

THE IDENTIFICATION OF NATIVE GRASSES
BY THEIR VEGETATIVE CHARACTERS

By

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TABLE OF CONTENTS

	Page
INTRODUCTION -----	3
ACKNOWLEDGEMENTS -----	5
REVIEW OF LITERATURE -----	6
PRELIMINARY INVESTIGATIONS -----	9
MATERIALS AND METHODS -----	10
RESULTS-----	16
A Key for the Identification of Native Grasses by their vegetative characters -----	16
Glossary -----	21
Characters Illustrated, Plates 1 and 2 -----	25
Drawings and Descriptions of Species -----	28
SUMMARY -----	80
BIBLIOGRAPHY -----	82
INDEX TO SCIENTIFIC AND COMMON NAMES -----	84
INDEX TO COMMON AND SCIENTIFIC NAMES -----	86

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INTRODUCTION

The total area of land in the United States is 1,903 million acres of which 55% is pasture land. The reasons this vast acreage is in pasture land is due to steep topography, light rainfall and type of soil, which makes cultivation impossible or unprofitable.

According to statistical information (21) Kansas has approximately 23 million acres or 44% of the total area of the state which is pasture land. About seventy-five per cent of this area can never be used for other than grazing purposes due to rough topography and poor soils.

The basic reasons for conducting pasture and range research are: first, large areas are useful only for pasture purposes; second, the cost of production of meat and milk on pastures is considerably less than when cultivated crops are fed (23) and third, a detailed knowledge is necessary of the flowering requirements and life history of the main pasture species in order to intelligently improve and maintain the productivity of the pasture lands.

In numerous pastures the better forage species are being replaced by weeds or less palatable species. A reduc-

tion of 40% in carrying capacity is not uncommon during a period of twenty-five or thirty years. Changes in pasture vegetation cannot be noted by general observations. Systematic and detailed examinations of the flora are necessary to determine any changes that may be taking place in the individual species which makes up the total vegetation. Little information is available on the native pasture forage.

The species of vegetation growing in the better Kansas pastures are normally composed principally of grasses. Broad leaved plants are rare. A knowledge of the forage value, growth habits, methods of reproduction, ability to withstand drought, cropping, burning and trampling by livestock are very essential in order to obtain maximum productivity. The forage value varies for different species at different periods of growth. Some withstand drought and burning and others do not. The beginning of growth and the time of maturity vary.

Pasture research is based on a thorough knowledge of the individual grasses during May, June, and July at which period the dominant species are not only making their greater growth but are also producing their greatest volume of leaves and number of tillers and are in their stage of

greatest nutritive value for the consumption of live stock.

The purpose of this thesis is to present data on the identification of native grasses in their vegetative or flowerless stage. This thesis is not a botanical manual. Many botanical terms are omitted purposely. It is a rough reference to aid field men who are learning the common native pasture grasses. Its scope is very limited. Many plants are omitted. Twenty-six of the more or less common native pasture grasses are included in this report. Twenty-eight plates with 195 figures are included to simplify the descriptive data.

That errors are entirely absent from such a report as this is perhaps too much to expect. I hope that those who have occasion to refer to this will oblige me with any corrections they may find necessary or advantageous to the betterment of the subject.

ACKNOWLEDGMENTS

I have pleasure in acknowledging my indebtedness to Professor A. E. Aldous, Dr. F. E. Clements, C. O. Johnson, C. D. Davis, J. W. Zahnley, Dr. J. E. Eckert, Dr. J. V.

Cortelyou,, Dr. C. O. Swanson, and others for helpful suggestions and criticisms in the preparation of this manuscript.

I am indebted not only to Professor Emil Deere of Bethany College who translated the booklet written by Ernst Henning, but especially to the Agronomy Department of the Kansas State Agricultural College which made the translation possible by its financial contributions.

REVIEW OF LITERATURE

The usual classification of grasses is based on the structure of the flowering parts, but in the absence of these parts, vegetative characters must be used.

The first attempt to study the grasses in their flowerless state was by the German Jesson (1), (see (6) p. 1.), *Deutschlands Graser*, 1863.

The basic work on the subject was done by Samsø Lund (2) 1882 (Swedish) "Direction for the Recognition of Grasses in the Flowerless State". The publications which followed on this subject are principally revisions of the work of Lund.

Stebler and Schreeter (3) in 1889 studied the best hay and pasture grasses.

