ALBERTA FABABEAN
PRODUCERS MANUAL 1.0

December 2013
DISCLAIMER

The Alberta Fababean Producers Manual is a reference tool for growers in Alberta. The authors have tried to ensure that all information is accurate and complete. If there are any questions, please consult with one of the experts who assisted with the manual. All that is written is strictly for information purposes and the authors make no guarantee on the use and applicability of the information. The authors are not liable for any personal damages or losses encountered arising from the use of the information provided.

PROCESS OF INFORMATION ACQUISITION

This manual was developed through information gathered from international peer-reviewed articles as the research on fababean within Canada is limited. We then went to industry professionals and current producers in order to get “in the field” knowledge and experience. All this information was then compiled to provide an oversight of fababean production.
ACKNOWLEDGMENTS

The Fababean Producer Manual was created to benefit Alberta growers interested in the production of fababean. We would like to extend a special thanks to: our sponsor Parkland Alberta Commodities, our contributors Dan Visser of Galloway Seeds, Aubrey and Bonnie Bickford, Harvey Brink, Greg Stamp of Stamp’s Select Seeds, Mel Stickland, Shane Strydhorst, Sarah Weigum, Dane Lindholm of Lindholm Seed Farm, Cliff Cyre, Richard Foshaug, Dr. Kan-Fa Chang, Alberta Pulse Growers and Alberta Agriculture and Rural Development. Also, to our editors Linda Hall (University of Alberta), Mark Olson (ARD) and Robyne Bowness (ARD).
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INTRODUCTION

This manual has been created with the intention of providing current and tested information to growers about the production of fababean (Vicia faba, minor), a burgeoning crop on the Albertan landscape. Information was gathered from industry professionals, researchers, scientific publications and producers from across Alberta. By using this blended approach to create this manual, we hope to provide information that encourages more farmers in Alberta to integrate this truly interesting and beneficial pulse crop into their rotations. The future of fababean marketing holds promise of international trade, local feed markets and health food potential, so long as a steady supply is provided.

Currently, there are approximately 2.6 million hectares of fababean grown worldwide, mostly in China, Ethiopia and the European Union (Jenson, Peoples and Hauggaard-Nielsen, 2010). Canada accounts for a very small percentage of global production. 2013 Alberta production is estimated to be a minimum of 15,000 acres, but may be as high as 30,000 acres. Acreage is expected to double, or even triple in 2014. In this manual, the basics of fababean agronomics will be explored, as well as pest management, uses, and marketing possibilities.
FABABEAN MORPHOLOGY

Fababean originated in the Near East and Mediterranean basins and have been cultivated for over 8000 years. They also go by the names broadbean, horsebean and field bean in other areas of the world (Duc, 1997). Classified as an annual grain legume, fababean is a vigorous pulse crop.

Unlike some other pulses, such as pea, fababean has a thick stem that holds an increased height, up to 1.5 metres tall. Some other identifying characteristics are listed below:

- Compound leaves, large in comparison with other pulses.
- Stem is hollow and green, turning dark at maturity.
- Flowers present at the base of the leaf.
- White to pink flowers, some varieties have black spots, gathered in clusters.
- Flower clusters produce 1-4 pods per cluster.
- Pods are long and green, turning dark brown-black at maturity.

(Saskatchewan Agriculture, 2013)
Flowering occurs approximately 45-60 days following emergence, and full maturity is reached within 110-130 days. Desiccants are required in most parts of Alberta in order to complete maturation. Growth stages of fababean can be seen in table 1 below.

**Table 1 Fababean Growth Stages**

<table>
<thead>
<tr>
<th>Stage</th>
<th>Photo Source</th>
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<tbody>
<tr>
<td>Emergence</td>
<td>Photo Source: Alberta Pulse</td>
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<tr>
<td>Elongation</td>
<td>Photo Source: Sarah Weigum</td>
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<tr>
<td>Flowering</td>
<td>Photo Source: Alberta Agriculture</td>
</tr>
<tr>
<td>Pod Fill</td>
<td>Photo Source: Sarah Weigum</td>
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<tr>
<td>Maturity</td>
<td>Photo Source: Alberta Pulse</td>
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<tr>
<td>Harvest</td>
<td>Photo Source: Dan Visser</td>
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</tbody>
</table>
Unlike canola, pods are not formed from every flower on the plant. Only approximately one quarter of the flowers will produce pods. Many factors determine whether a flower will produce a pod.

- **Pollination** – fababean can be both cross and self-pollinated. If pollination does not occur on a particular flower, it will not form a pod (Duc, 1997)

- **Abiotic factors** – adequate soil nutrition, light and water influence pod fill (Patrick and Stoddard, 2010)

  On average, three to four seeds will form in each pod. Seeds vary in size and colour, depending on the variety of the fababean. Tannin-containing varieties produce a light brown seed. Low tannin varieties will produce white seeds. Seed size ranges from 350 – 800 thousand seed weight.
CULTIVARS

The following cultivars are registered in Alberta:

<table>
<thead>
<tr>
<th>Variety</th>
<th>Overall Yield</th>
<th>Station Years of Testing</th>
<th>Type</th>
<th>Relative Maturity</th>
<th>Plant Height (cm)</th>
<th>Thousand Seed Weight (g)</th>
<th>Flower Color</th>
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<tbody>
<tr>
<td><strong>FABABEANS</strong></td>
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<tr>
<td>SNOWBIRD (KG/HA)</td>
<td>7650</td>
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<tr>
<td>SNOBWIRD ❀</td>
<td>100</td>
<td>22</td>
<td>Zero Tanin</td>
<td>E</td>
<td>92</td>
<td>480</td>
<td>W</td>
</tr>
<tr>
<td>FB18-20</td>
<td>103</td>
<td>8</td>
<td>Tanin</td>
<td>M</td>
<td>77</td>
<td>670</td>
<td>C</td>
</tr>
<tr>
<td>Imposa ❀</td>
<td>99</td>
<td>8</td>
<td>Zero Tanin</td>
<td>L</td>
<td>80</td>
<td>540</td>
<td>W</td>
</tr>
<tr>
<td>Malik</td>
<td>98</td>
<td>8</td>
<td>Tanin</td>
<td>M</td>
<td>80</td>
<td>610</td>
<td>C</td>
</tr>
<tr>
<td>Snowdrop ❀</td>
<td>85-</td>
<td>8</td>
<td>Zero Tanin</td>
<td>E</td>
<td>84</td>
<td>297</td>
<td>W</td>
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<tr>
<td><strong>Fully Tested Varieties: 2000-2007</strong></td>
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<td>EARLIBIRD (KG/HA)</td>
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<td>EARLIBIRD ❀</td>
<td>100</td>
<td>Fully Tested</td>
<td>Tanin</td>
<td>E</td>
<td>93</td>
<td>520</td>
<td>C</td>
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<tr>
<td>Ben ❀</td>
<td>112+</td>
<td>Fully Tested</td>
<td>Tanin</td>
<td>E</td>
<td>101</td>
<td>580</td>
<td>C</td>
</tr>
<tr>
<td>CDC Blitz R</td>
<td>102</td>
<td>Fully Tested</td>
<td>Tanin</td>
<td>ML</td>
<td>96</td>
<td>460</td>
<td>C</td>
</tr>
<tr>
<td>CDC Fatima R</td>
<td>97</td>
<td>Fully Tested</td>
<td>Tanin</td>
<td>M</td>
<td>92</td>
<td>530</td>
<td>C</td>
</tr>
<tr>
<td>Cresta</td>
<td>96</td>
<td>Fully Tested</td>
<td>Zero Tanin</td>
<td>M</td>
<td>86</td>
<td>590</td>
<td>W</td>
</tr>
<tr>
<td>Scirocco</td>
<td>106</td>
<td>Fully Tested</td>
<td>Tanin</td>
<td>ML</td>
<td>89</td>
<td>580</td>
<td>C</td>
</tr>
</tbody>
</table>

