Canadian Food Inspection Agency
Agence canadienne d'inspection des aliments

SWI 142.1.2-5

SEED PROGRAM SPECIFIC WORK INSTRUCTIONS

FORAGE, TURF, GROUNDCOVER AND NATIVE SPECIES PEDIGREED SEED CROP INSPECTION PROCEDURES

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DATE

This version of the Forage, Turf, Groundcover, and Native Species Pedigreed Seed Crop Inspection Procedures was issued May 15, 2006.

CONTACT

The contact for this Seed Program Specific Work Instruction (SWI) is the Chief, Import and Domestic Office, Seed Section.

REVIEW

This Seed Program Specific Work Instruction (SWI) is subject to periodic review. Amendments will be issued to ensure the SWI continues to meet current needs.

ENDORSEMENT

This Seed Program Specific Work Instruction is hereby approved.

_____ _____
Director, Plant Production Division Date:

DISTRIBUTION

The most up to date version of this document will be maintained on the CFIA Intranet site (Merlin) and/or Internet site. In addition, the signed original will be maintained by the National Manager, Seed Section.

0.0 INTRODUCTION

The purpose of pedigreed seed crop inspection is to provide a third party unbiased inspection and the completion of a report for the Canadian Seed Growers' Association (CSGA) noting the isolation, condition, and purity of the crop. It is the inspector's responsibility to describe the crop as observed at the time of inspection.

1.0 SCOPE

This Seed Program Specific Work Instruction (SWI) outlines the procedures that a crop inspector will follow in inspecting forage crops and related species for pedigreed seed crop status. The crop inspection program ensures that crops grown for pedigreed status meet the requirements for varietal purity and crop standards as specified by CSGA's *Canadian Regulations and Procedures for Pedigreed Seed Crop Production* (Circular 6). The procedures may also be used for the inspection of seed crops of grasses and legumes of similar species where the seed will be used to establish lawns or turf, for reclamation purposes or for the establishment of native stands.

This SWI applies in all cases where CFIA crop inspection services are provided for perennial forages, turf, groundcover, native species and similar species.

2.0 REFERENCES

The publications referred to in the development of this SWI are those identified in SPRA 111 and QSP 142.1. In addition, the following were used:

a) Pedigreed Forage Seed Production, Canadian Seed Growers' Association, 1996.
b) Certification Handbook, Association of Official Seed Certifying Agencies, 1993.
c) Forages, Third Edition, M.E. Heath et al., Iowa State University Press, 1978.
d) Licensed Varieties of Cultivated Grasses and Legumes, Agriculture Canada, 1974.
e) Alberta Forage Manual, Alberta Agriculture, 1981.
f) OECD Guidelines for Control Plot Tests and Field Inspection of Seed Crops, OECD, 2001.
g) Wild Purple Prairie Clover, Oak Prairie Farm, 2003.
h) *Dalea candida*, White Prairie Clover, Easyliving Wildflowers, 2003.
i) White Prairie Clover, John Hilty, 2002.
j) Purple Prairie Clover, M. Haddock, 1997.
k) USDA-NRCS, The PLANTS Database (http://plants.usda.gov/plants). National Plant Data Center, Baton Rouge, LA 70874-4490 USA, 2003.
l) *Agrostis stolonifera*, USDA Forest Service (Fire Effects Information System), 2003.
m) Creeping Bentgrass Description, University of Illinois Turfgrass Program, 2000.
n) Creeping Bentgrass, University of Kentucky, 2003.
o) Canary Grass, IENICA, 2003.
p) Canarygrass, Putnam et al., 1990.
q) Poaceae of the Canadian Arctic Archipelago: Descriptions, Illustrations, Identification, and Information Retrieval. Version: 10th December 2001, S.G. Aiken et al., 1995 onwards.

r) Hard Fescue, S. Smoliak et al., 2003.
s) Guide to Grasses, Pawnee Buttes Seed Inc., 2001.
t) Native plants - Tufted Hairgrass, Washington State University, 2003.
u) Tufted Hairgrass, USU Extension, 2002.
v) Western Wetland Flora - Field Office Guide to Plant Species, Northern Prairie Wildlife Research Centre, 2003.
w) *Deschampsia cespitosa*, André Bonneau, 2003.
x) Slender Wheat Grass, Mississipppi National River and Recreational Area, 2002.
y) Blue Grama, M. Haddock, 2001.
z) Little Bluestem, J. Isaacs, 1992.
aa) Little Bluestem, Magness et al., 1971.
ab) Little Bluestem, Sharp Brothers Seed Company, 1999.
ac) Botanical and Ecological Characteristics (*Bromus ciliatus*), USDA Forest Service (Fire Effects Information System), 2003.
ad) *Bromus Ciliatus* L. Fringed Brome-Grass, West Virginia University Extension Service (Agriculture and Forestry), 2003.
ae) Green Needle Grass (*Stipa viridula*), Alberta Prairie Conservation Forum, 2003.
af) *Stipa viridula*, André Bonneau. 2003.
ag) Needle-and-thread Grass (*Stipa comata*), S. Smoliak et al., 2003.
ah) Needle-and-Thread, USU Extension, 2002.
ai) Beardless Wildrye, S. Smoliak et al., 2003.
aj) Siberian Wheatgrass, Magness et al., 1971.
ak) Siberian Wheatgrass, S. Smoliak et al., 2003.
al) Alpine Bluegrass, Pawnee Buttes Seed Inc., 2003.
am) Alpine Bluegrass, Prairie Seeds, 2003.
an) Dahurian Wildrye, in Re-Grassing Farmland: A Practical Guide to Selecting The Right Forage Species, AgriCarta, 1999.
ao) A general system for coding taxonomic descriptions. Taxon, 29: 41-46, Dallwitz, M.J., 1980.
ap) User's Guide to DELTA: a general system for processing taxonomic descriptions. 4th ed. Dallwitz, M.J. et al., 1993 onwards.
aq) User's Guide to Intkey: a Program for Interactive Identification and Information Retrieval. 1st edition. Dallwitz, M.J. et al., 1995 onwards.
ar) Interactive keys. In Information Technology, Plant Pathology and Biodiversity, pp. 201-212. (Eds P. Bridge, P. Jeffries, D.R. Morse, and P.R. Scott.) (CAB International: Wallingford.), Dallwitz, M.J. et al., 2000.
as) Flora of the Canadian Arctic Archipelago: Descriptions, Illustrations, Identification and Information Retrieval, Aiken, S.G., et al., 1999 onwards.
at) 111 Range and Forage Plants of the Canadian Prairies, Looman, J., 1983.
au) Wild Plants of the Canadian Prairies, Best, Keith, F., and Budd, Archibald, C., 1964.
av) Common Plants of the Western Rangelands, Tannas, Kathy.
aw) OECD List of Varieties Eligible for Certification, OECD, 2001.

3.0 DEFINITIONS

For the purposes of this SWI, the definitions given in SPRA 101, QSP 142.1 and the following apply,

Apomixis -	The development of seed without the fusion of pollen and ovule.
Circular 6 -	Canadian Seed Growers' Association, *Canadian Regulations and Procedures for Pedigreed Seed Crop Production*.
Cross-pollination -	Fertilization by pollen of another plant.
Ecovar -	Collection or assemblage of native plant species usually collected from a large geographic area of genetic diversity that are developed by phenotypic selections for specific traits.
Forage crop -	A crop of cultivated plants or plant parts, other than separated grain, produced to be grazed, or harvested to be used as feed for livestock. Grasses to be used in land reclamation also fall under the forage crop category.
Hybrid -	In forage species, two types of hybrids exist: a) intergeneric or interspecific hybrids between closely related species; the progeny of these hybrids progress through seed multiplication in the same manner as traditional crops b) hybrids resulting from controlled pollination within a species as in hybrid corn or hybrid canola
Intergeneric hybrids -	Hybrids resulting as a result of two different genera being crossed together. For example *Festulolium* from *Festuca pratensis* and *Lolium perenne*.
Interspecific hybrids -	Entirely new varieties created by the complex hybridization of two different species. For example the R/S (*Agropyron repens* and *Agropyron spicatum*) hybrid developed through hybridization of couchgrass and beardless wheatgrass.
Off-types -	Plants in a seed crop which deviate by one or more characteristics from the official description of the variety.
Pre-Variety Germplasm -	Indigenous or non-indigenous plant material including propagating material of species, selections, clones or interspecific hybrids which have not been released as a variety. This plant category does not fit into traditional certification systems as the selection intensity of traditional crop breeding programs that result in varieties is often not appropriate for native plant species where maintaining genetic diversity for reclamation and conservation plantings is more important than specific agronomic characteristics.

Selected Class -	A seed class recognized under the Pre-Variety Germplasm certification program. Seed of this class is produced from phenotypically selected plants of untested parents that have the potential of genetic superiority or distinctive identifiable traits.
Self-pollination -	Fertilization of a plant by its own pollen.
Source Identified -	A seed class recognized under the Pre-Variety Germplasm certification program. Seed of this class is produced from a parental population where no selection or testing has been done. The seed is source identified for a specific geographic location. Both seed from native stands and seed production crops are eligible for this class.
Variant -	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) was originally part of the variety as released. It is not an off-type.
Volunteer plants -	Unwanted plants growing from residual seeds from the previous crop or a replanted crop.

4.0 SPECIFIC INSPECTION PROCEDURES

4.1 Assessment of Application for Crop Inspection

Upon receipt from the CSGA, the inspector must review the submitted application and preprinted forms. In addition to the standard application information, the application should also be reviewed for the following additional information specific to forages:

- Whether the crop is eligible for pedigreed status based on the appropriate application information including the age of stand and the seed used to establish the crop.

- Since this is a perennial crop, was the crop inspected last year, and if so, did it receive pedigreed status?

- A field layout with planting plan for hybrid alfalfa being produced using parental lines planted in rows or bays.

If any of the above information is missing, the applicant should be contacted to ensure that all necessary information is present before the initial inspection of the crop.

In Canada, breeders have two options for seed multiplication. The variety may proceed

from Breeder seed to Foundation and Certified Seed or from Breeder Seed to Foundation, Registered and Certified seed. Information on the classes of seed for a specific variety are often found in the variety description under "Additional Information".

The Canadian Seed Growers' Association sets standards for the maximum age that a stand/crop may reach in order to produce pedigreed seed. The breeder may, at his or her discretion, set ages of stand for crops producing seed of his or her variety that are more restrictive than the CSGA standards. Where this has occurred, the ages of stand are listed on the description of variety in the "Additional Information" section.

4.2 Crop Inspection

The procedures for pedigreed seed crop inspection provided in QSP 142.1 must be used.

Each grass crop requires inspection at full head emergence, while legumes must be in bloom.

The inspector must review the varietal description to become familiar with the characteristics of the variety and allowable variants. The application must be checked for previous land use to identify the potential for volunteer plants. The inspector must refer to:

- Appendix V for descriptions of forages and related species to assist in identification.
- CSGA Circular 6 section 'Age of Stand' to observe the restrictions according to pedigreed class.
- CSGA Circular 6 for isolation distances for forage crops and related species.
- CSGA Circular 6 for the requirements of border removal in lieu of isolation.

As plant population density is often low or very high in older stands, it may be difficult to identify individual plants, making it difficult to arrive at a 10 000 plant population. In this case counts should be done by area. If this alternative method is used, the inspector must identify the reason for performing the counts on an area basis in the Comments section of the Report of Seed Crop Inspection.

When border removal is used as an alternative to isolation distances, the inspector must ensure that the border was allowed to shed pollen before being discarded.

The following procedure should be used to do counts of impurities and off-types by area:

- for Foundation crops, the size of the count area is 100 square metres. As per Circular 6, the maximum impurity tolerance is 0.1%, which is 1 plant per 100 square metres.
- for Registered and Certified crops, the count area is 10 square metres. As per Circular 6 the tolerance is 1% for these crops, which is 1 plant per 10 square metres.

The inspector must report the numbers of other crop kinds and weeds that may appear in the crops as indicated in Appendices II and III.

4.3 Completion of the Report of Seed Crop Inspection (CFIA/ACIA 1115)

The preprinted Report of Seed Crop Inspection (CFIA/ACIA 1115) received from CSGA is to be completed for crop inspection. If a non-preprinted form is used, state the reason in the Comments section of the Report of Seed Crop Inspection.

The inspection report must be completed fully, accurately and legibly to ensure the correct information is recorded by CSGA. Failure to do so may cause economic hardship to the grower who could lose the pedigreed status of the crop. Inspectors must not anticipate any action of the CSGA with respect to the acceptance or refusal of the pedigreed status. All information pertaining to crop inspection must remain confidential under all circumstances.

Key factors in completion of the report are:

- Abbreviations other than those presented in QSP 142.1 should not be used for forage reports, or areas on the form left blank or open. All efforts should be made to ensure correct spelling.
- Other crops or weeds difficult to separate are to be recorded by count in the section "for crops and weeds difficult to separate." Prohibited noxious and objectionable weeds are to be reported in the "objectionable weeds" section. Other weeds and crops easy to separate may be reported in the Comments section when they occur at a frequency which makes inspection difficult. See Appendices II and III.
- A cross-pollinated crop must be isolated from any possible contaminating sources of pollen in accordance with the standards outlined in sections 6.6 and 7.6 of the Circular 6. Any crop of a different variety, or non- pedigreed crop of the same kind within the maximum distance must be reported in the open pollinated crops section. If none are present, state "none within (required distance) of crop". Required distances vary according to field size, crop kind, and pedigree. If border removal has been done in lieu of isolation, the distance to the potential contaminating crop, its variety and pedigree, the distance removed in lieu of isolation and the time of removal in relation to pollination must be recorded.
- The area of Breeder plots should be reported as metres x metres. If the plots are found to be larger than permitted by Circular 6, the inspector must ensure the measurements are accurate to prevent economic hardship.

5.0 INSPECTION OF INTERSPECIFIC GRASS HYBRIDS

When a variety is of an intergeneric or interspecific hybrid, it may be difficult to distinguish between the hybrid and either parental species. A current example of this is the R/S (*Agropyron repens and Agropyron spicatum*) hybrid developed through hybridization of couchgrass (quackgrass) and beardless wheatgrass. When encountering

plants in crops of R/S hybrids that appear to be couchgrass, the plants are to be considered plants of the R/S hybrid. However, following R/S hybrid production, the onus will be on the grower to ensure thorough volunteer control.

When encountering plants in crops that were previously used to produce an R/S hybrid, the plants that appear to be couchgrass are to be reported as couchgrass. The onus will be on the grower to present information to the contrary to the CSGA.

6.0 INSPECTION PROCEDURES FOR PRE-VARIETY GERMPLASM CERTIFICATION

Native plant certification programs have been adopted by the Association of Official Seed Certifying Agencies (AOSCA) members including the CSGA. The purpose of this program is to verify the origin of native plant reproductive materials which have not been released as a variety. Pre-variety germplasm may be produced from a single plant, clone or stand of plants.

6.1 Seed Classes And Generations

There are two classes of seed recognized in Canada under this program: "Source Identified" and "Selected". For both classes, the pedigreed names for multiplication generations are replaced by generation designations.

"Generation $_0$" (G_0) is equivalent to Pre-Breeder seed and represents the original native stand collection for initial multiplication. G_1, G_2, G_3 and G_4 are equivalent to Breeder, Foundation, Registered and Certified classes respectively. The recognized plant breeder responsible for the plant line will determine the number of certification generations and include this in the description of the variety.

For species that reproduce asexually, one asexual generation is equivalent to one sexual generation. For each type of germplasm, inspection will be conducted when the crop is in bloom to verify isolation and freedom from off-types.

6.2 Land Requirements

The location of Source Identified parental material shall be defined by means of administrative, geographic, latitudinal or other descriptions.

For the Selected germplasm type, seed zones and/or breeding zones may be defined in order to indicate the location of naturally produced seed. Certification tags from reproductive material planted must be retained for the life of the stand and must be made available to CSGA upon request. Artificially established crops may be listed either by specific site or zonal definition.

A crop is eligible for certification providing it meets the following criteria:

- the reproductive material must not be a noxious weed under municipal, provincial or federal regulations;
- an established source is necessary, and is to be supported by either a Native Plant

Origin Report or proper documentation when the plant material is purchased from another source.

Applications for certification are made available from CSGA and must be completed and submitted to CSGA prior to the species specific deadline as indicated by CSGA. Completed applications for certification and maps must be provided to the CSGA. A description of the distinguishing morphological and physiological characteristics is required to be submitted along with the application.

The crop inspections of pre-variety germplasm are performed by CSGA recognized inspectors. Native stand collection sites G_0 will be inspected the initial year they are entered into the Source Identification program, and in subsequent years as deemed necessary by CSGA. This information is to be reported on the Native Plant Origin Report. Inspection of production areas are made each year prior to harvest. Inspections include verification of location, elevation and area size.

6.3 Isolation

Production areas must be isolated from plants of the same species of different or unknown genotypes in order to maintain identity purity for native plant certification. Species must be isolated as using distances as prescribed in CSGA or AOSCA regulations or certification policy, unless otherwise described in the variety description.