The following year, 1890, Nees (4) published a report, "How to Know Grasses by their Leaves". In 1900, Percival (5) prepared a very complete key on English grasses. Ward (6) 1901, published a very excellent handbook on English grasses in which he includes the following subjects:

- Chapters 1 - 2 - The vegetative organs.
- 3 - Grasses classified according to their vegetative characters.
- 4 - Anatomy and histology.
- 5 - Grasses classified according to the anatomical characters of the leaf.
- 6 - Grasses in flower.
- 7 - Grasses grouped according to their flowers and inflorescence.
- 8 - The fruit and seed.
- 9 - Classification of grasses by the "seeds" (grains) .
- 10 - Bibliography.

Schindler, (17) 1925, published a very comprehensive key with illustrations which is based on detailed, microscopic cross-sections of grass blades. Schlissel zur mikroskopischen Bestimmung der Wiesengrazer im blütenlosen Zustande (Key to the microscopic determination of meadow grasses in the flowerless condition.)

Henning (16) 1927, prepared the most complete Swedish report not only from Sweden but from Europe. The key includes seventy-four grasses and forty-one legumes of the native pastures. The booklet includes a review of early literature, a description of vegetative organs of grasses and legumes with illustrations.

In the United States the available data is very meager as compared to that in Europe. England especially, has given more attention to pasture research than to other lines of agriculture which is opposite to conditions in United States.

Carrier (9) 1917, published a very excellent key for the tame grasses common to the eastern section of the United States. Ball (19) 1927, (unpublished), compiled a very excellent thesis on native and tame grasses of Colorado.

The Forest Service, the Land Classification Department, and no doubt many others have used vegetative characters as a means of identifying grasses for many years.

Talbot (14) 1922, prepared a very unique pamphlet, "Grama, Bunch Grass and Buckbrush" which includes descriptions and photographs of ten species of grasses and six species of browse which are important in New Mexico and Arizona.

9

The references indicate that this method of identification is not new by any means and has been used for at least sixty-seven years.

PRELIMINARY INVESTIGATIONS

It occurred to the author ten years ago that illustrated vegetative characters could be used to advantage in identification of grasses, especially under conditions where no flower stalks were available. This method will be made use of more and more in the future due to the advancement of pasture and range management as well as other phases of research which involve the study of grasses.

Any research on our native and tame grasses, whether it involves studies on stock management, erosion, clipping, burning or other phases, necessitates a critical examination of the species under consideration in order to make practical adjustments on our conservation program.

The vegetation under observation in many instances is not in flower. This situation is due to many common causes of which the more important are: (1) cropping by live stock, (2) clipping, (3) burning experiments, (4) immaturity, and (5) drought.

Considerable data has been accumulated during the last few years in southwestern Colorado, Arizona, and New Mexico, on the vegetative characters of native grasses.

The most practical key appears to be regional in scope and application. A key on grasses of the semi-desert region in Arizona will not be applicable to Kansas grasses, even though some of the same grasses occur in both regions. However, detailed drawings of the outstanding characters supplemented with a detail description of any species should be representative for that habitat.

MATERIALS AND METHODS

At Manhattan, Kansas, during the fall of 1929, the vegetative characters of numerous grasses in the field were recorded and specimens were collected for comparative studies during the winter. Seventy-five species of native and tame grass seeds were planted in the greenhouse during September. The seedlings were frequently studied during the winter. Composite sod samples of the native grasses were transferred from the pastures during the fall, winter and spring to the greenhouse in order to compare established sod with seedlings of the same species.

Germination results of many of the perennials was comparatively poor except where selected seed was used which indicates that seed selection probably has considerable possibilities among the important native grasses and presents a fertile and important field of work. Some preliminary work on seed selection has been initiated at this station.

A variation of from six to fifty-eight days was recorded for the differences in germination.

The later the sod samples were transferred to the greenhouse the greater the vigor of the new growth.

A comparison of the seedlings in the greenhouse with the perennial sod growth of the same species indicates that: (a) sod growth is conspicuously more vigorous and represents more nearly actual growth conditions in pastures, (b) sod growth shows the characteristic method of vegetative reproduction much earlier than seedlings.

In general, composite sod samples transferred to the greenhouse or actual pasture conditions are more satisfactory for study than greenhouse seedlings of the same species with the exception of the annuals.