**Remarks:** All colored flower types have seed coats that contain tannins and may be suitable for export food markets if seed size and quality match customer demand. Varieties with more than ten site years are Fully Tested. ❀ = Protected by Plant Breeders' Rights (PBR); R = Registered with CFIA.

New varieties: Malik (FB9-4) and FB18-20.

1 Maturity: E = early, M = medium, ML = medium late, L = late; 2 Flower Colour: W = white flower, zero tannin, C = colored flower, tannin.

Taken From: Alberta Agriculture and Rural Development, 2013
SEEDING

Seeding is seen by many producers as the biggest hurdle growing fababean. Though the large seed size can plug up seeding equipment, we found in interviews with growers that this was largely dependent on the speed of seeding and the type of seed treatment that has been applied to the seed. Below are some observations and guidelines to follow when seeding.

- Fababean can be seeded into a wide range of soil types, though it prefers soils with clay to loamy textures with high water holding capacity.
- Prior to seeding ensure growers test seed for germination and vigour. This will ensure a competitive and healthy stand.
- Seed as early as possible: It is advised to seed before May 7th, or as soon as the ground is able to be seeded into, to ensure enough time for the crop to reach full maturity and to utilize early season water from snow melt.
- Plants will emerge and germinate in cool soils. It has been noted that seedlings can handle cool temperatures as low as -3 to 5°C.
- When seeding, ensure that you are seeding into good soil moisture. This is a key factor to ensuring seedling germination.
- Population densities for optimum yields are as follows:
  - 30,000 plants x hectare\(^{-1}\) (174,240 plants x acre\(^{-1}\))
  - 43 plants x m\(^2\) (4 plants x f\(^2\))
- It is important to do a 1000 seed weight on each seed lot before seeding. This will help ensure proper seeding rates as seed weights vary due to variety and growing conditions.
- Calibrate seed drills for each variety and seed lot before seeding to ensure optimum seeding rates.
Growers are encouraged by experts to adhere to seed treatment practices. Seed treatments have not been shown to set back the growth or maturity of crop production. Producers in Southern Alberta generally treat their fababean with an insecticide along with fungicide (CruiserMaxx), in order to treat for pea leaf weevil infestations. Seed treatments are recommended in order to maintain a healthy plant stand and avoid preventable disease problems, such as dampening off.

**Seeding Rate Calculation:**

Seeding Rate \((\text{lbs x ac}^{-1})\) = desired plant population \(\times \text{ft}^2\) \(\times 1,000\) seed weight (g) \(\div\) expected seed survival %.

**Seeding drill calibration:**

Grams of seed per 100 feet row = seeding rate \((\text{lbs x ac}^{-1})\) \(\div\) 2

(Based on 15 cm or 6 inch row space)

Grams of seed per 100 feet of row = seeding rate \((\text{lbs x ac}^{-1})\) \(\div\) 2 \(\times\) (row space \(\div\) 6)

(Based on 22 cm or 9 inch row space)
SEEDING EQUIPMENT

Growers can use the same drills for smaller seeded fababean (such as Snowbird and Snowdrop) as those used for other crops. For very large seeded varieties, alterations to the seeding drill may be required (ie. An extra coarse metering wheel).

- Adjustments such as using larger hoses (on seed drill), making sure that there are no bends in the hoses and slower seeding speed may be required to obtain an even seed flow and distribution.
- Hoe press drills are preferred over double disc drills because when using double disc drills seed may be left at the soil surface due to heavy trash or due to high seeding speeds.

PRODUCER ADVICE:
SEED EARLY! BE PREPARED TO PRE-SEASON SPRAY.
CONSIDER DOING A TRIAL WITH YOUR SEEDER BEFORE HITTING THE FIELD TO MAKE SURE THERE ARE NO MAJOR FLOW ISSUES.
- SARAH WEIGUM

- Before seeding ensure that the drill has large enough seed cups and an extra coarse metering device to handle this large seeded crop.
- Maintain constant ground speed in order to obtain proper seed distribution.
- Air seeders are also an alternative option. They plant seeds with precision regardless of slope or varying ground speed, but uniform depth control may be an issue.
- With the use of an air seeder, very high air flow may damage the seed, especially at the bends of hoses.
- Always ensure that air seeders are equipped to handle and seed fababean at the proper seeding rate.
- Ensure seed can flow through the seed boots.

SEEDING DEPTH

In order to ensure uniform germination, crop emergence and maturity, uniform seeding into moisture is required.
- Plant seeds to 6 to 9 cm deep (2.5 to 3.5 inches).
- Ensure to avoid shallow seeding, especially in sandy soils, as seed may get stranded in dry conditions.
Potential plugging points:

- **Distributor heads**
  Seeds can be damaged as they hit the distributor head.
  Blockages occur at outlet holes.

- **Tubes**
  Hoses block on bends.

- **Seeding boot**
  Blockages occur, especially if boot narrows or changes in shape from circular to oblong.

- **Seed box**
  Check for bridging, especially following transport.

- **Metering device**
  Check roller type, for seed clearance and possible seed damage.
  Check device can meter correct seeding rate.
FERTILIZER REQUIREMENTS

Nitrogen
As a member of the pulse family, fababean, are known for their ability to fix nitrogen. Alipour et al. (2013) reported that fababean acquire 79% of their required nitrogen (N) through biological fixation, 20% from soil and only 1% from fertilizers. When deciding what fertilizer is required for this crop, it is recommended that a soil test be taken.

