Specific work instructions (SWI 142.1.2-3): Pulse seed crop inspection procedures

The purpose of pedigreed seed crop inspection is to provide an unbiased inspection and complete a Seed Crop Inspection Report on the isolation, condition, and purity of the seed crop to support a certification decision made by the Canadian Seed Growers' Association (CSGA). It is the inspector's responsibility to describe the seed crop as observed at the time of inspection.

Updated: April 1, 2025

On this page

1.0 Scope

This Seed Program Specific Work Instruction (SWI) outlines the procedures that a seed crop inspector will follow in inspecting seed crops of field bean, chickpea, fababean, lentil, lupin, and pea for pedigreed status. The seed crop inspection program supports the CSGA determination of whether seed crops grown for pedigreed status meet the requirements for seed crop production and seed crop purity standards as established in the CSGA's Canadian Regulations and Procedures for Pedigreed Seed Crop Production (Circular 6).

2.0 References

The publications referred to in the development of this SWI are those identified in Seed Program Regulatory Authority Standard SPRA 101 - Definitions, acronyms and references for the seed program. In addition, the following were used:

- Bean Diseases and Their Control, Agriculture Canada Publication #1758, 1984
- Sweet White Lupin: A potential crop for Ontario, Brebaum, S. and G. L. Boland, 1995, Can. J. Plant Sci., 75: 841-849
- Alberta Agriculture, Food and Rural Development
- British Columbia Ministry of Agriculture
- Purdue University Center for New Crops and Plant Products
- Saskatchewan Ministry of Agriculture

3.0 Definitions

For the purposes of this SWI the definitions given in SPRA 101 and the following apply.

Anthocyanin
pigment ranging from red to blue to violet

Bean
includes field, garden, white, navy, coloured or dry edible type bean

Determinate growth habit
the terminal bud ceases vegetative activity when flowering begins

Fasciation
flattening of stems

Indeterminate growth habit
the terminal bud continues vegetative activity throughout the growing season

Internode
the part between 2 nodes

Lentils
includes reclamation and green manure types

Node
place on a stem where a leaf is attached, often swollen

Pea
includes field, pigeon, maple and forage types

Tall
(only applicable to fababean and field pea) a plant can be considered tall when the main stem is approximately 15 cm above other main stems of the general plant population

4.0 Specific inspection procedures

Inspection of pedigreed seed crops of pulses should be carried out as described in Specific work instructions (SWI 142.1.1): Pedigreed seed crop inspection, with the additional conditions and information provided in the following sections.

4.1 Inspection requirements

Inspection of pulse crops differs from other crop kinds in that the time of inspections for each kind of pulse crop varies.

- Peas (all types) – flowering (early to full flower); recommended at early flower stage about 60 days after planting date
- Lentil, chickpea, and lupin – at full flower
- Beans (field) – at 7 days after inception of flowering when flower colour can be observed; in periods of cool temperatures, inspections could be done as late as 14 days after the inception of flowering as the cool weather can delay flowering
- Fababean – at full flower stage

The inspection requirements for chickling vetch (grass peas) may be found in SWI 142.1.2-5 Forage legumes and grasses seed crop inspection procedures.

Lentil is an early maturing crop kind with harvest, under ideal conditions, beginning in early August. Seed crop inspectors should obtain the seeding date of the crop and anticipate inspection times accordingly.

The seed crop inspector should refer to appendices I to VII for general descriptions of pulse species to assist in varietal identification.

4.2 Crop inspection

The seed crop inspector can obtain a description of the variety (DOV) through CSGA SeedCert.

Seed crop inspectors should note the various diseases in appendix VIII which may affect the appearance of the crop.

4.2.1 Field peas

Peas may include commodity, forage type and specialty peas for inspection purposes. Peas must be inspected at flowering (early to full flower). The crop will become more difficult to move through as it matures and gets taller and denser. Therefore it is recommended to inspect at the early flower stage whenever possible.

In some exceptional cases, it may be necessary to reduce the count size for field peas to closely examine off-types that are very difficult to observe in the crop. Common off-types are leafed types in semi-leafed varieties, some of which are shorter than the norm of the variety. The procedures set out in appendix V of SWI 142.1.1 are used in those exceptional cases.

The inspector must note the percentage of pea plants in flower at the time of inspection and indicate this on the report.

4.2.2 Chickpea

Seed crop inspectors must watch for potential mixtures of fern-type and unifoliate type varieties which are difficult to see.

4.2.3 Fababean

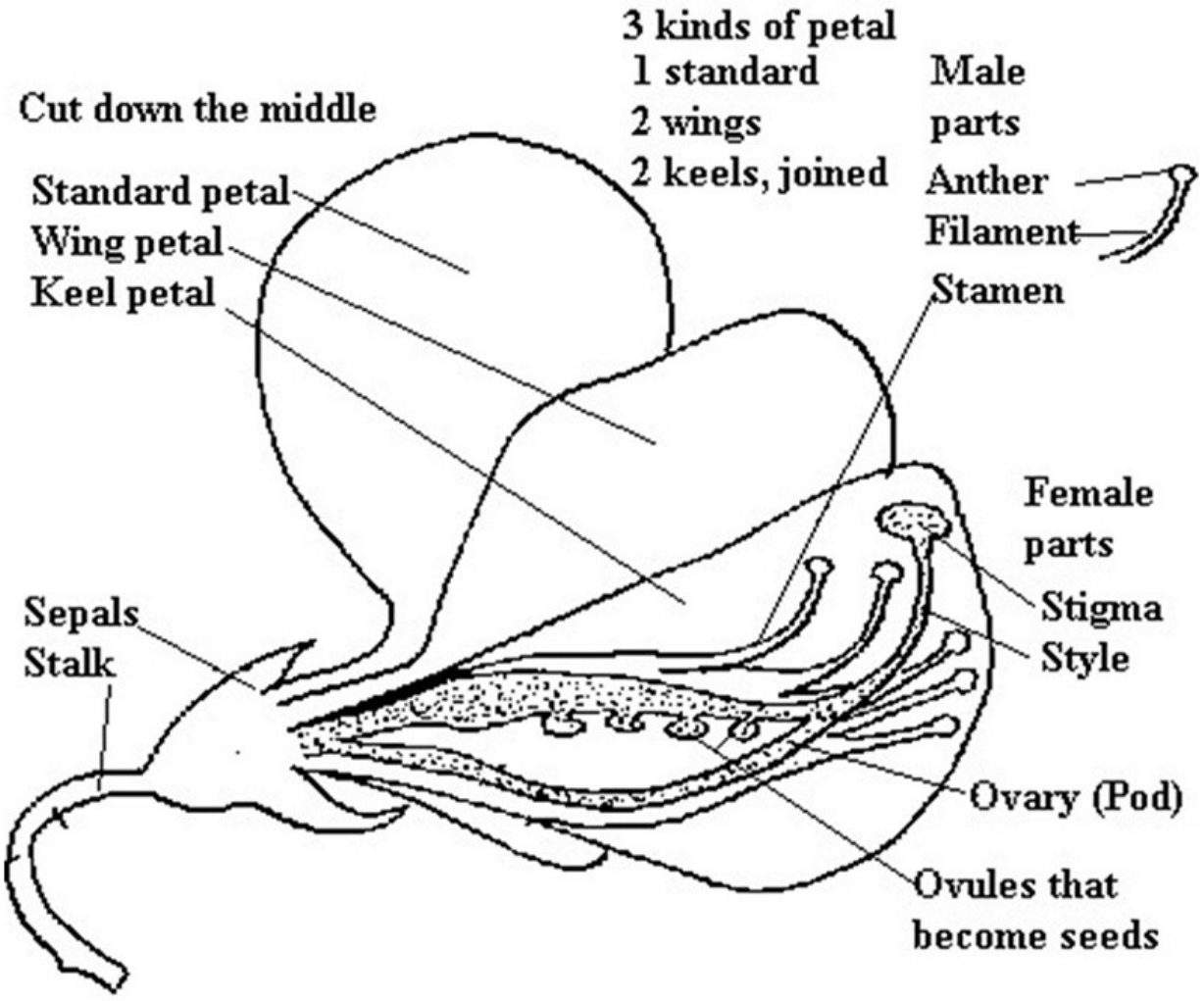
Fababeans are predominately self-pollinating but have a high risk to cross-pollinate (approximately 30% of the plants in a population cross). For reporting purposes, inspectors should treat fababeans as an open-pollinated crop, and must report on the required varietal isolation distance in the "Isolation Comments / Open Pollinated Crop Isolation" section of the report. Refer to the procedures in SWI 142.1.1 section 6.1.3.