The stage of plant growth used for the descriptions and drawings was principally the period at which the third or fourth leaf appeared, however, they were also studied well

toward maturity. The first leaf developed on both seedlings and sod growth is usually much different than the succeeding leaves, especially in shape and amount of pubescence. However, the first leaf may have characteristics that are valuable for identification. Ball (19) who used the first leaf for identification has emphasized the need of stating the portion of the plant used for observation. He also states that this portion of the plant is less likely to be cropped off by grazing animals. The preceding years growth of perennial grasses should not be overlooked as an additional means of identification to that of the current growth. Examples: rachis of side oats, leaf glands of Hairy Grama and Side Oats Grama.

The vegetation making up the better native pasture should have approximately 95% grasses and 5% weeds (23). The abundance of the individual species of grasses which make up the total, vary from a trace to 25%.

In general the per cent of stand of the individual grasses in the tall grass type at Manhattan is as follows:

Big Bluestem -----	25%
Little Bluestem -----	25%
Side Oats Grama -----	12%
Sorghastrum -----	4%
Kentucky Blue Grass -	5%

Others, a trace to 1/4

Big Bluestem is more abundant in ravines and slopes while Little Bluestem is dominant on the ridges.

Kentucky Blue Grass is encroaching upon the native tall grasses, especially on ridges where Buffalo Grass is common. Kentucky Blue Grass is also spreading along the east and north slopes where moisture is more abundant.

A good hand lens of six to twelve power is recommended for field use in the study of grasses. Also, a short ruler graduated in both millimeters and inches is desirable.

The principal characters used for separating the grasses are shown on Plates 1 - 2, pages 26 and 27.

The three major characters used for the initial separation are: 1 - Blade folded in the bud.

2 - Blade clasping in the bud.

3 - Blade curled in the bud.

Character 2, "Blade clasping in the bud", heretofore has not been included separately in the keys by others but has been included in the third division or, "Blade curled in the bud". The author considers the separation justified and as outstanding as the other major characters. The major characters are supplemented by the character of the cross-

section of the stem.

The initial separation generally necessitates a cross-section immediately below the upper ligule, especially on small grasses. After making the cross-section a short period of time of approximately one minute is necessary for the wound to contract sufficiently in order to bring out details and make an examination possible with the hand lens. For the larger grasses, a cross-section may not be necessary where the shape of the leaf in the bud can be readily determined without a lens.

Ward (6), emphasizes the occurrence of variation in plants.

Carrier (9), also emphasizes the necessity of examining a number of individuals of the same species before attempting their identity.

Schindler (17), and others have included the use of stomata as a means of identification but this method does not appear practical for field methods.

The shape of the leaf in the bud appears to be constant which is not always true of pubescence on seedlings.

This key is not infallible. The characters have been used with satisfactory results. The key is based on the principal of opposing statements as typical of many keys. If

the specimen does not agree with the first statement, then all intervening headings should be passed over at once until the opposing statement is reached, which does apply.

RESULTS

A Key for the Identification of Native Grasses by their Vegetative Characters

- GROUP I. Blades folded in the bud, stems flat to elliptical.
- 1a - Growth usually low, spreading and decumbent.
- 2a - Plant with crooked hairs 1-5 mm. long on collar and sheath margin and dorsally on leaf near ligule.
 Plate 15 Goose Grass - *Elusine indica*.
- 2b - Plant usually smooth, if hairy, $\frac{1}{2}$ mm. long.
- 3a - Blades and sheath margins conspicuously white. Ligule collar-like, entire, smooth, higher in the back. Veins usually 3 in groups of threes each side of midvein.
 Plate 20 Texas Crab Grass - *Schedonardus paniculatus*.
- 3b - Blades and sheath margins not so conspicuously white. Ligule collar-like but divided, fringed and shorter in the back. Veins distinct and not in groups of threes.
 Plate 18 Windmill Grass - *Chloris verticillata*.
- 1b - Growth erect.
- 4a - Stems elliptical, plant glabrous, color dark green, blade tip boatshaped, sheaths at ground white. A sod

Grass. Plate 19 Kentucky Blue - Poa pratensis.

4b - Stems conspicuously flattened, usually without hairs, color light green, blades usually folded at base, sheaths usually pinkish near ground. Generally a dense turf.

Plate 5 Little Blue Stem - Andropogon scoparius.