- Soil testing provides a baseline for the nutrient availability in soil and is a critical step in nutrient management (Alberta Fertilizer Guide. 2004).
- Generally, the yield potential and N fixation is highest in deep, heavy soils with adequate water supply (Kopke and Nemecek, 2010).

When choosing a fertilizer rate, the major difference seen in the formulation will be the N levels. Since fababean have a high nitrogen fixing capability, the addition of this compound is not required.

Phosphorus
Alternatively, fababean requirements for phosphorus (P) is high due to the strong energy expenditure utilized during nodule formation and operation (Kopke and Nemecek, 2010). There are a few things to note about phosphate fertilizers:

- These fertilizers do not move readily in the soil, therefore placing the band of phosphate near developing seedling roots of annual crops is most effective (Alberta Fertilizer Guide. 2004).
- However fababean have adapted to acquire P from low P soils, and may indirectly make more P and K available for subsequent crops (Kopke and Nemecek, 2010).
SOIL CONDITIONS

It’s important not to seed fababean on a field that has high levels of soil nitrate as this is known to delay the formation of nodules, the onset of nitrogen fixation and produce excessive vegetative growth (biomass). Factors that can positively contribute to these levels include:

- excessive tillage
- summer fallows
- application of fertilizer containing nitrogen
- extended legume rotations

High levels of soil mineral N will also delay nodule formation. If nodules are not well established at the time of the highest N demand, during flowering and early pod fill, then N may temporarily be limiting growth and final grain yield (Jensen, Peoples, Hauggaard-Nielsen, 2010).

- The first nodules are set about two to three weeks after crop emergence.
- The highest nitrogen fixation rates are found after flowering, when the pods and grain become strong active sinks for assimilates and fixed nitrogen (Kopke and Nemecek, 2010).
- Fababean have slower rates of N accumulation during the first months after seedling emergence, but after two months the rate of N accumulation was greater in fababean than pea. This is related to the indeterminate growth habit of fababean as they continue to assimilate N for a longer period than pea (Jensen, Peoples, Hauggaard-Nielsen, 2010).

Figure 7, Photo Source: Sarah Weigum
INOCULANTS

Nitrogen fixation is the result of a symbiotic relationship between the fababean plant and rhizobium bacteria. The proportions of plant N derived from biological nitrogen fixation significantly increases with inoculation rate (Denton, Pearce, Peoples. 2013).

There are 3 different formulations of inoculants available:

1. Peat powder inoculant – Applied directly to the seed with a non-toxic sticking agent, this formulation is a finely ground peat that contains over a billion rhizobia per gram.

2. Liquid inoculant – Also contains over a billion rhizobia per gram, is applied directly to the seed, and a sticking agent is typically included in the fluid. Liquid inoculant comes in bags that make it easy to distribute evenly onto the seed while it’s being augered into a truck box or through a drill fill.

3. Granular soil inoculant – Not applied directly to the seed but rather is banded with the seed in the row. It contains about the same amount of rhizobia as the powder and liquid inoculants and has been gaining popularity because of its convenient form.

(Alberta Pulse Growers)

Inoculants for fababean, specifically, are available and include:
- Nodulator

(Figure 8, Photo Source: http://www.nodulatorxl.com/faba/default.aspx)
Current fababean growers in Alberta have had success inoculating fababean with pea inoculants such as:
- Establish
- Cell-tech

Increasing the number of rhizobia applied to fababean seed improved biological nitrogen fixation, particularly in situations with low soil rhizobia numbers, due to increased nodulation (Denton, Pearce, Peoples. 2013).

**Fababean In Cropping Systems**

Fababean roots and stubble have been reported to contribute up to 44-50 kg N x ha$^{-1}$ to the requirements of the following crop in a temperate climate (Kopke and Nemecek, 2010). The organic nitrogen that remains in the soil increases protein in the following crops. Alberta producers have seen an increase of 10-15% bu x acre$^{-1}$ on cereal crops that are grown after fababean versus their own crop kind. Alberta producers also find fababean improve the tilth of the soil, when compared to growing other crops. Fababean improves soil structure by stabilizing soil aggregates (Jensen, Peoples, Hauggaard-Nielsen, 2010).
INTEGRATED PEST MANAGEMENT

Common diseases

CHOCOLATE SPOT (Botrytis sp.)

Chocolate spot is one of the most common diseases found in Western Canada. It is caused by the pathogen Botrytis sp. The first observation of this disease was first noted in Britain by Berkeley around the mid 1800's. Now it has developed worldwide, occurring in almost all regions where fababean are grown.

Symptoms

The leaves are the main affected tissue; flowers and pods can also be infected when conditions are favourable. There are two phases of the disease that are easily identifiable:

- Non aggressive phase; in this phase, the classic symptoms are the regular reddish-brown/chocolate-brown spots which give a 'peppered' appearance to the foliage, especially on the older leaves.

- Aggressive phase; the coalesced lesions become greyish and darker in color. They are irregular and elongated in shape, with a brownish tinge. This stage is often developed under humid conditions; as long as the disease becomes aggressive, the lesions start to spread until the whole leaf been covered.

Similar symptoms could be caused by other factors, such as aphid feeding damage. Young lesions may also show on pods or the floral end.
Life Cycle

This fungus can grow on fallen leaves. It then infects the younger leaves. Many conditions can accelerate disease development:

- high humidity
- increased rainfall
- low wind speeds
- favourable temperature (between 15-20°C)
- Plants that have been previously weakened by other factors (Wilson, 1973)
- Age of leaf

Some infection has been detected within the seed. These infections are not considered significant, as the fungus does not remain viable for long, and the infection frequency is low.

Management

- Stick to the seeding rate - by increasing crop density, a preferable environment is created and will foster pathogen growth.
- Adhere to a proper crop rotation. This will decrease inoculant load found in the soil.
- Intercropping with cereals can reduce disease severity. (Fernandez-Aparicio et al., 2011)
- Burning or ploughing the straw residues after harvest and avoiding bean crop debris as well as volunteers can reduce the inoculum rate.
- Seed treatment using Thiram 75 WP can be used to help control the disease.
- Soaking seeds in ethephon could reduce the disease severity (Salem et al., 1992).

Figure 13, Photo Source: Government of Western Australia, Department of Agriculture and Food.
**Sclerotinia Stem Rot – Sclerotinia trifoliorum**

Sclerotinia stem rot or sclerotinia disease is caused by the pathogen *Sclerotinia trifoliorum*. This disease can also infect leaf and root tissues. In Western Canada, this pathogen mainly causes symptoms of stem rot, though foliar, as well as root rot can be observed.