4.3 Completing the Seed Crop Inspection Report

The requirements for completing a Seed Crop Inspection Report for pulse seed crop inspection are the same as those described in SWI 142.1.1 – Pedigreed Seed Crop Inspection, with additional comments for peas and fababeans as noted above.

Appendices

Appendix I: Legume flower illustration



Description of diagram of legume flower illustration

The illustration of the legume flower is labelled with the following information:

- 3 kinds of petal: 1 standard, 2 wings, 2 keels joined
- Cut down the middle: standard petal, wing petal, keel petal
- Sepals
- Stalk
- Male parts: anther, filament, stamen
- Female parts: stigma, style, ovary (pod), ovules that become seeds

Appendix II: Field pea descriptions and illustrations

Field pea (*Pisum sativum*) is an annual cool-season grain legume (pulse) crop. There are 2 main growth types of field pea. The first type has normal leaves on vines that are 1 m to 2 m in length. The second type is the semi-leafless type that has modified leaflets reduced to tendrils, resulting in shorter vines of 0.75 m to 1.3 m in length. Pea normally has a single stem but can branch from nodes below the first flower.

Most varieties of pea produce white to reddish-purple flowers, which are self-pollinated. Each flower will produce a pod containing 4 to 9 seeds. Pea varieties either have indeterminate or determinate flowering habit.

Indeterminate flowering varieties will flower for long periods and ripening can be prolonged under cool, wet conditions. Indeterminate varieties are later in maturity ranging from 90 to 100 days. Determinate varieties will flower for a set period and ripen with an earlier maturity of 80 to 90 days. Field pea is sensitive to heat stress at flowering, which can reduce pod and seed set. Indeterminate varieties are more likely to compensate for periods of hot, dry weather and are more adapted to arid regions. Determinate, semi-leafless varieties that have good harvestability are more adapted to wetter regions.

Flowering usually begins 40 to 50 days after planting. Flowering normally lasts for 2 to 4 weeks, depending on the flowering habit and weather during flowering.

Distinguishing characteristics of field pea:

- plant growth type
- plant height
- plant anthocyanin colouration
- plant foliage colour
- stem fasciation
- stem vine length
- axil anthocyanin colouration
- leaflet presence
- maximum number of leaflets
- leaf margin dentations
- leaf dentation degree
- rabbit-eared stipules
- stipule size
- stipule marbling density
- time to flowering
- flower standard colour
- flower standard base shape
- pod length
- pod width
- pod curvature degree
- pod shape of distal part

- cotyledon colour

Stem fasciation

The expression of stem fasciation varies considerably due to environmental conditions, although the presence or absence of fasciation is usually clear.

Stem vine length

The vine length indicated in the variety description is generally based on harvested plants at the mature green seed stage. The measurement includes nodes with scale leaves. Both plant height at flowering and stem length at the mature green seed stage may vary with site and season due to different responses to day length, temperature and soil moisture but can be used at a single site to allow the separation of different varieties.

Number of nodes

The number of nodes on a stem can vary due to flower abortion under certain environmental conditions. Nodes with scale leaves should be included in the observation.

Axil anthocyanin colouration

The colour of the axil can be reddish purple or pink in varieties with anthocyanin colouration. The assessment of the colouration of the axil should be made over the whole plant; double rings may not always be clearly defined at any 1 particular node. The latter is best observed on the underside of the stipules.

Maximum number of leaflets

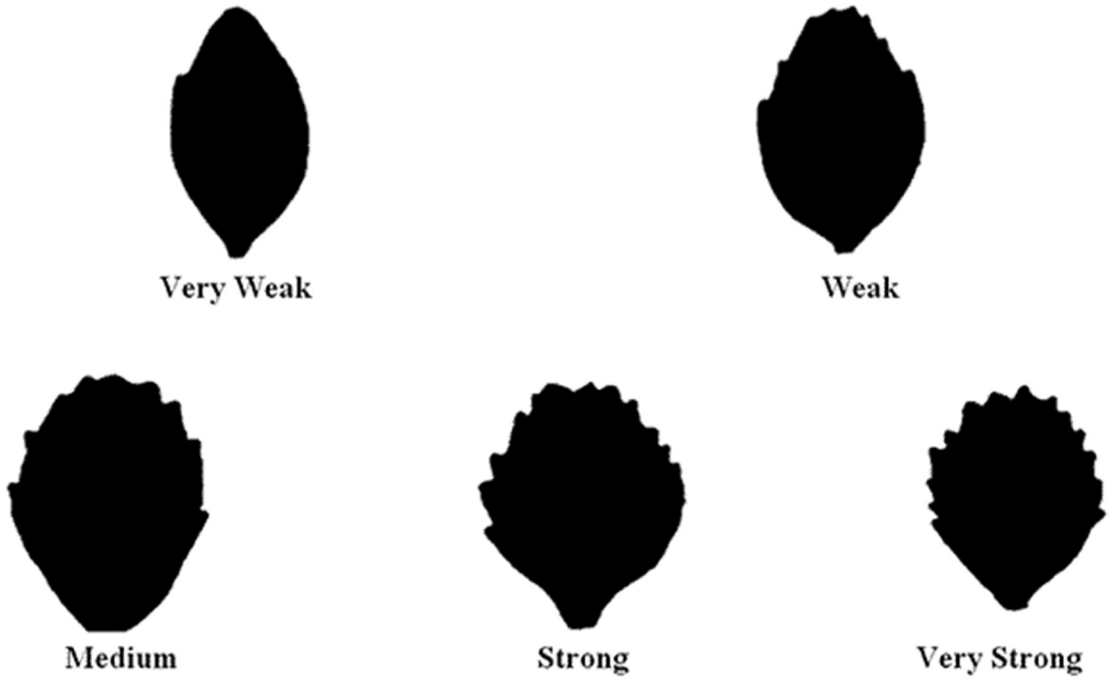
The maximum number of leaflets per leaf should be recorded over the whole plant. The occasional plant may have a larger number of leaflets per leaf. The maximum number of leaflets per leaf for a sample of plants should be recorded and an average value calculated. Note that for semi-leafless and leafless varieties observation of this characteristic will not be relevant.