GROUP II. Blades clasping to flat in the bud, stems round.

5a - Sheaths and both blade surfaces conspicuously hairy (without use of lens).

6a - Blades (2-4") long; narrow (1½-3 mm.) and drooping.

Plate 9 Buffalo Grass - Bulbilis dactyloides.

6b - Blades 1-3" long, 3-4 mm. wide and not drooping.

Plate 14 Salt Grass - Distichlis spicata.

5b - Sheaths and blade surfaces not conspicuously hairy.

7a - Hairs 1-3 mm. long, conspicuously glandular on blade margin. Plate 8 Hairy Grass - Bouteloua hirsuta.

7b - Hairs ½ to 1 mm. long, not conspicuously glandular on blade margin. Plate 17 June Grass - Koeleria cristata.

8a - Blades narrow, soft and drooping.

9a - Blades 1-3" long.

Plate 7 Blue Grass - Bouteloua gracilis.

9b - Blades 3-12" long

10a - Collar hairy, ventrally; sheaths hairy.
Plate 26 Framie Droseed - Sporobolus heterolepis.

10b - Collar smooth ventrally, sheaths smooth.
Plate 24 Long Leaved Rush Grass - Sporobolus aspera.

8b - Blades not narrow, soft drooping but stiff and conspicuously ribbed dorsally.

11a - Ligule collar-like, growth erect, collar smooth.
Plate 27 Porcupine Grass - Stipa spartea.

11b - Ligule hairy, growth decumbent to semi-decumbent, collar hairy.
Plate 23 Alkali snoton - Sporobolus airoides.

GROUP III. Blades curled in the bud.

12a - Auricles present, leaves blue green.
Plate 3 Western Wheat Grass - Agropyron and thil.

(Elymus would be here)

12b - Auricles absent.

13a - Plant smooth and ligule collar-like (2-3 mm.).
Plate 22 Blunt-sealed Grass - Sphenopholis obtusa.

13b - Plants pubescent

14a - Ligule two-toothed with thickened margins, when young frequently colored pink to brown.
Plate 21 Indian Grass - Sorghastrum nutans.

- 14b - Ligule not two-toothed.
- 15a - Stems elliptical.
- 16a - Plant all conspicuously hairy and usually blade margins are wavy or pucker'd, ligule collar-like.
Plate 13 Crab Grass - Digitaria sanguinalis.
- 16b - Blades not conspicuously hairy and wavy, ligule hairy.
- 17a - Blade with long crooked hairs (2-6 mm.) dorsally near ligule, growth generally erect (annual).
Plate 10 Yellow Foxtail - Chaetochloa glauca.
- 17b - Blades with short hairs 1 mm. long dorsally near ligule, growth generally semi-erect.
Plate 28 False Red Top - Tridens flavus.
- 18b - Stems round or nearly so.
- 18a - Plants not erect, but decumbent.
Plate 25 Sand Dropseed - Sporobolus erythandrus.
- 18b - Plants erect.
- 19a - Sheaths with marginal hairs.
- 20a - Blades erect, conspicuously hairy dorsally near ligule.
Plate 18 Switch Grass - Panicum virgatum.
- 20b - Blades drooping, smooth and soft (annual).
Plate 11 Green Foxtail - Chaetochloa viridis.

19b - Sheaths without marginal hairs.

21a - Plant hoary, canescent, very fine hairs over plant (annual).
Plate 16 Little Barley - Hordeum pusillum.

21b - Plants not hoary, but with conspicuous hairs on leaves and sheaths.

22a - Conspicuous glandular hairs (without lens) quite regular along blade margin (4-7 mm.), dorsal and ventral hairs short (1 mm.), stems round, forms a tuft.
Plate 6 Side-Oats Grass - Bouteloua curtipendula.

22b - Glandular hairs (4-7 mm.) not conspicuous nor regular along blade margin, dorsal hairs (4-6 mm.) conspicuous, ventrally absent, sheaths conspicuously red, forms a sod.
Plate 4 Big Bluestem - Andropogon furcatus.

