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Solid seeded beans - A prairie system for bean production

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Beans are usually grown as a row crop in western Canada. This production system was imported from Ontario in the late 1960's and has served prairie farmers well over time. Growing beans on rows requires the addition of several pieces of machinery to an enterprise. Namely, row crop planter, row crop cultivator, under cutter/puller and windrower. These additional pieces of machinery, or more importantly the added capital required to purchase the machinery has impaired the expansion of bean acres in the prairies. Another significant factor was the availability of more adapted varieties.

The development of early maturing, upright bean varieties has enabled prairie farmers to produce beans with traditional small grains seeding and harvesting equipment...creating a prairie system for bean production.

Plugging into the system

As a pulse crop it seems logical to place beans where peas or lentils currently fit in a crop rotation. Beans however, are extremely susceptible to sclerotinia (white mold) and should be considered as a canola replacement.

Regardless of what beans will replace in your system, from a weed and disease management perspective, beans work well following a cereal crop. Since beans are uncompetitive plants, a pre harvest ROUNDUP application in the wheat crop could be used to **clean up** any perennial weeds.

Beans fits into a delayed seeding system. Beans are usually not planted till the end of May, allowing time for weed growth, a total burn off treatment and then planting.

Herbicide carryover can impact where beans can be planted. Watch these products:

2,4-D, MCPA

Phenoxy products like 2,4-D or MCPA will not leave residues that can harm pulse crops when applied the previous year. However, more spraying occurs now just before seeding pulses. 2,4-D or MCPA applied pre-seeding will damage pulse crops.

Do not apply these products before seeding beans..

Accord

Certain pulse crops are sensitive to Accord. Contact BASF regarding recroppin restrictions.

Ally

Ally is extremely residual and damaging to pulse crops. The safest recommendation is not to use Ally on farms where beans are grown.

Assert

Only peas may be grown the year after an Assert application.

Attain

Do not grow beans the year after Attain application. Lentil and peas may be grown the year after application.

Atrazine

All pulses may be affected the year following atrazine use. Peas and fababeans are usually not affected by rates of up to 0.9 L/acre atrazine (500g/L formulation). Other crops may be affected 2 or more years after application. Consider a soil analysis or a soil bioassay before planting other pulse crops.

Banvel

Fall applications of Banvel for thistle control can affect certain pulse crops the following year, however field beans can be grown the year following a fall application of Banvel up to 0.5 l/acre rate.

Bladex

When corn rates are used, the only pulse crops that may be grown the following year are soybean and peas. Do not plant beans the following year.

Curtail

Do not grow beans or other pulse crops the year after Curtail application.

Lontrel

Do not grow beans the year after Lontrel application.

Muster

Do not grow beans the year after Muster application. Beans, lentils and fababeans may be grown the second year after application.

Poast FlaxMax

Do not grow beans or other pulse crops the year after Poast FlaxMax application.

Prevail

Do not grow beans or other pulse crops the year after Prevail application.

Pursuit

Only lentils and field peas may be grown the year after an application of Pursuit.

Tordon 202C

Tordon is extremely residual (5 plus years) and damaging to pulse crops. The safest recommendation is not to use Tordon on farms where pulse crops are grown.

Herbicide residues can be managed. It just requires some good record keeping, a little “reading up” on the problem herbicides, and a bit of a plan. Attention to detail is all you need to avoid problems caused by herbicide residues.

Variety selection

The three main considerations when selecting a variety are often maturity, upright growth habit and yield.

Never attempt to squeeze in a variety that *may* mature in time. Look to varieties that will mature in time based on average conditions for your location. Higher yields are often associated with varieties that mature a few days or a week later. Do not be tempted.

An upright growth habit is essential for solid seeded bean production. Pods below the cutter bar will simply be impossible to get. In Manitoba we have seen good success with the navy bean variety Envoy and the blackbean varieties CDC Espresso and CDC Nighthawk. Out of a pool of 40 varieties to select from, that’s not a long list of varieties. But you need to go with something that will work at harvest.

Yield unfortunately is that last thing to look at. If the variety will not mature in time or is too low to the ground, yield potential is irrelevant.

Breeding programs at AAFC, Lethbridge and CDC, Saskatoon will do nothing but enhance the opportunity for bean production in the prairies. The development and likely registration of early maturing Pinto and Great Northern varieties from the CDC will add more bean types that growers can select from.

Seed and Seeding

Seeding rate will vary with seed size. For navy and black beans we’re recommending 50-60 lbs/acre. Planting with a gravity drill will cause less seed damage. Seed damage (splits) can run as high as 70% with an air seeder. Air seeders can be used, however ensure that fan speed is kept to a bare minimum. Also, look to seed with a seed moisture content of 14- 17%. A dry seed will be easily damaged.

We use May 20 as a reference date for starting to plant beans. A frozen bean will not regrow, so plant after the risk of a spring frost has past. Beans require warm soil to germinate (1 OC), so going early into cold ground is not recommended. A wise old bean grower once said, “You know *its right for planting when you can pull your pants down, sit on the soil and the temperature is comfortable*”. I’ve never met this wise old bean grower, but I’ve heard the story more than once.