Leaf margin indentations

The observation of leaf margin indentations should be made over the whole plant, with the exception of the lowest 6 nodes and aerial and basal branches.

Leaf indentation degree

Diagram of leaf indentation degree

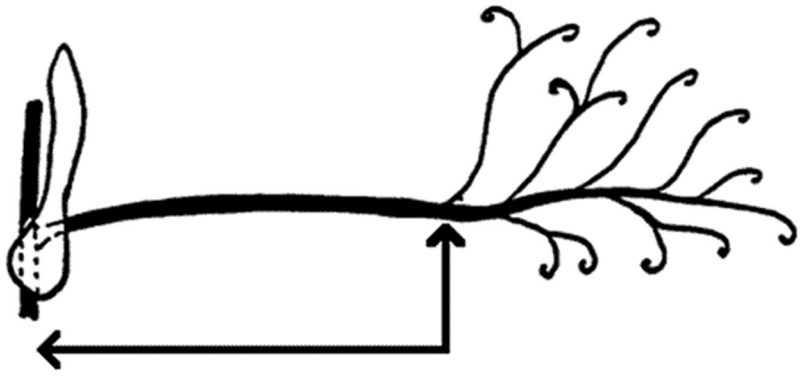


Description of diagram of leaf indentation degree: 5 leaves are depicted with very weak, weak, medium, strong and very strong leaf indentations

Petiole length

The observation of petiole length should only be made at the second fertile node on varieties without leaflets. The length should be recorded from the axil to the point where the first tendril occurs.

Diagram of petiole length



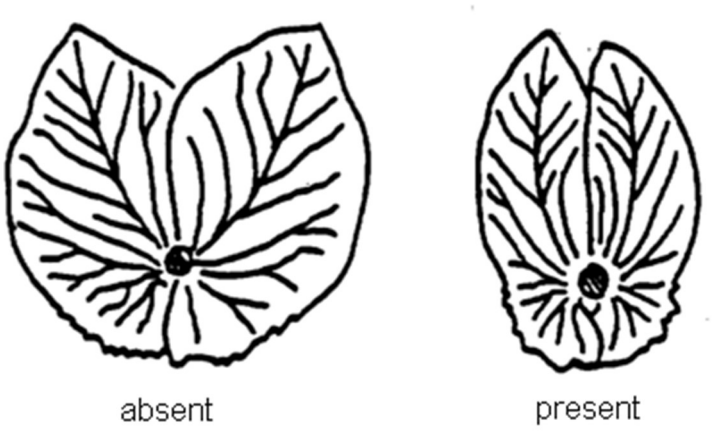
Description of diagram of petiole length: Measurement from node to tendril closest to node

Stipule development

Rudimentary stipules are lanceolate and surface area is reduced significantly by up to 80%. Plants with "Rabbit-eared" stipules are not examples of rudimentary stipules.

"Rabbit-eared" stipules

"Rabbit-eared" stipules are parallel, rather than divergent, with pointed tips.



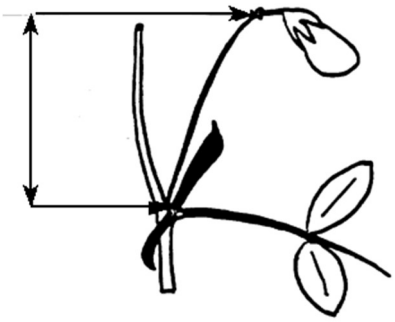
Description of diagram of Rabbit-eared stipules:
absent – stipules are divergent with ovate tips
present – stipules are parallel with pointed tips

Stipule size

The observations for length and width of the stipule should be made at the second fertile node. To measure stipule size, the stipules should be detached from the plant and flattened. The width of the stipule is measured at the **widest** part.

Peduncle length

The length of the peduncle should be measured from the axil to the first node or bend in the peduncle.

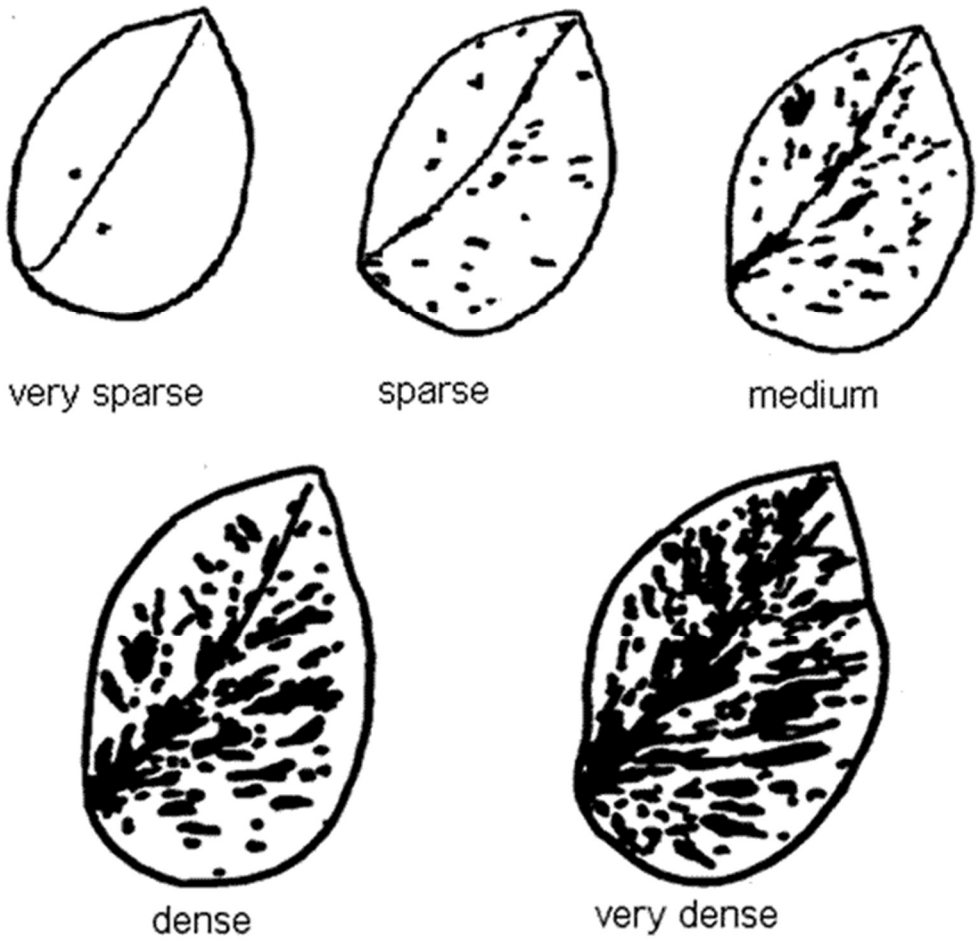


Description of diagram of peduncle length measurement: Measure from the axil to the first node or bend in the peduncle.