6.4 Weeds

The removal of objectionable plants is the responsibility of the grower and is required before seed crop inspection is performed. Reporting of weeds is to be performed as described in QSP 142.1 *Pedigreed Seed Crop Inspection Procedures.*

6.5 Maximum Impurity Tolerances

Unless otherwise specified by the variety description the following applies.

In a crop offered for G_2 status, the presence of other varieties, types foreign to the variety or other crop kinds (the seed of which are difficult to separate from the seeds of the crop offered for pedigree) must not exceed 0.1 per cent of the plant population of the inspected crop (i.e. 1 plant per 100 square metres).

In a crop offered for G_3 or G_4 status, the presence of other varieties, types foreign to the variety or other crop kinds (the seeds of which are difficult to separate from the seeds of the crop offered for pedigree) must not exceed 1 per cent of the plant population of the inspected crop (i.e. 1 plant per 10 square metres).

7.0 INSPECTION PROCEDURES FOR HYBRID ALFALFA

This refers to alfalfa hybrids resulting from controlled pollination. It does not refer to interspecific hybrids between *Medicago sativa* and *M. falcata.*

The italicized excerpt is from "Forages: The Science of Grassland Agriculture" by M.E. Heath, D.S. Metcalfe and R.F. Barnes (1973). The other information is from the AOSCA Certification Handbook.

A hybrid is the product of a cross between individuals of unlike genetic constitution. Unlike corn, ...the alfalfa flower is bisexual and cross-pollinated by bees. This makes pollination control difficult in alfalfa. For years, it was assumed that alfalfa was 90-95% cross pollinated, but studies indicate that the percentage of crossing is less.

Some type of pollen control must be used in hybrid seed production...Use of cytoplasmic male sterility is a....efficient method of pollen control. A scheme to produce a hybrid is (paraphrasing begins) a male sterile (female parent) that is crossed with a genetically different male fertile parent to produce a hybrid. The male sterile female line is maintained by crossing it with a genetically similar male fertile restorer line. The traditional method of producing a hybrid is to plant a series of female parent rows, leaving an empty row and planting a series of male parent rows. Seed is harvested solely from the female rows.

The only pedigreed class of hybrid alfalfa seed is Certified.

Parental lines used to produce the variety or to maintain a male sterile parent is pedigreed as Foundation seed.

The minimum isolation distance for the crops producing female parental lines (Foundation seed stock, i.e. maintainer or the male sterile x maintainer) is 400 m. Where the crop is producing female parent seed, a border of maintainer is desired.

The minimum isolation distance for crops producing male parental lines and hybrids is 200 m.

In producing either female parent seed (male sterile x maintainer) or hybrid seed, there must be at least 2 m between the blocks. The ratio of male sterile and either maintainer line or male fertile line shall not be more than 2:1.

Currently in Canada, hybrid alfalfa production involves the blending of parental seed in specific ratios with the seed of both lines being harvested. Rather than planting rows or bays of male and female parents, seed of male and female lines are blended together in a specific proportion under the supervision of the plant breeder. This blended seed is labeled as Synthetic Select seed with a CSGA label. This seed is planted to produce Certified seed. The isolation distances, previous land use, and impurity standards will be identical to those used for traditional crops (as per CSGA standards). The crop is to be inspected when in bloom to verify isolation distances.

Descriptions of the parental lines of registered hybrids are available on the Product Registration System. They may be retrieved by using the query function in the variety name field for "Male Parent of *Variety name*" or "Female Parent of *Variety Name*". An alternate method is to query on the variety registration number followed by -M or -F i.e. 2345-M . For hybrids developed by the blended seed method, you will need to contact the Variety Registration Office to determine the proportions of parental lines that should be present. This information is considered to be confidential.

7.1 Pollen Production Index

At the time of inspection, the Pollen Production Index (PPI) of the male sterile (female) parent must be determined. This is done by examining untripped flowers on 200 plants. Plants must be sampled in a manner that is representative of the crop. Inspectors must classify each of the 200 plants as:

Male Sterile (MS) - no pollen
Partially Male Sterile (PMS) - trace amount of pollen
Partially Fertile (PF) - substantially less than normal amount of pollen
Fertile (F) - normal pollen

Inspectors must be careful when examining pollen to determine the level of fertility. Empty pollen sacks may be confused with intact pollen. Empty pollen sacks can be found on fully sterile flowers.

To determine the PPI, the number of plants in each class of fertility must be multiplied by a factor, the results all classes are added together and divided by the total number of plants examined to come up with an index value for the crop. The factors are as follows:

MS multiply the number of plants by 0
PMS multiply the number of plants by 0.1
PF multiply the number of plants by 0.6
F multiply the number of plants by 1

The maximum allowable PPI for a Foundation crop would be 0.14. The maximum allowable PPI for a Certified crop with a 95% hybridity standard is 0.06. The maximum allowable PPI for a Certified crop with a 75% hybridity standard is 0.42.

If less than 68% of the plants are male sterile, then no further examinations are required because the crop will not meet CSGA requirements. If more than 80% of the plants are male sterile, no further examinations are required because the crop will clearly meet CSGA requirements. If between 68% and 80% of the plants are male sterile, then another 100 plants shall be sampled and included in the calculation.

The results for inspected crop's PPI must be reported on the Pollen Production Index Worksheet and submitted along with the completed Seed Crop Inspection. The information on the worksheet should include documentation of the shape of the field, the travel pattern followed and the location at which plants were examined to obtain the PPI.

APPENDIX I: REPRODUCTION MECHANISM FOR FORAGE SPECIES

In general, forage legumes and grasses are generally considered to be predominantly cross pollinating i.e. seed is produced by fertilization by other plants. Some self pollination is expected to occur. However, slender and awned wheatgrass and nodding bromegrass are considered to be highly self-pollinated species. Kentucky bluegrass is considered to be highly apomictic, such that it is capable of producing offspring without the fertilization of the egg.

APPENDIX II: REPORTING OF OTHER CROP KINDS DIFFICULT TO SEPARATE

	Crop Kind	Other Crop Kinds to Report
LEGUMES	Alfalfa	Canola, Red Clover, Sweet Clover
	Alsike Clover	Timothy, Birdsfoot Trefoil, Black Medick, White Clover
	Birdfoot Trefoil	Alsike Clover, Black Medick, White Clover
	Black Medick	Alsike Clover, Birdsfoot Trefoil, White Clover
	Cicer Milkvetch, Crownvetch	Canola, Other Vetch species
	Red Clover	Alfalfa, Sweet Clover
	Sainfoin	Barley, Oat, Wheat
	Sweet Clover	Alfalfa, Red Clover
	White Clover	Alsike Clover, Birdsfoot Trefoil, Black Medick

	Crop Kind	Other Crop Kinds to Report
GRASSES	Bentgrasses	Bluegrasses, Orchardgrass, Redtop, Other Bentgrasses
	Bluegrasses	Bentgrasses, Orchardgrass, Redtop, Other Bluegrasses
	Bromegrasses	Meadow Fescue, Wheatgrasses, Wild Ryes, Other Bromegrasses
	Fescue	Bromegrasses, Ryegrasses, Wheatgrasses, Wild Ryes, Other Fescues
	Orchardgrass	Bentgrasses, Bluegrasses, Redtop
	Redtop	Bentgrasses, Bluegrasses, Orchardgrass
	Reed Canarygrass	None
	Ryegrasses	Fescues, Wheatgrasses
	Timothy	None
	Wheatgrasses	Bromegrasses, Fescues, Ryegrasses, Wild Ryes, Other Wheatgrasses
	Wild Rye	Fescues, Wheatgrasses, Other Wild Ryes

Other crop kinds found in inspected legume or grass crops are to be reported on a per area inspected basis.

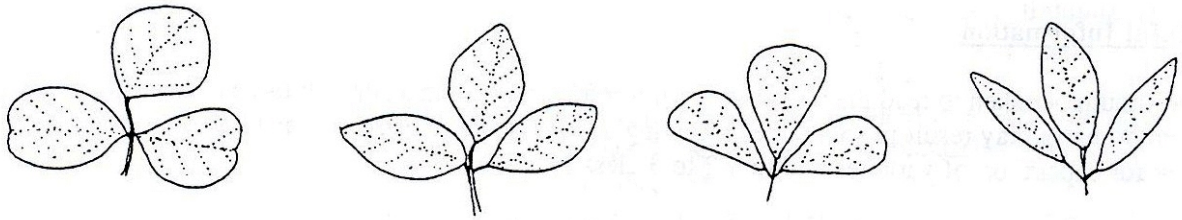
APPENDIX III: WEEDS TO REPORT IN INSPECTED CROP

Inspected Crop	Weeds that may be "Difficult to Separate"	"Objectionable" Weeds
LEGUMES		
Alfalfa, Black Medick, Cicer Milkvetch, Crown Vetch, Red Clover, Sainfoin, Sweet Clover	None	American Dragonhead, Bladder Campion, Canada Thistle, Cleavers, Cow Cockle, Dock, Green Foxtail, Hemp Nettle, Kochia, Night-flowering Catchfly, Redroot Pigweed, Round-Leafed Mallow, Russian Pigweed, Russian Thistle, Stickseed, White Cockle, Wild Mustard
Alsike Clover, Birdsfoot Trefoil, Persian Clover, White Clover	None	American Dragonhead, Bladder Campion, Canada Thistle, Cleavers, Dock, Green Foxtail, Hemp Nettle, Kochia, Lambsquarters, Night-flowering Catchfly, Redroot Pigweed, Russian Pigweed, Russian Thistle, Smartweed, Stickseed, White Cockle, Wild Mustard
GRASSES		
Bromegrass	Couchgrass, Downy Brome	Barnyard Grass, Canada Thistle, Green Foxtail, Lambsquarters, Wild Oats
Fescue, Ryegrass, Wheatgrass, Wild rye	Couchgrass	Barnyard Grass, Beckmann's Grass, Beggars Tick, Canada Thistle, Cinquefoil, Cleavers, Dock, Downy Brome, Green Foxtail, Hawksbeard, Lambsquarters, Persian Darnel, Russian Pigweed, Scentless Chamomile, Shepard's Purse, Sow Thistle, Stickseed, Stinkweed, Wild Barley, Wild Oats
Bentgrass, Bluegrass, Orchardgrass, Redtop, Reed Canarygrass	None	Barnyard Grass, Canada Thistle, Chickweed, Cleavers, Couchgrass, Crabgrass, Dock, Flixweed, Heal-all, Lambsquarters, Night-flowering Catchfly, Ox-eye Daisy, Panic Grass, Rat's-tail Fescue, Rough Cinquefoil, Stickseed, Windgrasses
Timothy	Ox-eye Daisy	Barnyard Grass, Bladder Campion, Canada Thistle, Chickweed, Cleavers, Couchgrass, Narrow-leafed Hawksbeard, Night-flowering Catchfly, Perennial Sow Thistle, Scentless Chamomile, Stickseed, Stinkweed, Wild Mustard, White Cockle

APPENDIX IV: FORAGE CROP TRAIT DIAGRAMS

The following diagrams have been included to aid in identifying plants. Additional diagrams of each species are included along with the species descriptions in Appendix V.

Fig 1.0: Alfalfa Leaflet: Shape (Measure Central Leaflet)



round	ovate	obovate	lanceolate

Fig 2.0: Alfalfa Pod Shape

sickle	crescent-shape in one spiral	crescent-shape in two spirals	crescent-shape in three spirals

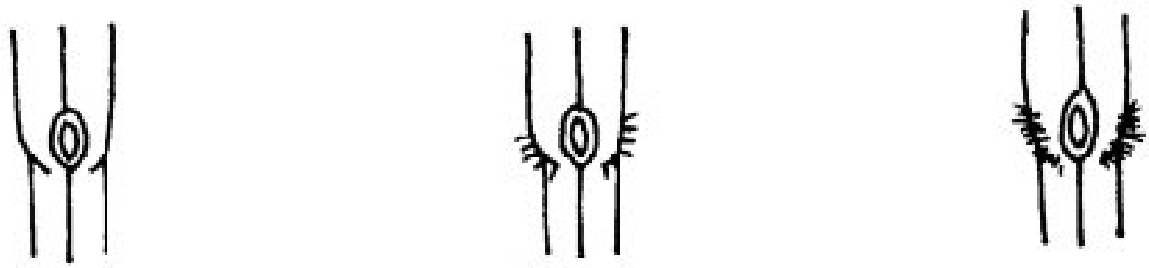
Fig 3.0: Grass Growth Habit

erect	semi-erect	intermediate	semi-prostrate	prostrate

Fig 4.0: Grass Leaf Blade - Density of Hairs on Upper Side

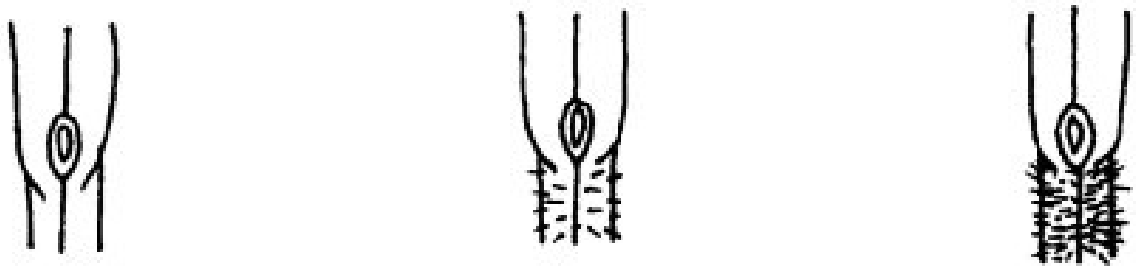
absent to very sparse	medium	very dense

Fig 5.0: Grass Leaf Blade - Density of Fringe Hairs on Margin of Base



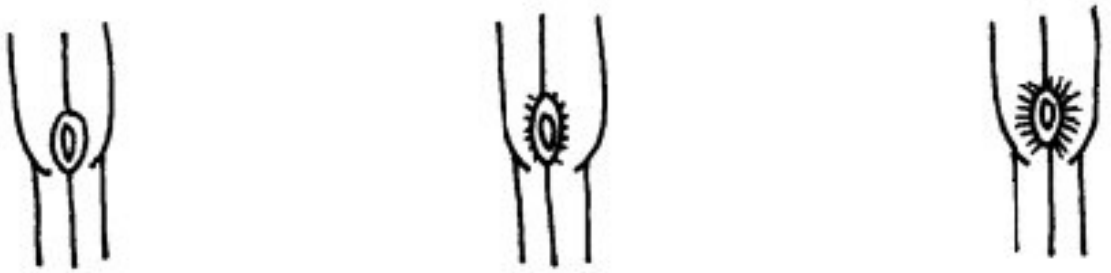
absent to very sparse	medium	very dense

Fig 6.0: Grass Leaf Sheath - Density of Hairs on Margins



absent to very sparse	medium	very dense

Fig 7.0: Grass Leaf Sheath - Density of Hairs on Both Sides Just Beneath Leaf Blades

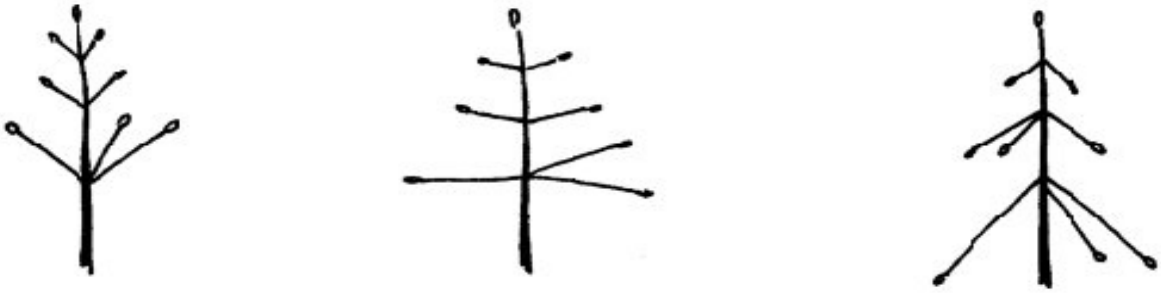


absent to very sparse	medium	very dense

Fig 8.0: Grass Leaf Sheath - Length of Hairs on Ligule

absent to very short	medium	very long

Fig 9.0: Grass Inflorescence - Attitude of Lower Side Branches

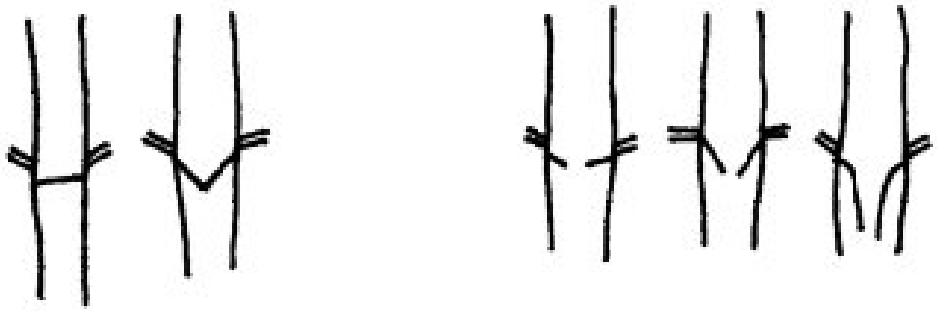


erect	horizontal	deflexed

Fig 10.0: Grass Inflorescence - Shape of Rachis Opposite Lower Side Branches (When Fully Expanded)

straight bent

Fig 11.0: Grass Inflorescence - Form of Collar of Rachis Opposite the Lower Side Branches (When Fully Expanded)



closed open

APPENDIX V: DESCRIPTIONS OF FORAGES AND RELATED SPECIES

The following section describes commonly inspected species in terms of traits that are displayed at time of inspection.