**Symptoms**

The first symptom shows at seedling stage; a wet rot of the lower stem extends down into the soil. Plants that are infected can be easily pulled out of the soil. One way to distinguish sclerotinia stem rot from other rot diseases is:
- base of the stem is dark
- covered with white cottony mold

As the plant grows the disease symptoms can be found in any part of the infected plant including stem, leaf and pods. White mycelium and black sclerotia are produced within the stem. Leaves become wilted and the plants collapse.

**Life Cycle**

The black sclerotia germinate when temperatures are cool and moist in fall following their dormant period and produce apothecia which can keep on releasing ascospores in favourable conditions. Then ascospores are spread by wind kilometres over to the next host plant. Any wounds on the plant can increase the chance of infection.

Currently, sclerotinia is not present in economically significant levels in Alberta. Though severe damage of fababean yield has not yet been seen, one should be cautious and conscious of rotational advantages that can help to decrease the sclerotia populations present in the field, such as not following a canola crop. Canola is a prolific producer of sclerotia bodies.
Management

One practical way to manage this disease is through crop rotation. However, a long rotation is required since the pathogen has a wide host range and sclerotia can survive up to 8 years.

- rotation shouldn’t be less than 4 years and other less susceptible crops should be utilized within the rotation
- reducing seeding density and increasing row spacing can decrease severity

**Fusarium Foot and Root Rot**

Fusarium sp. is the most widespread disease of fababean around the world, though it is not currently found in Alberta. This pathogen can also infect other legume species such as soybean, chickpea and field pea. This same disease in China, lead to up to 40% yield loss in fababean (Yu and Fang, 1948).

**Symptoms**

The pathogen is favoured by high moisture and high soil temperatures and develops fast as the infected plant grows. After infection, the leaves start to pale and begin yellowing. Soon after, the leaves become necrotic. The disease spreads from the lower leaves to the upper leaves. The leaves and young shoot tips may wilt and die under dry weather, even if they are still green. The root and base stem blacken and rot following infection. Just before the plants death, white or pink spores appear. Discoloration of vascular tissue can be observed at the base of stem and in the root tissues.

**Life Cycle**

The pathogen can attack both seedling and mature stages of the plant, but the most severe symptoms become present at the flowering stage. Many different *Fusarium* sp. can cause this disease, so, as an unspecialized pathogen it can attack a wide range of species and survive underground for a long time.

- low tannin cultivars are more susceptible than tannin-containing fababean to this disease.

![Fusarium diseases](http://www.hgca.com/minisite_manager/output/3613/3613/Cereal%20Disease%20Encyclopedia/Diseases/Fusarium%20(Foot%20Rot,%20Seedling%20Blight,%20Ear%20(Head)%20Blight).msp?minisiteId=26)
Management
Crop rotation can be used to decrease the severity of the disease.
Proper irrigation and weed control methods should be applied to the field. (Belete et al., 2013)
Treating seed with Agrox FL (captan) could reduce infection. (El-Naggar et al., 1997)
Soaking seeds in salicylic acid and hydrogen peroxide has been shown to effectively control the disease in studies, but is impractical. (Abdel-Monaim, 2013)

**RHIZOCTONIA DAMPING-OFF AND ROOT ROT**

This disease is caused by the pathogen *Rhizoctonia solani* and is widespread around the world. The pathogen has a wide host range and often associates with other pathogens on host plants, so the control is difficult.

**Symptoms**
Damping-off, root and crown rot are often the most obvious symptoms. Under moist, high soil temperatures, the infected plant will exhibit yellowing and wilt. Symptoms can get more obvious when the *Rhizoctonia* sp. is infecting the plant along with the pathogen *Pythium* sp. Dark lesions appear on base stem and leaf and eventually cause foliage discoloration to a greyish to brown. Roots turn brown and begin to grow in all directions. Flowers are often shed and fewer pods develop after infection.

**Management**
- Delayed seeding seeding date can reduce infection (Gowily et al., 1994), but this may be difficult in many areas of the province where long maturity is observed
- Fungicides can be used to control the disease, such as Benlate (benomyl) (Gowily et al., 1994).
**ASCOCHYTA LEAF, STEM AND POD SPOT**

This is the disease that holds the potential to cause large yield loss due to the nature of its fast infection of all above ground host tissue. Currently, this disease has not been reported within Alberta. The pathogen is *Ascochyta fabae* and can be introduced through by soil movement.

**Symptoms**

The leaf lesions are circular and dark brown in color, with a light colored center that is slightly sunken. Symptoms in the early stages look similar to non-aggressive chocolate spot lesions on foliage. In later stages, lesions enlarge and coalesce to cover the whole foliage surface and then the infected leaf turns brown. Lesions on stems and pods are sunken and darker. The stem lesions are elongated and can cause stem break. The pod lesions are yellowish coloured in center and may penetrate inside of the pod.

**Life Cycle**

Not many studies show the pathogen can spread through host plant interactions. The short distance (6-10 m) spread of conidia may occur under favourable conditions. The most common way of spreading this fungus is through infected seed. Adjacent susceptible weed hosts and infected debris can be another inoculum source.

**Management**

- control host weeds and debris in adjacent fields.
- use certified seeds that contain the lowest level of disease inoculation (1-3% infection is reasonable).
- Non-systemic fungicides work well by foliar application of Bravo (chlorothalonil) and Polyram DF (metiram).
**RUST**

The casual pathogen is *Uromyces* sp. and it can infect almost all pulse crops. This disease is not considered a serious problem in Alberta since the yield loss is low. The infection rate is relatively low compared to other pathogens. A high level of humidity needs to be reached in order for infection to take place. Infected plants can experience premature defoliation at late growing stages. Most yield loss occurs at the seed filling stage.

Leaf symptoms include small necrotic spots with reddish-brown in centers. Blisters can be observed on the stem and pods of infected plants.

**Management**

- Clean infected tissue from plants to reduce the infection.
- Look for resistant-type cultivars

---

**BEAN YELLOW MOSAIC VIRUS**

Bean yellow mosaic virus (BYMV) is a common mosaic disease of fababean caused by potyvirus group. This virus is not currently producing economic losses in Alberta. The symptom starts to show 7-10 days after the plant has been infected. The youngest leaves have milder green mosaic mottling and veins appear to be banded or yellow; rolling and narrowing of leaves occurs and plants suffer from stunting.

**Management**

- Using certified seed
- Farmers can experiment with mineral oils as a ground spray. (Proeseler et al., 1975)
**LYGUS BUGS**

Adult lygus are soft bodies and around 5-7 mm long. They have piercing-sucking mouth parts and cause damage by feeding on foliage. Symptoms include leaf necrotic spots and small holes. Spots can cause severe damage and the plants eventually die. Symptoms are more intense at the edge of the field. By piercing pods of maturing plants, these insects can cause dark spots on the beans. These spots can cause downgrading in the edible market.