If rocks are present roll the field prior to plant emergence. Rolling will also level the field, making direct harvesting or cutting much easier.

Fertility

NITROGEN

Inoculated field beans have responded to fertilizer nitrogen under certain conditions in Manitoba trials. The plant requires approximately 15 lb/acre of nitrogen from the time of seeding to nodule fixation of nitrogen about a month later. Yield increase with applied nitrogen is likely when:

1. soil nitrogen is low in the spring (less than 35 lb nitrate N/ac in 0-24" depth)
2. spring soil temperatures are below average
3. seed yield expectations are high (exceeding 1800 lb/ac)
4. root efficiency is impaired by root rot

Under these conditions, consider applying 20-40 lb N/acre.

Excessive nitrogen applications may cause increase foliage growth and disease severity (especially white mold), delay maturity and reduce the effectiveness of rhizobium.

PHOSPHORUS

Beans have not responded well to applied phosphorus in Manitoba. However, it is well recognized that good yields of beans are usually associated with high levels of available phosphorus in soils. It appears that residual affects of phosphate fertilization is more important for beans than direct phosphorus fertilization. Each hundred weight of beans does remove 1.25 lb of P_2O_5 . Refer to Table 1 for recommended phosphorus application rates and placement for beans.

Table 1. Phosphorus fertilizer recommendations using the sodium bicarbonate (Olsen) method.

Sodium Bicarbonate Extractable Phosphorus Soil Content (kg/ha in 0-15 cm depth)	P_2O_5 Recommendation kg/ha With The Seed
0 - 9	20
10-19	15
20-29	10
30-39	0
40-49	0
>50	0

The microbial seed inoculant PROVIDE is registered for use on beans. PROVIDE contains the naturally occurring soil fungus Penicillium bilaji. This treatment may increase the availability of fertilizer and soil phosphorus to the crop during the growing season. PROVIDE can make available the equivalent of 10 lbs P_2O_5 /acre. However, field results have not been consistent and there has been little use among bean growers. The routine use of seed treatments for beans containing fungicides (captan or thiophanate-methyl) further impair the abilities of this organism. This inoculant is not a substitute for long term phosphorus fertility programs because PROVIDE has no residual benefit.

POTASSIUM

Potassium levels may be low on sands, sandy loam and organic soils in Manitoba. Each hundred weight of beans removes some 1.67 lbs of K_2O . Potassium fertilizer must be placed away from the seed. Refer to Table 2 for recommended rates.

Table 2. Potash fertilizer recommendations using ammonium acetate exchangeable K' method.

Ammonium Acetate Exchangeable K content (kg/ha in 0-15cm depth)	Fertilizer Potash K,O Recommendation
0 - 95	70
96 - 190	35
191 - 285	0
286 - 380	0
381 - 450	0
>451	0

SULPHUR

Sulphate sulphur is recommended on well-drained sandy to sandy-loam soils. Sulphur distribution in the field is often related to topography, with higher levels in low areas and low levels on knolls. Soil test these areas separately to design your sulphur fertility program. Refer to Table 3 for recommended sulphur application rates.

Table 3. Sulphur fertilizer recommendations using calcium chloride extracting solution method.

Soil SO₄-S Content (kg/ha 0-60 cm)	Fertilizer Sulphur (S) Recommendation (kg/ha)
0- 11	20
12-22	20
23 - 33	20
34 - 44	0
45 - 56	0
> 57	0

MICRONUTRIENTS

Micronutrient deficiencies are uncommon on most Manitoba soils. When a micronutrient deficiency is suspected, confirm the diagnosis with visual symptoms, tissue and soil tests.

Low spring soil temperatures may reduce iron, zinc or phosphorus uptake on some Manitoba

weeds like Canada thistle, perennial sow thistle, dandelion and quack grass. Be aware of which annual weeds may be present, and only plant to beans if they can be controlled. Crop rotation is important in determining the types of weeds present. Cereal crops offer a good opportunity to clean up fields before planting to field beans.

Here is a typical weed management strategy for beans that are to be planted in Year 2:

Timing	Management Strategy
June, Year 1	Grow a cereal. Control annual grassy and broadleaf weeds. Scout thoroughly to understand what weeds are present.
August, Year 1	Consider Pre-harvest Roundup to control perennial weeds.
September Year 1	Review the year. What weeds were present? How many were there? Can you control them in beans? Is the field clean enough to plant to beans? Decide if beans should be sown.
October, Year 1	Consider applying a pre-emergent treatment such as Edge. Be sure to incorporate properly for best weed control. May also be applied the following spring.
May, Year 2	If using conventional tillage, control existing weeds with a tillage operation. Plant immediately after. If additional weeds germinate before the beans, consider a harrow operation.
June, Year 2	Scout fields for grassy and broadleaf weeds. Treat with Basagran, Pursuit (coloured only), and/or Poast if needed.
June - August, Year 2	If crop was row planted, conduct interrow tillage as needed. Weeds should be controlled while still small. Must watch not to prune roots, with late cultivations.
August, Year 2	Consider desiccation to improve harvest ability if a large number of green weeds are present.