This section also provides the scientific names of the species as they are listed in the *Seeds Regulations*. In addition, where the scientific name has been revised by the International Commission on Biological Nomenclature, this scientific name is provided.

Source: Looman, J. 1983. 111 Range and Forage Plants of the Canadian Prairies. Swift Current, Saskatchewan: Research Branch, Agriculture Canada.

Alfalfa (*Medicago spp.*)

Alfalfa is a widely grown perennial legume with a woody yet narrow crown, tap roots and flowers borne on racemes or spikes in various shades of blue, purple, cream and white. Pods range in shape from sickle to spiraled with one or more coils. Leaflets are 9.5 mm to 3.2 cm long, obovate and sharply toothed towards the apex. Traditional varieties are trifoliate, however an increasing number of multifoliolate varieties have been developed. The erect stems usually reach 30 to 90 cm.

Some yellow flowered varieties of *M. falcata* have been developed; these have a decumbent growth pattern with a deeply set crown and branching roots. The two species interpollinate and many varieties of *M. sativa* contain *M. falcata* germplasm.

Multifoliolate leaf (MF) expression on a per plant basis and the number of plants within the population with MF expression are visually scored about 30 days after final clipping. The multifoliolate leaf expression score per plant is based on an average of individual stems and on the number of MF leaves per stem.

Score		Description
0	=	all trifoliate leaves
1	=	1 MF leaf/stem
2	=	2-3 MF leaves/stem
3	=	4-5 MF leaves/stem
4	=	6-7 MF leaves/stem
5	=	8+ MF leaves/stem

Frequency of MF leaf expression: Percentage of plants within a population with MF leaflets is calculated as the sum of the number of plants scored 1-5, and divided by the total number of plants scored.

Varieties are classified as follows:

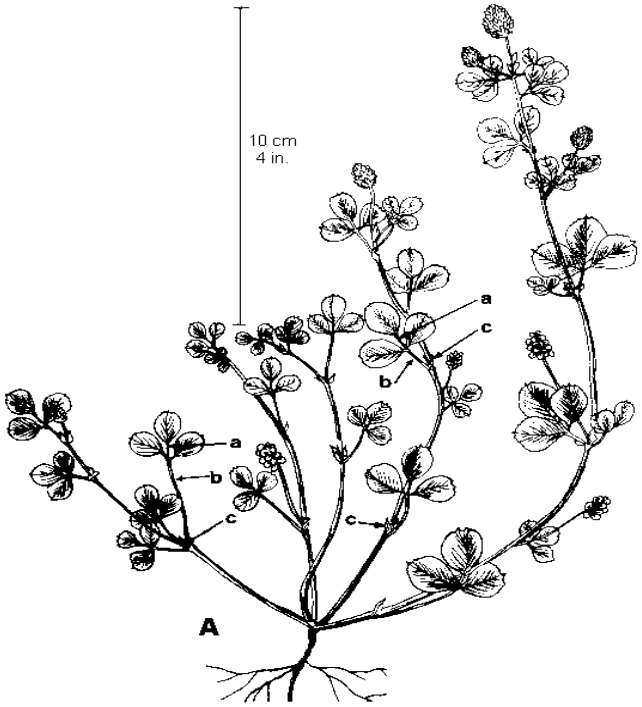
1-normal	=	0 - 5% MF
3-low	=	6 - 20% MF
5-medium	=	21 - 40% MF
7-high	=	41 - 75% MF
9-very high	=	>76% MF

Traits useful in distinguishing among alfalfa varieties:

1. Spring growth habit
2. Autumn growth habit
3. Flower colour - expressed as a percentage of the number of plants with flowers of a specific colour
4. Root type i.e. creeping root or tap root
5. Pod shape
6. Percentage of plants with multifoliolate leaves

Physiological Stresses that may affect alfalfa plant appearance:

1. Soil pH outside of neutral range
2. Poor drainage
3. Limited moisture, particularly tap rooted types



Black Medick *(Medicago lupulina)*

Black medick is usually an annual plant but in some rare cases, under favourable environments, they can survive as short-lived perennial plants. The roots of this species are in a branching system. The growth habit is prostrate when it reaches maturity; sometimes it grows up to 80 cm. The leaves are green, trifoliate and covered with fine hairs. The small yellow flowers of the black medick are composed of small florets and the shape is similar to the flowers of clovers. The kidney-shaped seedpods are black and usually 3 mm in length. Its distinguishable features are its leaves and the small yellow flower clusters.

Surce: Looman, J. 1983. 111 Range and Forage Plants of the Canadian Prairies. Swift Current, Saskatchewan: Research Branch, Agriculture Canada.

Birdsfoot Trefoil (*Lotus corniculatus*)

Birdsfoot trefoil is a perennial forage with weak roots as a seedling, but that has a strong, well-developed tap root system with many branches once mature. It has several stems arising from the rootcrown. The slender and moderately leafy stems are usually 60 to 90 cm in height, and thinner and more flexible than those of alfalfa. Its compound leaflets close over the petiole and stem in darkness.

The flowers of birdsfoot trefoil vary from light to dark yellow in colour, with four to eight florets. Multiple seed pods that attach to the stem at right angles give it the appearance of a bird's foot. Birdsfoot trefoil pods are long and cylindrical, which turn brown to black and maturity. Due to the proximity of the flowers to the ground, birdsfoot trefoil is capable of reseeding itself even while being closely grazed.

The Common type of birdsfoot trefoil has an early and erect spring growth habit, as well as a rapid seedling and recovery growth. The Empire type of birdsfoot trefoil flowers 10 to 14 days later than the Common, and has a semi-erect growth habit.

Traits useful in distinguishing among varieties:

1. Plant growth habit
2. Plant height at maturity
3. Growth type
4. Stem anthocyanin colouration
5. Stem pubescence
6. Time to flowering
7. Flower Keel tip colour
8. Flower Striping

Source: Wheeler, G. 1981. Alsike Clover. In the Alberta Forage Crops Advisory Committee, *Alberta Forage Manual*. 4th Edition. Edmonton: Alberta Agriculture.

Alsike Clover (*Trifolium hybridum*)

Varieties of alsike clover are either diploid (2n=16) or tetraploid (2n=32). Diploid types are the most commonly grown. Tetraploid varieties tend to have larger flowers and leaves, and are taller and later maturing than their diploid counterparts. Tillers grow profusely from the crown of Alsike clover, and its stems are at least as long as those of red clover, though more slender and prostrate. It has pink or white flowering heads which are somewhat smaller than those of red clover. Both its leaves and stems are glabrous. It differs from red clover in that the main axis of the stem does not end in a flowering head but rather keeps growing. Flowering branches grow successively from each leaf axil, causing the youngest flowers to be those in the terminal heads and the oldest heads to be located farther down on the stem towards the crown.

Traits useful in distinguishing among varieties:

1. Time of flowering
2. Number of internodes (stem)
3. Density of hairs (stem)
4. Length of longest stem (including head)
5. Stem thickness
6. Leaf length (central leaflet of the upper normally developed leaf below the terminal flower)
7. Leaf width
8. Frequency of plants with white mark on leaves
9. Stem anthocyanin colouration
10. Flower colour
11. Flower head size

Physiological stresses that may affect alsike clover plant appearance:

1. Heat stress
2. Drought stress

Source: Best, Keith F., Budd, Archiblad C.. 1964. Wild Plants of the Canadian Prairies. Publication 983. Ottawa, Ontario.

Prairie Clover (*Dalea sp.*)

Two types of prairie clover exist - white and purple.

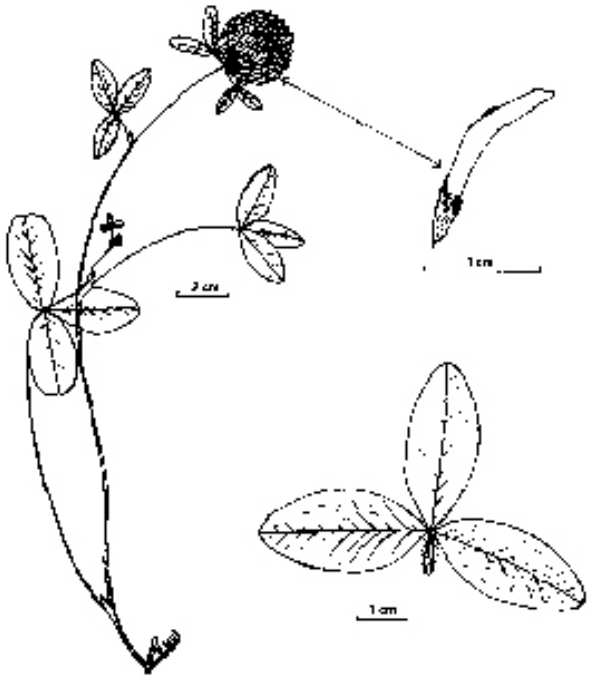
Purple prairie clover (*Dalea purpurea*) can grow up to 91 cm tall, with its leaves at the base of its stem. The stem can be ascending or erect, 20 to 91 cm long. Leaves are alternate and pinnately compound. The leaves are 1.2 to 4.4 cm long, while the leaflets are 1.2 to 1.9 cm long and less than 2.5 mm wide. The leaflets have pointed tips, and often have edges which roll inwards towards their upper side. Flowers are purple or pinkish with five stamens.

White prairie clover (*Dalea candida*) grows to 45 to 60 cm high. It is usually unbranched or only sparsely branched. Its central stem is light green and has longitudinal lines running up it. Leaves are alternate and pinnately compound, with 3 to 9 leaflets per leaf. Leaflets are either linear or narrowly oblanceolate. The leaflet margins are smooth, and there are numerous translucent dots on the underside of each leaf. Flowers are arranged on a 2.5 to7.6 cm spike found at the end of each major stem. Each flower is white, with 5 petals and 5 white stamens. The root system includes a central taproot which can go as deep as 1.5 m down into the earth.

The two types of prairie clover can be distinguished by the length of the flowering spikes (usually longer in white prairie clover), and the foliage (lighter, longer and more sparse in white prairie clover).

Traits useful in distinguishing among varieties:

1. Leaflet length
2. Time to flowering



Source: Wheeler, G. 1981. Red Clover. In the Alberta Forage Crops Advisory Committee, *Alberta Forage Manual*. 4th Edition. Edmonton: Alberta Agriculture.

Red Clover (*Trifolium pratense*)

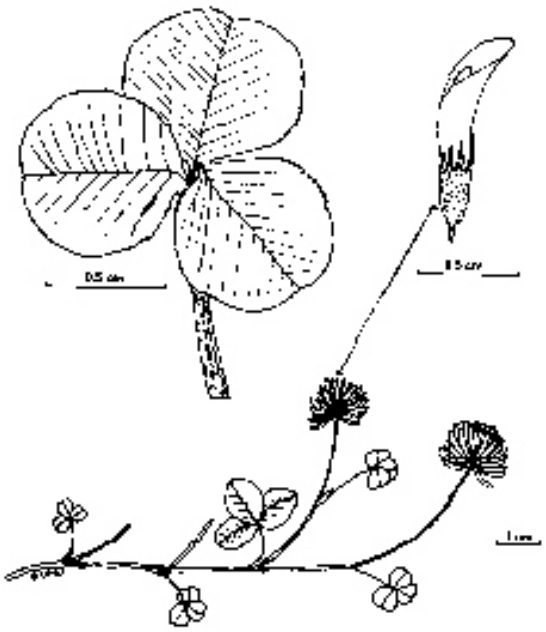
Two types of red clover exist: single and double cut.

Single cut varieties are diploid (2n = 14) and tend to be smaller and later-flowering than the double cut varieties.
Double cut varieties are tetraploid (2n = 28). Most varieties grown in Canada are of the double cut type. It has a taproot system as well as many secondary branches.

Red clover plants are composed of numerous leafy stems arising from a crown. The stems and leaves of American strains are generally pubescent while European strains are glabrous. Each leaf is made up of three oblong leaflets usually bearing a characteristic reddish, inverted V leaf markings in the centre of each leaflet (Heath et al., 1978). The heads are compact clusters of up to 125 flowers. Under favourable conditions, these flowers are 9 to10.5 mm long (Heath et al., 1978). Flower colour varies from magenta to pale pink.

Traits useful in distinguishing among varieties:

1. Time of flowering
2. Number of internodes (while flowering)
3. Density of hairs (stem)
4. Flower colour



Source: Wheeler, G. 1981. White Clover. In the Alberta Forage Crops Advisory Committee, *Alberta Forage Manual*. 4th Edition. Edmonton: Alberta Agriculture.

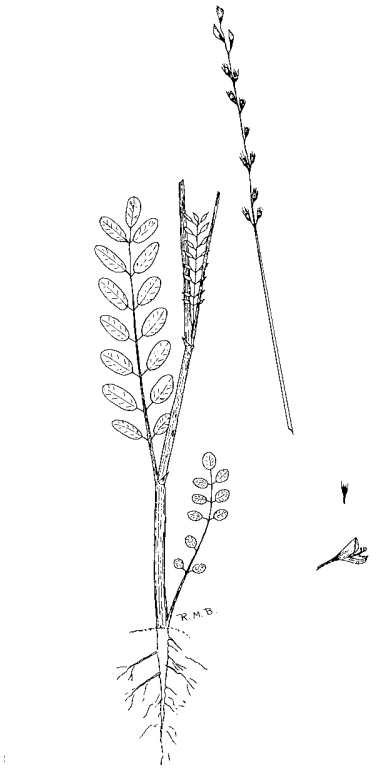
White Clover (*Trifolium repens*)

White clover is a short to long lived perennial with a shallow tap root system and very small crowns. The primary stems are short with many internodes. Its flowers are usually white, though occasionally they are tinged with pink. The flowers of white clover are borne on peduncles that are somewhat longer than the petioles. There are 20 to 150 florets per head. Each leaf has 3 leaflets, and each leaflet usually has a v-shaped white mark in its centre. The leaflets are usually elliptical to heart shaped. The seeds of white clover are small and yellow. Its stems are glabrous, have a prostrate growth habit, and grows to 30 to 45 cm tall. The stolon of white clover is solid.

The species is highly polymorphic resulting in a great deal of variation in plant and plant part size.

Traits useful in distinguishing among varieties:

1. Time of flowering
2. Leaf length (central leaflet of the upper normally developed leaf below the terminal flower)
3. Leaf width
4. Frequency of plants with white marks on leaves
5. Length of petiole
6. Thickness of stolon



Source: Looman, J. 1983. 111 Range and Forage Plants of the Canadian Prairies. Swift Current, Saskatchewan: Research Branch, Agriculture Canada.

Sainfoin (*Obobrychis viciaefolia*)

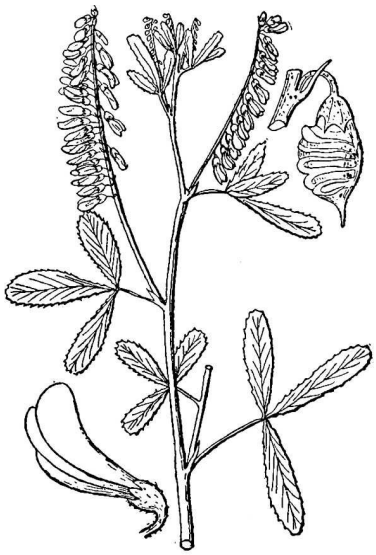
Sainfoin is a deep-rooted legume that usually grows taller than alfalfa, to a height of 1 m or more. The stems of sainfoin are upright and hollow, but appear very succulent, and it has a root system consisting of deep tap roots with many side branches.

The leaves have 6 to 14 pairs of leaflets which are more or less hairy. The flowers are large and either rosy pink or white in colour, and appear on spike-like heads up to 15 cm long, one to two weeks before alfalfa blossoms. The flowers are characteristic of this crop. Pods which are less than 1 cm long, hairy, and toothed on the margins contain single seeds, roughly 3 mm in length, shatter as they mature.

Traits useful in distinguishing among varieties:

1. Plant growth habit
2. Plant canopy
3. Size of secondary leaf
4. Leaf colour
5. Leaf hair type
6. Plant height
7. Time of flowering
8. Flower colour

White Sweetclover



Yellow Sweetclover

Source: USDA-NRCS PLANTS Database / Britton, N.L., and A. Brown. 1913. Illustrated flora of the northern states and Canada. Vol. 2: 352.

