ROGUES AND ROGUING MANUAL FOR PEDIGREED SEED CROPS

Canadian Seed Growers' Association

Revision 01-2009 **March 15, 2009**

This revised version 01-2009 of *Rogues and Roguing* supersedes all previous versions. The electronic version of *Rogues and Roguing* is maintained at the CSGA's website: www.seedgrowers.ca. This version is published for convenient reference.

TABLE OF CONTENTS

Acknowledgements

The Canadian Seed Growers' Association (CSGA) appreciates the work of the Plant Breeders' Committee and the assistance provided by seed growers as well as seed program and inspection staff of the Canadian Food Inspection Agency (CFIA) in revising the content of this manual.

CANADIAN SEED GROWERS' ASSOCIATION

ROGUES AND ROGUING MANUAL
FOR PEDIGREED SEED CROPS

RECORD OF AMENDMENTS

Amendments to the *Rogues and Roguing Manual for Pedigreed Seed Crops* will be issued as required. Amendments will be numbered and dated and the amendments outlined below should have been inserted. If any amended pages are missing, contact the CSGA or download pages from the CSGA website (www.seedgrowers.ca). Remove obsolete pages.

Amendment Number & Date	**Description of Amendment** Section / Sub-section Number(s), Page Number(s)	**Entered by:**

1.0 INTRODUCTION

The Canadian Seed Growers' Association (CSGA) is officially recognized in federal Seeds Regulations as responsible for seed crop pedigreeing and varietal certification in Canada. Pedigreed seed growers in Canada, through the CSGA, assume responsibilities that in most other countries belong to government agencies. Seed growers accredited as Plot Growers produce the first multiplication or generation of pedigreed or certified seed. Breeder seed is carefully multiplied by Plot Growers in order to have sufficient parent seed stocks for other seed growers to produce certified seed of the variety. Plot Growers multiply, and often process, the first generation(s) of new varieties, performing the function that is the responsibility of plant breeders in many other countries. The seed growers of CSGA multiply pedigreed parent seed of new varieties through the pedigreed class generations to deliver true-to-type Certified seed to commercial crop producers.

This *Rogues and Roguing* manual provides information to CSGA seed growers on how to identify rogues (undesirable plants) and also on roguing (removing them from) pedigreed seed crops. Roguing is to multiplication of pedigreed seed crops what selection is to plant breeding.

WHAT IS A ROGUE?

A rogue is any undesirable plant in a seed crop. There are several types of rogues. The simplest type to recognize is a barley plant in an oat field, whereas those most difficult to identify arise from genetic change within a variety or from intercrossing. Rogues also result from simple mechanical mixtures with other varieties, or with other crop kinds or weeds that are difficult to separate. This type of rogue cannot be taken lightly as such admixtures can occur at many stages in the production of pedigreed seed. Volunteer growth, diseased plants and objectionable weeds should also be rogued when feasible.

WHAT IS THE PURPOSE OF ROGUING?

Mutations and intercrossing in self pollinated crops occur at definite measurable frequencies, generally at extremely low levels. Plot Growers are responsible for keeping these variants at the minimum level and reporting the type of rogues removed and their incidence levels to the CSGA (in the *Report on Plot Production – Form 50*). This information is provided to the Breeder responsible for maintaining the variety. Plot Growers also provide the CSGA each year with a sample of harvested seed for variety verification testing. This exchange of information between Plot Growers, CSGA and Breeders is a critical varietal identity control point for new varieties entering pedigreed seed crop certification.

WHERE CAN GROWERS GET INFORMATION TO ASSIST WITH ROGUING?

Plot Growers must get to know their plot variety very well and become familiar with the normal ranges of distinguishing characteristic expression in that variety. Official variety descriptions prepared by Breeders and this manual are helpful guides. More information is available through visits to variety distributors' plot tours and field days as well as seed growers' meetings and visiting other seed growers with experience in the same variety. A valuable source of information can be pedigreed seed crop inspectors and the training documents used by the Canadian Food Inspection Agency (CFIA) to certify and authorize pedigreed seed crop inspectors. The general training document, *Pedigreed Seed Crop Inspection Procedures,* is available at: http://www.inspection.gc.ca/english/plaveg/seesem/proc/qsp142-1e.shtml . Directions and links to Specific Work Instructions for inspecting specific crop kinds are provided in Section 3. of this manual. At the time of the crop inspection, plot growers should accompany seed crop inspectors.

HOW CAN ROGUES BE DISTINGUISHED FROM THE NORM OF THE VARIETY?

The same characteristics used to distinguish varieties can be used to recognize and describe rogues. Plot Growers must know them well.

To find and remove genetic rogues, growers require a sound knowledge of the distinguishing characteristics of the variety being produced. Many factors contribute to the distinguishing characteristics which vary individually in the degree of their expression and may be influenced and modified by environment, fertility and stage of growth. Despite these limitations it is by recognizing a deviation from the normal range that growers will first identify a rogue in the standing crop. The suspect plant can then be checked against the norm to determine if in fact it is a rogue.

WHEN AND HOW SHOULD CROPS BE ROGUED?

General plant form changes throughout the growing season as the plants grow and mature. Many identifying characteristics reach optimum expression at different stages of plant development. Once a crop is established it must be rogued repeatedly and systematically to take advantage of the differences as they appear at each stage of growth. It is not sufficient to rogue only once after the crop is fully ripened. Flower parts, particularly important in flax and canola, can be checked at heading or flowering time; pubescence of the stem or leaves is evident in the green stage of many cereal crops but may be lost by abrasion as the crop ripens; stem color is best expressed at early ripening; chaff color does not develop until full ripening. By roguing in the seedling stage, volunteer plants are often more easily found and removed. A roguing plan must be established and adhered to, for roguing to be successful.

The first obvious rogues that can be removed are other crop kinds, diseased plants and weeds. These rogues can often be found in the seedling stage. Plants heading much earlier than the main crop are suspect and should usually be removed. For example, barley plants in an oat crop should be removed as soon as they come into head before the oats head out. Wild oats should be removed from oats as soon as possible to prevent intercrossing. All rogues should be removed from the field and destroyed.

Pests and weeds may be managed with appropriate pesticides and during crop inspection periods, the chemical control measures used should be brought to the attention of the inspector. Growers should remember that the primary objective and roguing priority is to maintain genetic or varietal purity and freedom from other kinds. A few weeds, particularly those that can be easily removed by cleaning machinery, can be tolerated in order to achieve the main objective.

The time of day is an important consideration in roguing. Roguing during mid-day is not as effective as in the morning or afternoon due to the glare of the sun. Some rogues, such as talls, beards, nonbeards and wild oats are very visible when back lighted by the evening sun. They are easily spotted by bending low over the crop and looking into the sun.

The land requirements for crops and pedigreed classes of seed are specified in CSGA regulations. In addition to these requirements and particularly for plots, land should be carefully chosen to provide good drainage and protection from animals. Plots should be sown in single spaced rows or sub plots to assist roguing. Plots seeded too thinly may be difficult to rogue.

Plot growers: A record describing the rogues should be kept and recorded on the plot report form submitted to CSGA.

2.0 CEREAL PLANT CHARACTERISTICS

The following section deals with those characteristics of cereal plants that are useful for distinguishing varieties and identifying off-types and rogues. In order to rogue effectively it is necessary to become thoroughly familiar with the variety being rogued. The first step in this direction is to study the official variety description which can usually be obtained from the variety distributor or Canadian Seed Growers' Association (CSGA).

STEM

The stem of cereals is typical of the grass family, with solid nodes and hollow internodes. Saw fly resistant wheats differ in this respect since they have solid internodes from which they derive resistance to the wheat stem sawfly. There are differences in the strength of the stem and also in the height. Differences in the plant heights of cereal varieties is readily apparent in contrasting plots but of limited value to the grower. In most varieties there is an acceptable range of expression for such characteristics as plant height. It is only when a plant significantly exceeds the normal range for no apparent reason that it should be classed as a rogue.

LEAF

A single leaf arises from each node of the stem and consists of a sheath and a blade. Crop kinds can be readily distinguished in the seedling stage by the presence or absence of ligules and auricles. The ligule is a collar-like appendage that extends upward above the junction off the leaf blade and sheath. The auricles are ear-like appendages that clasp or encircle the stem of barley, wheat and rye.

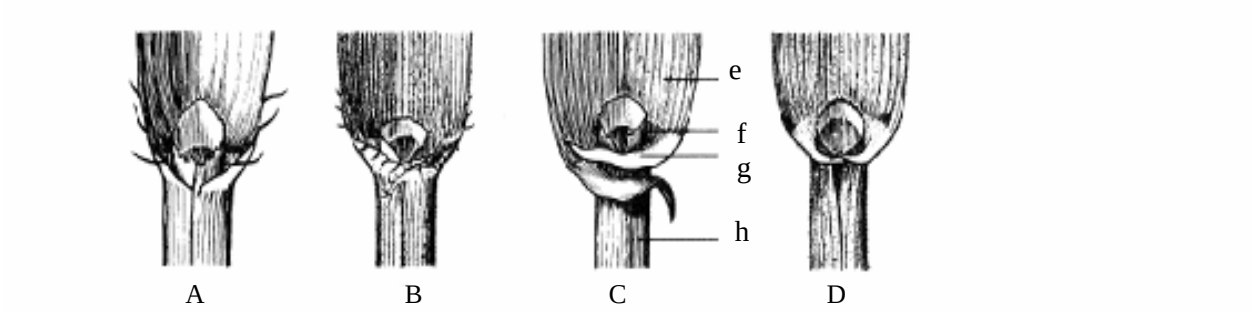

Fig. 1: Junction of Leaf Blade and Sheath
A. Oats B. Wheat C. Barley D. Rye
e. Blade, f. Ligule, g. Auricle, h. Sheath

Oats	Auricles absent, leaf sheath and blade mostly glabrous; a few long hairs on the margins of the lower leaf sheath of some varieties. Ligule medium length. Blades with more than twelve veins, usually twisted counter-clockwise.
Wheat	Auricles short, with blunt tips, hairy; leaf sheath and blade covered with short, fine hair (slight to very hairy); ligule medium length. Blades with about twelve veins twisted clockwise.
Rye	Auricles very short, glabrous; leaf sheath and blade covered with short fine hair (slight to very hairy); ligule short. Blade with about twelve veins twisted clockwise.
Barley	Auricles long, slender, glabrous, with pointed tips and considerable overlap. Leaf sheath and blade usually glabrous; ligules medium length. Blades with about twelve veins twisted clockwise.
Triticale	Auricles are medium length. Leaf sheath and blade covered with short, fine hair (slight to very hairy); ligule medium length. Blades with about twelve veins twisted clockwise.

INFLORESCENCE

The majority of reliable distinguishing characteristics for rogues are found in the inflorescences, and knowledge of the parts of the inflorescence is important for a cereal crop seed grower. There are two types of inflorescences, the oat panicle with its branched rachis, and the spike of the wheat, barley and rye in which the rachis is not branched and its internodes are compacted.

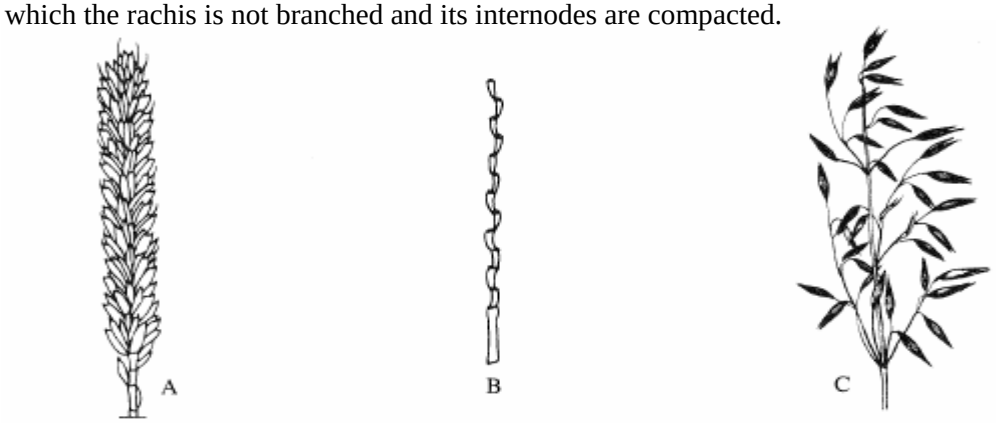

Fig. 2: Inflorescences
A. Spike of wheat B. Rachis of spike C. Panicle of oats.

