of the prairies are prone to wind and water erosion when left uncovered. This is especially significant for land with light textured soils. Making efforts to prevent soil erosion will go a long way to maintain the land's productivity. Periods of highest risk are in the early spring prior to planting, early June before the crop is large enough to supply cover, and especially after harvest when the surface is left loose and friable. The following steps can be taken throughout the season to prevent soil loss.

- Plant beans following a cereal if possible, spreading the straw and chaff evenly and select equipment and settings which will keep adequate residue on the surface.
- Work your pre-plant chemicals into the soil as early in the spring as possible, so that there is enough moisture to allow lumps and clods to form. Then leave the field alone until just before planting.
- If soil starts drifting after planting, make a light application of water followed by in-row cultivation at a slow speed to bring up lumps and add surface roughness.
- After harvest the top 1-2" of soil is loose and prone to movement. Chiseling will bring up larger lumps which will resist weathering and provide more surface roughness.
- Use a minimum amount of preparation for the following crop. Plan on seeding these fields to a cereal in early spring if possible. Consider implementing a cover crop in the meantime.
- It is not recommended to graze bean ground as cattle will quickly graze off the residue and break down lumps and clods left on the surface.
- If erosion becomes severe, emergency actions such as ridging or spreading manure or straw should take place before the eroded area spreads.

Cover Crops

The highest erosion risk is in the following spring after preparations are made for the succeeding crop. Cover crops can be an effective method to stabilize and protect soil during this period after the beans are harvested. Wheat, winter wheat, and barley have been used with success as cover crops with the following methods.

- After windrowing with a Pickett One Step, use a grain drill to seed cover crop strips in-between the swaths. Harrow and pack as necessary.
- Using a broadcaster, spread the cover crop over the standing beans just prior to cutting/windrowing. The cutting and windrowing activity works the soil enough to get seed-soil contact. This can be problematic with extended wet weather at harvest time which slows the drying process for the beans but stimulates growth of the cover crop beneath.
- Seed with winter wheat after the beans are cut and harvested. This can work well with a long mild fall, but early winter conditions will prevent getting sufficient growth.

Having a sufficient cover crop established will reduce the risk of soil blowing, but getting enough growth is dependent on several factors. Early bean maturity allows for early harvest and early cover crop seeding. Warm fall weather is beneficial, whereas early snow or frost is detrimental to getting enough growth in the cover crop. Winter wheat may provide better protection because it will resume growing in the early spring.

Choosing the type of cover crop and method of establishment will depend on bean production practices, equipment, and time constraints. We recommend that growers use this information and experiment further to find out what works best for them to protect their land from erosion.

Quality Control

Food safety is critically important to all of us in the food chain. With growing consumer awareness of the foods, they consume the methods that are used to process and produce them are being scrutinized more each year. Consumers continue to demand more information from producers, to reduce risk of contaminants at the production level. Good record keeping of all aspects (especially pesticides) will become extremely important in the future. Viterra requires growers to keep accurate records of all pesticide and fertilizer inputs and submit them prior to harvest delivery. Forms will be distributed to growers by Field Representatives before harvest time.

These records must include dates of application, rates applied and tank-mix additives. See attached below a template of the Field Production Record. The Seed Lots number and seed treatments are recorded for you at the time of seed purchase.

VITERRA

Alberta Bean Division
Bow Island, Alberta
Box 96 T0K 0G0

Phone: 1-888-756-4039
Fax: (403) 545-6892 (BI)
Fax: (403) 223-2786 (T)

ALBERTA BEAN DIVISION
Bow Island and Taber

ABD QA-001 (07-20)

BEAN FIELD PRODUCTION RECORD AND CERTIFICATE

1/4_____ Sec_____ Twp_____ Rge_____ M_____

Farm Name_____ **Address**_____

Market class: **Pinto GN Red Black Mayacoba** **Variety**_____ **Acres** _____

Preplant Soil-incorporated Herbicides:		Rate applied:	Date applied	How applied	Rate applied:	Date applied	How applied
Edge	Ethalfluralin						
Other:							

Pre-emerge Burn off:		Rate applied:	Date applied	How applied	Rate applied:	Date applied	How applied
Aim	Cartentrazone-ethyl						
Goldwing	Pyraflufen-ethyl/MCPA ester						
Glyphosate							
Other:							

Post-emergent Herbicides:		Rate applied:	Date applied	How applied	Rate applied:	Date applied	How applied
Basagran / Basagran Forte	Bentazon						
Permit	Halosulfran-Methyl						
Poast Ultra	Sethoxydim						
Select, Centurion	Clethodim						
Solo	Imazamox						
Viper / Python	Bentazon/Imazamox						
Other:							

Fungicides:		Rate applied:	Date applied	How applied	Rate applied:	Date applied	How applied
Acapela	Picoxystrobin						
Allegro	Fluazinam						
Cotegra	Boscalid / Prothioconazole						
Elatus	Azoxystrubin/Benzovindithlupyr						
Lance	Boscalid						
ProPulse	Fluopyram / Prothioconazole						
Other:							

Bacteriacides:		Rate applied:	Date applied	How applied	Rate applied:	Date applied	How applied
Parasol /Kocide/ Coppercide/ Cueva	Copper hydroxide						

Foliar Fertilizers:	Rate applied:	Date applied	How applied	Rate applied:	Date applied	How applied

Pre-plant Burn off / Desiccants:		Rate applied:	Date applied	How applied	Rate applied:	Date applied	How applied
Heat	Saflufenacil						
Other							

Bean Field Production Record

1. I am the Grower or an authorized officer of the Grower and have personal knowledge of the facts in this Record and Certificate
2. The Grower acknowledges that Viterra is relying on the truthfulness of this Record and Certificate as an inducement to purchase the Commodity
3. The Grower purchased the Seed, planted and tended it on the Seeded Acres and harvested, handled and stored the Commodity produced from it in accordance with the Contract and good agricultural practices so as to ensure that the Seed and the Commodity were not contaminated or commingled with any other seed, crop or foreign material.
4. The Grower used pesticides, if any, that were registered under the Pest Control Products Act (Canada) or that were not prohibited by the Contract, and used them in strict compliance with instructions of the manufacturers and requirements of applicable laws and regulatory authorities.
5. The Grower did not contaminate the Commodity with any substance that constitutes a food safety hazard and did not adulterate or misbrand it within the meaning of the Food and Drugs Act (Canada)
6. The Grower did not allow any other person to use pesticides or to contaminate, adulterate or misbrand the Commodity contrary to ss.2, 3 and 4 and does not know or suspect that any other person did so.
7. The Grower produced the Commodity from the Seeded Acres and delivered / will deliver it to Viterra when called for in accordance with the Contract.
8. The Grower has good title to the Commodity free from all liens, charges and other encumbrances.
9. The Grower is authorized to sell the Commodity to Viterra and has not committed it to any other person.
10. Capitalized terms have the meanings set out in the Contract.

Without limiting the rights and remedies of Viterra under the Contract or at law, the Grower agrees that if the Grower makes any misrepresentation or false statement in this Record and/or Certificate:

(a) the Grower shall indemnify and pay Viterra for all resulting losses, damages and costs (including legal, collection and interest expenses) incurred by Viterra as a result of the misrepresentation and/or false statement; and

(b) Viterra shall be entitled to reject the Commodity and to report the misrepresentation and/or false statement and the rejection to appropriate regulatory authorities.

GROWER:

Signature: _____

Name: _____

Date: _____

Approved By: _____

Date: _____

If a Deferred Payment is desired, please list the deferral date:

Date: _____