Sweetclover (*Melilotus alba* and *Melilotus officinalis*)

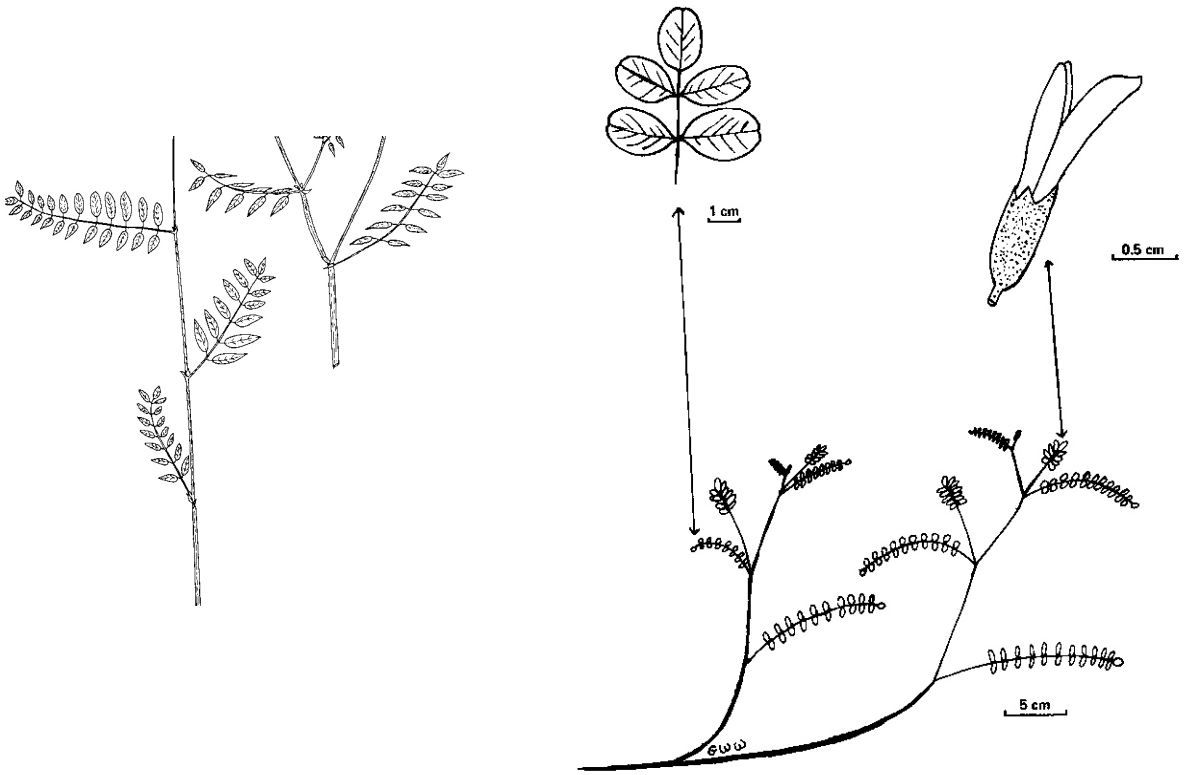
Sweetclover is typically a biennial legume, with a deeply penetrating taproot similar to that of alfalfa. It has trifoliate leaves, with leaflets that tend to be toothed around the margin (as opposed to only at the tip as in alfalfa). Sweetclovers have small and narrow stipules. Seed pods typically contain one seed but occasionally have two.

Two types of sweetclover exist; white sweetclover (*M. alba*) and yellow sweetclover (*M. officinalis*). White sweetclover is taller and has coarser leaves and stem than yellow sweetclover. Yellow sweetclover has a finer stem and matures earlier than the white sweetclover.

Sweetclover seeds are sometimes distinguished from alfalfa by the use of ultraviolet light - alfalfa seeds are fluorescent under such light, but those of sweetclover are not.

Traits useful in distinguishing among varieties:

1. Plant growth habit
2. Plant spring vigour
3. Leaf size
4. Leaflet size (yellow sweetclover only)
5. Leaf colour
6. Stem thickness
7. Time of flowering
8. Flower colour
9. Flower size
10. Plant height



Source: Wheeler, G. 1981. Cicer Milk-Vetch. In the Alberta Forage Crops Advisory Committee, *Alberta Forage Manual*. 4th Edition. Edmonton: Alberta Agriculture.

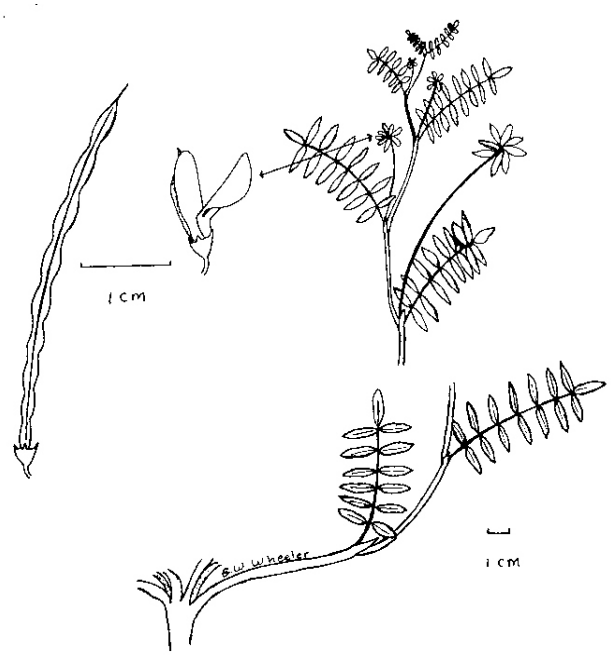
Source: Looman, J. 1983. 111 Range and Forage Plants of the Canadian Prairies. Swift Current, Saskatchewan: Research Branch, Agriculture Canada.

Cicer Milkvetch (*Astragalus cicer*)

Cicer milkvetch is a long-lived, perennial legume with a deep, vigorous root system which may be as wide as 120 cm in good conditions. While growth is upright when young, the stems tend to droop down as the plant matures. Plant height rarely exceeds 60 cm, even though the stems may be up to 120 cm long. Its stems are succulent, coarse and hollow. Leaves are divided into many leaflets (usually 10 to 13 leaflets plus one terminal leaflet per leaf). Flowers are white to pale yellow, and are borne on racemes. There are 20 to 60 flowers per raceme. The pods are pale yellow to white when young, turning black and leathery as the seeds mature. The seeds are flattened, very hard and roughly twice as large as those of alfalfa, with 3 to 11 seeds per pod.

Traits useful in distinguishing among varieties:

1) Time to flowering
2) Flower colour
3) Plant height



Source: Wheeler, G. 1981. Crownvetch. In the Alberta Forage Crops Advisory Committee, *Alberta Forage Manual*. 4th Edition. Edmonton: Alberta Agriculture.

Crownvetch (*Coronilla varia*)

Crownvetch is a perennial that derives its name from its vetch-like leaves and crown-shaped flower arrangement. It has a deep and branching tap root with many fleshy creeping roots that can develop to a length of 3 m or more.

Flowers are a variegated white to purple colour and are borne on angular, decumbent to ascending hollow stems ranging from 30 to 120 cm in length. The pods are long and cylindrical with 3 to12 segments. Its leaves are alternate and pinnately compound, with 9 to 25 leaflets per leaf.

Traits useful in distinguishing among varieties:

1) Plant growth habit
2) Plant canopy size
3) Size of secondary leaf
4) Leaf colour
5) Leaf hair type
6) Plant height
7) Time of flowering
8) Flower colour

Source: USDA-NRCS PLANTS Database / Britton, N.L., and A. Brown. 1913. Illustrated flora of the northern states and Canada. Vol. 1: 203.

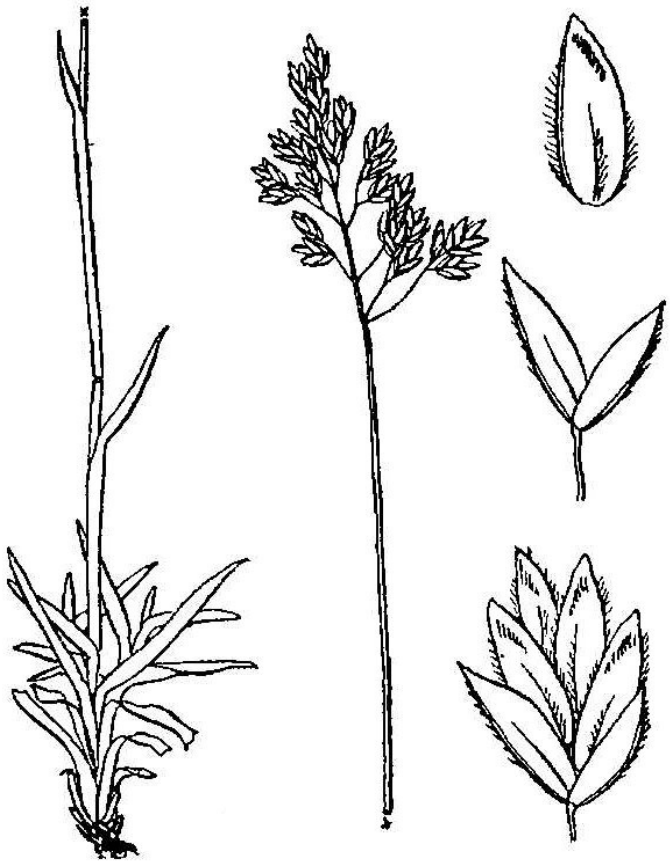
Source: Looman, J. 1983. 111 Range and Forage Plants of the Canadian Prairies. Swift Current, Saskatchewan: Research Branch, Agriculture Canada.

Creeping Bentgrass (*Agrostis palustris*, *Agrostis stolonifera*)

Creeping bentgrass is a cool-season, stoloniferous grass which forms a dense turf. Its culms are prostrate, and grow to 39 to 100 cm long. It has blue-green leaves, approximately 3 mm wide and 2 to 10 cm long. The short and mostly basal leaves are usually rough on their upper and lower sides as well as the margins. It has no auricles but has a long, tapered ligule. Its stolons are usually white. Like all bentgrasses, its seeds are very small. It's open to somewhat narrow panicle that may reach up to 40 cm in height bears many tiny reddish/ purplish flowers.

Traits useful in distinguishing among varieties:

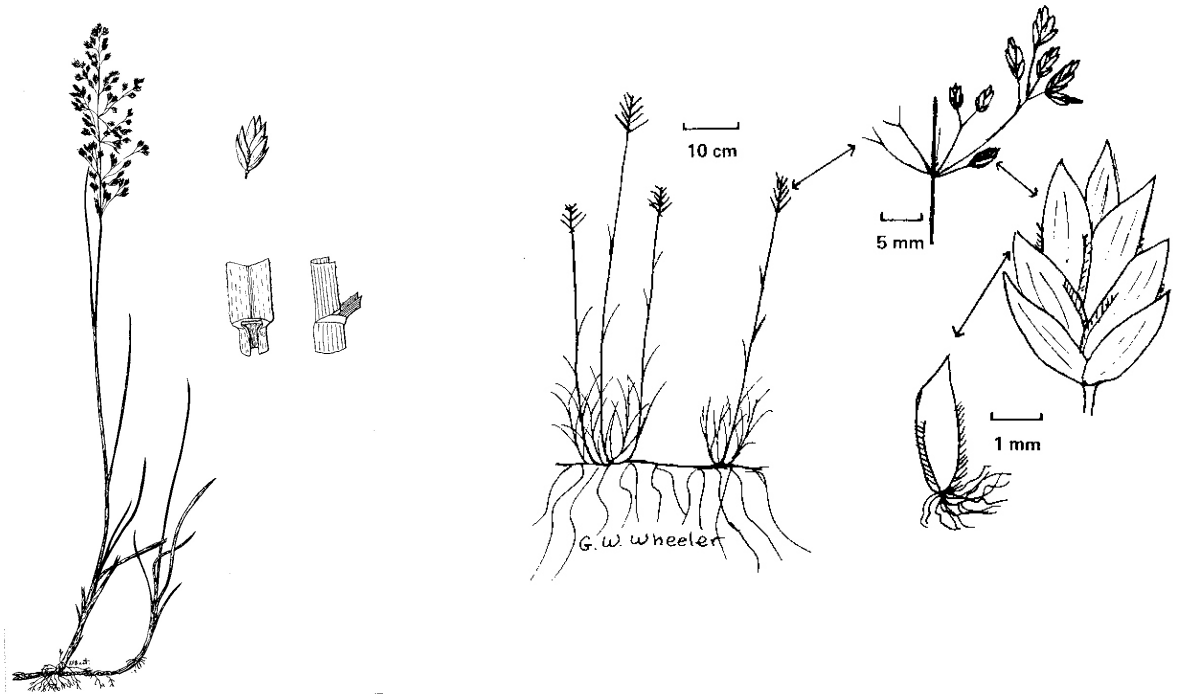
1. Leaf colour
2. Leaf width
3. Time of inflorescence emergence



Source: USDA-NRCS PLANTS Database / Britton, N.L., and A. Brown. 1913. *Illustrated flora of the northern states and Canada*. Vol. 1: 254.

Alpine Bluegrass (*Poa alpina*)

Alpine bluegrass is an erect, short bunchgrass with culms, growing 20 to 60 cm tall. Its flowers are set in a panicle 2.5 to 5 cm long. Its leaves are thick and fleshy, and tend to be dark green in colour.



Source: Wheeler, G. 1981. Kentucky Bluegrass. In the Alberta Forage Crops Advisory Committee, *Alberta Forage Manual*. 4th Edition. Edmonton: Alberta Agriculture.

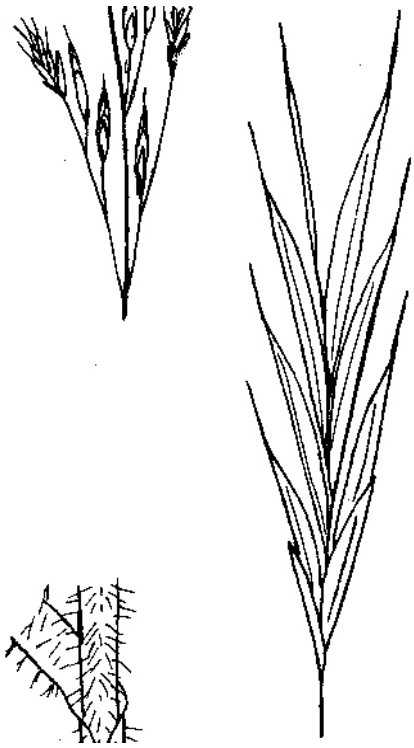
Source: Looman, J. 1983. 111 Range and Forage Plants of the Canadian Prairies. Swift Current, Saskatchewan: Research Branch, Agriculture Canada.

Kentucky Bluegrass (*Poa pratensis*)

Kentucky bluegrass is a long lived perennial grass. It has a dense network of creeping and deep feeding roots. The stems are usually 30 to 60 cm high, with several in a tuft. Leaves are green to dark green, shiny, smooth, soft, and mostly basal, ranging from 10 to 30 cm long and boat-shaped at the tip. Its inflorescence is an open, pyramidal panicle roughly 5 to 20 cm long, usually with 5 branches at each node. Of the five nodular branches, the centre and outer branches are long and the others are short. The spikelets are 3 to 5 flowered, located primarily at the ends of branches. Each seed has a mat of cobweb-like hairs at its base.

Traits useful in distinguishing among varieties:

1. Time of inflorescence emergence
2. Length of longest stem (including inflorescence)
3. Shape of rachis opposite the lower side branches of the inflorescence
4. Leaf width
5. Leaf sheath: anthocyanin colouration
6. Leaf sheath: density of hairs on both sides, just beneath the leaf blade
7. Leaf sheath: length of hairs of ligule
8. Leaf blade: density of fringe hairs on margin of base
9. Leaf blade: density of hairs on upper side



Source: Wheeler, G. 1981. Meadow Bromegrass. In the Alberta Forage Crops Advisory Committee, *Alberta Forage Manual*. 4th Edition. Edmonton: Alberta Agriculture.