SPIKELET AND SPIKELET GROUPS

The spikelet is composed of two outer glumes and one to five contained florets on a jointed rachilla. The outer glumes must not be confused with the lemma and palea which enclose each floret, and remain as part of the seed unit of oats and barley. The spikelet or floret group is the basic part of the inflorescence and occurs singly or in multiples at each rachis node of a spike, and singly at the end of each rachis branch of the oat panicle.

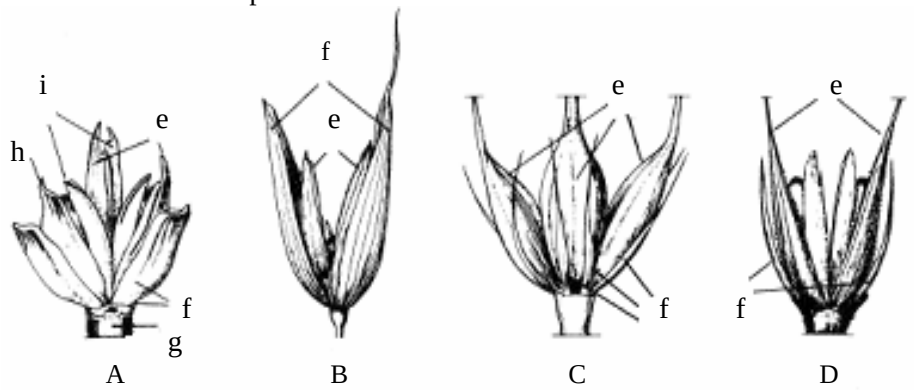

Fig. 3: Spikelet Arrangements
A. Wheat B. Oats C. Barley D. Rye
e. inner floret, f. outer glumes, g. rachis, h. lemma, i. palea.

Wheat	There is a single spikelet at each rachis node. There may be three to five florets per spikelet.
Oats	There is a single spikelet on each rachis branch. The spikelets have three to five florets. The outer glumes are large and papery.
Barley	Six-row barley has three single-flowered spikelets at each rachis joint. In two row barley the lateral spikelets are sterile there is then a single fertile floret at each rachis node.
Rye	There is one spikelet at each rachis node and two fertile florets in each spikelet.
Triticale	There is a single spikelet at each rachis node. There may be three to five florets per spikelet

CEREAL FLOWER

The cereal flower or floret is similar for each crop kind. The florets are borne on jointed rachillas. Barley has only one flower per spikelet and the rachilla remains rudimentary. The rachilla is a useful tool for distinguishing varieties and rogues.

MUTATIONS

A mutation is a heritable alteration of the genes or chromosomes of a plant. Two undesirable mutations, speltoids in wheat and fatuoids in oats should be rogued in order to prevent a buildup in a seed stock.

VARIANTS

Any seed or plant which (a) is distinct within the variety but occurs naturally within the variety; (b) is stable and predictable with a degree of reliability compared to other varieties of the same kind, within known tolerances; and (c) is described as a variation in the official variety description. It is not an off-type, and only considered an impurity if reported in excess of the acceptable level specified by the responsible Breeder.

ADDITIONAL INFORMATION

A valuable source of roguing information can be pedigreed seed crop inspectors and the training documents used by Canadian Food Inspection Agency (CFIA) to certify and authorize pedigreed seed crop inspectors. The general training document, *Pedigreed Seed Crop Inspection Procedures,* is available at: http://www.inspection.gc.ca/english/plaveg/seesem/proc/qsp142-1e.shtml and
Specific Work Instructions for *Cereal Crop Inspection Procedures* are available at:
http://www.inspection.gc.ca/english/plaveg/seesem/man/swi-cereale.shtml .

Fig. 4: Roguing a pedigreed wheat seed crop

3.0 ROGUES AND ROGUING OF SPECIFIC PEDIGREED SEED CROPS

3.1 BARLEY (*Hordeum vulgare* L.)

PLANT FORM

Spring and winter barleys share the same general plant form. The basic difference between spring and winter barleys is the winter growth habit of the latter or the need for exposure to cool temperatures to initiate stem development.

STEM

Varieties will differ in the length and strength of straw. The spike may remain partly enclosed in the upper leaf sheath or it may emerge from the sheath for several inches. The expression of these characteristics is dependent on growing conditions.

The part of the stem just below the spike is referred to as the neck. It is usually straight or gently curved but can also be snake shaped.

The collar is found at the point where the stem ends and the rachis begins. There are three basic types of collars: V shaped; closed collar; open collar. Generally one type will predominate in a variety but the other types can also appear.

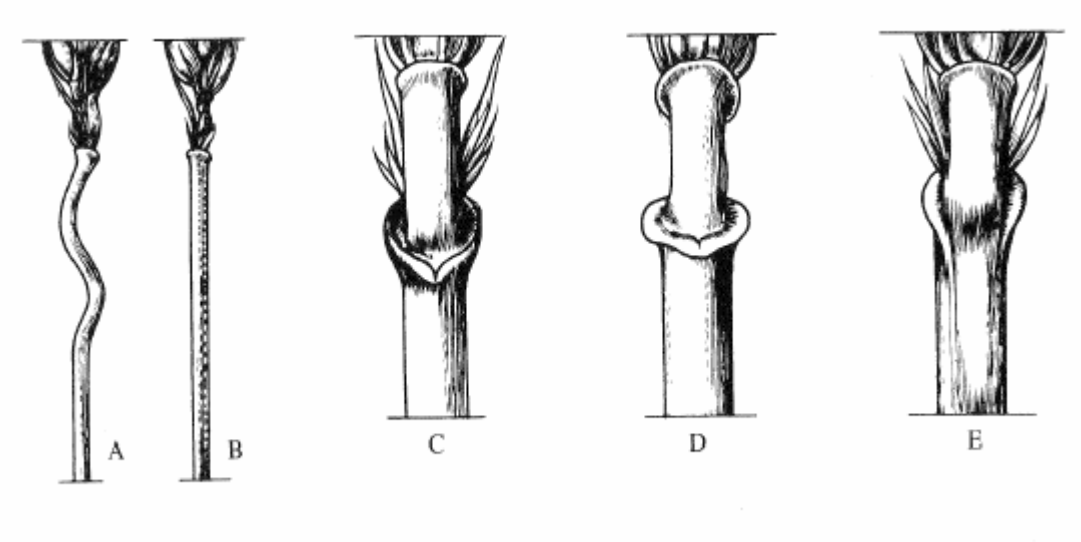

Fig. 5: Neck Shapes and Collar Forms
A. Snaky neck B. Straight neck C. V-shaped collar D. Closed collar E. Open collar

LEAF

Leaf size can vary both in length and width. In general two row barleys have narrower leaves than six row barleys. Leaf color can range from dark to light green to yellowish green.

SPIKE AND SPIKELET FORM

Spike or head characteristics are the most useful for the identification of varieties and rogues. The spike can range from lax to dense and from erect to fully nodding.

There are two main spike types: two-row, with one developed kernel and two sterile florets in each spikelet and six-row, with three developed kernels in each spikelet.

Both fully awned and awnless (hooded) types exist in barley. The awns can vary in the degree of barbing and are classified as rough-awned, smooth-awned, or semi-smooth-awned. Those classified as smooth awned will have a few barbs at the tip. Those classed as semi-smooth have awns on one half to two thirds of the awn; the smooth section is always next to the kernel. The degree of barbing can be found by running the awn through the fingers.

The length of the awns on the outer glumes varies with the variety and is expressed as a fraction or a multiple of the glume length. The position and number of hairs on the glumes, rachillas, and rachis edges are useful distinguishing characteristics.

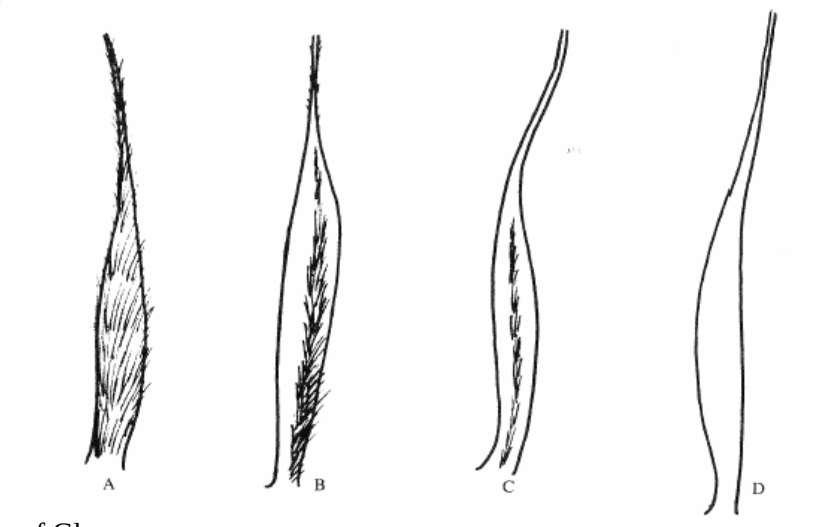

Fig. 6: Hairiness of Glumes
A. Covered B. In band C. On midline D. Without hairs

The shape of the rachis internode sections in two row barley is different from that in six row barleys the latter being flared at the top to accommodate three seeds. The basal rachis internode, or the first internode above the collar is different from other internodes on both two and six row barleys. The shape of this internode is classed as straight, curved, or greatly elongated.

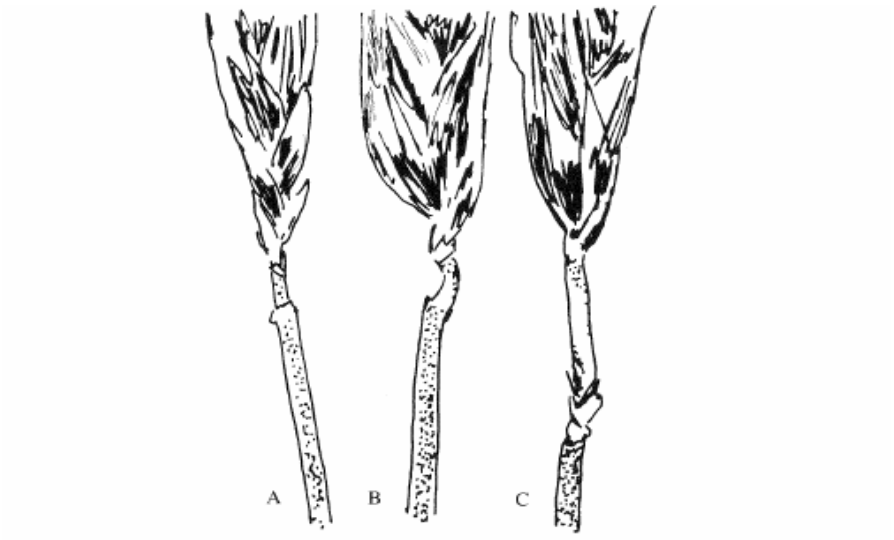

Fig. 7: Length and Shape of Basal Rachis Internode
A. Short, straight B. Short, curved C. Long, straight

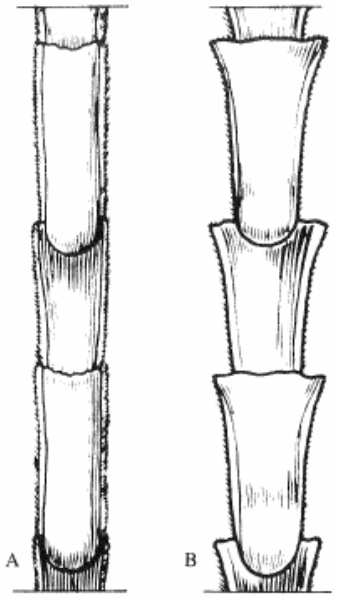

Fig. 8: Rachis Internodes

A. Parallel sided B.Flared

KERNEL CHARACTERISTICS

In six-row barley, the central kernels are slightly larger and plumper than the lateral kernels that also have slightly twisted bases. Two-row kernels are uniform in size and shape. The degree of barbing on the lateral veins and the wrinkling of the hulls are useful distinguishing characteristics. The basal markings on the mature kernels can be a horseshoe shaped depression or a transverse crease. The aleurone color of a dehulled barley kernel may be yellow white or a shade of blue. In hulless varieties the lemma and palea do not adhere to the kernel at maturity.