Consult provincial pest management guides for detailed information on registered herbicides.

Disease Management

There are three serious diseases of dry edible beans in Manitoba.

Bean Rust: Rust is a defoliating fungal disease which is an occasional problem. The disease

generally develops late in the season. There is no registered fungicide control for rust.

Bacterial Blights: Blight can be caused by any of four different bacterial organisms. Blights are seedborne and spread by rain splash. Blights caused defoliation. Copper fungicides are ineffective or expensive and genetic resistance to the most prevalent blight organism (*Xanthomonas*) is almost nil. Use clean seed.

White Mold: White mold is a fungal rotting disease most serious in wet years. Fungicides, appropriately applied, can reduce losses. The pathogen attacks many broadleaf crops ie: canola, sunflowers, field peas and lentils, and weeds ie false ragweed, wild mustard and wild sunflower. Resistance is not available in commercially acceptable bean varieties,

Other diseases such as root rots, zinc deficiency, and virus diseases are important sometimes.

No dry bean field is disease free. A producer's goal should be to maximize yields and profits in the presence of these diseases. Dry beans need intensive management, including close and frequent observation (walking the field) to detect problem areas early.

Field identification of disease is often difficult because symptoms of disease vary with environmental conditions.

Diseases are a continual problem and control procedures must be planned for developing sustained production. Each condition which affects plant growth also affects the disease organism and the effectiveness of any control procedure. In general, conditions which favor rapid, lush plant growth also favor disease development. No single control procedure is best in every situation. Often a complex of disease interactions defies simple explanations or solutions.

Harvest and Handling

Beans should be combined when the seed is at a moisture content of 16-22%. Seed moisture > 17% will need to be dried down through aeration. Combining at a seed moisture <16% can increase seed splitting and seed coat cracking. Changes in seed moisture occur rapidly. Keep checking the sample as you combine during the day. Cracked seed coats or splits end up as dockage, so consider anything less than perfect being a waste product.

Cylinder speed should be set up between 300-400 rpm, slowing the speed down as the beans dry. Initial concave setting should be 1/2" front, 1/4" rear. Increase settings as beans get drier. Set chaffer at 5/8" and sieve at 7/16". Wind speed should be high.

Going for Quality

A quality product is usually worth more. A quality product is usually easier to market. Minimizing seed coat damage and splitting is critical.

No matter what type of combine is used it should be in good repair. Ensure surfaces are smooth and clearances are what they need to be. Elevator paddles should be snug in the housing and the chain tight.

Adjustments have to be made routinely. Cylinder speeds should be kept as low as possible. Most seed damage occurs at the cylinder. Before cylinder speed is increased, try closing the concave somewhat. As cylinder speed increases, so does the total seed damage. Some combine models will require a cylinder slow down kit.

Conventional cylinder bars can be used, however bars with uneven wear should be replaced. When fitted with new bars, the combine should run at least 50 hours on another crop to smooth out any rough edges that may cause damage to the bean crop.

Removal of concave wires can reduce seed damage in some situations.

Maintaining a full cylinder or rotor can be achieved by increasing ground speed. A full cylinder or rotor will act to cushion beans throughout the threshing action.

■ **Some Tips:**

- ✓ Start combining when beans are around 18-20% seed moisture content, with a cylinder speed of 300-400 rpm.. Ensure that pod and straw is dry enough.
- ✓ As the beans dry down, reduce the cylinder speed to 150 - 200 rpm.
- ✓ If conditions are too dry (notice excess splits or cracking), wait for better conditions... in the morning or later in the evening.
- ✓ Also, as beans dry down, open concave settings.
- ✓ If you notice excess dirt and chaff in the grain tank close sieves a bit and increase fan speed.
- ✓ Unload beans very slowly.

Beans have a relatively thin seed coat and need to be handled with extreme care to minimize damage to the seed. Small hairline cracks to the seed coat will discount the product. When beans take in water in the canning process these small cracks will widen, and be unappealing to the canner.

Beans are often stored and traded at 17% seed moisture content, but are considered dry at 16%. Aeration can be applied to seed harvested between 18 -20% seed moisture content. Harvesting at those moistures minimize seed damage during the threshing operation. Excessive drying to a seed moisture content 46% will make the seed coat more fragile and susceptible to cracking or splitting when handled. Beans may be discounted when too dry (<15% seed moisture content). When beans are stored on a flat surface, rake the surface of the pile periodically in the winter time (once/week) to **avoid** surface crusting and sealing in moisture.

Beans should be moved with a belt conveyor. Belt conveyors can only work with an elevated bin, hopper bottom bin or when the seeds are on a flat surface and scooped into a belt conveyor. Beans can be safely stored on a concrete floor, however avoid dropping the bean from a height greater than a few feet.

Avoid contaminating the seed with foreign material, especially corn and pea seed which can be difficult to separate. Ensure trucks and storage facilities are thoroughly cleaned.