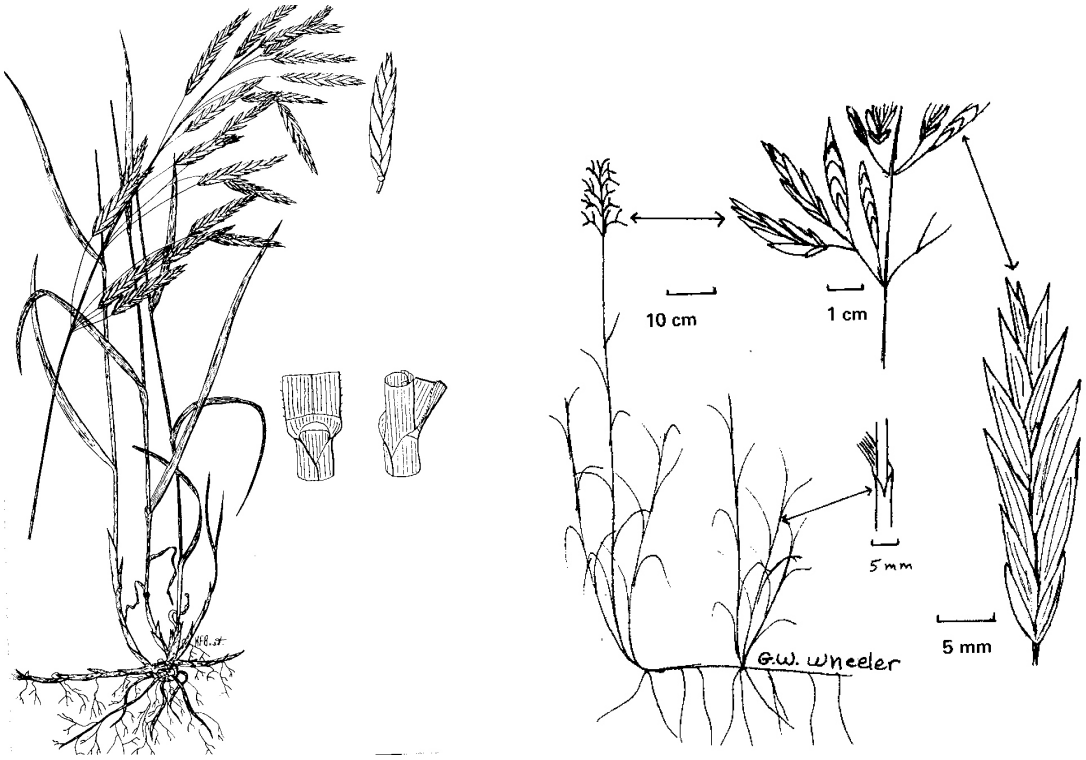
Source: Looman, J. 1983. 111 Range and Forage Plants of the Canadian Prairies. Swift Current, Saskatchewan: Research Branch, Agriculture Canada.

Meadow Bromegrass (*Bromus biebersteinii*)

Meadow bromegrass is a relatively early maturing, long-lived, densely tufted perennial used for pasture. Its sheath and numerous light green leaves are usually pubescent. The leaves which are predominantly basal are attached to stems that may reach 60 to 120 cm in height, with an open panicle at the end. The seed head is 10 to 20 cm long, and the seed 10 to 12 mm long. The plants head and mature 7 to 10 days earlier than smooth bromegrass.

Traits useful in distinguishing among varieties:

1) Plant growth habit
2) Leaf colour
3) Time of flowering
4) Plant height
5) Leaf canopy size
6) Leaf length
7) Leaf width
8) Panicle length



Source: Wheeler, G. 1981. Smooth Bromegrass. In the Alberta Forage Crops Advisory Committee, *Alberta Forage Manual*. 4th Edition. Edmonton: Alberta Agriculture.

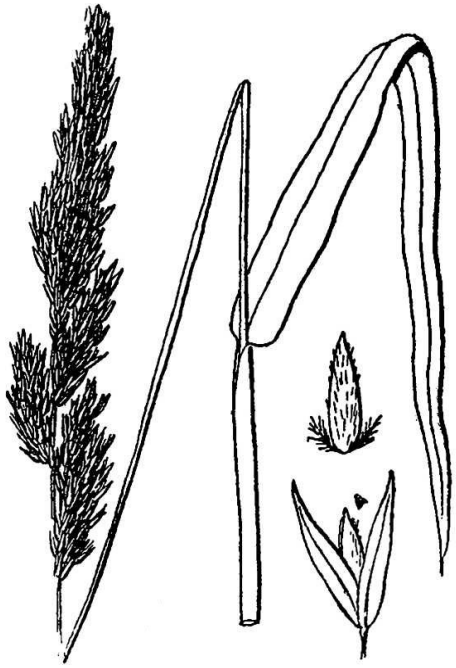
Source: Looman, J. 1983. 111 Range and Forage Plants of the Canadian Prairies. Swift Current, Saskatchewan: Research Branch, Agriculture Canada.

Smooth Bromegrass (*Bromus inermis*)

Smooth bromegrass is a leafy, cool-season sod-forming perennial that spreads underground by rhizomes and is readily propagated by seed. Its stems are usually between 60 to 120 cm long, but only half of the tillers actually produce stems. The basal and stem leaves are tender, broad and long and form a tubular sheath. In early summer, stems are produced on which large, open panicles are found. The panicle type head composed of many florets produces a heavy seed crop. Individual seeds are enclosed in brownish husks that may have a short awn up to 3 mm long. At pollen shed, visible clouds of pollen are disseminated at intervals over several days.

Traits useful in distinguishing among varieties are:

1. Plant growth habit
2. Collar shape
3. Leaf attitude, pubescence, length, sheaf colour, and the presence of ligules
4. Plant height
5. Flag leaf length and wide
6. Flag leaf auricle pubescence
7. Panicle colour, shape and attitude.



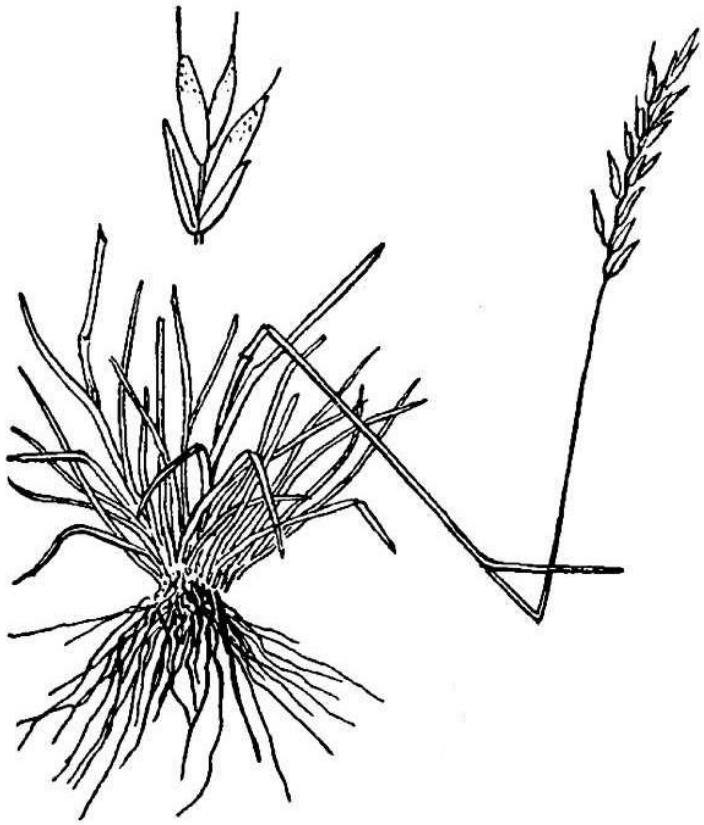
Source: USDA-NRCS PLANTS Database / Britton, N.L., and A. Brown. 1913. Illustrated flora of the northern states and Canada. Vol. 1: 170.

Reed Canarygrass (*Phalaris arundinacea*)

Reed canarygrass is a long-lived perennial which grows in clumps and spreads by underground rhizomes and stands between 60 and 240 cm tall. It has deep feeding roots and leafy stems thick enough to prevent most lodging, and long, wide, light green basal leaves. Its flowers are borne in semidense, spikelike panicles 5 to 20 cm in length. Many spikelets containing only one formed seed grow on each branch of the head. The seeds are shiny brown and narrow and as long as flax seeds.

Traits useful in distinguishing among varieties:

1. Plant height
2. Leaf length
3. Leaf width
4. Time of head emergence
5. Head length
6. Head shape



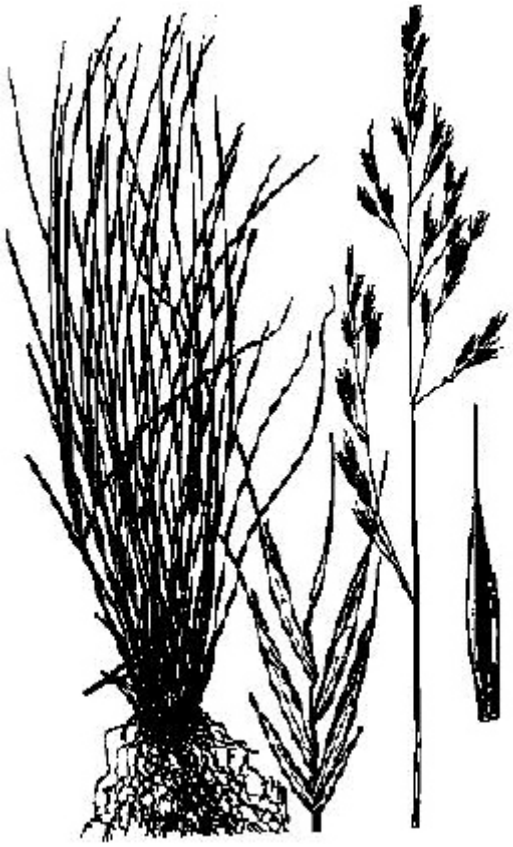
Source: USDA-NRCS PLANTS Database / Britton, N.L., and A. Brown. 1913. *Illustrated flora of the northern states and Canada*. Vol. 1: 271.

Alpine Fescue (*Festuca brachyphylla*)

The stems usually grow 5 to 35 cm high and have an erect growth habit. Its leaves are folded, and mostly in a basal tuft and are blueish-green to yellow-green in colour, possibly with a purple tinge. The leaves are 2 to 10 cm long, and 0.1 to 2 mm wide when folded. Its sheaths are glabrous or weakly pubescent, and fused only in their lower part, with no auricles. Its inflorescence is paniculate and often spike-like, usually 1.5 to 4 cm long and 5 to 7 mm wide.

Traits useful in distinguishing among varieties:

1) Plant height
2) Time to flowering

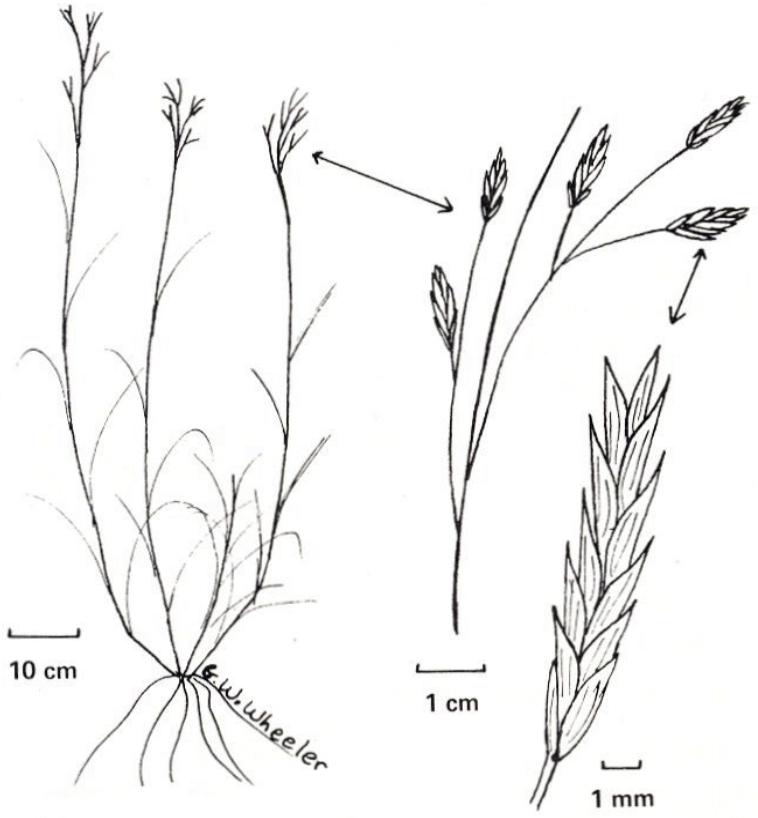


Hard Fescue (*Festuca longifolia, Festuca ovina, Festuca trachyphylla*)

Hard fescue is a cool-season, semi-erect bunchgrass, with leaves 5 to15 cm long. Leaves are greyish-green or pale blue-green, narrow and tightly infolded. Panicles are erect, and can be loose, contracted, oblong or narrow. Seed heads range in length from 2.5 to 12.7 cm long. Spikelets have 4 to 9 flowers. Hard fescue produces a significant number of roots, but has no rhizomes and so spreads by tillering.

Traits useful in distinguishing among varieties:

1. Plant rhizomes
2. Time of heading
3. Flag leaf length
4. Length of longest stem including inflorescence
5. Length of inflorescence on longest stem



Source: Wheeler, G. 1981. Meadow Fescue. In the Alberta Forage Crops Advisory Committee, *Alberta Forage Manual*. 4th Edition. Edmonton: Alberta Agriculture.

Meadow Fescue (*Festuca pratensis*)

Meadow fescue is a short-lived perennial. It grows 40 to 75 cm tall and has rather succulent, bright green leaves and leaf sheaths that are smooth and reddish purple at the base. The predominantly basal leaves are glossy on the underside. The panicles of meadow fescue somewhat resemble those of Kentucky bluegrass. It does not propagate by rootstocks or form a heavy sod, but does develop a large number of tough, coarse roots.

Source: USDA-NRCS PLANTS Database / Hitchcock, A.S. (rev. A. Chase). 1950. *Manual of the grasses of the United States*. USDA Misc. Publ. No. 200. Washington, DC.

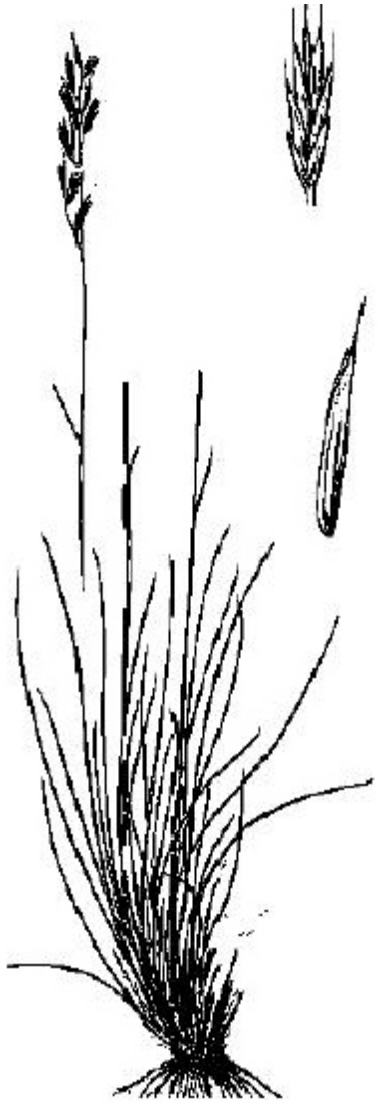
Red Fescue (*Festuca rubra*)

The three distinct forms of red fescue are distinguishable by their creeping habits.
Creeping red fescue spreads by strong rhizomes. Chewings fescue does not possess extensive creeping rootstocks and is therefore tufted and does not spread. The foliage has a finer texture, a brighter green colour, and the seed stems are shorter than those of creeping fescue. The third type is intermediate in stature between creeping and chewings types and forms short rhizomes.

All red fescues have deep feeding roots. The leaves are basal, shiny, folded and bright green, except for the reddish lower sheath. The stems are nearly leafless, shiny and up to 1 m tall for the strongly creeping types. The seed head is a closed panicle with purple-tinged spikelets of awned seed hulls.

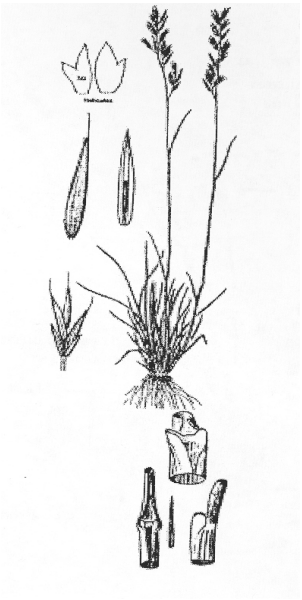
Traits useful in distinguishing among varieties are:

1. Flag leaf length and width
2. Flowering date
3. Plant height
4. Panicle length, shape and attitude



Sheep Fescue *(Festuca ovina L.)*

Sheep fescue closely resembles Bluebunch (Idaho) fescue. It is a deep rooted plant with dense basal leafage that is fine, long and of a green colour. It spreads by tufts which grow at the edge of the clumps. The sparse 30 to 60 cm long, nearly leafless stems bear a 5 to 15 cm closed panicle bearing florets with long awns.



Source: Tannas, Kathy. Common Plants of the Western Rangelands. Volume 1. Lethbridge, Alberta.

Rocky Mountain Fescue (*Festuca saximontana*)

Rocky Mountain Fescue is a densely tufted perennial with a fibrous root system. The stems are hairless and 10 to 50 cm tall. Most of the leaves arise in a basal tuft and are 1 mm wide and 5 to 15 cm long. The very slender blades are folded to inroll, hairless and are green in colour. The round to slightly compressed sheaths are split and mostly hairless and smooth, of light green colour with overlapping margins. The basal sheaths are yellow to brown in colour and are persistent. Very short membranous ligules with fringed hairs are present, though no auricles exist. The 2 to 10 cm long panicles are linear-lanceolate in shape with erect branches. The 2 to 3 mm long lanceolate shaped glumes accompany the 2 to 4 mm long lemmas that are roughened on the back with awns 1 to 3 mm long.