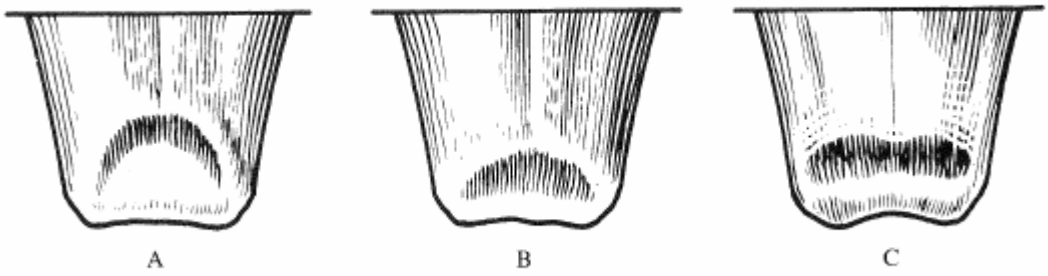

Fig. 9: Basal Marking of Kernel

A. Horseshoe B. Incomplete horseshoe C. Transverse crease

The length of the hair on the rachilla, as in Fig. 11 below, can also be a useful distinguishing characteristic. The length of rachilla hair can range from short to long and feathery in appearance.

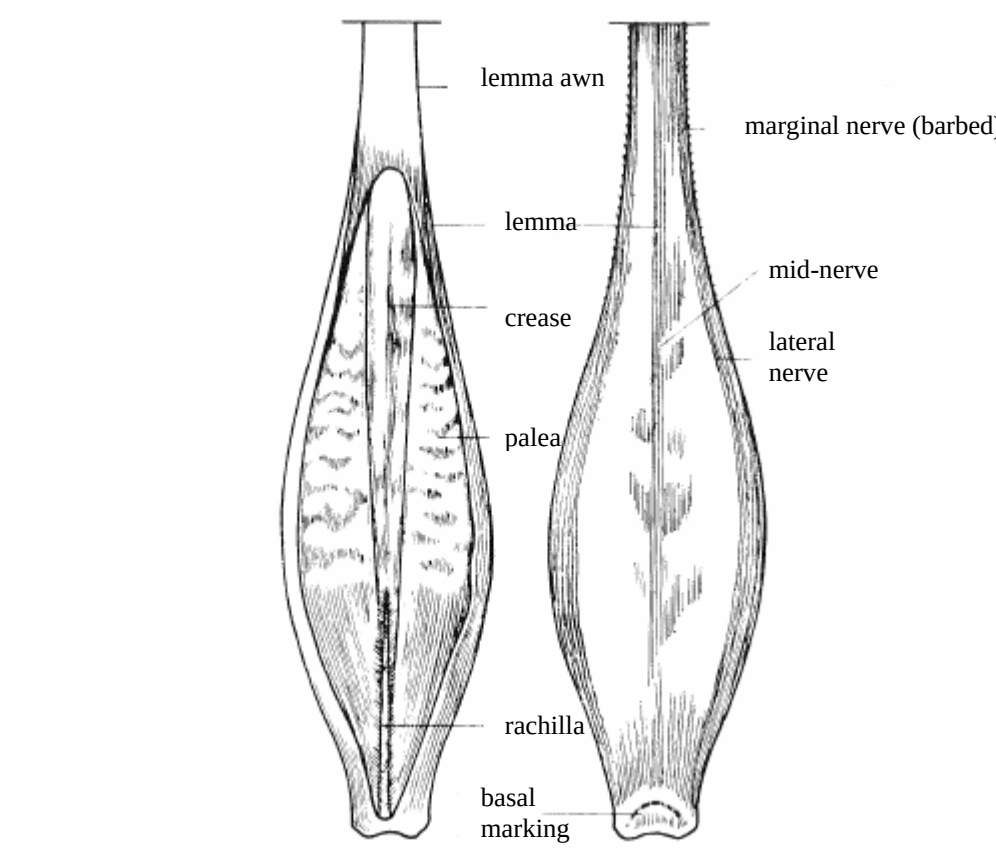

Fig. 10: Barley Kernel.

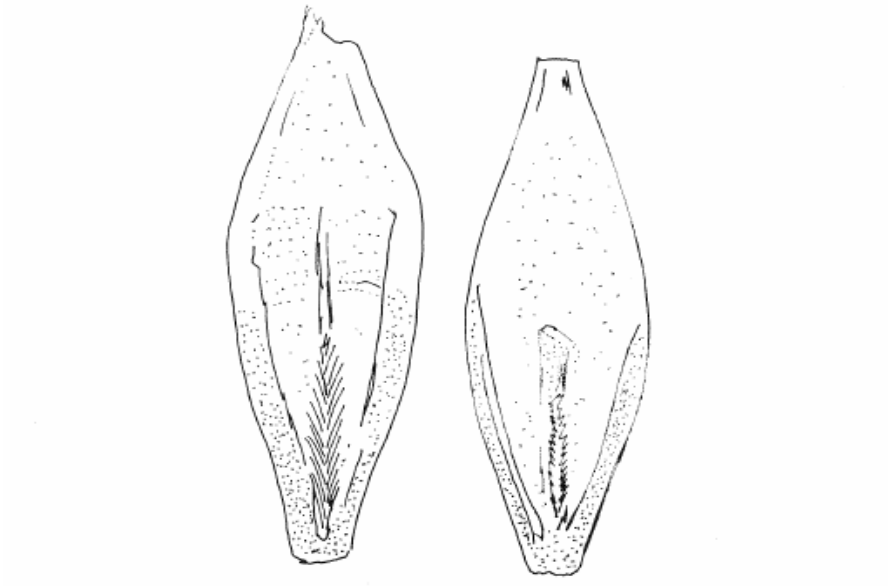

Fig. 11: Rachilla Hairs

A. Long haired B. Short haired

DISEASE REACTION

Disease reaction has only limited value in the detection of rogues. Susceptibility or resistance to mildew, rust and smut and some leaf spot diseases in some cases may be used for rogue identification if conditions are favorable for the infection and development of these diseases.

ADDITIONAL INFORMATION

A valuable source of roguing information can be pedigreed seed crop inspectors and the training documents used by Canadian Food Inspection Agency (CFIA) to certify and authorize pedigreed seed crop inspectors.. The general training document, *Pedigreed Seed Crop Inspection Procedures,* is available at: http://www.inspection.gc.ca/english/plaveg/seesem/proc/qsp142-1e.shtml and
Specific Work Instructions for Barley are in the *Cereal Crop Inspection Procedures* available at: http://www.inspection.gc.ca/english/plaveg/seesem/man/swi-cereale.shtml .

Fig. 12: Barley Leaf Sheath with auricles clasping stem

Fig. 13: Wheat Spike (Head) fully emerged

Fig. 14: Barley Spike (Head) half emerged

3.2 BEANS, DRY (*Phaseolus vulgaris* L.)

Field or Dry Beans include market class types such as pinto, navy, black, great northern, yellow, kidney, cranberry and others.

Distinguishing characteristics used for roguing seed crops of Field Beans include:

- Plant Form: Type I: Bush
  Type II: Upright, partially indeterminate growth
  Type III: Trailing, indeterminate growth
- Flower Color: White
  Purple
- Seed Size: Small
  Medium
  Large

Fig. 15: Bean Market Classes (clockwise from top left):

- Small Red
- Pinto
- Pink
- Great Northern
- Black
- Navy

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3.3 CANOLA (*Brassica napus, Brassica rapa,* canola-quality *Brassica juncea* L.) AND MUSTARD (*Brassica juncea, Sinapis alba* L.)

Canola and rapeseed include three separate and distinct species: *Brassica napus* (Argentine type), *Brassica rapa* (Polish type) and canola-quality *Brassica juncea*. While they are different species they are very similar and share common identification characteristics. Canola is the term used to designate varieties of all three species with low erucic acid and low glucosinolate content. Varieties of *B. napus* with unique fatty acid profiles (e.g. high erucic acid) are usually grown under closed loop contracts.

All three species out-cross naturally (*B. rapa* 100%, *B. juncea* 30% and *B. napus* 30%). Since it is virtually impossible to identify an admixture of two varieties of the same species using morphological characteristics, CSGA crop certification involves testing harvest seed to verify hybridity and other distinguishing characteristics. The most frequent and important rogues in canola are off-types within the variety and other Brassica species such as *Brassica juncea* condiment mustards (Brown and Oriental types) and the weed *Sinapis arvensis* (wild mustard). Leaf and flower characteristics are the best identification features for distinguishing between the various Brassica species and weeds.

LEAVES AND STEMS

Leaf color and the presence or absence of hairs on the leaves and stems are good identification features particularly before or after blossom time. As shown in Fig. 20 below, the most reliable leaf characteristic is the shape of the upper leaves at the point where the leaf attaches to the stem. The leaves of B. rapa clasp the stalk completely whereas the blade of the leaf of B. juncea does not reach the stalk. B. napus is intermediate with the leaf blade only half clasping the stalk. The main stems of S. arvensis and Sinapis alba are not straight and the branches come off at larger angles giving the plant something of a bushy appearance.

- B. napus: Leaves are dark green, smooth with no hairs. Leaf blade only partially clasps the stem.
- *B. rapa*: Leaves are lighter green with many small hairs on the underside and on the petiole. The blade of the upper leaves completely clasps the stem.
- *B. juncea*: The blade of the upper leaves does not reach the stem.
- *Sinapis arvensis*: Leaves are dark green and both the stem and leaves are covered with coarse hairs. There is a purple coloration where the leaf stalk joins the main stem. Leaf blade does not reach stem.
- *Sinapis alba* (white or yellow mustard): The leaf blade terminates well above the stem. The leaf is distinctly lobed. Leaves and stems are pale green in color and covered with coarse hairs.

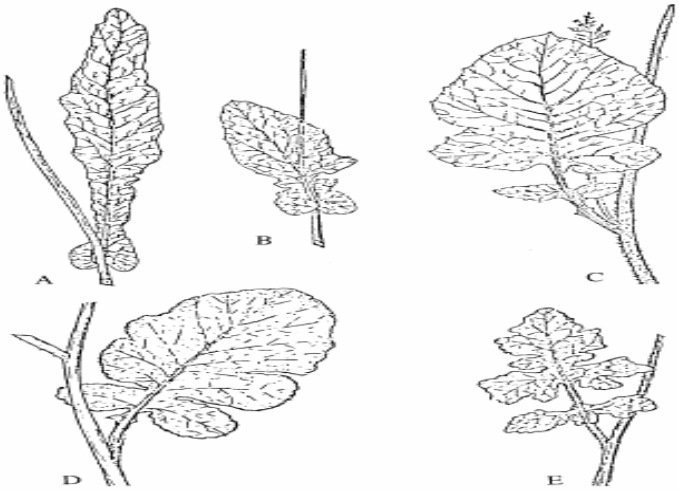

Fig. 16: Distinguishing characteristics of Canola and Mustard leaves

A. *Brassica napus:* leaf blade only partially clasping stem.
B. *Brassica rapa*: leaf blade clasping stem completely.
C. *Sinapis arvensis* (wild mustard): leaf blade terminates well above stem.
D. *Brassica juncea* (canola-quality) (and condiment mustard): leaf blade terminates well above stem.
E. *Sinapis alba* (yellow mustard): leaf blade distinctly lobed.