**Management**

- Scout fields regularly to ensure that severe damage does not occur
- net sweep every second or third day starting mid-July is recommended in several spots of the field
- spraying is likely worthwhile, even if you only find 1 or 2 lygus per dozen sweeps.
- fields should be monitored into the first week of August. (Fisher Seeds Ltd., F. G. Beaudette, Fababeans Newsletter February 2002)

Three insecticides are registered for lygus bug control in canola:

- Dylox (550 mL/ac)
- Lorsban 4E (405 mL/ac)
- Matador 120EC (34 mL/ac).

Minor use registrations for fababeans should be verified before usage. (Alberta Agriculture and Rural Development, 2013)
**CUT WORM SPECIES**

This is a large group belonging to the Lepidoptera family and contains many different species. Although, they can be common in fababean fields, they most often occur in low densities, and yield loss is low. The most common pests includes the lima pod borer (more than one generations per year and damaging stage is larvae which mainly attack pods but also could damage shoots and flowers), and cutworms (damaging stage is larvae in spring, around 35 mm long, could cause severe seedlings damage). There are three common cutworms found in Alberta; Army Cutworm, Redbacked Cutworm and Glassy Cutworm.

Management

- using crop rotations and avoiding susceptible hosts can reduce the number of eggs laid and number of larvae hatched.

- controlling weeds is also an important method to reduce the damage.

- insecticides can be used if economic threshold levels are reached.

Growers should be cautious of using insecticides on crops that are intended for human consumption. Check the label for any adverse affects and be conscious of pre-harvest intervals.

- For controlling pod borer, spray should between hatching and the time when larvae entry pods.

**PRODUCER OBSERVATION:** THIS PAST YEAR WE FOUND THAT BERTHA ARMYWORMS WILL FEED ON THE PODS OF BEANS JUST AS THEY DO IN CANOLA. IF THEY ARE NOT CAUGHT EARLY THEY CAN DO A CONSIDERABLE AMOUNT OF DAMAGE. WE DID NOT KNOW OF THEIR INFESTATION IN OUR CROP UNTIL DESICCATION AND I WOULD SAY THAT THAT THE DAMAGE WAS WORTHWHILE TRYING TO MANAGE IF WE WOULD HAVE CAUGHT IT EARLIER.

DANE LINDHOLM - NEW NORWAY

![Figure 22, Photo source: Manitoba Agriculture Food and Rural Initiave]
**APHIDS**

Aphids are known to be the most damaging pest to fababean in the world, but have not yet been reported to cause severe yield loss in Western Canada. The most common species include the black bean aphid, the pea aphid, and the vetch aphid. Aphids can cause plants to wilt and collapse. Their saliva contains chemicals that down-regulates plant growth. Feeding damage can cause a lowered rate of leaf and flower production. This leads to fewer seed pods and smaller seeds produced by the plant. Aphids can also be the host of many viral diseases.

**Management**

- Insecticidal treatments work well for aphids such as some systemic products organophosphorous and carbamate.

- Delayed sowing date has been shown to reduce damage, though this leaves the plant more susceptible to disease establishment and not maturing.

- Planting dense populations and in narrow spacing can reduce infestation. A population density of 600,000 plant m⁻² has been shown to be beneficial, although, the recommended plant population is 430 00 plant m⁻².

**NEMATODE**

More than 2500 nematode species have been found to attack fababean. Some species are common and can cause yield loss. These species include

- Stem nematode

- Stunt nematode

- Root-lesion nematode

- Cyst nematode

Nematode damage is not currently considered a serious problem in Western Canada. Infested plants usually swell and become distorted in appearance.
The infested tissues often are dark-brown in coloration and infested leaves may have necrotic stems that are often blistered.

**Management**
- Controlling host weed populations.
- Crop rotations to reduce pest populations.
- Methyl bromide could be used to control light infestations in harvested seed.

**WEED CONTROL**

Fababean, like other pulse crops, are relatively poor competitors. Therefore, this crop is particularly sensitive to any competition that may be present from broadleaf and grassy weeds, particularly during the seedling stage. As in other crops, competition for resources can greatly reduce yield. To maintain a healthy plant stand and to ensure a productive fababean crop:
- Prepare the seed bed prior to planting/emergence
- Carefully plan weed control measures in the previous year as fababean are sensitive to herbicide residues (ex. Lontrel).
- Applying glyphosate before emergence can be helpful to control winter annual and early emergent weeds. Farmers should not apply any herbicides that contain phenoxy compounds, such as 2,4-D.
- Use a pre-harvest glyphosate treatment to control difficult weeds (ex. Canada Thistle).
- Pre-burn application with herbicide if necessary, but be aware of residues.
- Continual and sustainable selection of herbicide in order to avoid herbicide resistant weeds.
- Cultivation is an option within organic systems
  - If cultivation is necessary in conventional agriculture, wider rows could be utilized
  - Cultivation is recommended 3-4 weeks after emergence
- Farmers should try to avoid post-emergent harrowing.
- Farmers should not use 2,4-D/MCPA for herbicide use, especially under dry conditions.

Using chemical controls such as Odyssey (imazamox and imazethapyr) can effectively control grasses and broadleaf weeds.
<table>
<thead>
<tr>
<th>Herbicide (Active Ingredient)</th>
<th>Weed</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Basagran (Bentazon)</strong></td>
<td>Canada Thistle, Cleavers, Cocklebur, Common Chickweed, Common Groundsel, Cornspurry, Hairy Nightshade, Lamb’s-quarters, Mustards, Purslane, Redroot Pigweed, Russian Thistle, Shepard’s Purse, Stinkweed, Volunteer Canola, Wild Radish</td>
</tr>
<tr>
<td><strong>Basagran Forte (Bentazon)</strong></td>
<td>Canada Thistle, Cleavers, Cocklebur, Common Chickweed, Common Groundsel, Cornspurry, Hairy Nightshade, Lamb’s-quarters, Mustards, Purslane, Redroot Pigweed, Russian Thistle, Shepard’s Purse, Stinkweed, Volunteer Canola, Wild Radish</td>
</tr>
<tr>
<td><strong>Bonanza (Trifluralin)</strong></td>
<td>Barnyard Grass, Common Chickweed, Cow Cockle, Green Foxtail, Knotweed, Lamb’s-quarters, Purslane, Wild Buckwheat, Wild Oats</td>
</tr>
<tr>
<td><strong>Edge (Ethalfuralin)</strong></td>
<td>Barnyard Grass, Cleavers, Common Chickweed, Cornspurry, Cow Cockle, Green Foxtail, Hemp Nettle, Lamb’s-quarters, Persian Darnel, Prostrate Pigweed, Purslane, Redroot Pigweed, Russian Thistle, Volunteer Cereals, Wild Buckwheat, Wild Oats</td>
</tr>
<tr>
<td><strong>Roas Ultra (Sethoxydim)</strong></td>
<td>Barnyard Grass, Green Foxtail, Persian Darnel, Quack Grass, Volunteer Cereals, Volunteer Oats, Wild Oats</td>
</tr>
<tr>
<td><strong>Rival (Trifluralin)</strong></td>
<td>Barnyard Grass, Common Chickweed, Cow Cockle, Green Foxtail, Knotweed, Lamb’s-quarters, Persian Darnel, Purslane, Russian Thistle, Wild Buckwheat, Wild Oats</td>
</tr>
<tr>
<td><strong>Trelan (Trifluralin)</strong></td>
<td>Barnyard Grass, Common Chickweed, Cow Cockle, Green Foxtail, Knotweed, Lamb’s-quarters, Persian Darnel, Purslane, Wild Buckwheat, Wild Oats</td>
</tr>
</tbody>
</table>
### Table 3 Registered Pre-Emergent Herbicides and Dessicant