Stipule marbling

The observation of stipule marbling should be made over the whole plant. In order to assess, the plant should have at least 8 nodes, since flecking or marbling in some varieties may not be expressed at lower nodes.

Stipule marbling density



Description of diagram of stipule marbling density: 5 stipules varying from very sparse, sparse, medium, dense and very dense

Flower standard base shape

The observation of the shape of the base of the flower standard should be made on a sample of a minimum of 20 different plants. The standard should be detached from the flower and flattened on a hard surface for observation.

Description of flower standard base shapes: strongly raised, raised, level, arched and strongly arched

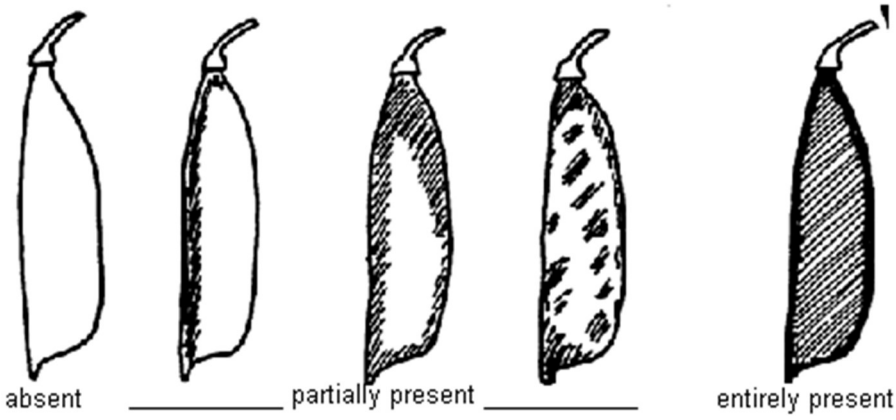
Pod length

The length of the pod should be measured at the second fertile node on a sample of at least 20 plants. Pods should be fully developed or swollen. Green seed should be firm and becoming starchy.

Pod width

The width of the pods at the second fertile nodes should be measured on a sample of at least 20 plants. The measurements should be taken from suture to suture on unopened pods.

Pod parchment

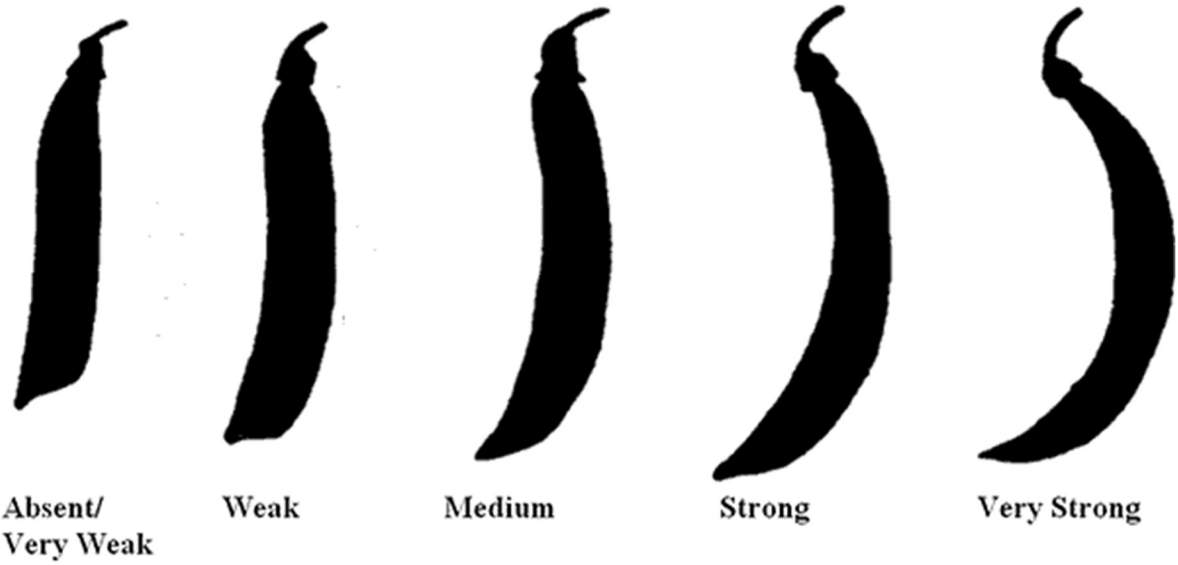


Description of diagram of pod parchment: 5 pods ranging from parchment absent, to partially present, to entirely present

The observation of pod parchment should be made on samples from different plants when the pods are dry and papery. The pod should be opened along the suture without damaging the edges of the 2 valves. The distribution of sclerenchyma, which makes up the parchment, may be observed by reflecting light (preferably daylight) on the inside of the pod wall.

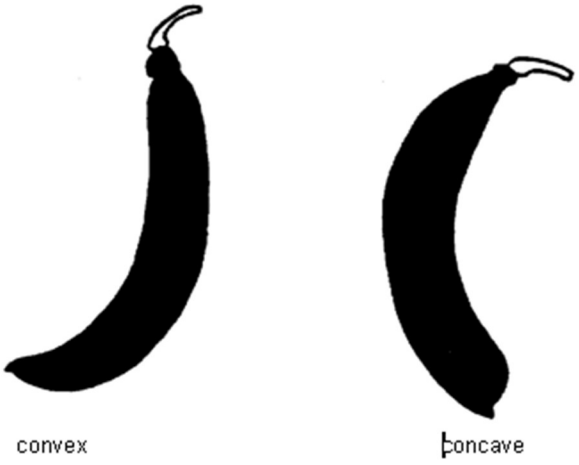
If parchment for any pod is difficult to determine, pods from other nodes on the same plant should be examined.

Pod curvature degree



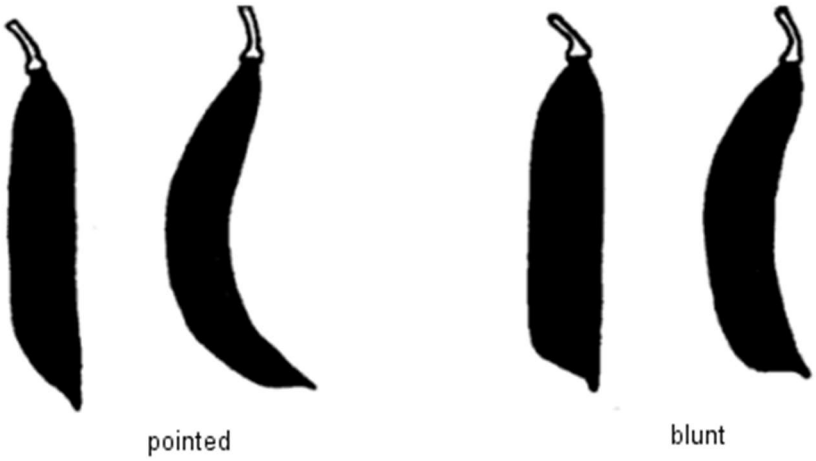
Description of diagram of degree of pod curvature: 5 pods are depicted showing a range of curvatures from absent/very weak, weak, medium, strong and very strong.