Fig. 17: *B. napus* Leaf Blade partially clasping stem

Fig. 18: *B. rapa* Leaf Blade completely clasping stem

INFLORESCENCE

On canola plants the flowers are borne on pedicels in racemes. Flowering starts at the base of the raceme and progresses to the tip. The raceme elongates during the flowering period. The flowering period lasts roughly ten to twenty days; however, this is heavily influenced by the growing conditions at the time. Two of the best features for locating rogues are the time of flowering and the shape of the racemes. There is considerable variation in the time of flowering for the different Brassica species. *B. rapa* and *S. arvensis* plants generally flower ten days to two weeks earlier than *B. napus*. Flowering time for *B. juncea* is intermediate between *B. napus* and *B. rapa*. To rogue canola effectively, intense roguing should start with the appearance of the first blossoms and continue until the plants are in full flower. In *B. rapa*, if inter-specific off-types are suspected, watch for late flowering plants after most flowering has finished. These off-types can be less vigorous and therefore will tend to hide lower in the canopy.

The shape of the raceme is a very visible and distinctive characteristic. In *B. napus* the buds are carried on the tip of the raceme, beyond the flowers, and this gives the raceme a blunt or flattened tip appearance. In *B. rapa* the flowers extend beyond the buds on the tip of the raceme giving the raceme a round end appearance.

Fig. 19: *B. juncea* Leaf Blade terminates above stem

Fig. 20: *S. alba* Leaf Blade distinctly lobed

A B

Fig. 21: Canola Inflorescence Shapes

A. *Brassica napus*: buds are at a higher level than the flowers just opened
B. *Brassica rapa*: buds are at a lower level than flowers just opened

Fig. 22: *B. napus* Inflorescence with buds at a higher level than flowers just opened

Fig. 23: *B. rapa* Inflorescence with buds at lower level than flowers just opened

SEED CHARACTERISTICS

Seeds of the different species of canola differ in color and size. *B. napus* has a large black seed while *B. rapa* has a smaller seed with color ranging from dark brown to yellow brown. Seeds from most current varieties of *B. rapa* are yellow brown. *B. juncea* can be brown-seeded (Brown condiment mustard) or yellow-seeded (canola quality and Oriental condiment mustard). Both seed size and seed color can vary with growing conditions.

Sinapis alba has very large pale yellow seeds. There are generally 4 to 6 seeds per pod. The pods are covered with hair and have long flattened beaks.

DISEASE REACTION

B. napus is resistant to all currently known races of white rust in western Canada. *B. rapa* and all types of *B. juncea* may be resistant or susceptible, depending on the canola variety and the race of white rust present. *S. alba* is generally intermediate in resistance to all the white rust races in western Canada. More than one race of white rust may be present in a field.

B. napus may be resistant or susceptible to blackleg, depending on the canola variety and the pathotype of blackleg present. Most *B. rapa* are susceptible to blackleg, while *B. juncea* and *S. alba* are resistant. More than one blackleg pathotype may be present in a field.

ADDITIONAL INFORMATION

A valuable source of roguing information can be pedigreed seed crop inspectors and the training documents used by Canadian Food Inspection Agency (CFIA) to certify and authorize pedigreed seed crop inspectors.. The general training document, *Pedigreed Seed Crop Inspection Procedures*, is available at: http://www.inspection.gc.ca/english/plaveg/seesem/proc/qsp142-1e.shtml .
Specific Work Instructions for *Cruciferous Crop Inspection Procedures* are available at: http://www.inspection.gc.ca/english/plaveg/seesem/man/swi-crue.shtml and *Hybrid and Composite Canola Crop Inspection Procedures* are available at: http://www.inspection.gc.ca/english/plaveg/seesem/man/swi142e.shtml

3.4 CHICKPEAS (*Cicer arietinum* L.)

Chickpeas have market class types such as Desi and Kabuli.
- Desi type chickpeas have purple flowers and pigmented seed coats.
- Kabuli type chickpeas have white flowers and thin, light colored seed and coats.

Distinguishing characteristics used for roguing seed crops of Chickpeas include:

- Leaf Type: Compound (also known as 'fern')
Unifoliate (leaflets are replaced by a single large leaf.)
- Stem Pigmentation: Present
Absent
- Growth Habit: Bush
Narrow
Prostrate
- Flower Color: White
Purple
-
- Cotyledon Color: Yellow
Green
- Seed Shape: Desi: Angular, Plump
Kabuli: Ram's Head, Round
- Seed Coat Color: Desi: Light Tan, Tan, Dark Brown, Black, Green
Kabuli: Beige, White

ADDITIONAL INFORMATION

A valuable source of roguing information can be pedigreed seed crop inspectors and the training documents used by Canadian Food Inspection Agency (CFIA) to certify and authorize pedigreed seed crop inspectors.. The general training document, *Pedigreed Seed Crop Inspection Procedures*, is available at: http://www.inspection.gc.ca/english/plaveg/seesem/proc/qsp142-1e.shtml and Specific Work Instructions for Chickpeas are in the *Pulse Crop Inspection Procedures* at: http://www.inspection.gc.ca/english/plaveg/seesem/man/swi-pule.shtml .

Fig. 24: Chickpea Seedling Leaf Types
Left: Unifoliate type Right: Compound (Fern) type

Fig. 25: Desi Chickpeas: Seed Coat Color and Shape (clockwise from top left)

- Light tan seed coat, yellow cotyledon, plump seed shape
- Green seed coat, green cotyledon, angular seed shape
- Black seed coat, yellow cotyledon, angular seed shape
- Dark brown seed coat, yellow cotyledon, plump seed shape
- Tan seed coat, yellow cotyledon, angular seed shape
- Tan seed coat, yellow cotyledon, plump seed shape

3.5 FABABEANS (*Vicia faba* L.)

Distinguishing characteristics used for roguing seed crops of Fababeans include:

- Flower Color: White
  White with large black spots
- Plant Height: Medium
  Tall
- Seed Size: Small
  Medium
  Large
- Seed Coat Color: Tan
  Brown
  Grayish White

Fig. 26: Fababeans: Large Seed Size with medium size Pea for comparison (clockwise from top left)

- Large food-type Fababean
- Medium size yellow Pea
- Large food-type Fababean
- Extra-Large food-type Fababean

Fig. 27: Fababeans: Small Seed Size with medium size Pea for comparison (clockwise from top left)

- Small Fababean
- Medium size yellow Pea.
- Small Fababean
- Small Fababean with black seed coat

ADDITIONAL INFORMATION

A valuable source of roguing information can be pedigreed seed crop inspectors and the training documents used by Canadian Food Inspection Agency (CFIA) to certify and authorize pedigreed seed crop inspectors.. The general training document, *Pedigreed Seed Crop Inspection Procedures,* is available at: http://www.inspection.gc.ca/english/plaveg/seesem/proc/qsp142-1e.shtml and Specific Work Instructions for Fababeans are in the *Pulse Crop Inspection Procedures* at: http://www.inspection.gc.ca/english/plaveg/seesem/man/swi-pule.shtml .

3.6 FLAX (*Linum usitatissimum* L.)

PLANT FORM

Oilseed flax plants grow to heights ranging from 38 cm to 76 cm (15-30 in.). Fiber flax varieties are generally taller. The plant has a distinct main stem and a short tap root. One or more basal branches may arise from the main stem just above the soil surface unless the plant is under stress or if the stand is thick. The main stem and basal branches give rise to the primary, secondary, and tertiary branches that bear the leaves, flowers and bolls.

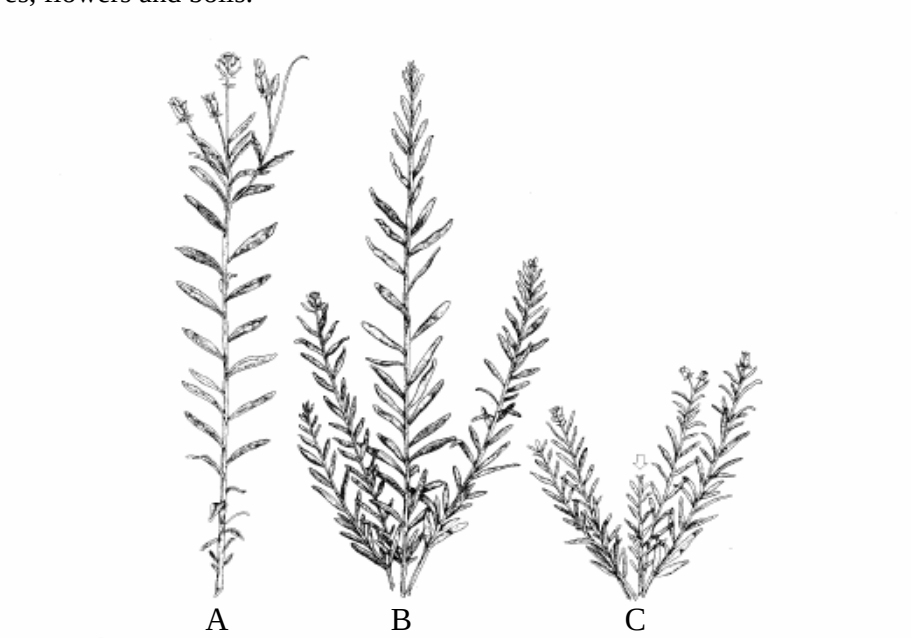

Fig. 28: Flax Plant Forms

A. One main stem – no basal branching

B. Plant with basal branching

C. Plant with growing point killed

INFLORESCENCE

The flax blossom is the best plant feature for the identification of flax varieties and rogues. The flowering stage is a two to three week period although a small number of flowers continue to appear until maturity. Flowering for flax begins early in the morning and the petals are shed by early afternoon. Flower characteristics are most distinctive in fresh fully opened flowers. Flax is self pollinated with 0.3% to 2.0% outcrossing under normal circumstances.

Flowers are regular and are borne in terminal multi-flowered panicles. The flower is from 6 to 20 mm in diameter depending on variety and the petals, sepals, and stamens all occur in units of five. Most varieties will have funnel form or open funnel form shaped flowers. Both the "flattened disk" shape and the "Star" shape are off-types that can occur in any variety and should be removed. The star shape is caused by the edges of the petal rolling inward giving them a pointed appearance resembling the points on a star.

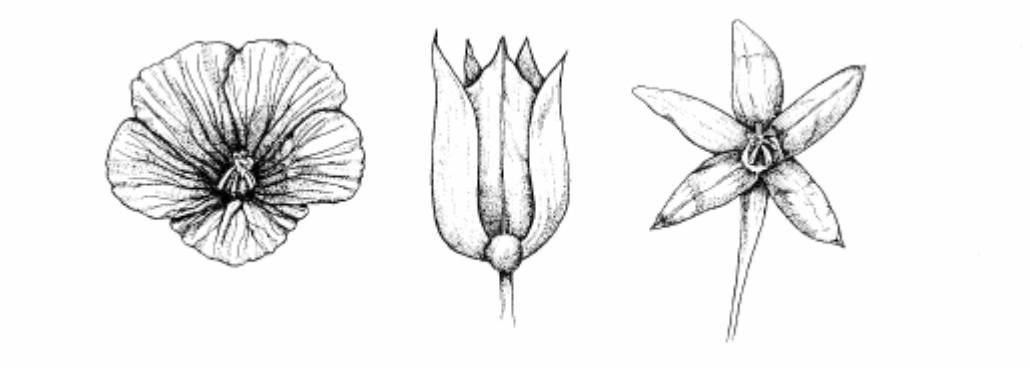

Fig. 29: Flax Flower Shapes
A. Flattened disk B. Funnel form (norm) C. Star shape.

COLOR OF FLOWERS AND FLOWER PARTS

The color of the petals can range from dark blue to very light blue to white or pale pink depending on variety. The anthers of the flax flower also are either blue, pale blue, yellowish or nearly colorless. The pollen can be bluish or yellowish but in most cases will be similar in color to the anthers. The five filaments each bear an anther and the five styles each bear a stigma. Both filaments and the styles may be colorless or blue at the top or bottom or both.