Soucee: Looman, J. 1983. 111 Range and Forage Plants of the Canadian Prairies. Swift Current, Saskatchewan: Research Branch, Agriculture Canada.

Tall Fescue (*Festuca arundinacea*)

Tall fescue is a long-lived perennial with an open bunch growth habit having deep, coarse roots and short rhizomes. It has numerous shiny, dark green, ribbed leaves. The branched, panicle-type heads are 10 to30 cm long and borne on seed stalks that are 100 to 150 cm in height. Tall fescue produces 5 to 7 short-awned seeds per spikelet that are similar in size and shape to ryegrass but have a purple tinge on the glumes or chaff and a dark purple tinge on the caryopsis. Tall fescue has a number of small hairs on the auricle that do not appear on meadow fescue.

Traits useful in distinguishing among varieties:

1. Plant growth habit
2. Plant height
3. Flag leaf width
4. Flag leaf length
5. Time of head emergence

Source: USDA-NRCS PLANTS Database / Hitchcock, A.S. (rev. A. Chase). 1950. *Manual of the grasses of the United States*. USDA Misc. Publ. No. 200. Washington, DC.

Source: Tannas, Kathy. Common Plants of the Western Rangelands. Volume 1. Lethbridge, Alberta.

Tufted Hairgrass (*Deschampsia caespitosa*)

Tufted hairgrass is a perennial bunchgrass with a dense and shallow fibrous root system. It grows from 20 to 120 cm tall, and its stems are unbranched. The head is a feathery panicle which has several branches growing in whorls of 6 or 10 at points 2 to 3 cm apart. Spikelets are roughly 3 mm long, with awnless glumes as long as the entire spikelet. Each spikelet contains 2 dark brown to black seeds. Tufted hairgrass has abundant, glabrous, narrow leaves which are typically 12 to 20 cm in length. The leaves which are usually 1.5 to 3 mm wide are folded, and swelling is noticeable where the sheath and blade join.

Traits useful in distinguishing among varieties:

1) Plant height
2) Time to flowering

Source: Looman, J. 1983. 111 Range and Forage Plants of the Canadian Prairies. Swift Current, Saskatchewan: Research Branch, Agriculture Canada.

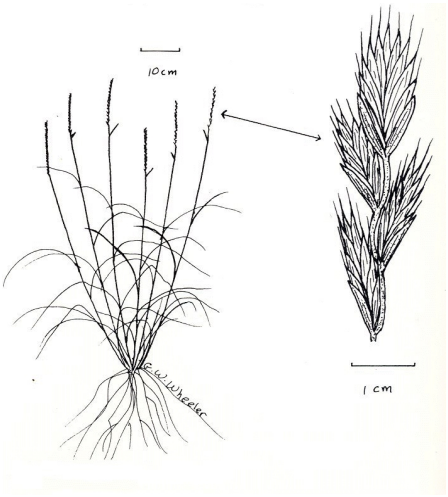
Source: Tannas, Kathy. Common Plants of the Western Rangelands. Volume 1. Lethbridge, Alberta.

Orchardgrass (*Dactylis glomerata*)

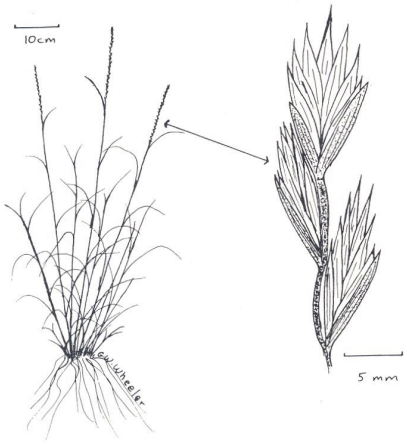
Like most other grasses, orchardgrass produces a fibrous root system that is deep and dense, resulting in tussocks. Its shiny leaves are folded in the bud and in cross section appear v-shaped. Leaf blades are 2 to 12 mm wide and may reach a length of 1 m. Leaves vary in colour from light green to dark blue-green. The sheath is compressed and strongly keeled with no auricles. Many leaf characteristics will vary according to the variety and the environmental conditions in which the plant is grown. Although the flowering stems have few leaves, there are many basal leaves. The flowering stems are generally 1 to 1.7 m high and end in panicles 10 to 25 cm long that are composed of spikelets bearing 2 to 5 florets. The lowermost branches of the panicle are longer and more branching than those near the top. In general the panicle is closed, but when open during the short flowering period, it has purplish appearance. The panicle has a distinctive appearance: the flower clusters are borne at the ends of the panicle branches in an asymmetrical pattern, giving the panicle a rather lumpy form. Orchardgrass is also known as “cock’s-foot” due to the shape of its seed head.

Traits useful in distinguishing among varieties are:

1. Plant growth habit
2. Plant height
3. Time of maturity
4. Leaf width and length



Annual Ryegrass



Perennial Ryegrass

Source: Wheeler, G. 1981. Italian Ryegrass, Perennial Ryegrass. In the Alberta Forage Crops Advisory Committee, *Alberta Forage Manual*. 4th Edition. Edmonton: Alberta Agriculture.

Ryegrass (*Lolium sp.*)

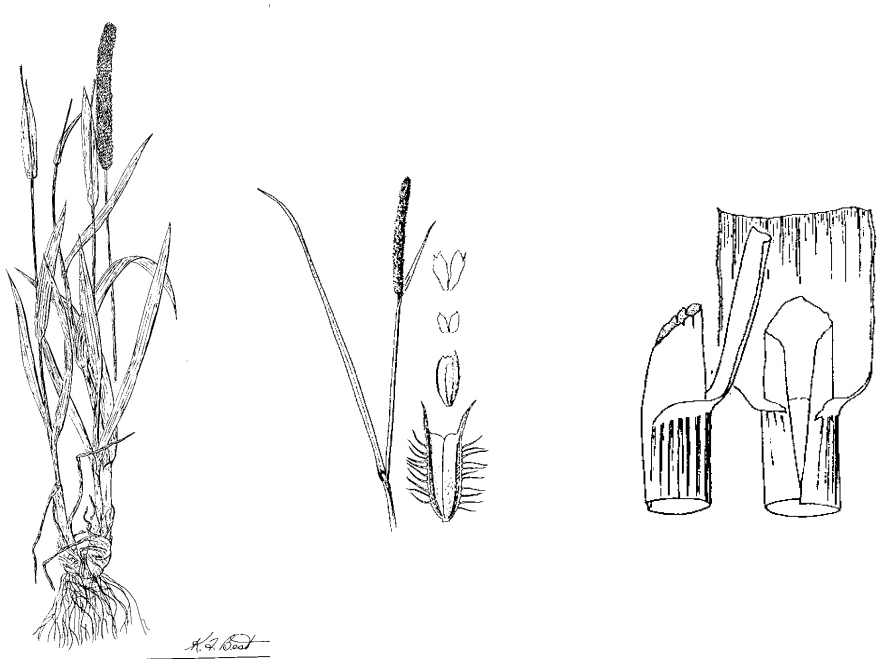
Ryegrasses are bunchgrasses with no creeping growth habit.

Perennial ryegrass (*Lolium perenne*) grows to approximately 90 cm in height with erect culms. The leaf sheathes are dark green and glabrous, and the leaf blades are folded in the young shoots. Its stems are usually 30 to 60 cm tall and are nearly leafless, ending in a stiff, slender spike. The spike is usually slightly curved and up to 30 cm in length. There are up to 35 spikelets per spike which are set at right angles to the stem with 2 to 10 fertile florets per spikelet. The caryopsis of perennial ryegrass is generally awnless.

Annual ryegrass (*Lolium multiflorum*), also known as Italian ryegrass, has erect culms but is generally taller than perennial ryegrass, reaching up to 130 cm in height. Annual ryegrass also has an abundance of glabrous leaf sheathes but the leaf blades are rolled in the young shoots. The leaves are typically dark green. The spikes are 17 to 30 cm long, with up to 38 spikelets per spike and 11 to 22 fertile flowers per spike. Unlike perennial ryegrass, the caryopsis of annual ryegrass is generally awned at various lengths. As with perennial ryegrass, the spikelets are set at right angles to the stem. Italian ryegrass can be distinguished from perennial ryegrass by the characteristic awn and stem and by the arrangement of the leaves as they emerge. As well, annual ryegrass is typically yellow-green at the base, while perennial ryegrass is more often reddish.

Traits useful in distinguishing among varieties:

1. Leaf colour
2. Plant growth habit (in Spring)
3. Plant height
4. Flag leaf width
5. Flag leaf length
6. Length of longest stem (including inflorescence)



Source: Looman, J. 1983. 111 Range and Forage Plants of the Canadian Prairies. Swift Current, Saskatchewan: Research Branch, Agriculture Canada.

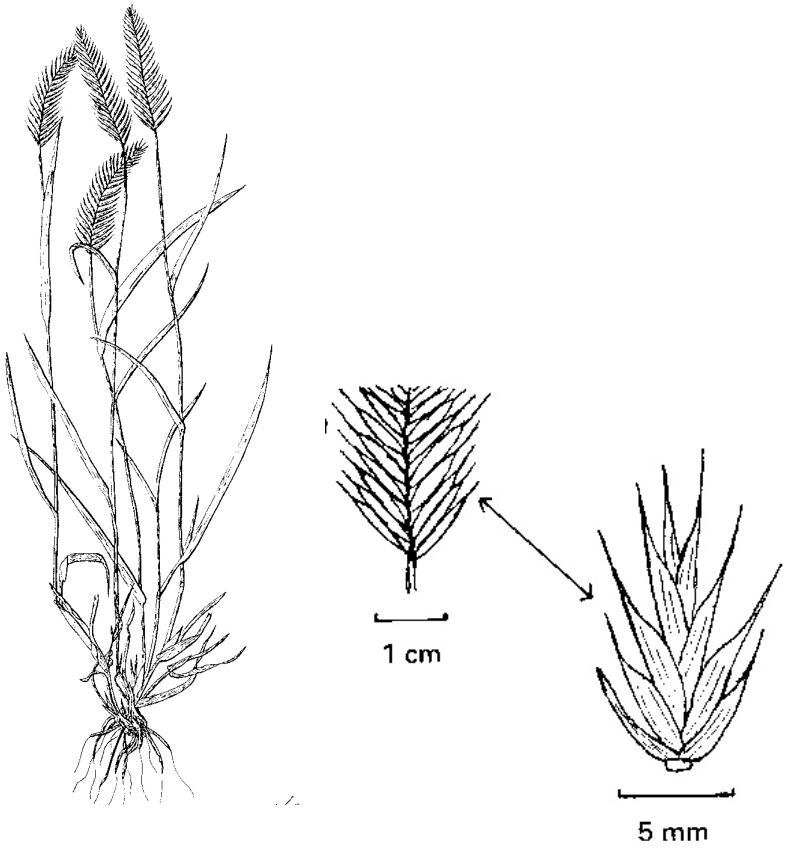
Source: Tannas, Kathy. Common Plants of the Western Rangelands. Volume 1. Lethbridge, Alberta.

Timothy (*Phleum pratense*)

Timothy is a perennial bunchgrass characterized by its dense cylindrical spike that may reach up to 15 cm in length and erect stems. Most varieties are 80 to110 cm in height and have flat elongated leaves. The spikelets usually have one floret. Timothy differs from most grasses in that one and sometimes several basal stem internodes become greatly swollen and produce a haplocorm or corm. New shoots develop from buds at the base of the stem below the haplocorm. From these shoots, new stems arise and develop new haplocorms and the old stem or haplocorm dies. Timothy roots are relatively shallow and fibrous. The leaves of timothy are soft, light green, and grow 5 to 15 cm long. Its small seeds are enclosed in an awned, urn-shaped husk.

Traits useful in distinguishing among varieties:

1. Growth habit
2. Leaf characteristics
3. Stem characteristics
4. Heading date
5. Glume size
6. Pollen fertility
7. Time to maturity



Source: Looman, J. 1983. 111 Range and Forage Plants of the Canadian Prairies. Swift Current, Saskatchewan: Research Branch, Agriculture Canada.

Source: Wheeler, G. 1981. In the Alberta Forage Crops Advisory Committee, *Alberta Forage Manual*. 4th Edition. Edmonton: Alberta Agriculture.

Crested Wheatgrass (*Agropyron cristatum* and *Agropyron desertorum*)

Two types of crested wheatgrass exist - the diploid (2n = 14) (*Agropyron cristatum*) type and the tetraploid standard type (2n = 28) (*Agropyron desertorum)*. The diploid type is shorter, has smaller seeds and finer leaves and stems than the standard type.

Crested wheatgrass is a long-lived, bunch-type grass with a deep, fibrous root system. Stem habit is upright and can reach a height of up to 90 cm. Seeds may or may not have awns.

Traits useful in distinguishing among varieties:

1) Plant growth habit
2) Leaf colour
3) Time of flowering
4) Length of spike
5) Stem pubescence
6) Leaf pubescence
7) Leaf attitude
8) Leaf length
9) Leaf width
10) Plant height

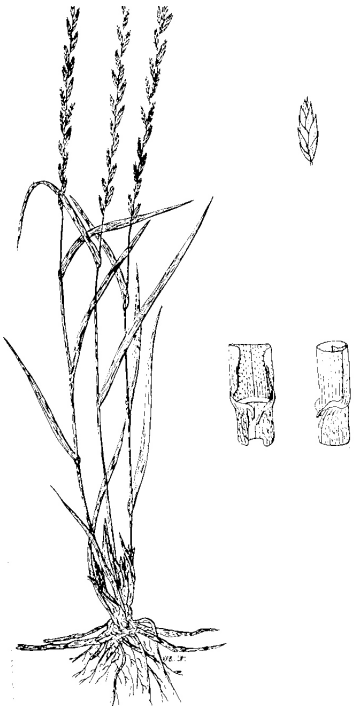
Source: Looman, J. 1983. 111 Range and Forage Plants of the Canadian Prairies. Swift Current, Saskatchewan: Research Branch, Agriculture Canada.

Intermediate Wheatgrass *(Elytrigia intermedia* formerly *Agropyron intermedium*)

Intermediate wheatgrass is a short-lived, sod-forming perennial grass. Its extensive deep-feeding root system also has creeping root stalks. It has an erect growth habit with heavy basal leaf growth, and can reach a height of 90 to 150 cm by maturity. It can be distinguished from other closely related grasses as many of the leaves have short hairs along the edge. The heads are usually 15 to 25 cm long and are typical of wheatgrasses. The seed heads are made up of spikelets spaced at one per node, each containing two to six seeds similar in size to oats. The pointed glumes are one half the length of the spikelet.

Traits useful in distinguishing among varieties are:

1) Plant growth habit
2) Leaf colour
3) Time of flowering
4) Length of spike
5) Stem pubescence
6) Leaf pubescence
7) Leaf attitude
8) Leaf length
9) Leaf width
10) Plant height



Source: Looman, J. 1983. 111 Range and Forage Plants of the Canadian Prairies. Swift Current, Saskatchewan: Research Branch, Agriculture Canada.

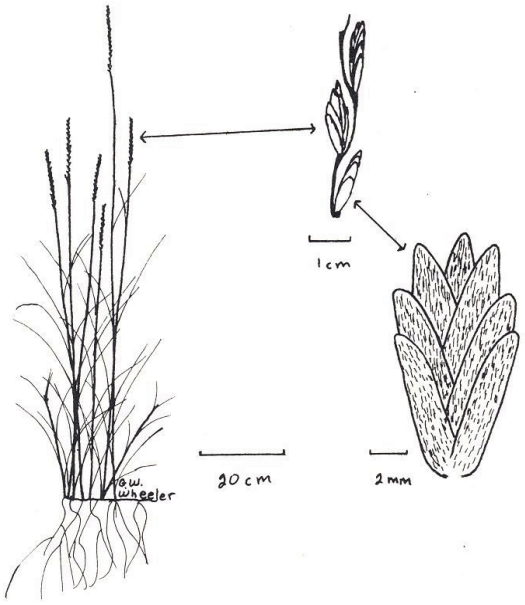
Northern Wheatgrass *(Elymus lanceolatus* formerly *Agropyron dasystachyum*)

Northern wheatgrass, also known as thickspike wheatgrass, is a long-lived perennial with a three-way root system made up of creeping underground rootstocks, a dense shallow root system which penetrates to a depth of about 25 cm, and a couple of deep roots which can penetrate to a depth of at least 60 cm.

Plants are tufted with erect leaves and stems that grow 45 to 75 cm high. The leaves are a light greyish-green and are rolled when conditions are dry. Its seed heads are 6 to 12 cm long. The seed is generally 50% larger than that of crested wheatgrass.