Direction of pod curvature



Description of diagram of direction of pod curvature: convex and concave

Shape of distal part of pod



Description of diagram of shape of distal part of pod: pointed and blunt

The observation of the shape of the distal part of the pods should be made only on varieties without a thickened pod wall. They should be made on a sample of plants and on several nodes of each plant when pods are fully developed. Care should be taken where pods are strongly curved, where the beak is longer than the pod tip, or where parchment is not entire. Some varieties have a blunt tip which is rounded, but the beak is higher up the pod.

Pod colour

Varieties with yellow pods may also have milky yellowish peduncles and sepals. In the presence of anthocyanin, colouration of the pods will appear pale red.

The appearance of green pods is the result of yellow, purple and blue-green colours not being expressed.

Blue-green pods are dark and slightly bluish, but not as blue as blue-green foliage. The colour develops with time and may be more accentuated in hotter, drier conditions.

The expression of purple pods can be variable and unstable, often disappearing on the same plant or being reduced in its distribution on the pod.

Strings of pod suture

The observations of the strings of the pod suture should be made on fully developed pods. If assessed when pods are not fully developed, strings of suture will be absent or partial. The strings are best observed when temperatures exceed 20°C. With cooler conditions and/or more developed pods, the strings of the suture will appear later than normal. The occurrence of less wrinkled seeds in compound starch grain types appears to be associated with the absence or reduction of the strings of the suture.

Anthocyanin colouration of pod suture

The observation of the anthocyanin colouration of the pod suture should be made on varieties known to contain anthocyanin. Observations should be made over the whole plant when pods are well developed and are beginning to dry out.

Intensity of green colour of immature seed

The observation of the intensity of the green colour of immature seeds should be made when the seed is firm, but before seeds become starchy to taste.

Seed with green cotyledons may appear creamy white before the seed is fully developed. Varieties with blue-green pods may also have very dark green seed colour.

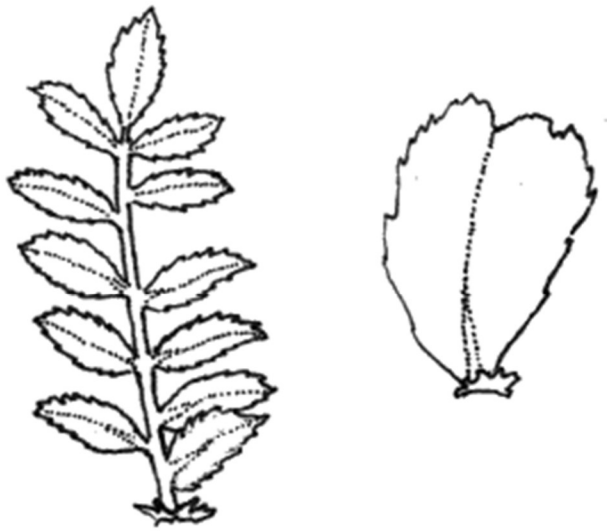
Appendix III: Chickpea descriptions and illustrations

Chickpea (*Cicer arietinum*) is classified into "desi" or "kabuli" types based primarily on seed colour. Desi chickpea has a pigmented (tan to black) thick seed coat and small seed size along with coloured flowers. Kabuli chickpea, sometimes called "Garbanzo bean", has thin, white to cream-coloured seed coats and range in size from small (greater than 100 seeds per 30 g) to large (less than 50 seeds per 30 g). Kabuli type chickpeas have white flowers.

Chickpea matures later than dry pea or lentil, and prefer a longer, warmer growing season. Desi chickpea flowers 1 day to 1 week earlier than kabuli types, depending on the specific varieties being compared. Large-seeded kabuli varieties generally mature 1 to 2 weeks later than desi types, but new Canadian kabuli varieties have been bred for earlier maturity. Average maturity will range from 100 to 130 days depending on the variety and the climatic conditions.

The chickpea plant is erect with primary and secondary branching, resembling a small bush. There are 2 leaf types, the "fern" leaf with multiple leaflets attached to a leaf stem, and the single or "unifoliate" leaf that is present on some kabuli varieties. Most varieties have fern type leaves that are about 5 cm in length with 9 to 15 leaflets. The plant flowers profusely and has an indeterminate growth habit, continuing to flower and set pods as long as climatic conditions are favourable. Chickpeas are predominately self-pollinating however, cross-pollination by insects does occur.

Chickpea leaf types



Description of chickpea leaf types: fern-type leaf and unifoliate leaf

The pods are short, inflated and oval and typically contain 1 or 2 seeds. Plant height typically ranges from 25 cm to 65 cm, with kabuli types often slightly taller than desi types. The lowest seed pods are typically 10 cm to 15 cm from the soil surface under dry conditions.

Chickpea plant

Description of chickpea plant diagram: stem showing fern-type leaves and flowers arising from nodes

Distinguishing characteristics of chickpea:

- growth habit
- plant height
- leaf shape
- flower colour
- flowering date
- green pod colour intensity
- leaflet type, colour, length and width
- maturity date
- pod length and width
- presence of stem anthocyanin
- seed colour, shape and ribbing

Appendix IV: Field bean descriptions and illustrations

There are 2 basic plant types found in dry edible bean: determinate (bush) or indeterminate (vining or trailing). Varieties may be classified according to plant types. For example, navy beans may be either of the bush or vining type.

There are 3 main growth habits of dry bean:

- type I – determinate bush type
- type II – indeterminate bush type
- type III – indeterminate vine type

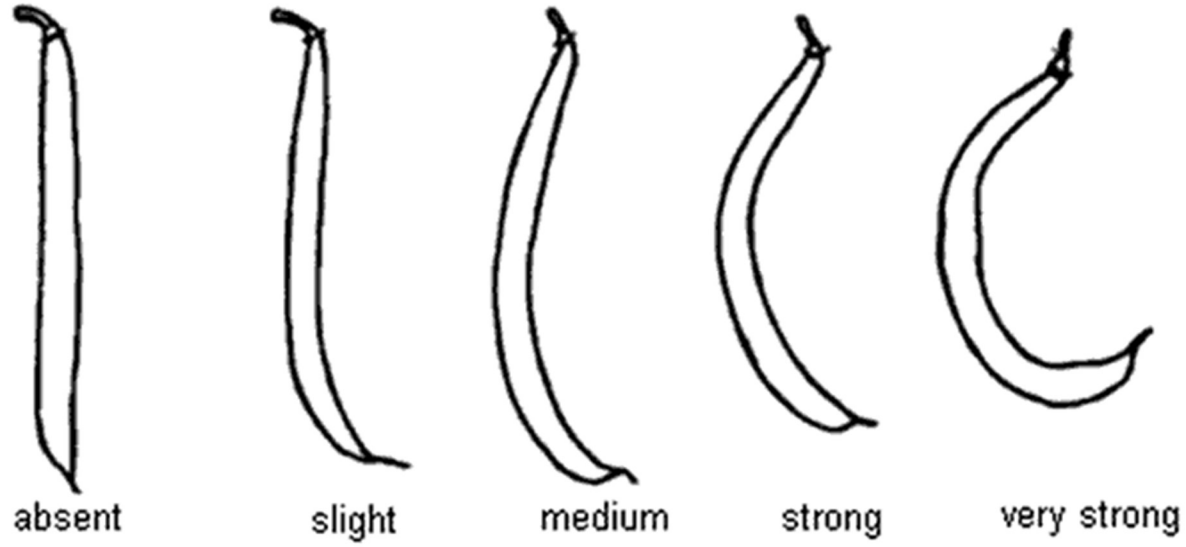
The determinate growth habit has 5 to 9 nodes on the main stem with 2 to several branches. Stem elongation ceases when the terminal flower racemes of the main stem or lateral branches have developed. The indeterminate growth habit may have 12 to 15 nodes on the main stem. On indeterminate types, flowering and pod filling will continue simultaneously or alternately as long as temperature and moisture permit growth to occur.