GLOSSARY

- Annual..... Of only one year's duration. (A winter annual is a plant from autumn sown seed which matures the following season.)
- Auricle..... An appendage at base of blade on collar, usually clasping or horn-like.
- Bearded..... Bearing long hairs in tufts over small areas.
- Blade..... The expanded part of a leaf, sepal, or petal.
- Canescent..... Hoary with gray pubescence.
- Caryopsis..... The dry indehiscent one-seeded fruit of grasses, in which the pericarp is adherent to the seed, as the grain of wheat or corn.
- Chartaceous..... Having the texture of writing paper.
- Ciliate..... Fringed with hairs on the edge.
- Compressed..... Flattened.
- Creeping..... Extending along or just below the surface of the ground and rooting.
- Culm..... The stem of sedges and grasses.
- Decumbent..... Reclining, but with the end ascending.
- Dorsal..... Upon or relating to the back or outer surface of an organ. Upper surface of leaf.
- Extravaginal..... Where buds break thru the base of the enclosed leaf sheath, plants cover con-

- siderable area and form a close tuft.
Example: Big Bluestem.
- Floret**..... Each flower of a spikelet, together with its subtending lemma and palea.
- Glabrous**..... Smooth in the sense of not pubescent or hairy.
- Glandular**..... Gland-bearing, gland-like.
- Glaucous**..... Covered or whitened with a bloom.
- Hirsute**..... Pubescent with rather coarse or stiff hairs.
- Hoary**..... Grayish-white with a fine close pubescence.
- Hyaline**..... Transparent or translucent.
- Indigenous**..... Native and original to the region.
- Intravaginal**..... Where buds grow up between the leaf sheath and the stem emerging near the ligule, ultimately tearing the subtending leaf--results in tillering.
Example: Little Bluestem.
- Internode**..... The portion of a stem between two nodes.
- Ligule**..... In grasses a thin, often scariosus or hairy projection from the summit of the sheath.
- Linear**..... Long and narrow, with parallel margins.
- Membranaceous**..... Thin, rather soft, and more or less translucent.
- Midrib**..... The central or main rib.
- Nerve**..... A simple or unbranched vein or slender rib.

- Node..... In grasses the point of the stem from which originate the leaf-sheath and branches.
- Perennial..... Lasting year after year.
- Pilose..... Hairy, especially with soft hairs.
- Procumbent..... Lying on the ground or trailing but not rooting at the nodes.
- Pubescent..... Covered with short soft hairs.
- Raceme..... An inflorescence in which the flowers or spikelets are supported on pedicels along a common axis.
- Rachilla..... The axis of the spikelet, the continuation of the branch, to which the glumes, lemmas and palea are attached.
- Rachis..... The main axis or any of the branches to which the spikelets are attached.
- Rhizome..... A subterranean stem, usually rooting at the nodes and becoming erect at the apex.
- Root-stock..... Same as rhizome.
- Runner..... A slender stolon.
- Scabrous..... Rough to the touch.
- Scarious..... Thin, dry, and membranaceous, not green.
- Serrate..... Having sharp teeth pointing forward.
- Sheath..... In grasses the lower part of the leaf which envelopes the stem or culm.
- Smooth..... Either opposed to scabrous, i.e. not rough, or glabrous, i.e. not pubescent; the former is the more correct application.

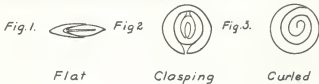
- Spike..... A form of inflorescence in which the spikelets are sessile on the axis.
- Spikelets..... In grasses the name applied to the cluster of one or more flowers subtended by the glumes.
- Sterile..... Unproductive, as a flower without pistil, or a stamen without an anther.
- Stolon..... A runner, or any basal branch that is disposed to root.
- Tomentose..... Densely pubescent with matted wool.
- Villous..... Bearing long soft hairs.
- Woolly..... Clothed with long matted hairs.

CHARACTERS ILLUSTRATED

Plates 1 and 2

Plate I

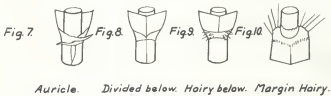
Blades in the bud: cross-section



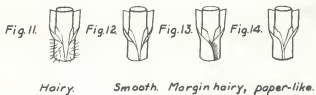
Ligule



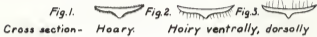
Collar



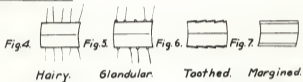
Sheath



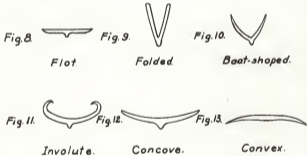
Blades: pubescent or hoiry



Blade margin



Blade: cross section



Stem: cross section



DESCRIPTION OF PLATE 3

Agropyron smithii, Rydb., (Western Wheat Grass)

General Description. A rough, rigid perennial of bluish green color with creeping root stalks, auricled, sparse stems, not forming a dense sod. Growth begins approximately March 15.