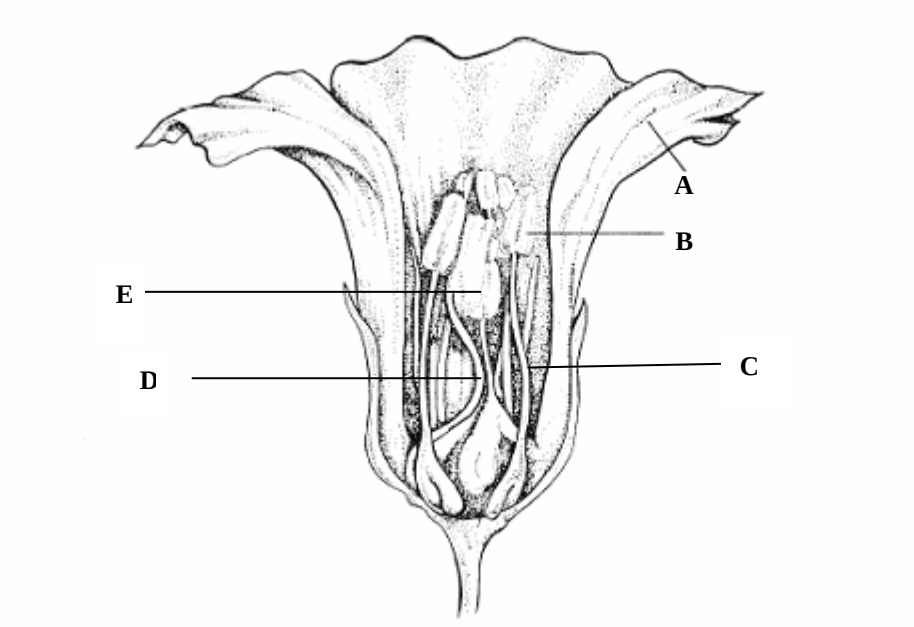

Fig. 30: Cross Section of Flower Showing Flower Parts
A. Petal B. Anther (male) C. Filament D. Style E. Stigma (Female).

SEED BOLLS

The flax boll or seed pod has five chambers or segments and each segment has two seeds which are separated by a low partition called the septum. In some varieties the septa are distinctly ciliate or hairy on the margins; in others they are smooth or non-ciliate.

When ripe the flax boll is either Dehiscent, opening and shedding its seed when ripe, Semidehiscent, partially opening or Indehiscent, not opening at all. Most current varieties are all Semidehiscent. This characteristic is a factor in allowing moisture to enter the seed boll.

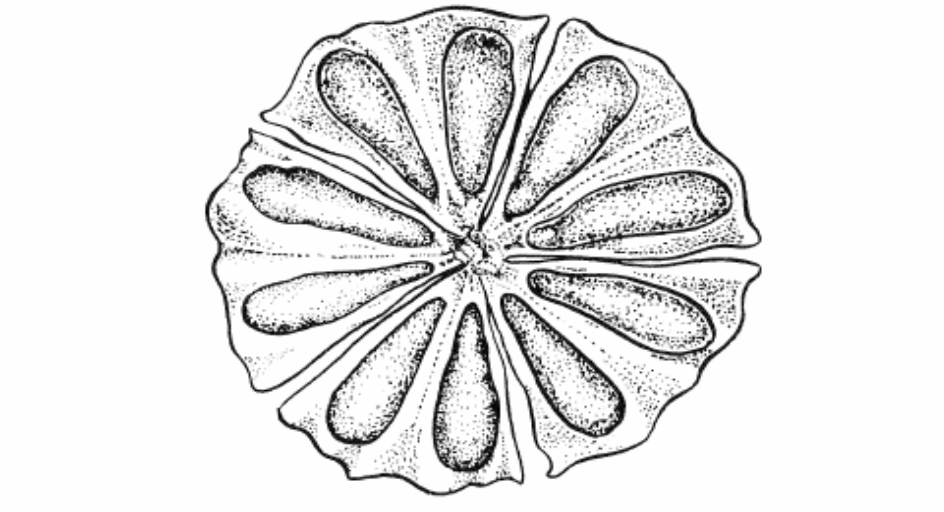

Fig. 31: Cross Section of Flax Seed Boll showing five (5) segments and ten (10) seeds.

SEED

The color of a flax seed is light to dark brown and yellow.

Mottled seed, a combination of yellow and brown on the same seed, is usually a physiologic condition, not an inherited characteristic.

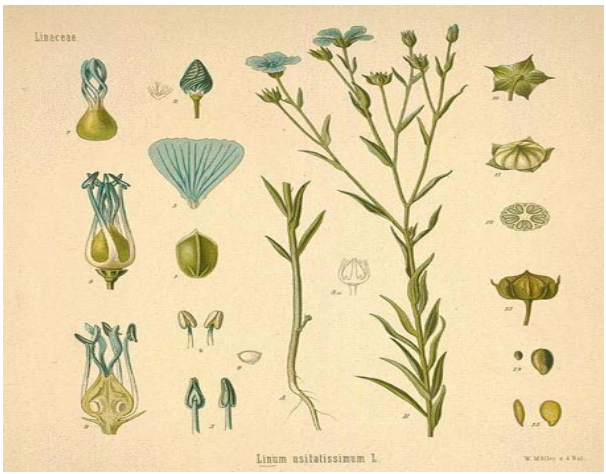

Fig. 32: Flax Plant Parts

Fig. 33: Flax Flowers

ADDITIONAL INFORMATION

A valuable source of roguing information can be pedigreed seed crop inspectors and the training documents used by Canadian Food Inspection Agency (CFIA) to certify and authorize pedigreed seed crop inspectors.. The general training document, *Pedigreed Seed Crop Inspection Procedures,* is available at: http://www.inspection.gc.ca/english/plaveg/seesem/proc/qsp142-1e.shtml and Specific Work Instructions for Flax are in the *Special Crop Inspection Procedures* are available at: http://www.inspection.gc.ca/english/plaveg/seesem/man/swi-spece.shtml#a1.0 .

3.7 LENTILS (*Lens culinaris* L.)

Lentils have market class types such as Green lentils and Red lentils.
- Green lentils include large (6mm) seed size Laird type, medium (Richlea), small (4-4.5mm) seed size Eston type and French Green (dark speckled) lentils with green seed coats.
- Red lentils include extra small to large seed sizes with red-orange seed coats.

Distinguishing characteristics used for roguing seed crops of Lentils include:

- Flower Color: White with faint blue veins
  Purple
- Leaflet Size: Small
  Medium
  Large
- Plant Height: Short
  Medium
  Tall
- Seed Size: Green: Small
  Medium
  Large
  Red: Extra Small
  Small
  Medium
  Large
- Cotyledon Color: Yellow
  Red
  Green
- Seed Coat Color: Grey
  Brown
  Green
  Black
- Seed Coat Pattern: Unpatterned
  Speckled or Marbled (French Green type)
  Slight mottling (Eston type)
  Dotted (Spanish brown)

ADDITIONAL INFORMATION

A valuable source of roguing information can be pedigreed seed crop inspectors and the training documents used by Canadian Food Inspection Agency (CFIA) to certify and authorize pedigreed seed crop inspectors.. The general training document, *Pedigreed Seed Crop Inspection Procedures*, is available at: http://www.inspection.gc.ca/english/plaveg/seesem/proc/qsp142-1e.shtml and Specific Work Instructions for Lentils are in the *Pulse Crop Inspection Procedures* at: http://www.inspection.gc.ca/english/plaveg/seesem/man/swi-pule.shtml .

Fig. 34: Lentils: Seed Market Classes (clockwise from top left)

- Large Green: green seed coat, yellow cotyledons
- Medium Green: green seed coat, yellow cotyledons
- Medium Red: grey seed coat, red cotyledons
- Extra-Small Red: brown seed coat, red cotyledons
- Small Red: grey seed coat, red cotyledons
- Medium Green: green seed coat, yellow cotyledons
- Large Green: green seed coat, yellow cotyledons

3.8 OATS (*Avena sativa* L.)

PLANT FORM

Although the oat plant does not have many distinguishing characters, there are differences in the general plant form that become recognizable with experience. Included in these differences are plant height, width of leaf, time of heading, maturity and a special characteristic in oats, panicle shape. "Side oats" have panicles which are unilateral, giving a "maned" appearance. Although most present varieties have bilateral symmetrical panicles there are degrees of difference based on the angle between the panicle branches and the main stem.

Plant color is a varietal characteristic and can range from dark to light green to yellow green.

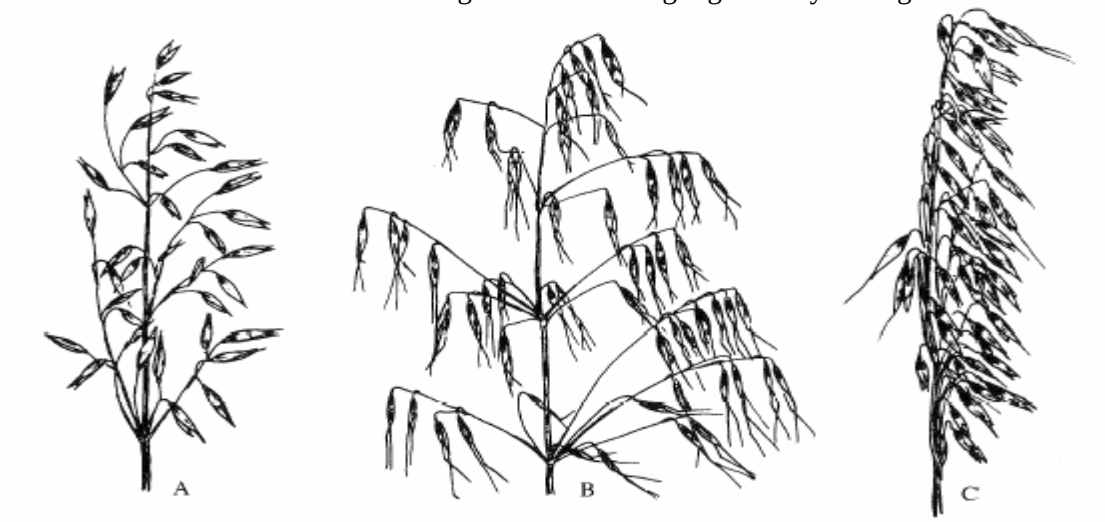

Fig. 35: Oat Panicle Shapes
A. Symmetrical (cultivated oat) B. Wild oat C. Side oat

Fig. 36: Emerging Cultivated Oat: Panicle Shape

AWNS

The presence or absence or degree of awns is a varietal characteristic. The awn is an extension of the mid rib of the lemma, arising from the lemma at the middle of the grain. In wild oats and false wild oats it appears on all of the grains of the spikelet, and is usually twisted below the bend. In most cultivated varieties the awn is carried only by the lower floret and is usually straight, weak, and scarcely twisted, and variable in color ranging from white to black.

Hairiness of stem, leaves and stem nodes can be a useful distinguishing characteristic. These hairs are readily visible in the green stage but can be lost by abrasion in a ripened crop. It is often possible to check an immature tiller for these characters.

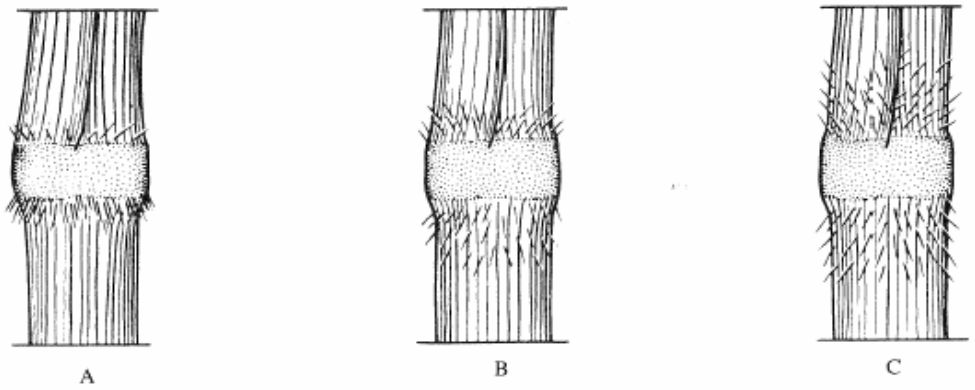

Fig. 37: Hairiness of Stem Node
A. as a crown below node B. scattered below node C. scattered above and below node

WILD OATS

Wild oats are taller, bending and have wide pendulous panicles. Each spikelet has two coarse protruding awns. The kernels are slender, normally dark colored and have a sucker mouth scar. Remove wild oats in the green stage since they mature and shatter early and reinfest the soil in that field if not removed from the field.