<table>
<thead>
<tr>
<th>Pre-emergent</th>
<th>Dessicant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sencor Solupak 75 DF (tank mixed with Treflan EC or Edge)</td>
<td>Reglone</td>
</tr>
<tr>
<td>Authority/ Authority Charge (in registration process for fababean)</td>
<td></td>
</tr>
<tr>
<td>Roundup Weather MAX (can also be used for preharvest weed control)</td>
<td></td>
</tr>
</tbody>
</table>

### Lontrel Residue Damage

![Figure 24, Photo Source: Mark Olson, Agriculture and Rural Development](image)

![Figure 25, Photo Source: Mark Olson, Agriculture and Rural Development](image)
HARVEST

Depending on water availability, temperature and (drought or excess moisture) it takes approximately 110 to 130 days till the fababean crop is mature. As expected, fields that had a later seeding date will result in later maturity in the fall. Because fababean are highly sensitive and responsive to moisture, several aspects of growth can be affected. These include:

- time of maturity
- crop height
- pod ripening

As fababean plants mature, the lower leaves darken and drop, and bottom pods turn black and dry progressively up the stem. As more pods begin to mature to the blackened stage the fababean crop may shatter - this is especially true if there is a wet-dry-wet-dry cycle of weather. When pods are mature, the seeds will have a moisture content of over 40%, while seeds found in the upper portion of the plant may exceed 60% moisture content. Moisture content of the entire plant will be 70% or greater at this stage. It is very important to ensure harvest is completed with correct timing (16% Moisture is considered dry). Yield losses of up to 50% can appear from harvesting too early. Pressure to harvest crops to early can arise from late seeded crops not maturing before frost.

- Seeding Loss = number of seeds ft⁻² x 1000 kwt (g) ÷ 10

Fababean has strong stems and has very good standability. Straight cutting is preferred but some farmers swath with varying success. The reason is swaths may be difficult to pick up off the ground. As well, snowed under crops may pick up mycotoxins.

Figure 26, Photo Source: Greg Stamp
Figure 27, Photo Source: Lindsey Douglas
Swathing

Swathing can be timed to be done when 10 to 20% of the pods have turned black. This time can be observed when the bottom one to three pods turn color. At this time the uppermost pods are fully developed while the middle pods are turning a light green.

- Swathing at the correct stage can minimize any shattering or yield loss.

In order to ensure even drying of the crop, be sure make sure you to have a fairly light and even swath. Poorly swathed crops will have higher moisture content and will require a fairly long drying period (a week). Depending on the crop stand, population and water content, adaptations may have to be taken in order to ensure maximum yield:

- Smaller portions of the crop may have to be taken to cut by the swather in situations where tall heavy stands exist.

- Pick up reels may need to be used for lodged crops.

- Swathing in one direction may be necessary for lodged crops.

**Producer Advice:** Depending on the year and location in Alberta, desiccation will take place anywhere from the last week in August to the middle of September. You want about 70% color change in your plants which means your field will be looking quite dark. Your lower pods will be black and somewhat brittle. Your upper pods will still be plump and green. You may also notice the tops of the plants will be starting to break over. Reglone is the only product registered for desication. Come time to harvest (generally 10-14 days after desication) straight cutting would be a preferable type of combining. **Dane Lindholm - New Norway**

**Figure 28, Photo Source: Greg Stamp**
Combining can be easily done when the grain is dry (16% moisture). An alternative is to harvest fababean at 18 to 20% seed moisture and aerated down to 16% moisture. If aeration and drying is used, in some cases a two-stage drying process may need to be implemented in order to prevent the seed coat from cracking. Due to the fact that fababean seeds can crack and become damaged during the harvesting stage it is important to actively change the auger speed, pick-up speed and ground speed depending on conditions.

**PRODUCER SUCCESS:** SUCCESS?

**THEY GREW HUGE-6-FEET TALL-AND SINCE THEY DID NOT LODGE LIKE PEAS, THEY WERE A TREAT TO HARVEST. AND THEY ARE BEING SOLD AT A SIGNIFICANT PREMIUM OVER YELLOW PEAS. SHANE STRYHORST - LACOMBE**

*Figure 29, Photo Source: Alberta Pulse*

*Figure 30, Photo Source: Sarah Weigum*

*Figure 31, Photo Source: Mark Olson, Agriculture and Rural Development*
Storage

Fababean is a large kernel crop. Therefore, to reduce the amount of cracking and damage to the seed during harvest, transportation and storage always ensure careful practices are taken in order to reduce damage to the seed. These practices may include:

- Use of chain and flight, belt, bucket elevators, and conveyors where suitable for moving fababean. These methods of moving fababean lower the risk of cracking or damaging the seeds.

- Harvesting at 18-20% moisture and aeration down to dry.

- If these methods cannot be used and an auger is the only available option. Try minimizing dropping distance when moving seeds into storage
  o example: this can be done by lowering auger as far as possible when loading trucks)

Fababean must be monitored carefully and continuously throughout the storage period in order to ensure the best quality.

Numerous issues can arise from the improper storage of fababean. With continuous monitoring, quick and early identification of storage problems can help reduce downgrading of seed, moulding, discoloring, heating, and rotting of seeds.

- It is advised that the fababean not be stored for more than one year. This is due to the fact that as time passes, fababean seed will darken, and can be downgraded.