Traits useful in distinguishing among varieties are:

1) Plant growth habit
2) Leaf colour
3) Time of flowering
4) Length of spike
5) Stem pubescence
6) Leaf pubescence
7) Leaf attitude
8) Leaf length
9) Leaf width
10) Plant height



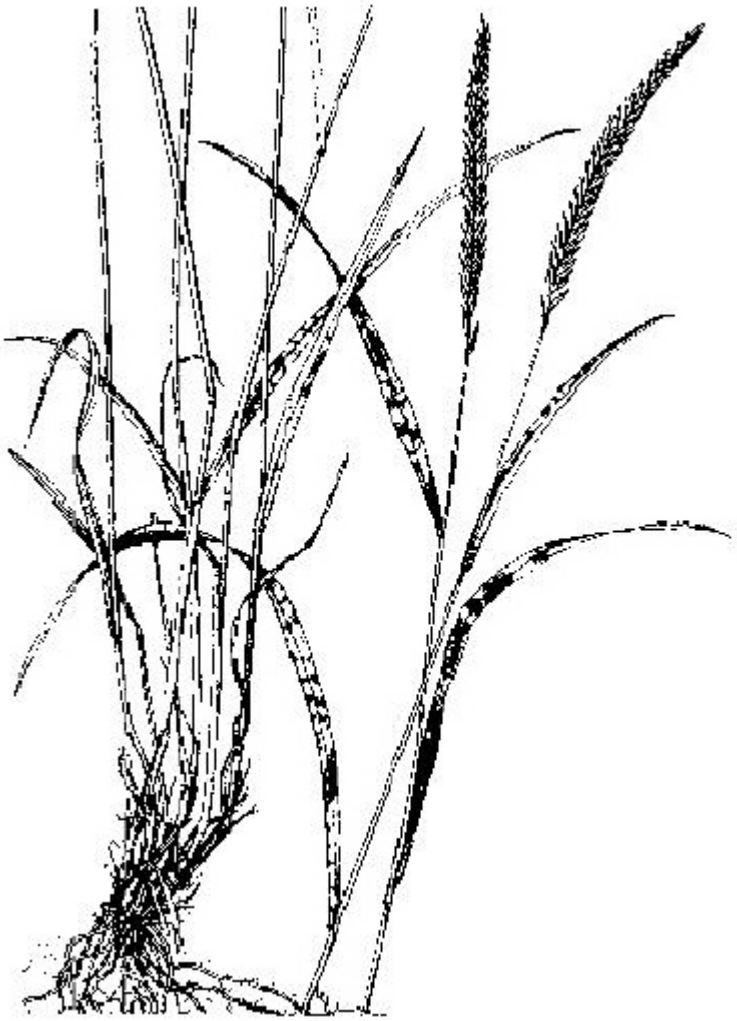
Source: Wheeler, G. 1981. Pubescent Wheatgrass. In the Alberta Forage Crops Advisory Committee, *Alberta Forage Manual*. 4th Edition. Edmonton: Alberta Agriculture.

Pubescent Wheatgrass (*Agropyron trichophorum*)

Pubescent wheatgrass is a long-lived, sod-forming grass which closely resembles intermediate wheatgrass, but can be distinguished by the presence of short stiff hairs (pubescence) on its heads and seeds. The two species reproduce together easily, resulting in a gradual grading between the two species (i.e., there are plants which carry traits of both and appear to be a mix of the two). Because of this grading, it has been suggested that they should be called the same species (*Agropyron intermedium*). However, pubescent wheatgrass is both more drought tolerant and longer lived than intermediate wheatgrass.

It has an erect growth habit with heavy growth of basal leaves. Its stems grow to a height of 90 to 150 cm with seed heads that are 10 to 20 cm long. The plant, seed heads, and seed are all somewhat hairy.
Traits useful in distinguishing among varieties are:

1) Plant growth habit
2) Leaf colour
3) Time of flowering
4) Length of spike
5) Stem pubescence
6) Leaf pubescence
7) Leaf attitude
8) Leaf length
9) Leaf width
10) Plant height

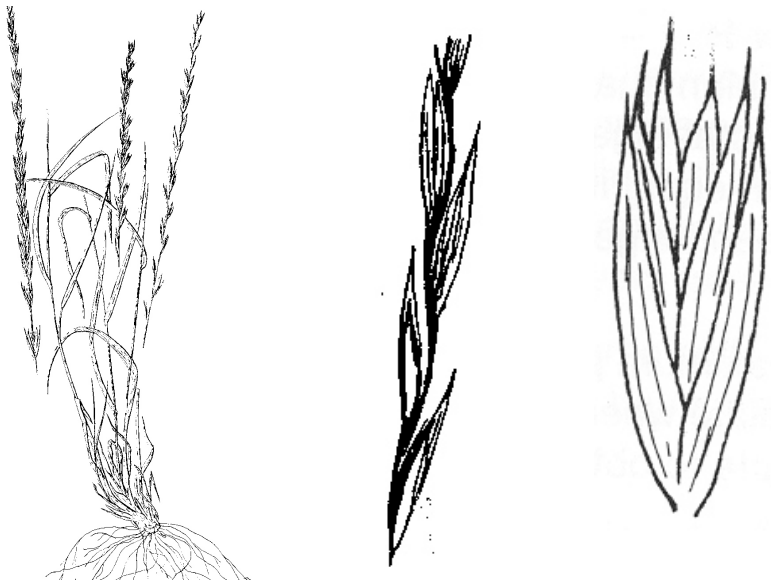


Siberian Wheatgrass (*Agropyron sibericum, Agropyron fragile*)

Siberian wheatgrass is a long-lived, drought-resistant bunchgrass. It is similar to crested wheatgrass, but has finer stems and more narrow seed heads with awnless glumes. As well, its leaves are more lax, and it tends to mature later than standard crested wheatgrass.

Traits useful in distinguishing among varieties are:

1) Plant height
2) Time to flowering



Source: Wheeler, G. 1981. Slender Wheatgrass. In the Alberta Forage Crops Advisory Committee, *Alberta Forage Manual*. 4th Edition. Edmonton: Alberta Agriculture.

Source: Looman, J. 1983. 111 Range and Forage Plants of the Canadian Prairies. Swift Current, Saskatchewan: Research Branch, Agriculture Canada.

Slender Wheatgrass (*Elymus trachycaulus* formerly *Agropyron trachycaulum*)

Slender wheatgrass is a native, short-lived, perennial bunchgrass. It has a leafy, bunch growth habitat and a dense, fibrous root system that extends to a depth of 50 cm. Its bunches enlarge by tillering. Stems have an erect growth habit and are rather coarse. Seed stalks are 60 to 120 cm tall and have numerous leaves and spikes that are either dense or very open. Short awns extend from the seed hulls. Almost all plants have a reddish or purple colouring of the stems near their base. Leaves grow up to 30 cm long and 1.2 cm wide. It can be distinguished from other wheatgrasses by its slender seed head and larger seed.

Traits useful in distinguishing among varieties are:

1) Plant growth habit
2) Leaf colour
3) Time of flowering
4) Length of spike
5) Stem pubescence
6) Leaf pubescence
7) Leaf attitude
8) Leaf length
9) Leaf width
10) Plant height

Source: Wheeler, G. 1981. Streambank Wheatgrass. In the Alberta Forage Crops Advisory Committee, *Alberta Forage Manual*. 4th Edition. Edmonton: Alberta Agriculture.

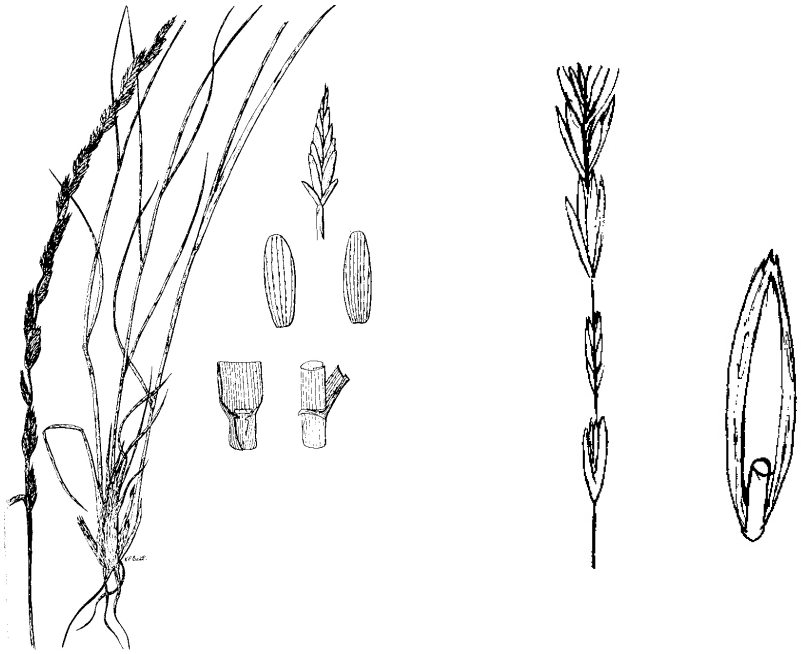
Source: Looman, J. 1983. 111 Range and Forage Plants of the Canadian Prairies. Swift Current, Saskatchewan: Research Branch, Agriculture Canada.

Streambank Wheatgrass (*Elymus lanceolatus* formerly *Agropyron riparium*)

Streambank wheatgrass is a cool-season, long-lived grass. It resembles northern wheatgrass, but can be distinguished by its lack of hair on its seed heads and seeds, and narrower leaves. The numerous slender rhizomes of streambank wheatgrass are more vigorous than those of northern wheatgrass. In the past the two have been considered to be the same species, but now are generally recognized as being distinct. The leaves are a light greyish-green, tough, narrow and smooth, 10 to 25 cm long and can be somewhat curled at the margins. The stems grow to 90 cm high. The seed head is 5 to 10 cm long, and its seeds are somewhat larger than those of crested wheatgrass.

Traits useful in distinguishing among varieties are:

1) Plant growth habit
2) Leaf colour
3) Time of flowering
4) Length of spike
5) Stem pubescence
6) Leaf pubescence
7) Leaf attitude
8) Leaf length
9) Leaf width
10) Plant height



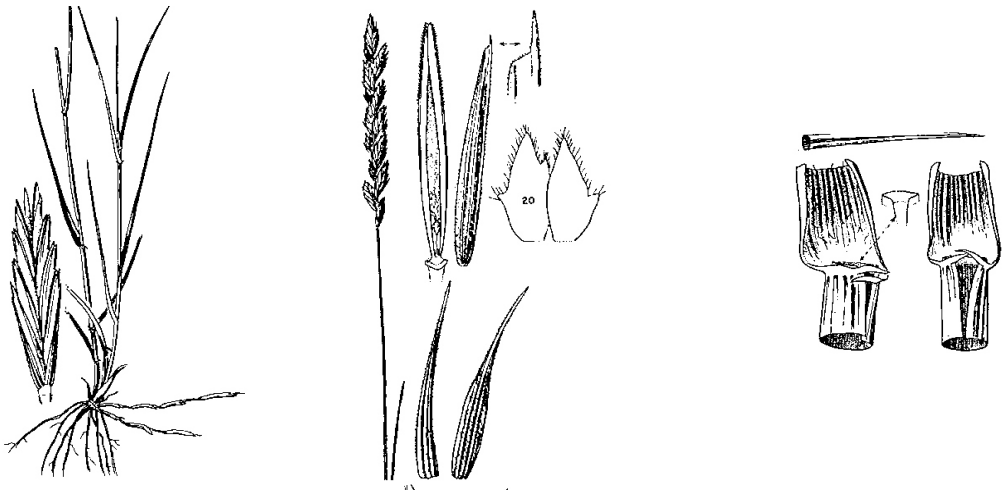
Source: Looman, J. 1983. 111 Range and Forage Plants of the Canadian Prairies. Swift Current, Saskatchewan: Research Branch, Agriculture Canada.

Tall Wheatgrass *(Elytrigia elongata* formerly *Agropyron elongatum*)

Tall wheatgrass is a late maturing, coarse bunchgrass that grows by producing tufts on short rootstocks at the edge of mature plants. It has long, light-green, coarse basal leaves which surround several leafy stems that are 80 to 200 cm tall. Its seed heads are similar to those of intermediate wheatgrass, but are generally longer, from 15 to 25 cm in length. Unlike with western wheatgrass, the spikelets do not overlap. The spikelets and the four to ten enclosed seeds grow away from the stem like a sickle. Its seeds which are contained in glumes which are square across the tip are somewhat larger than that of intermediate wheatgrass, but tends to have a lower germination.

Traits useful in distinguishing among varieties are:

1) Plant growth habit
2) Leaf colour
3) Time of flowering
4) Length of spike
5) Stem pubescence
6) Leaf pubescence
7) Leaf attitude
8) Leaf length
9) Leaf width
10) Plant height_____



Source: Wheeler, G. 1981. Western Wheatgrass. In the Alberta Forage Crops Advisory Committee, *Alberta Forage Manual*. 4th Edition. Edmonton: Alberta Agriculture.

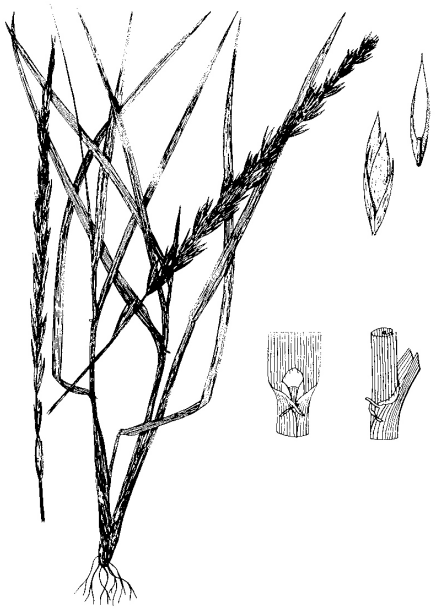
Western Wheatgrass (*Agropyron smithii*)

Western wheatgrass is also known as bluejoint. It has a well-developed root system made up of a mass of surface roots which feed to a depth of 20 cm and a set of deep feeding roots which can penetrate to a depth of up to 150 cm. It is very hardy and spreads by underground rhizomes.

The leaves of western wheatgrass are 20 to 30 cm long, and grow at a 45 degree angle to the stem. The plant as a whole grows 60 to 90 cm high. Its leaves are blue-green and more or less stiff and erect. The entire plant is covered with a greyish bloom, giving it a distinct colouration. Seed heads are 5 to 15 cm long, and the seed is roughly twice as large as that of crested wheatgrass.

Traits useful in distinguishing among varieties are:

1) Plant growth habit
2) Leaf colour
3) Time of flowering
4) Length of spike
5) Stem pubescence
6) Leaf pubescence
7) Leaf attitude
8) Leaf length
9) Leaf width
10) Plant height



Source: Looman, J. 1983. 111 Range and Forage Plants of the Canadian Prairies. Swift Current, Saskatchewan: Research Branch, Agriculture Canada.

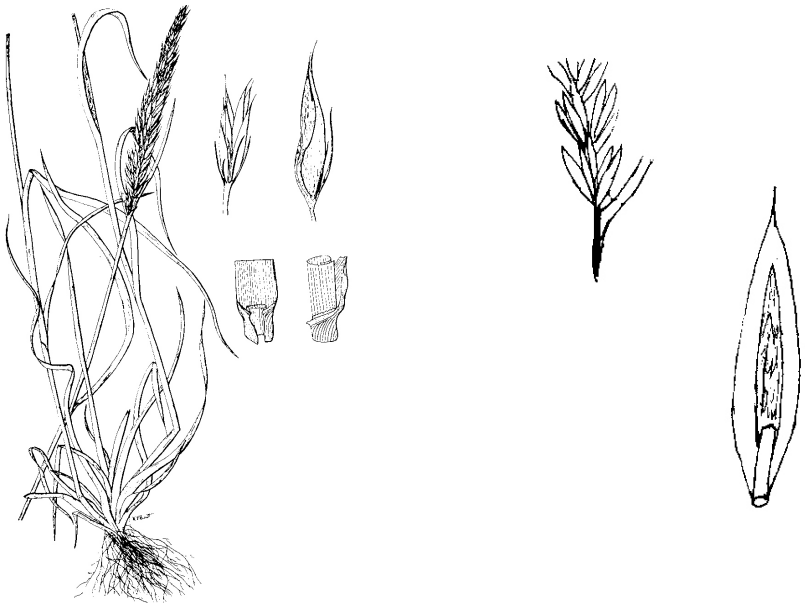
Altai Wildrye (*Elymus angustus*)

Altai wildrye is a long lived perennial bunchgrass. It has a well-developed root system that can penetrate 3 to 4 m deep. It has coarse stems 60 to 120 cm long and coarse, wide, erect basal leaves, light green to blue green in colour which can reach lengths of 40 cm and widths of 12 mm. Its seed heads are 15 to 20 cm long with its seeds being 10 to 15 mm long, about three times larger than those of Russian wildrye.

(No image available)

Dahurian Wildrye (*Elymus dahuricus*)

Dahurian wildrye is a short-lived, perennial bunchgrass with a shallow root system.