Flowers will continue to develop over several weeks such that the youngest flowers at the top of the raceme may be just beginning to show flower colour while the older flowers at the base of the raceme are finished and pod set is beginning. The inspection should be conducted when the flower colour can be easily determined, approximately 1 week after the inception of flowering. In cooler temperatures flowering is delayed therefore the inspection could be conducted as late as 2 weeks after the inception of flowering, depending on local conditions.

Distinguishing characteristics of field bean:

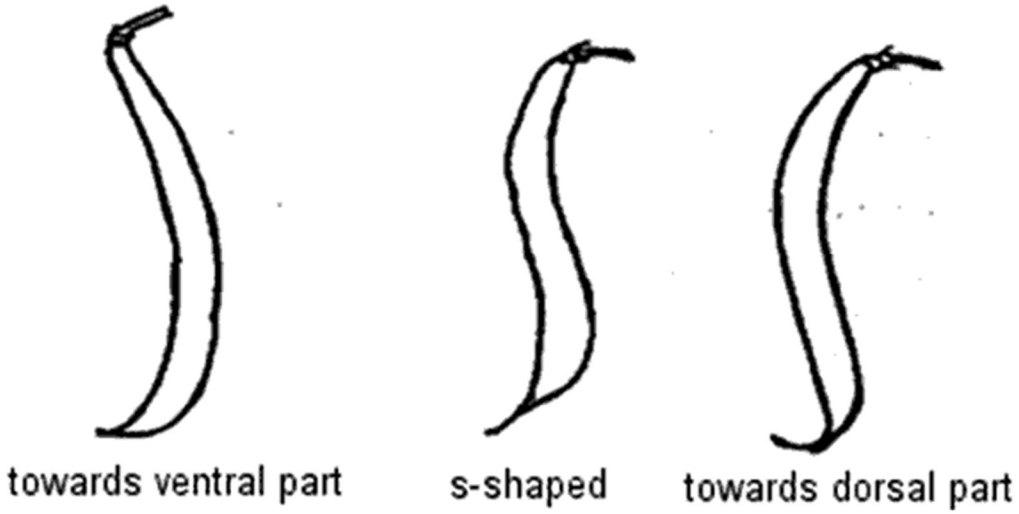
- plant growth habit
- branch habit
- vine length
- leaf colour
- terminal leaflet size
- terminal leaflet shape
- time to flowering
- flower standard colour
- flower wing colour
- pod length
- pod pigment
- pod curvature degree
- pod curvature shape
- pod beak shape
- pod beak length
- seed colour

Degree of pod curvature



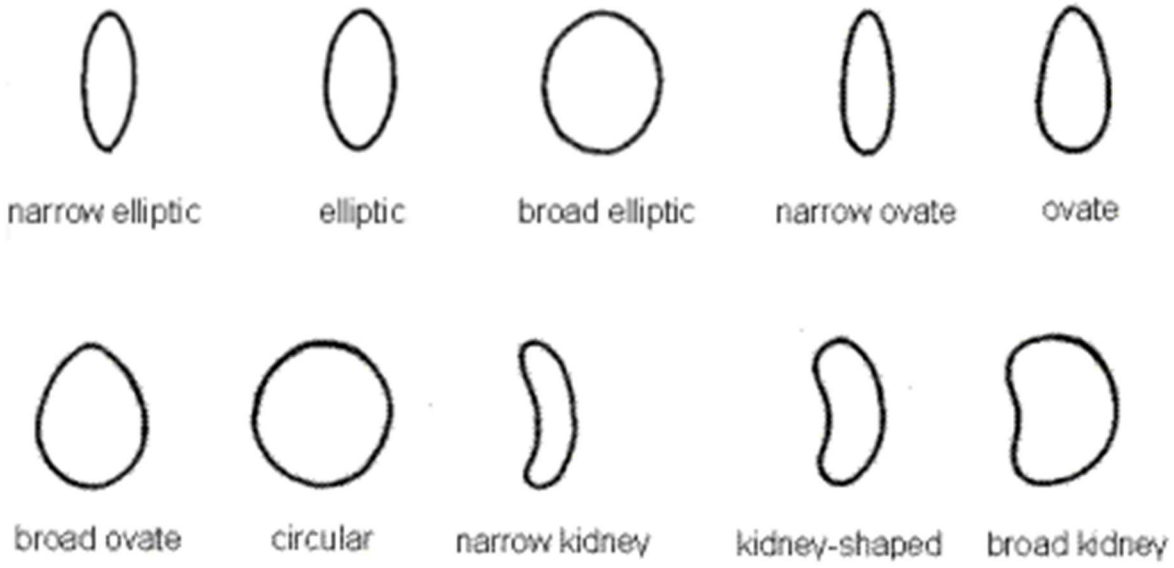
Description of diagram of pod curvature: absent, slight, medium, strong and very strong

Shape of pod curvature



Description of diagram of pod curvature shape: towards ventral part, S-shaped, and towards dorsal part

Seed shape



Description of diagram of seed shape: 2 rows of 5 seeds each – narrow elliptic, elliptic, broad elliptic, narrow ovate, ovate, broad ovate, circular, narrow kidney, kidney-shaped, and broad kidney.

Appendix V: Lupin descriptions and illustrations

Lupins are among the oldest cultivated crops in the world. The 3 most important agricultural species are the white lupin (*Lupinus albus*), yellow lupin (*L. luteus*) and blue lupin (*L. angustifolius*). The white lupin exists in both low (sweet) and high alkaloid (bitter) forms.