Fababean have been shown to have digestible energy similar to that of cereals, and in many areas can be found at a more favorable price than other protein ration components. In comparison to other pulse crops, fababean have a very favorable nutritive profile, as can be observed in Table 3.
Interest in using milled fababean has been explored by numerous animal production groups worldwide. Some of the findings are listed below:

**Hog Feed**

It has been shown that incorporating up to 200g kg\(^{-1}\) into rations has no effect of growth characteristics or meat quality when compared to conventional diets (Crepon et al, 2010)

- Low levels of sulphur containing amino acid groups in the beans can result in problems.
- Remedied through the supplementation of grain or tryptophan into feed mixture (Jezierny et al, )

**Dairy feed**

- Up to 3.5 kg of fababean per animal per day have been proven to not alter feed consumption, milk production or milk composition when compared to conventional feed

- Increasing rations over 4.5 kg of fababean per animal per day have shown decreases in milk protein content (Crepon et al, 2010)

**Poultry Feed**

Varieties that are low in the anti-nutritive, convicine, show suitable and comparable yields in broiler birds and laying hens can be increased to approximately 20% of diet

- Pelleting has positive effects on apparent metabolized energy in young chicks by increasing starch and protein digestibility (Crepon et al 2010)
Beef Cattle Feed

Lower daily gain observed when initial feed change occurred, but after an adaptation period, no problems were seen with high proportions of fababean protein (up to 90% of protein source) in the feed rations. (Crepon et al 2010)

Lamb Feed

No decrease has been noted in feed composition, daily gain or carcass composition, but feed presentation is important:
- Beans must be milled (not whole) and presented mixed with cereal

International niche markets

Fish Feed

Has been explored as a substitute for alternative feed in the aquaculture of tilapia (Azaza, 2009) and European seabass (Adamidou, 2009)

- Current interests have been surrounding the possibility of fababean in carp diets in Chinese production systems (personal communication, Harvey Brink)

Buffalo Feed

Italian buffalo have been classically bred for milk production, but with new growing prospects in the meat market, producers are looking for alternate feed for their herds to replace soybean due to current controversies surrounding genetically modified production.

Buffalo that are fed fababean as the protein source in their rations are shown to produce high quality meats that are lower in fats, cholesterol and saturated fatty acids than their conventional counterparts. (Calabro et al, 2014)
FABABEAN FOR FOOD

Fababean have been an essential food staple in Mediterranean areas for thousands of years. Some of these areas include: south of China, Egypt, Turkey, and Pakistan. Today, Egypt remains the biggest consumer of fababean for food. The components of the fababean are highly digestible and remain a high source of starch in these diets (Crepon et al, 2010). Varieties of fababean containing tannins and low tannins are desired by food markets worldwide. Other health benefits of fababean include:

- rich fibre source
- high levels of essential vitamins and minerals
- may decrease cholesterol levels
- antioxidant potential (Vioque et al, 2012)

In the 1990’s, the fractionation of fababean components was explored. This process entailed the separation of all of the nutritional element into three components: fibre, starch and protein. It was found that only the protein fraction was of use, due to anti-nutritional qualities such as convicine and bitter tannin flavoring.

More recently, the idea of fababean fractionation has become prominent again. Newer varieties have been designed to not contain these anti-nutritional qualities. The reduction of these unfavorable characteristics has been observed up to 99%.

The beans can be milled for flour and used in many recipes. Some of the flour characteristics are as follows:

- high in carbohydrates
- high in fibre
- high in protein
- low in lipids
- white after processing (no need for bleaching, which is required in some other flour milling processes, such as pea flour)

Fababean can be isolated into other fractions starch, fibre and protein isolates. The protein can be incorporated into either human or animal consumption products.

(Vioque et al, 2012)

Though the current use of fababean for human consumption is limited, the potential does exist for further research and market development.
Marketing

Marketing is a key aspect of growing fababean but should not deter producers from getting into the production of this crop. In Alberta, there is export potential for both tannin-containing and low tannin seed, as well as a local market for animal feed. The tannin-containing varieties are grown throughout Alberta. These products are less acceptable as animal feed, therefore, it is very important that they meet edible grade. Tannin containing seeds can be grown in dry land production systems, but with higher levels of risk as fababean is a moisture loving crop. Low tannin seeds have both an export and animal feed market. Many producers prefer to grow low tannin seed as if it does not meet edible grade, it can be sold into the feed market.

There are two major companies in Alberta that are currently accepting fababean:

- Saskcan Pulse Trading – Gibbons AB
- Parkland Alberta Commodities – Innisfail AB

PRODUCER ADVICE: IN OUR REGION, WITH THE INSECTS AND THE CLIMATE THAT WE HAVE, EDIBLE GRADE IS NOT ALWAYS A POSSIBILITY. YOU HAVE TO BE ABLE TO MARKET THEM IN SEVERAL DIFFERENT WAYS.

BONNIE BICKFORD – RED DEER
If you are growing fababean with the intent of export, it is suggested to pre-book approximately 20% of what you expect to yield. This guarantees yourself a set price for at least some of your seed, but does not commit your entire yield. This can act as a safeguard in years of lower yields. There does exist opportunities to book as much as 100% of your crop, however, if those amounts are not obtained in your set production year, you may be subject to cancellation fees. Processing plants have the ability to clean and mix seed with other lots in order to create the greatest amount of exportable seed as possible.

There are many producers that are growing fababean for the intent of animal feed. These seed lots can sustain a greater amount of damage; however, feed markets come at lower prices. For many hog producer’s fababean are an excellent source of inexpensive protein. These farms can utilize high volumes of fababean in their rations, so there is a constant need within the animal feed market for this product.

In the feed market, fababean protein is competing with soymeal, feed lentil, feed peas, canola meal and other protein sources. In general, fababean trade at the same price as feed pea and lentil. Saskcan exports seed, as well as breaks the fababean into their fractions: starch, protein and fiber.

In the event that fababean production in Alberta increases and more tonnage is available on the feed market, it is thought that dairy producers will begin to incorporate it into their systems. A stable long term supply needs to exist in order for dairy and cattle producers to incorporate this protein source into the diets of their animals.
The main export market for edible seed is to Egypt along with a few other Mediterranean countries. These countries enjoy the taste of both tannin-containing and low tannin fababean. Canadian fababean compete with other fababean exporting nations such as: The United Kingdom, France and Australia. It’s important to sell your export fababean in early fall, soon after harvest. By doing this, one ensures that they sell before the market is flushed with beans from the Australian market. Australia has a very strong export market, as the fababean grown here are of high quality and are large in size: Both desirable traits from the consumer’s perspective.