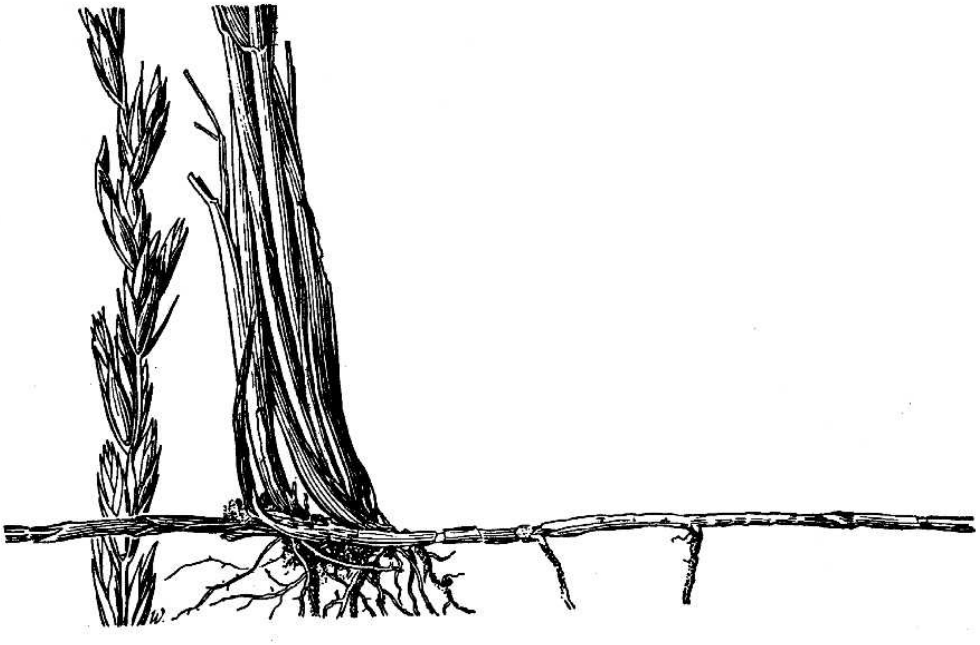


Source: Wheeler, G. 1981. Russian Wildrye. In the Alberta Forage Crops Advisory Committee, *Alberta Forage Manual*. 4th Edition. Edmonton: Alberta Agriculture.

Source: Looman, J. 1983. 111 Range and Forage Plants of the Canadian Prairies. Swift Current, Saskatchewan: Research Branch, Agriculture Canada.

Russian Wildrye (*Elymus junceus*)

Russian wildrye is a long-lived, large bunchgrass. Its roots are fibrous and can grow to a depth of 3 m. In addition, its wide horizontal spread can be as wide as 1.2 to 1.5 m around the plant. It has many long, dense basal leaves that are 15 to 45 cm long and up to 6 mm wide. The leaves of Russian wildrye vary from light to dark green, with many falling into the blue-green colour range. It has erect, naked stems that grow to 60 to 120 cm tall, having a straw colour when mature. The seed head is made up of overlapping spikelets. Two spikelets at each node contain one to four or more seeds.



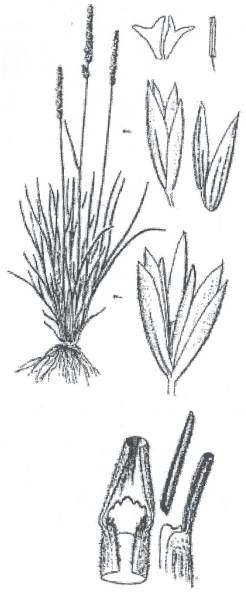
Source: USDA-NRCS PLANTS Database / Hitchcock, A.S. (rev. A. Chase). 1950. *Manual of the grasses of the United States*. USDA Misc. Publ. No. 200. Washington, DC.

Beardless Wildrye (*Elymus triticoides*)

Beardless wildrye is a perennial, sod-forming grass with a well-branched root system that can reach 1.5 m deep. It has predominately basal leaves and culms that grow from 50 to 100 cm in height. This species is also sometimes called “creeping wildrye”.

Traits useful in distinguishing varieties:

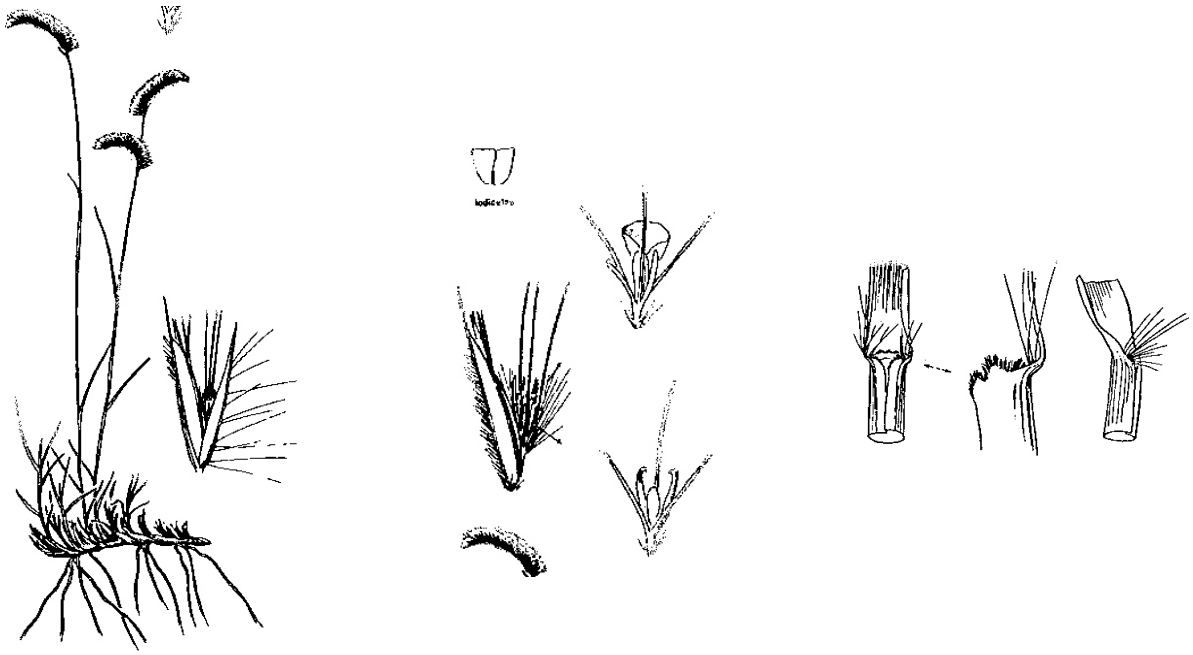
1) Plant height
2) Time to flowering



Source: Tannas, Kathy. Common Plants of the Western Rangelands. Volume 1. Lethbridge, Alberta.

June Grass *(Koeleria macrantha)*

June grass is a perennial grass that forms small dense tufts of softly hairy to hairless stems reaching 20 to 50 cm tall. The light green to blue-green leaf blades are predominantly basal and are 4 mm wide and 5 to 12 cm long, with somewhat boat -shaped tips. The leaves are hairless on both surfaces to softly hairy with shiny small hairs. The leaf margins are roughened with narrow white nerves that are folded at emergence. The sheathes are round, split, roughened, somewhat hairy and distinctly veined. The basal sheaths are pale cream-coloured and slightly swollen at the crown. The membranous ligules extend up to 1 mm long and are blunt, often split and are usually fringed with tiny hairs. It has a spike-like panicle that is somewhat open during flowering and is pale green to purplish in colour and 4 to 10 cm long. The spikelets usually contain 2 flowers and are 4 to 5 mm long. The glumes are 2 to 3 and 3 to 4 mm long and lightly roughened on the keels. The lemmas are often short awned and finely roughened to sparsely hairy.



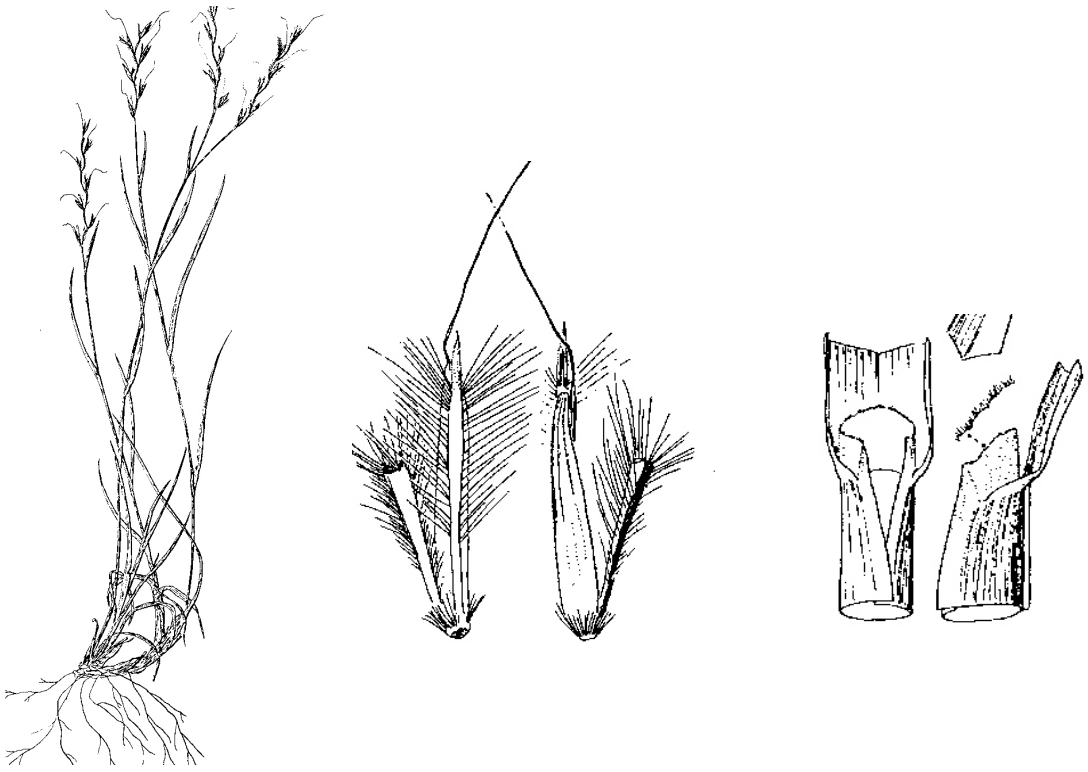
Source: USDA-NRCS PLANTS Database / Hitchcock, A.S. (rev. A. Chase). 1950. *Manual of the grasses of the United States*. USDA Misc. Publ. No. 200. Washington, DC.

Blue Grama (*Bouteloua gracilis*)

Blue grama produces a dense mat of short leaves growing from both short underground tillers and from the crown. The fine, curling basal leaves have a distinct grayish green colour to them. It has very narrow, tapering blades which are 2.5 to 17.5 cm long with ligules that are very short having ciliate hairs. The pith-filled stalks grow up to 50 cm in height and usually carry two dark brown, sickle shaped spikes, on which the flowers are clustered along the upper sides. Each spikelet contains a perfect floret (contains both the stamen and pistil).

Traits useful in distinguishing varieties:

1) Plant height
2) Time to flowering



Source: Looman, J. 1983. 111 Range and Forage Plants of the Canadian Prairies. Swift Current, Saskatchewan: Research Branch, Agriculture Canada.

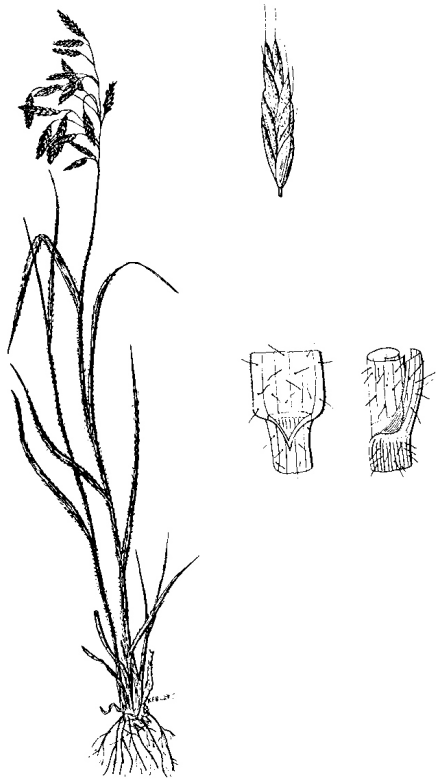
Source: Tannas, Kathy. Common Plants of the Western Rangelands. Volume 1. Lethbridge, Alberta.

Little Bluestem (*Schizachyrium scoparium*)

Little bluestem is a warm season bunchgrass with an extensive, dense root system. The pith-filled stems can reach heights of 0.6 to 1.2 m. Leaves can grow up to 20 cm long, and 6.3 mm wide. Its leaves are flat with fine hairs above the ligules, starting out blue-green but turning a red-brown at maturity or after exposure to frost. Each stem is topped by a single branched panicle which produces hair-covered and awned seeds.

Traits useful in distinguishing among varieties:

1) Leaf colour
2) Time of inflorescence emergence
3) Plant height



Source: Looman, J. 1983. 111 Range and Forage Plants of the Canadian Prairies. Swift Current, Saskatchewan: Research Branch, Agriculture Canada.

Fringed Bromegrass (*Bromus ciliatus*)

Fringed bromegrass is a perennial grass which is normally tufted with a well-developed root system. Its culms are slender and normally reach 50 to 125 cm tall. The leaf blades are flat, 15 to 25 cm long and 3 to 15 mm wide, and normally rolled in the bud-shoot, eventually tapering to a sharp point. The leaves are slightly pubescent and dark green, and have a distinct mid-rib on the lower surface and a slightly ridged upper surface. Its panicle is open, usually between 7 to 18 cm long with ascending to drooping branches which hold seeds whose husks are partly or completely covered with short hairs, yet remain awnless.

Traits useful in distinguishing varieties:

1) Plant height
2) Time to flowering

Source: Looman, J. 1983. 111 Range and Forage Plants of the Canadian Prairies. Swift Current, Saskatchewan: Research Branch, Agriculture Canada.

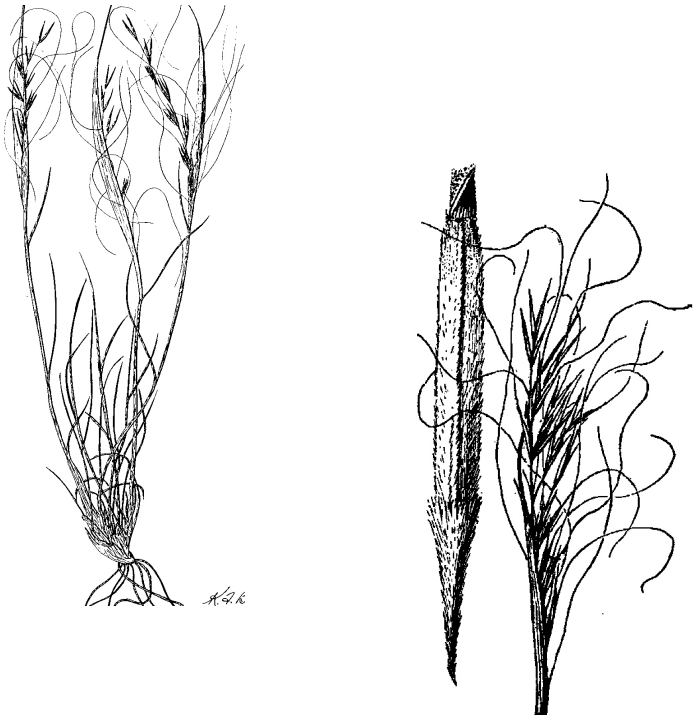
Source: Tannas, Kathy. Common Plants of the Western Rangelands. Volume 1. Lethbridge, Alberta.

Green Needlegrass (*Stipa viridula*)

It is believed to be called "green" needlegrass because, unlike many forages, its seed heads and foliage remain fresh and green through the entire growing season. Green needlegrass is a perennial bunchgrass with small, awned, black, hair coloured seeds that look and feel like needles. It grows to a height of 0.45 to 1.5 m. Needlegrass has a dense fibrous root system. Its panicle is 10 to 20 cm long, compact, with narrow appressed branches. Lemmas are 5 to 6 mm long and glumes are 7 to 10 mm long. There are white hairs at the junction of the leaf blade and sheath as well as along the edges of the sheath.

Traits useful in distinguishing among varieties:

1) Plant height
2) Time of flowering



Source: USDA-NRCS PLANTS Database / Hitchcock, A.S. (rev. A. Chase). 1950. *Manual of the grasses of the United States*. USDA Misc. Publ. No. 200. Washington, DC.

Source: Looman, J. 1983. 111 Range and Forage Plants of the Canadian Prairies. Swift Current, Saskatchewan: Research Branch, Agriculture Canada.

Needle and Thread Grass (*Stipa comata*)

Needle and Thread grass is a cool-season native grass, named after the combination of sharp seeds combined with long, bent and twisted thread-like awns. The plant's narrow, green to gray coloured leaves grow in a dense cluster and reach 20 to 30 cm in height, and tend to roll in as they mature. It has predominately basal leaves and culms which reach 30 to 120 m high. Its panicle is 10 to 20 cm long and loosely spreading. This grass is characterized by its long, notched and frayed, membranous ligule. It has no auricles.

Traits useful in distinguishing varieties:

1) Plant height
2) Time to flowering