Habitat: Ridges and dry bottoms.

Association: Kentucky Blue, Little Bluestem.

Forage Value: Good forage when young, makes good winter feed in arid regions.

Character of New Growth:

Leaf in bud: curled. Fig. 2.

Plant: smooth, rarely hairy.

Blade: conspicuously rough dorsally, stiff.

Blade ribs: prominent (6-8). Fig. 5.

Blade: width 2-3 mm.; length 2-5.

Blade margin: toothed, cuts the hands easily.

Blade: generally flat to concave, erect, narrow pointed.

Ligule: collar-like 1/3 mm. tall, greenish white, thickened.

Collar: smooth, divided.

Auricle: generally colored, large, 1-2 mm. Fig. 3.

Sheath: smooth (hairy, Western Kansas species frequently has hairs on margin), papery margin, round.

Midrib: not prominent.

Growth: erect, extravaginal.

Roots: fibrous.

Vegetative reproduction: rhizomes. Fig. 1.

Color: bluish green, stems below ground surface occasionally reddish.

Veins: (6) 2 principal or larger veins with 3 to 4 smaller on each side of midvein, with lens by transmitted light. Fig. 6.

Outstanding Characteristics.

Color bluish green.

Auricle present, occasionally colored reddish brown.

Blades conspicuously ribbed dorsally and stiff.

Growth erect and stems scattering.



Fig. 2.

Cross section of leaf and stem X12

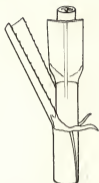


Fig. 3.

Back and side of sheath X6.

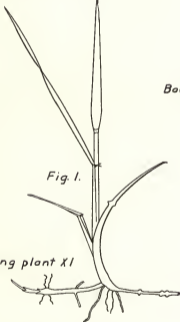


Fig. 1.

Young plant X1



Fig. 4.

Front of sheath X6



Fig. 6.

Cross section of leaf X16



Fig. 5.

Back of ligule, cross section of leaf and stem X12

DESCRIPTION OF PLATE 4

Andropogon furcatus, Muhl., (Big Bluestem)

General Description. A tall perennial, hairy especially the lower sheaths, growth erect, provided with creeping rootstalks and forms a thin sod. Blades tapering, pointed, thick at base. Growth begins about April 1.

Habitat: Ravines and slopes.

Association: Little Bluestem, Indian Grass, Switch Grass.

Forage Value: Excellent when young, becoming less palatable and nutritious as it matures.

Character of New Growth:

Leaf in bud: curled. Fig. 6.

Plant: hairy.

Blade: hairy, dorsally, 6-6 mm., average 5 mm., soft.

Blade ribs: indistinct.

Blade: base width 2-3 mm., middle 5-6 mm.; length 4-10".

Blade margin: toothed, glandular (not large as side
oats) few, not visible without lens.

Blade: flat to concave, drooping, narrow pointed.

Ligule: collar-like, medium 1-1½ mm., irregular
toothed, almost hidden by hairs on collar
(3-8 mm.) and on blade. Fig. 6.

Collar: hairy dorsally, rare ventrally and on margin,
divided.

Auricle: none.

Sheath: hairy 2-3 mm., veined, elliptical, frequently
colored below. Fig. 3 and 4.

Midrib: prominent ventrally, frequently colored.

Growth: erect, extravaginal.

Roots: fibrous.

Vegetative reproduction: rhizomes, Fig. 1.

Veins: 4 large (and one smaller near midvein) each
side midvein with lens by transmitted light.

Color: light green. Fig. 5.

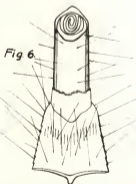
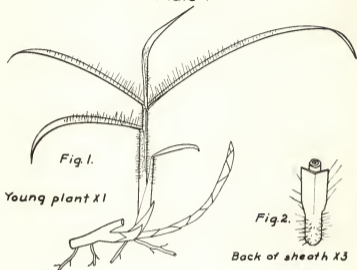
Outstanding Characteristics.

Sheath conspicuously pubescent.

Young shoot conspicuously reddish brown.