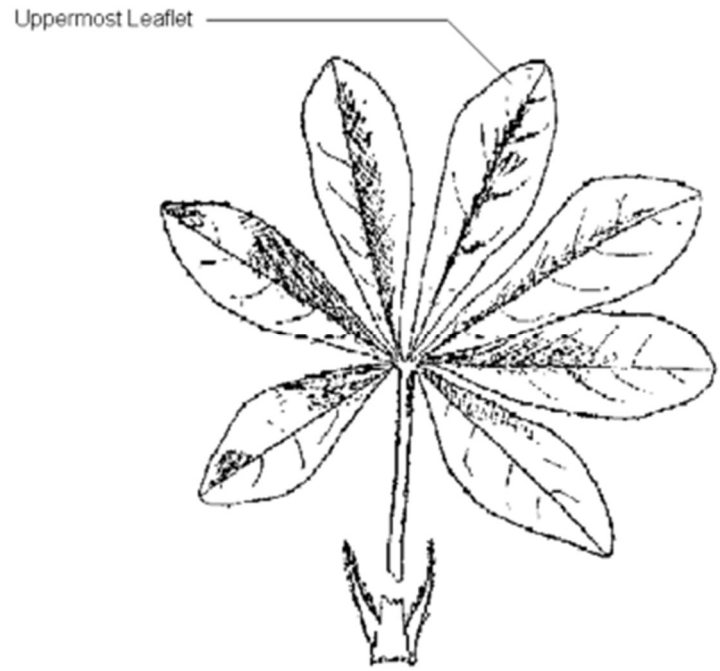
Sweet white lupin is an annual row crop that develops a vertical primary stem approximately 0.8 m tall with primary and secondary branches. Leaves are alternate, palmately divided into 10 to 15 narrowly oblong leaflets. The leaflets are smooth or hairy above, and very hairy beneath. Individual plants produce clusters of 3 to 7 pods, each containing 3 to 7 seeds. The seeds are cream-coloured and irregularly circular, and up to 6 cm in diameter. Sweet white lupin is sensitive to low temperatures and photoperiod during germination; high temperatures during germination and long days may delay flowering. This species has an indeterminate growth habit so the plant may not mature uniformly. Lupins are grown for both grain and green manure.

Lupins can be cross-pollinated or self-pollinated, depending on the species and variety.

Distinguishing characteristics of lupin:

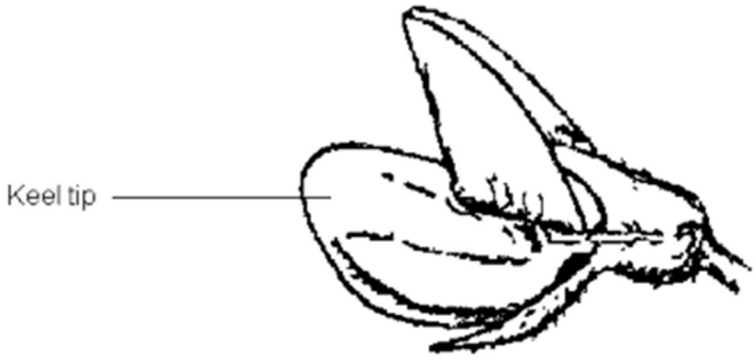
- plant growth habit
- plant height at maturity
- growth type
- time to maturity
- stem anthocyanin colouration
- leaf colour
- leaflet shape
- terminal leaflet length
- terminal leaflet width
- time to flowering
- flower colour
- flower keel tip colour
- pod length
- pod attitude
- seed colour
- seed ornamentation

Length of uppermost terminal leaflet



Description of diagram of length of uppermost terminal leaflet: palmate leaf indicating uppermost leaflet.

Keel tip colour of flower



Description of diagram of colour of keel tip of flower: indicating keel tip of flower

Appendix VI: Lentil descriptions and illustrations

Lentil is classified into 2 types: Chilean or large-seeded (greater than 50 g per 1000 seeds) and Persian or small-seeded (40 g or less per 1000 seeds). Seed coat colour can vary from clear to light green to deep purple, mottled, grey, brown or black. Cotyledon (seed leaf) colour is yellow, red or green. The 2 main market classes are green and red.

Lentil plants are typically short compared to cereal crops, ranging from 20 cm to 75 cm in height. The first 2 nodes on the stem develop below or at the soil surface and are known as scale nodes. Injury to young lentil seedlings by late spring frost, heat canker or wind damage may cause the plant to initiate re-growth from a scale node below the soil surface. The third node on the stem is the usual site of the first leaf development. Lentil seedlings can produce a new node every 4 to 5 days under good growing conditions. Just prior to flowering, new leaves will develop a short tendril at the leaf tip.

Leaves are about 5 cm long with 9 to 15 leaflets. Lentil plants have an indeterminate growth habit allowing them to continue to flower until there is some form of stress such as moisture, nutrient deficiency, or high temperature. Flowers are self-pollinated.

Flower stalks produce 1 to 3 flowers which develop pods. Pods are less than 2.5 cm in length and contain 1 or 2 seeds. Most of the seed is produced by the aerial branches which form from the uppermost nodes on the main stem just below the first flowering node.

Distinguishing characteristics of lentil:

- plant growth habit
- plant height
- number of nodes to first flower
- time to flowering
- flower colour
- time to maturity
- mature pod colour
- seed size
- seed testa pattern
- hilum colour
- cotyledon colour

Testa pattern

Description of diagram of pattern of testa: dotted (diffuse small dots), spotted (irregular larger spots) and mottled (spots of various sizes and lines).

Appendix VII: Fababean description

Fababean (*Vicia faba*) is an annual plant with coarse, upright and unbranched stems, 0.3 m to 2 m tall, with 1 or more hollow stems coming from the base. The leaves are alternate, pinnate and consist of 2 to 6 leaflets, each up to 8 cm long. Unlike most other members of the genus, it is without tendrils or has only rudimentary tendrils.

Flowers are large, white with dark purple markings, borne on short pedicels in clusters of 1 to 5 on each axillary raceme usually between the fifth and tenth node; 1 to 4 pods develop from each flower cluster, and growth is indeterminate, though determinate mutants can occur. About 30% of the plants in a population are cross-fertilized and the main insect pollinators are bumblebees. There is a robust tap root with profusely branched secondary roots.

Based on seed size, 2 subspecies were recognized, *Vicia paucijuga* and *Vicia faba*. The latter was subdivided into *V. faba* var. minor with small rounded seeds (1 cm long), *V. faba* var. *equina* with medium sized seeds (1.5 cm) and *V. faba* var. major with large broad flat seeds (2.5 cm). (Bond et al., 1985; Smart, 1990).

Distinguishing characteristics of fababean:

- plant growth habit
- plant height at maturity
- growth type
- stem anthocyanin colouration
- nectary colour on nodal bracts
- leaflet colour intensity before flowering
- leaflet length
- leaflet width
- time to flowering
- flower: standard petal colour
- wing: petal colour
- wing: melanin spot presence
- wing: colour of melanin spot
- wing: size of melanin spot
- standard petal anthocyanin colouration
- standard petal anthocyanin colouration intensity

Fababean plant

Description of fababean plant picture: fababean plant showing stems, leaves and flowers

Appendix VIII: Diseases that may affect plant appearance

Anthracnose of lentils

Typical field symptoms are lodged plants with abnormally dark-brown stems. The lesions appear on the pods, stems, leaves, and seed. The lesions are grey to black in colour and appear sunken. A salmon-coloured ooze may appear in the centre of the lesion. The lesions may start out as small black spots. In mid-season, the leaves may start to fall off rapidly. The leaf veins will appear darkened. The stem will darken in colour and appear weakened.

Bean anthracnose

Bean anthracnose, caused by *Colletotrichum lindemuthianum*, is almost worldwide in distribution. The disease is economically important as it affects seed quality, yield and marketability. There are numerous major races of the fungus that are characterized by the varieties they attack. Many varieties have been bred for resistance to 1 of more of the races.