Wild oats can cross with cultivated oats. This is another reason for early roguing of wild oats. In the first year following the outcross the crossed material will produce vigorous, tall, rank plants with a combination of the characters of both wild and cultivated oats. In the following year the offspring of the crossing will be highly variable ranging from typical wild oats to typical cultivated oats. This condition poses a serious roguing problem since the offspring of outcrossing will continue to produce both heterozygotes and wild oats and are very difficult to identify.

FATUOIDS

Fatuoids or false wild oats are common mutants found in oat fields. Fatuoid plants have the same height, maturity and general plant form as the variety in which they are found. This similarity to the normal oat plant makes them very difficult to identify and remove. The heavier protruding black awns make them distinguishable at maturity. There may also be a color difference but not always. In harvested seed, the awn, the scar (sucker mouth) and rachilla are similar to wild oats but the general size, color and surface of the grain is similar to the cultivated oat. The hairs on the scar are very much shorter than those on the wild oat. Fatuoids in oats are an important rogue to report to the plant breeder.

KERNEL CHARACTERISTICS

Several kernel characteristics are useful for identifying rogues. The number of lemma veins or nerves varies with the variety from five to ten although the usual number is seven. The lemma tip may be pointed or blunt. The presence or absence of awns or of pubescence at the base of the kernel or on the rachilla and also the length of the rachilla are useful characters. The general length and width of the kernel are useful for gross differences. Oat kernels are commonly white to creamy white but may be yellow, red, grey striped, or shades of brown to black.

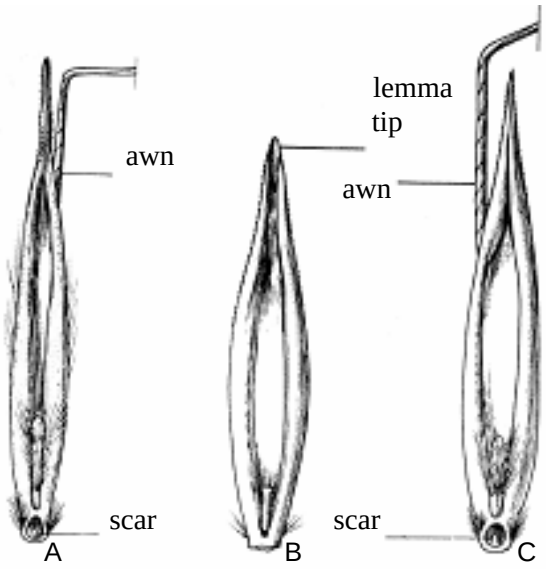

Fig. 38: Kernel Types
A. Wild Oat B. Cultivated Oat C. Fatuoid

DISEASE REACTION

Resistance or susceptibility to mildew, stem or leaf rust may be a diagnostic characteristic if present.

ADDITIONAL INFORMATION

A valuable source of roguing information can be pedigreed seed crop inspectors and the training documents used by Canadian Food Inspection Agency (CFIA) to certify and authorize pedigreed seed crop inspectors.. The general training document, *Pedigreed Seed Crop Inspection Procedures*, is available at: http://www.inspection.gc.ca/english/plaveg/seesem/proc/qsp142-1e.shtml and
Specific Work Instructions for Oats are in the *Cereal Crop Inspection Procedures* at:
http://www.inspection.gc.ca/english/plaveg/seesem/man/swi-cereale.shtml .

Fig. 39: Oat Leaf Sheath, medium length ligule

Fig. 40: Oat Leaf Sheath, auricles absent

3.9 PEAS (*Pisum sativum L.*)

Distinguishing characteristics used for roguing seed crops of Peas include:

- Leaf Type:
  Normal
  Semi-leafless: leaflets are replaced with tendrils.
- Stipule Size:
  Small
  Medium
  Large
- Stipule Density of Marbling:
  Sparse
  Medium
  Dense
- Flower Color:
  White
  Purple
- Plant Height:
  Short
  Medium
  Tall
- Pod Tip Shape:
  Blunt
  Pointed
- Powdery Mildew Reaction:
  Resistant
  Susceptible
- Cotyledon Color:
  Yellow
  Green
- Seed Size:
  Small
  Medium
  Large
- Seed Shape:
  Round
  Blocky
- Seed Coat Color:
  Colorless
  Dun (tan)
  Maple (mottled)
  Speckled

ADDITIONAL INFORMATION

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Fig. 41: Peas: Seed Shape and Surface Dimpling (clockwise from top left)

- Green cotyledon, round shape, no dimpling
- Yellow cotyledon, round shape, 50% dimpled
- Yellow cotyledon, blocky shape, minimal dimpling
- Green cotyledon, blocky shape, 50% dimpled

Fig. 42: Peas: Seed Market Classes (clockwise from top left)

- Maple: mottled seed coat, yellow cotyledons
- Small Yellow: opaque seed coat, yellow cotyledons
- Dun: tan seed coat, yellow cotyledons
- Medium Yellow: opaque seed coat, yellow cotyledons
- Large Yellow: opaque seed coat, yellow cotyledons
- Marrowfat: opaque seed coat, large, blocky green cotyledons

3.10 RYE (*Secale cereale* L.)

Unlike most cereals, Rye is a cross pollinated crop and the appearance of individual plants can be expected to vary considerably. Rye has rather lax spikes with three flowered spikelets. The central flower of the spikelet, however, is often abortive and very thin. The glumes are narrow and acute. The lemmas, longer than the glumes, taper gradually into long, thick awns, and bear stiff hairs on the keel. The lemma and palea of each floret tend to diverge so that the tip of each kernel is clearly visible. The kernel is hulless, longer and more slender than wheat. The rye spike can be erect or nodding depending on variety.

Most rye varieties have purple pigmentation of the seedling bases. The mature stems of the different varieties vary in length, strength and color. There are also differences in the length width and hairiness of the leaves. All present varieties are awned; their spikes may be fusiform, elliptic or oblong. Other useful distinguishing characteristics include kernel size and shape as well as the degree of green or bluish colorization.

Rye can be spring, winter, or perennial in growth habit.

ADDITIONAL INFORMATION

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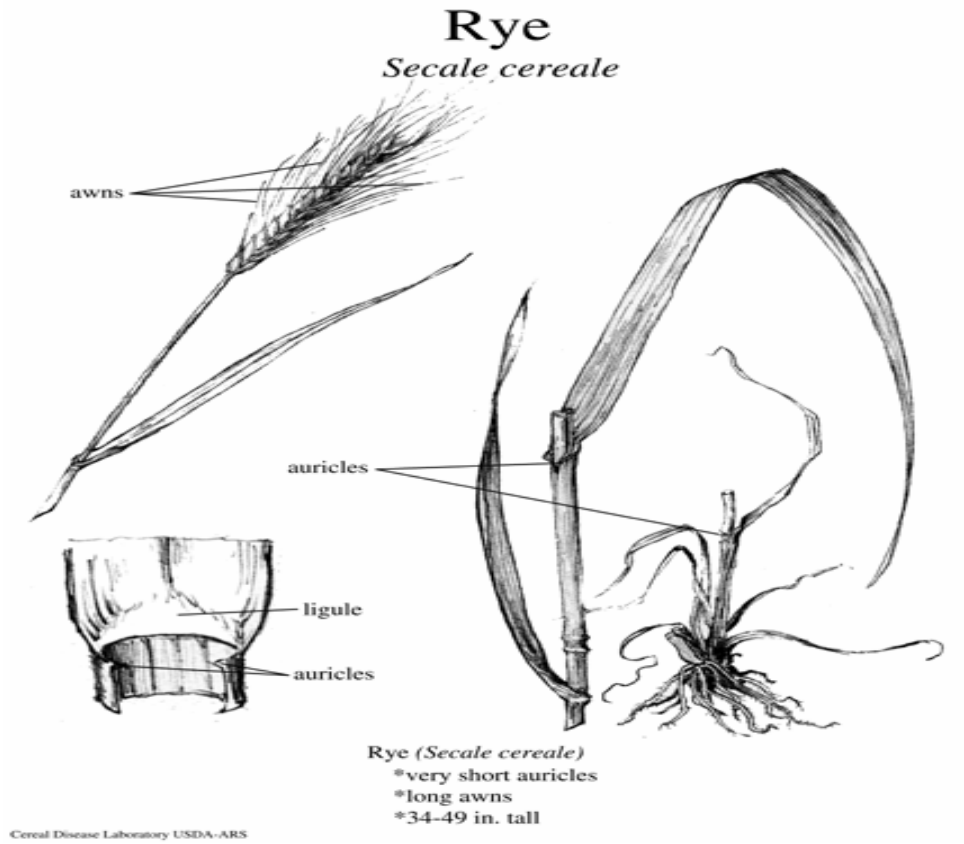

Fig. 43: Rye Distinguishing Characteristics

3.11 SOYBEANS (*Glycine max* L.)

DURING GROWING SEASON

Because of the soybean canopy it is generally difficult to rogue plants before leaf fall. However, there are some distinguishing plant characteristics that are useful. Flower color is either purple or white. Leaf shape may be either ovate (rounded) or lanceolate (narrow and long). The ovate type is most common. Varieties with ovate leaves have a genetic potential of three seeds per pod, whereas narrow-leafed varieties have a maximum potential of four seeds per pod.

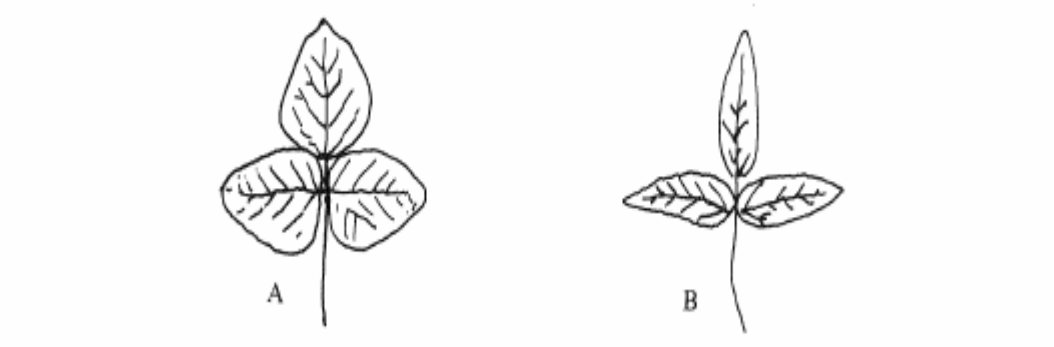

Fig. 44: Soybean Leaf Types
A. Ovate (norm) B. Lanceolate

AT MATURITY

Soybean varieties cover a side range of maturity, thus a single variety can have earlier- and/or later maturing off-types in it. Varieties of a given maturity also differ in plant height but earlier-maturing off-types would generally tend to be shorter and later maturing off-types would generally tend to be taller. Other factors such as variability in time of emergence, in soil and fertility, and in disease and pest damage may cause variability in maturity across a plot, thereby making it difficult to distinguish maturity and height off-types.

Soybean plants have hairs (pubescence) on the stems, leaves, and pods which are different colors, usually either brown or gray. The brown color begins to develop mid-season and is most conspicuous after leaf drop. The brown is a dark yellowish-brown color, readily distinguishable from gray.