Parkland Alberta Commodities stated that in 2013 approximately 2/3 of the seed they received was exported and only 1/3 went into animal consumption. Prices reported ($ per bushel) were as follows:

<table>
<thead>
<tr>
<th>Month</th>
<th>Feed</th>
<th>Edible</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sept</td>
<td>$6.00</td>
<td>$8.00</td>
</tr>
<tr>
<td>Oct</td>
<td>$5.50</td>
<td>$7.50</td>
</tr>
<tr>
<td>Nov</td>
<td>$6.00</td>
<td>$7.05</td>
</tr>
</tbody>
</table>

As the grade decreases from the top edible price, the price also drops. The feed price is the lowest price a producer can receive for their crop. Parkland Alberta Commodities expects feed prices to remain stable around $6.00/bushel for the next season. Edible prices are based on supply and export market strength in other areas of the world.

Parkland Alberta Commodities, as well as Saskcan, accept some low-tannin varieties and are able to clean and color sort them in order to meet better grade standards for export markets.

In order to be exported in the human food market, fababean seed must meet a certain standard. These standards are outlined by the Canadian Grain Commissions Official Grain Grading Guide for Fababean. All grading occurs following regular seed cleaning treatments. The most common dockages occur due to damage. Damage is considered:

- Blackened – seed coats are very dark blue to black
- Cracked – fababean with a discolored exposed cotyledon are considered cracked
- Cracked Seed Coats – fababean with cracked seed coats are
considered sound if the halves of the kernels are held together and the beans are not otherwise damaged.

- Discoloured – they are considered discoloured if the discoloration on the seed coat covers more than half the bean or when the discolouration penetrated the cotyledon. This may be caused by weather or disease.

- Splits – include halves or smaller pieces of fababean, halves that are loosely held together by cracked seed coats and fababean with cracked cotyledons.

- Sprouted – when the hull is parted over the area of the germ as a result of sprouting are considered damaged.

- Perforated – showing clear evidence of hull perforations caused by insects or disease.

- Rime – fababean that are completely and densely covered with white rime are considered damaged.

- Green – distinctly green from immaturity.

- Heated – materially discolored as a result of heating or rotting.

- Mouldy – showing clear evidence of mildew or mould.

- Fireburnt – fababean that have charred or scorched by fire.

- Odour

Other factors that cause dockages at the elevator include anything that is considered contaminated grain. Contamination is considered by the Canadian Grain Act as containing any substance in sufficient quantity that the grain is unfit for consumption by persons or animals, or contains other harmful substances as defined by the Food and Drugs Act. Contaminated grain may include the following:

- Ergot, Excreta, or Fertilizer pellets.
- Foreign Material – any material other than whole or split fababean.
- Insect Parts – pieces of insects.
- Sclerotinia sclerotiorum.
- Soft Earth Pellets – pellets that crumble under light pressure.
- Stones - hard shale, coal, hard earth pellets and any other non-toxic materials of similar consistency.

**Fababean as a profitable endeavor**

Many producers feel that growing a pulse crop, like fababean is not a profitable endeavour. Fababean grower, Greg Stamp, has put together an approximation of the cost breakdown of growing the crop in an irrigated system and compared it to many other production crops grown in Alberta.
### Table 5. Photo Source: Canadian Grain Commission, 2013

**Primary and export grade determinants tables**

<table>
<thead>
<tr>
<th>Fababeans, Canada (CAN)</th>
<th>Standard of quality</th>
<th>Splits %</th>
<th>Heated or rotted %</th>
<th>Mouldy %</th>
<th>Perforated damage %</th>
<th>Total %</th>
<th>Excreta %</th>
<th>Insect parts %</th>
<th>Sclerotinia %</th>
<th>Stones or slate %</th>
<th>Total %</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 1Canada</td>
<td>Reasonably well matured, reasonably good natural colour</td>
<td>0</td>
<td>Nil</td>
<td>Nil</td>
<td>1</td>
<td>4</td>
<td>0.01</td>
<td>0.02</td>
<td>0.05</td>
<td>0.1</td>
<td>0.2</td>
</tr>
<tr>
<td>No. 2Canada</td>
<td>Fairly well matured, fair colour</td>
<td>9</td>
<td>0.3</td>
<td>0.6</td>
<td>3</td>
<td>8</td>
<td>0.01</td>
<td>0.02</td>
<td>0.05</td>
<td>0.2</td>
<td>0.5</td>
</tr>
<tr>
<td>No. 3Canada</td>
<td>Cool and sweet, excluded from higher grades on account of immaturity, poor colour or damage</td>
<td>12</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>10</td>
<td>0.01</td>
<td>0.02</td>
<td>0.05</td>
<td>0.5</td>
<td>2</td>
</tr>
</tbody>
</table>

**Grade, if No. 1 specs not met**

<table>
<thead>
<tr>
<th>Fababeans, Sample Canada Account</th>
<th>Fababeans, Sample Canada Account Heated</th>
<th>Fababeans, Sample Canada Account Mouldy Kernels</th>
<th>Fababeans, Sample Canada Account Damaged</th>
<th>Fababeans, Sample Canada Account Elevita</th>
<th>Fababeans, Sample Canada Account Amixture</th>
<th>Fababeans, Sample Canada Account Amixture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Faba Beans</td>
<td>$0.22</td>
<td>$0.27</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peas</td>
<td>$0.00</td>
<td>$10.88</td>
<td>$8.70</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wheat</td>
<td>$65.31</td>
<td>$21.77</td>
<td>$0.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Barley</td>
<td>$54.42</td>
<td>$21.77</td>
<td>$0.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Canola</td>
<td>$65.31</td>
<td>$21.77</td>
<td>$0.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flax</td>
<td>$48.98</td>
<td>$10.88</td>
<td>$0.00</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 6. These numbers have been approximated by many other producers to be very close to dry land production as this table was generated under irrigation. Photo Source: Greg Stamp**

<table>
<thead>
<tr>
<th>Crop</th>
<th>Nitrogen (per acre)</th>
<th>Phos (per acre)</th>
<th>inoculant</th>
<th>Fertilizer (per acre)</th>
<th>Seed (per acre)</th>
<th>Treat (per acre)</th>
<th>Fungicide (per acre)</th>
<th>Herbicide (per acre)</th>
<th>Total costs (per acre)</th>
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<th>gross</th>
<th>net returns</th>
<th>percent of wheat's net</th>
<th>residual N</th>
<th>total net returns</th>
<th>percent of wheat's net</th>
<th>net returns</th>
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<td>$32.65</td>
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</tbody>
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REFERENCES


APPENDIX

Fababean grown in Alberta

Tannin containing flower. Photo source: Alberta Agriculture

Low tannin flower. Photo source: Dan Visser

Low tannin flower. Photo source: Dan Visser

Fababean pods. Photo source: Alberta Agriculture