Although infection may occur on both sides of the leaf and on the petiole, early signs of infection usually appear on the lower leaf surface along the veins, which show brick red to purplish red discolouration. Later, such discolouration also appears on the upper leaf surface. At the same time, brown lesions of various sizes with black, brown or purplish red margins develop around small veins. Dark brown eyespots that develop longitudinally along the stems are an early sign of stem infection. In the young seedling, the eyespots enlarge and the stem may break off. On older stems, the eye shaped lesion is limited to an approximate length of 5 mm to 7 mm and the lesion often has a sunken cankerous centre.

The most striking disease symptoms are small brown specks on rusty brown spots which appear on the pods. As the spots enlarge, their centres turn brown and many tiny black specks appear randomly on the brown area, replacing the brown specks. Each of the tiny black specks contains a mass of pinkish spores, often visible as a viscous droplet in humid conditions. The lesions on the pod usually reach a diameter of 5 mm to 8 mm. They are slightly sunken at the centre and have a dark brown or purplish brown margin. The seeds of heavily infected pods may show brown to light chocolate coloured spots on the seed coats. In badly infected seeds, the lesions may extend into the cotyledon.

Ascochyta blight

Lentil, field pea, chickpea and fababean all suffer from fungal diseases known as "ascochyta blight". Each crop kind is affected by a different species of ascochyta. As a result, lentil ascochyta will not spread to pea nor will pea ascochyta spread to lentil.

Ascochyta blight of chickpea

All above-ground portions of the plant are likely to show symptoms which begin as dark, sunken lesions. These soon erupt in pycnidia which often exhibit a pattern of concentric rings. Lesions may cause girdling of the stems or dieback of all plant parts above the lesions.

Ascochyta blight of fababean

Leaf spots are grey to brown, oval, and up to 1 cm in diameter with definite margins. Small, black pycnidia (small, black spore-producing structures) form in the center of lesions, often in a concentric ring pattern. Leaf spots may merge into irregular black patches causing a blighted appearance. Stem lesions are more elongated, usually sunken and reddish brown. Pod lesions are often sunken, tan to black, and frequently have darker margins. Infected seed may be discoloured and shrivelled.

Ascochyta blight of lentil

The first symptoms of ascochyta blight in lentils appear on the leaves. Symptoms appear on leaves, stems and pods as white to tan coloured spots, often with a darker margin. The centers of lesions are often speckled with pycnidia. When the disease becomes severe, leaves may drop prematurely and shoots may be blighted. Dieback and flower and pod abortion are the main causes of yield loss.

Ascochyta blight of pea

Leaf and stem symptoms include small, purplish-black, irregular flecks, which enlarge to 5 mm in diameter. Spots may also be brown with darker margins. Severe infection leads to drying of leaves, and stems may be blighted or girdled. On pods, lesions are initially small and dark, but purplish-brown discolouration may become extensive. Pycnidia may be produced on leaf or pod spots. Pod infection may lead to seed infection. Infected seed may occasionally be shrunken or discoloured but is more often symptomless. When infected seed is planted, seedlings with leaf spots or foot rot symptoms may be produced, or seedlings may die before emergence. Foot rot appears as purplish-black discolouration just above the soil line.

Seed discolouration develops later in the season after pods are infected. At this time, the seed surface becomes partially or completely brownish purple. Discolouration can continue to develop even after the crop is in the swath, particularly under damp weather conditions. Affected seed may also be shrivelled, and may have patches of white fungal growth and pycnidia on the surface.

Common bacterial blight

Common bacterial blight and fuscous blight are caused by *Xanthomonas phaseoli* and *X. phaseoli* var. *fuscans*. The symptoms of these diseases are virtually identical and the 2 diseases can only be distinguished in the laboratory. However, the 2 organisms may differ in the bean varieties that they infect. These 2 diseases are the most economically important bacterial bean diseases in Canada and they usually occur in late July and August and become progressively more severe as the field beans reach maturity.

The initial symptoms usually occur on the leaves. Infected leaves develop water-soaked or pale green spots that later turn brown and dry. These spots may merge to form irregular blotches of varying size. However, each spot or blotch has a narrow chlorotic margin around it. Similar spots

may occur on the pods but in this case they may appear somewhat cankerous and greasy. The pod spots may merge to form blotches that have a reddish brown discolouration.

Foot rot and mycosphaerella blight of field peas

Both fungi are stubble, seed, and soil borne and can survive for several years in the soil as resting spores. Initial infection occurs as the plant shoots come in contact with resting spores or by the fungus growing from seed across the point of attachment to the seedling. Infection from the seed develops as a foot lesion. Spores are produced from reproductive bodies of the fungus, and are released during wet weather to initiate leaf infection. During the growing season, new reproductive bodies are produced and release spores during wet periods to establish new infections.

Symptoms of foot rot usually begin at the point of seed attachment and extend as a bluish-black lesion to above the soil line.

Blight symptoms occur on leaves as small, purple lesions with indefinite margins that turn brownish-black and develop a target-like appearance. Lesions coalesce and leaves may dry up but remain attached to the stem. The lesions on the stem are purple and may extend 10 mm above and below the point of leaf attachment. Infection of the flowers causes the blossoms to drop. Small, purple lesions develop on infected pods. The pods may shrink if the infection is severe. Infected seeds may show various degrees of shrinkage and discolouration or they may show no signs of infection.

The seed crop inspector should look for bluish-black lesions on the stem, noting that stem lesions may merge and give the entire lower stem a bluish-black appearance. Infected pods are covered with small, purple lesions. The pods may appear shrunken if the infection is severe.

Powdery mildew of field peas

Powdery mildew is a widespread disease that is often most prevalent on late-maturing field peas. In severe infestations, brown, pitted spots may occur on pods and the seed may be visibly affected. Premature ripening may result in shrunken seed.

Powdery mildew overwinters on plant debris. It appears as cottony-white to tan fungal colonies and yellowed blotches on the upper and lower surfaces of the leaves. It develops more severely on the lower leaves but it can infect any of the leaves in cool, humid weather. When the disease is severe, the pea plants are stunted, turn yellow, and defoliate.

A lush stand of peas is an ideal environment for powdery mildew development. Dew formation and lack of rainfall also favour the development of the disease. Optimum temperatures for development are between 20 to 25°C (68 to 75°F). Rain showers are actually disruptive to the spread of powdery mildew. The inoculum is spread by wind. Once it is established, powdery mildew increases very rapidly.

Symptoms consist of a light, greyish, powdery growth on the leaves, pods and occasionally on the stems. This powdery growth is easily rubbed off. As the plant ages, tiny fruiting bodies of the fungus often form in the powdery growth. They develop as spots that enlarge and merge to cover the entire surface of the leaves, pods and stems.

Sclerotinia

This disease affects dry beans, field peas, and lentils. The symptoms usually develop several weeks after flowering begins. The plants develop pale-grey to white lesions, at or above the soil line and on upper branches and pods. The infections often develop in the axils where the leaf and the stem join because the infected petals lodge there. Infected stems appear bleached and tend to shred. Hard black fungal bodies (sclerotia), of varying sizes, develop within the infected stems, branches, or pods. Plants with girdled stems wilt and ripen prematurely. Sclerotia overwinter in the soil and produce disease spores the next year infecting the next crop.