In addition to pubescence color, the outer walls of pods may be either a dull, light brown or a bright tan. However, with the passing of time after maturity, the tan weathers and becomes difficult to distinguish from brown.

Fig. 45: Soybean Crop: Tawny Pubescence

Fig. 46: Soybean Pod Pubescence

SEED TRAITS

Soybean varieties have yellow seed coats. Variants occur as a result of a recessive gene mutation producing black, brown-black, brown or light brown seeds depending on the genetic makeup of the variety (see each varietal description). These colored variants will breed true and in order to avoid buildup should be removed from seed being used to plant plots. (Note: Although all colored seed are removed, some may re-appear the next fall as the result of segregation.)

Soybean varieties have either yellow (sometimes referred to by the trade as "white"), light brown (buff), brown, brown-black, gray, or black hila. Check the varietal description as to the norm and any variation present in a variety. Environmental-induced variability within a seed lot may make it difficult to distinguish some colors. For example, an intensely colored light brown hilum may appear similar to a weakly colored brown-black hilum. Any soybeans that can be distinguished as having off-type hila should be removed from seed being used to plant plots.

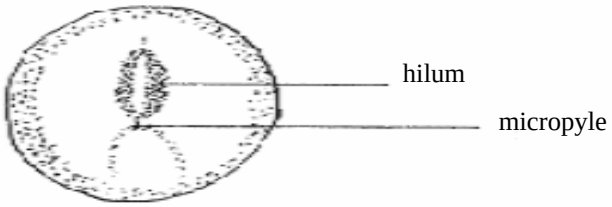

Fig. 47: Top View of Soybean Seed

Varieties may also differ in seed size. Although there is a range of seed size within each seed lot, it is possible to separate out seeds that are exceptionally smaller or larger than the norm for a variety.

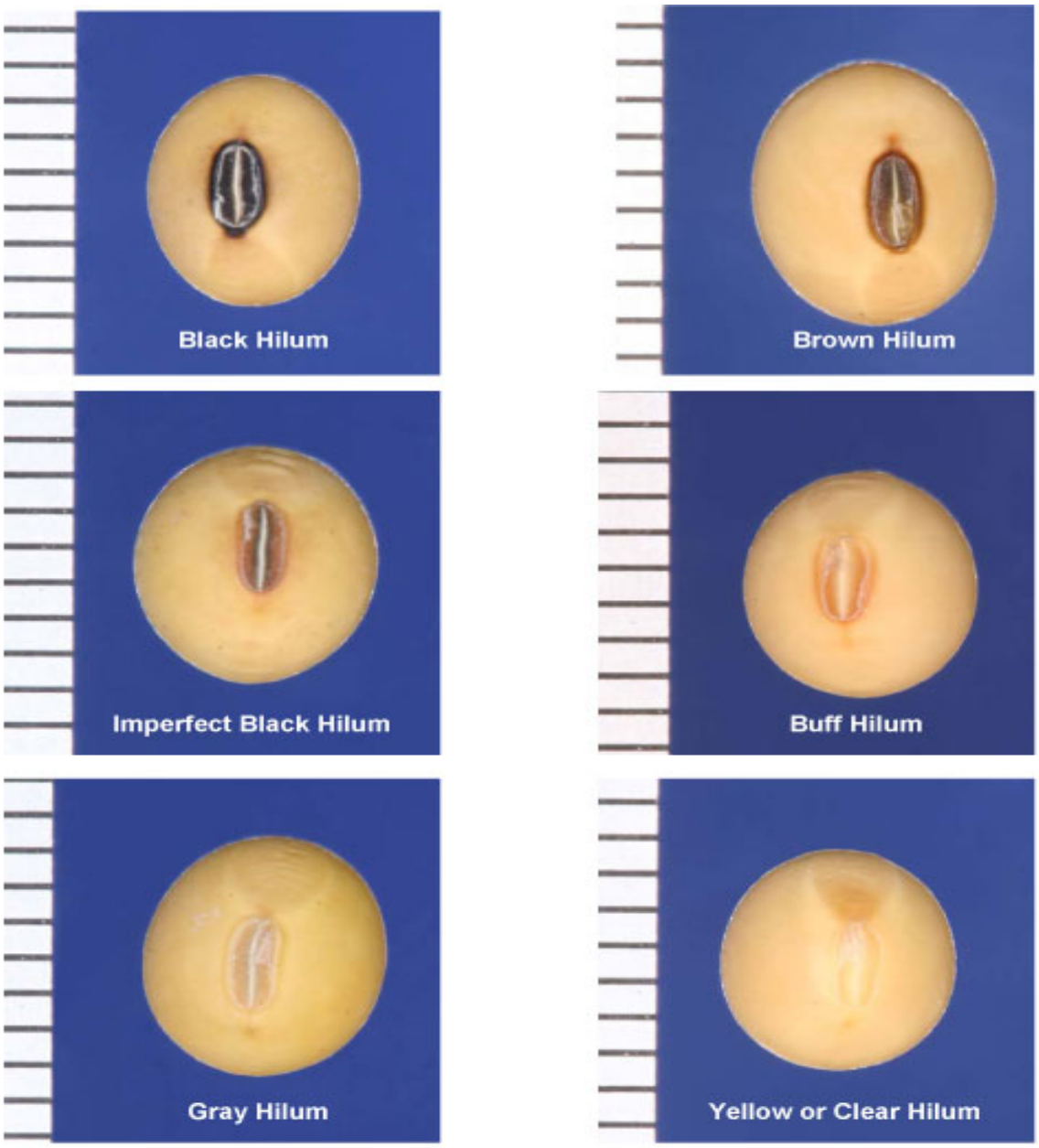

Fig. 48: Soybean Hilum Color

ADDITIONAL INFORMATION

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3.12 TRITICALE (*Triticosecale* L.)

Triticale is a self pollinated crop species originating from a combination of wheat and rye. Although self pollinated triticale may appear to be more variable in appearance than wheat. Triticale usually has rather long and lax spikes but can show the range of shapes found in wheat. Triticale spikes can have three to five florets per spikelet, however four fertile florets is quite common. Glume shapes in triticale cover the range of glume shapes in common wheat and can be either glaborous or pubescent. Fully awned, awnletted and awnless types are possible in triticale. Spikes can be erect, semi-erect or nodding. Triticale seed is larger than in wheat or rye and appears more wrinkled on the dorsal side. Current varieties are red seeded but other seed coat colors are possible.

Triticale can be spring, winter or intermediate in growth habit.

ADDITIONAL INFORMATION

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Fig. 49: Triticale Spikes (Heads) of different varieties

3.13 WHEAT (*Triticum aestivum* L.)

PLANT FORM

Plant height, general form of the head, color of the plant and head and the presence of awns are all useful major characteristics for identifying potential rogues. Plants can be examined for more specific minor characteristics to make positive identification.

SPIKE SHAPE

Wheat heads differ in shape, length, and width. Varieties have characteristic head shapes and attitudes. Head or spike shapes are classified as:

- Fusiform, if widest in the middle and tapering to both tip and base
- Oblong, if uniform in width and thickness throughout the length of the spike
- Clavate, if the upper part of the spike is broader and more dense
- Elliptical, if the spike is short, compacted and round at both ends

The spike may be carried erect, slightly inclined or fully nodding. The attitude will vary slightly with stage of kernel development in the spike. The color of wheat heads varies with the variety and can be either white or red. The kernels may be white or red independent of the chaff color.

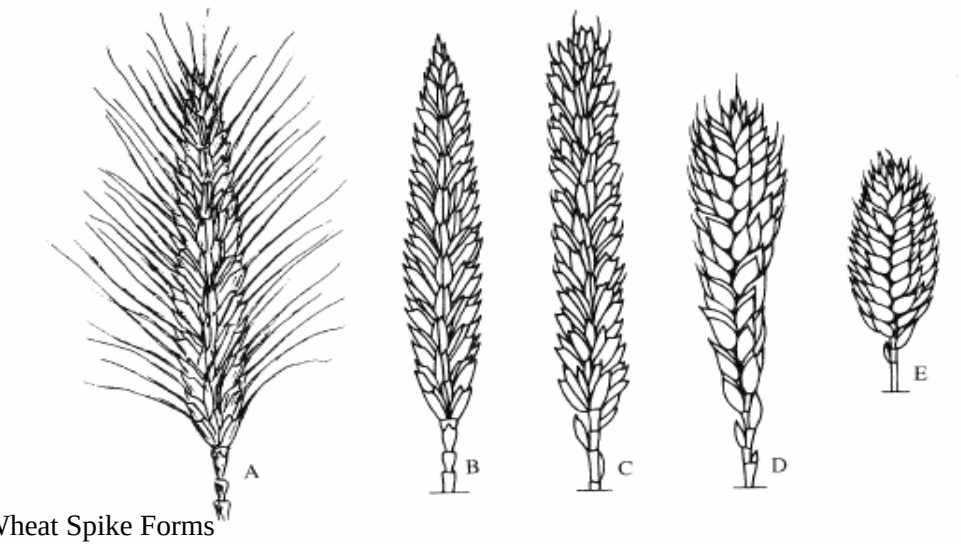

Fig. 50: Wheat Spike Forms
A. Fusiform Bearded (Awned) C. Oblong Apically Awnletted E. Elliptical or Club
B. Fusiform Bald (Awnless) D. Clavate Awnletted

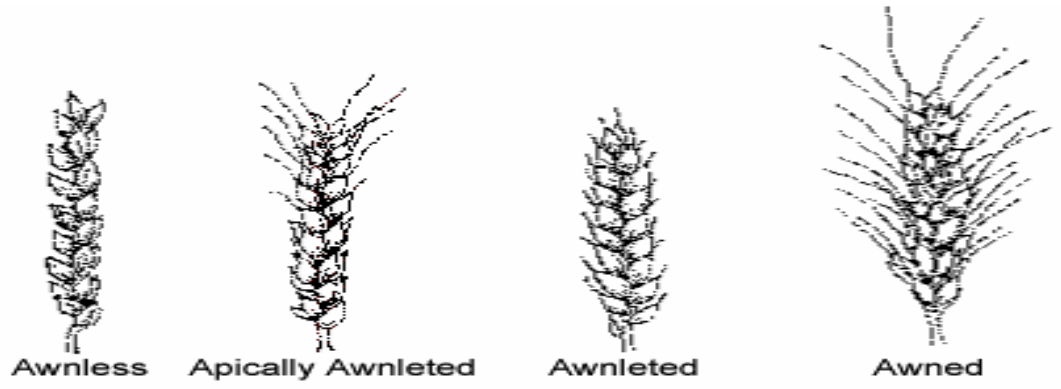

Fig. 51: Wheat Spike Awns

Fig. 52: Wheat Spikes (Heads) (left to right)
Awned, Awnless, Awnleted, Awned

Fig.53: Awned Wheat Spikes

Fig. 54: Awnless Wheat Spikes
with fusarium damaged head in center

Fig. 55: Apically (tip) Awnleted Wheat Spike

WHEAT GLUME SHOULDER AND BEAK SHAPES

The sizes, shapes and colors of the outer wheat glumes are very useful identification characters. Glume identification characters are generally best expressed in the middle spikelets. For the sake of uniformity the fifth spikelet from the bottom is one used to examine glume shape.

In more mature stages, the kernels also have reliable identification characteristics.

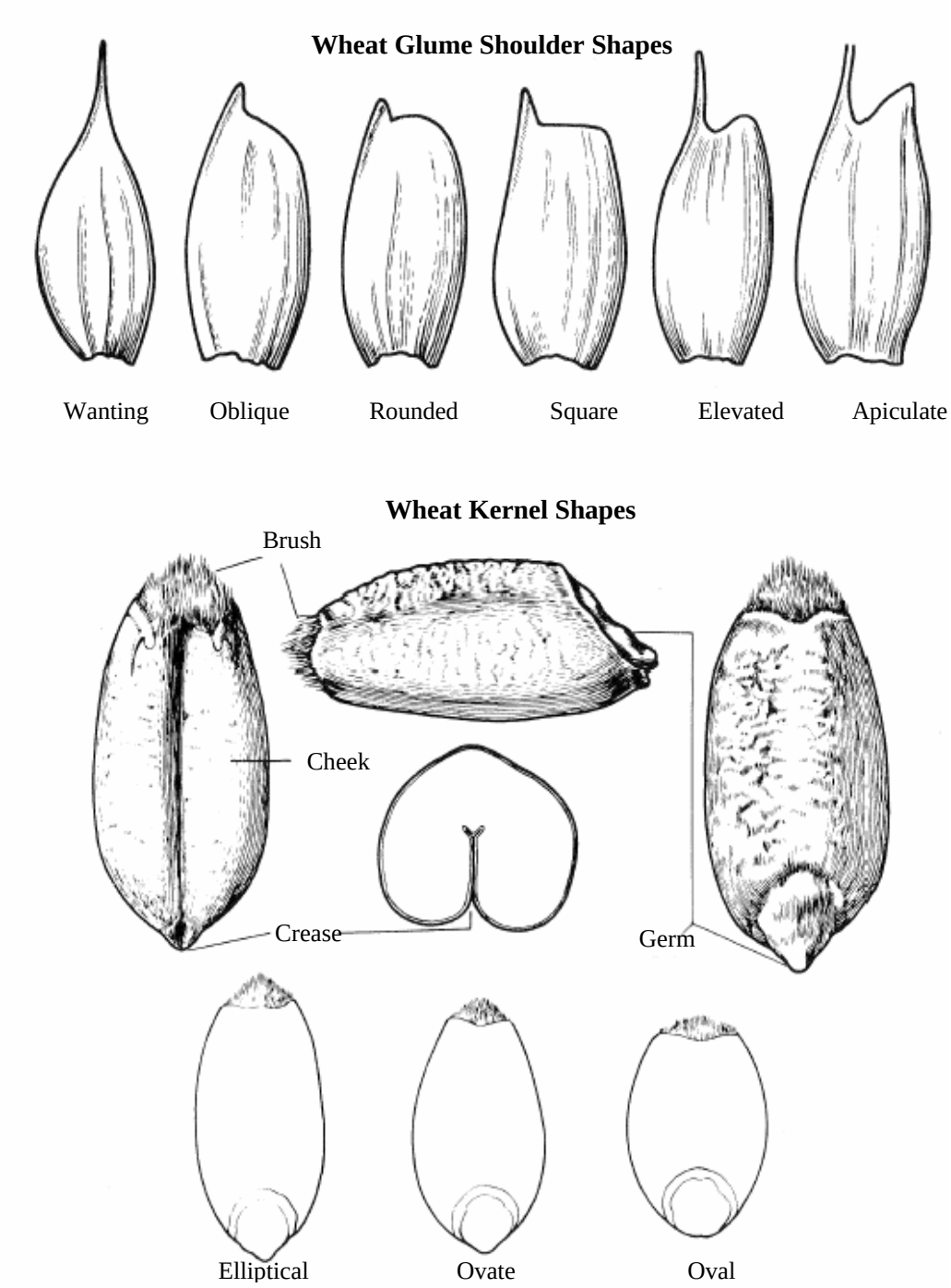

Fig. 56: Wheat Glume and Kernel Shapes

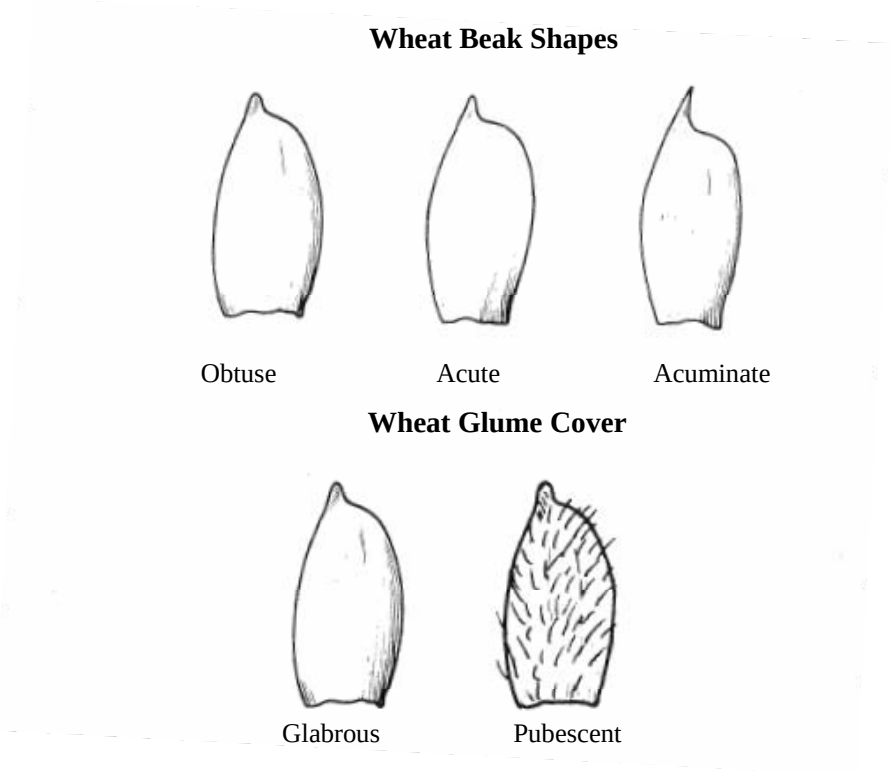

Fig. 57: Wheat Kernel Beak Shapes and Glume Covers

STEM

Stem color is a varietal characteristic. Color can range from the creamy white of most current varieties to yellow to the purple straw of some winter wheats. The degree of color is dependent on the stage of maturity and a number of growth factors. Therefore colored straw can be interpreted reliably but its absence in an individual plant does not in itself indicate a rogue.

SPELTOIDS

Speltoids are common mutants in wheat fields. Speltoids can appear in a number of different forms the most common and readily visible of these being the "Tall Late". This speltoid is taller and later than normal for the variety. The heads are longer and thinner with a distinct taper from base to tip. The glumes are strongly keeled with a square shoulder and generally are stiff and cannot be bent away from the spikelet without breaking. Speltoids tend to be self eliminating because they are late maturing, hard to thresh, small seeded and often have low fertility. The only sure way of keeping their numbers within acceptable limits however, is by vigorous roguing.

DISEASE REACTION

Susceptibility or resistance to mildew, rust and smut diseases in some cases may be used as a criteria for rogue identification, if the conditions are favorable for the infection and development of these diseases.

WINTER WHEAT

Winter wheats are the same species as spring wheats and therefore share the same identification characters. Winter wheat differs from spring wheat merely by having its winter habit. It requires exposure to cool temperatures to initiate stem growth.
The most serious rogues in winter wheat are other varieties of winter wheat and fall rye.

DURUM WHEAT (*Triticum turgidum* L.)

Durum is a distinct and separate species from the common species of bread, pastry, and winter wheats. While there is some difference in the degree of expression, the same identification characters used for common wheat are also used for durum wheats. The heads of all current varieties are fully awned. The awns may appear to have a tinge of black just prior to maturity which changes to buff or white as they mature. The awns in some varieties tend to break off at maturity. Compared to wheat, durum heads are more compact and appear squarish in cross section. The outer glumes of current varieties are glabrous and covered with a heavy bloom; they are sharply keeled and the color can vary through shades of brown or white.

The kernels are keeled, angular and much larger than common wheat. They are amber colored, harder and more translucent than common wheat.

SPELT (*Triticum spelta* L.)

Spelt is a hexaploid species of wheat, was an important staple in medieval Europe and has found a new market as a health food crop. Spelt is sometimes considered a subspecies of wheat (*T. aestivum*) and is then considered to be *Triticum aestivum* subsp. *spelta*.

The same identification characters used for wheat are also used for spelt. Compared to wheat, spelt heads are longer and thinner with a distinct taper from base to tip. Like speltoid mutants, spelt glumes are strongly keeled with a square shoulder and generally are stiff and cannot be bent away from the spikelet without breaking.

Fig. 58: Spelt Spikes (Heads), Awned and Awnless

ADDITIONAL INFORMATION

A valuable source of roguing information can be pedigreed seed crop inspectors and the training documents used by Canadian Food Inspection Agency (CFIA) to certify and authorize pedigreed seed crop inspectors.. The general training document, *Pedigreed Seed Crop Inspection Procedures*, is available at: http://www.inspection.gc.ca/english/plaveg/seesem/proc/qsp142-1e.shtml and Specific Work Instructions for Wheat are in the *Cereal Crop Inspection Procedures* at: http://www.inspection.gc.ca/english/plaveg/seesem/man/swi-cereale.shtml .

4.0 GLOSSARY and ADDITIONAL INFORMATION

Acute	Having a sharp and rather abrupt point.
Aleurone	The outer layers of the endosperm of a cereal seed.
Auricles	Ear shaped appendages of the leaf sheath encircling the stem at the juncture of the leaf blade and the leaf sheath.
Bilateral	Having two sides.
Chromosomes	Rod-shaped bodies, in the nucleus of plant cells, carrying the units of inheritance. The number of chromosomes in any species is usually constant.
Culm	The stem of cereals and grasses.
Dehiscent	Sudden opening or shattering of seed pod at maturity
Dense	Crowded closely together.
Elliptical	Narrow and tapering at each end.
Floret	Simple flower of the cereals, consisting of the lemma and palea containing an ovary with two feathery stigmas, three stamens and two lodicules at the base of the ovary.
Gene	The unit of inheritance arrange linearly in the chromosome.
Glume	One of a pair of dry bracts at the base of and enclosing the spikelet of grasses and cereals.
Homozygous	A plant or variety is homozygous for a given character when all its germ cells transmit identical genes for this character.
Inflorescence	The arrangement of the flowers of a plant.
Internode	The portion of stem between two nodes.
Lax	Arranged loosely.
Lemma	The lower of the two bracts enclosing the grass flower, sometimes called the flowering glume.
Ligule	Membranous outgrowth arising from the junction of the leaf blade and leaf sheath in many grasses.
Mutation	A sudden heritable variation that results from changes in a gene or genes.
Node	The point of the stem from which leaves arise.
Norm	The description of the characteristics of the variety; or plants that agree fully with the description.
Oblique	Slanting of unequal sides.
Oblong	Longer than broad with nearly parallel sides.
Obtuse	Rounded or blunt.
Palea	The upper bract enclosing the grass flower.
Pedicel	A small stalk.
Pendulous	Hanging down.
Petiole	The stalk of a leaf.
Physiologic	The vital processes and function of an organism.
Raceme	A definite inflorescence with main axis bearing stalked flowers.
Rachilla	A secondary axis in the inflorescence of grasses; the axis of a spikelet.
Rachis	The axis of a spike.
Sepal	One of the parts forming the calyx of the flower. It is usually green and protects the rest of the flower in the bud.
Spikelet	A secondary spike, the unit of the inflorescence in grasses, and generally consisting of two outer glumes and one or more enclosed florets.
Terminal	Situated at the tip.

ADDITIONAL INFORMATION

A valuable source of additional information can be pedigreed seed crop inspectors and the training documents used by the Canadian Food Inspection Agency (CFIA) to certify and authorize pedigreed seed crop inspectors.. The general training document, *Pedigreed Seed Crop Inspection Procedures* is available at: http://www.inspection.gc.ca/english/plaveg/seesem/proc/qsp142-1e.shtml . Directions to Specific Work Instructions for inspecting specific crop kinds are provided in Section 3. of this manual.

Related information on seed and crop certification is available from the following websites:

- CSGA: www.seedgrowers.ca;
- Canadian Seed Institute: www.csi-ics.ca;
- CFIA pedigreed seed crop inspection procedures: www.inspection.gc.ca.

The following publications are available from the Canadian Seed Growers' Association:

- *Regulations and Procedures for Pedigreed Seed Crop Production (Circular 6)*
- *Regulations and Procedures for Breeder Seed Crop Production*
- *Pedigreed Seed Plot Production Quality Manual*
- *Pedigreed Forage Seed Production*