Long hairs on margin and upper surface of blade.

Plate 4



Back of ligule, cross section of leaf and stem X12.



Side and front of sheath X3.



Cross section of leaf X12.

DESCRIPTION OF PLATE 5

Andropogon scoparius, Michx., (Little Bluestem)

General Description. A dense perennial, much smaller than Big Bluestem; leaves slender, roots fibrous; conspicuous brown color toward maturity. Forms tufts. Growth begins April 1.

Habitat: Well drained ridges and slopes.

Association: Big Bluestem, Indian Grass, Kentucky Blue.

Forage Value: Excellent in leafy stages of growth.

Character of New Growth:

Leaf in bud: folded. Fig. 4.

Plant: usually smooth, rarely hairy.

Blade: if hairy, HFE, on margin and near base, rough dorsally, moderately soft.

Blade ribs: none.

Blade: width 1 mm., length 2-8".

Blade margin: Toothed. Fig. 6.

Blade: usually erect, narrow pointed; ends folded midblade V shaped to flat.

Ligule: collar-like, small $\frac{1}{2}$ mm., lightly toothed.

Collar: hairs rare on margin, rarely divided.

Auricle: none.

Sheath: usually smooth, rarely hairy, margin papery, veined, flat, base pinkish colored. Fig. 4.

Midrib: prominent ventrally, light green color.

Growth: erect to occasionally semi-erect, extra-vaginal.

Roots: fibrous.

Veins: 3 each side of midvein with lens by transmitted light. Fig. 8.

Color: conspicuously light green.

Blade: not decidedly angled at stem as Kentucky Bluegrass, tips frequently colored brownish red.

Outstanding Characteristics:

Sheaths conspicuously pinkish colored and flat.

Leaf folded in the bud.

Leaf cross-section, flat to folded, generally V shaped to folded.

Mature plants conspicuously reddish brown color.

Plate 5

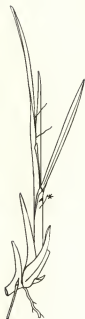


Fig. 1

Young plant X3

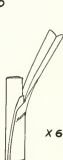


Fig. 2.

Side and back of sheath



Fig. 3.



X20

Fig. 4. Cross section of leaf and sheaths *



Fig. 6.

X20

Back of ligule,
Cross section of leaf
and stem.



Fig. 5. Cross section of leaf X20

DESCRIPTION OF PLATE 6

Bouteloua curtipendula, (Michx.) Torr., (Side Oats Grama)

General Description. Erect perennial from creeping rootstocks, blades with conspicuously glandular, hairy margins. Forms an open sod. Growth begins April 1.

Habitat: Gravelly hills, slopes and bluffs along streams.

Association: Blue and Hairy Gramas, Big Bluestem.

Forage Value: Good forage when young.

Character of New Growth:

Leaf in bud: curled. Fig. 2.

Plant: hairy. Fig. 1.

Blade: moderately stiff, rough dorsally, hairy 1 mm. long dorsally (rare), ventrally common, glandular marginal hairs 4-7 mm., average 5mm.

Blade ribs: indistinct, 10-20.

Blade: width base 2-3 mm., middle 4-5 mm.; length 5-8".

Blade margin: toothed, glandular (seen without lens), glands sometimes colored red. Fig. 2.

Blade: flat, drooping, narrow pointed.

Ligule: collar-like, small $\frac{1}{2}$ mm., lightly toothed.

Collar: hairy, rare ventrally, common on margin, frequently divided. Fig. 2 and 5.

Sheath: hairy 1 mm., papery margin, round, usually colored greenish brown to reddish brown below.

Growth: erect, intravaginal.

Roots: fibrous.

Vegetative reproduction: rhizomes. Fig. 1.

Veins: 4 (rarely 3) each side of midrib seen with lens toward transmitted light. Fig. 6.

Color: frequently red collar, margin and glands.

Outstanding Characteristics.

Conspicuous glandular hairs regular on blade margin. Frequently reddish color on lower sheaths, sheath margins, collar and glands.

Blades flat, drooping, short pubescent ventrally, and rare dorsally.

Old flower stalks have a zigzag rachis. Fig. 7.

Plate 6

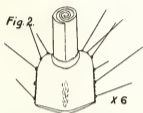


Fig. 2. Back of ligule, Cross section of leaf and stem. X 6

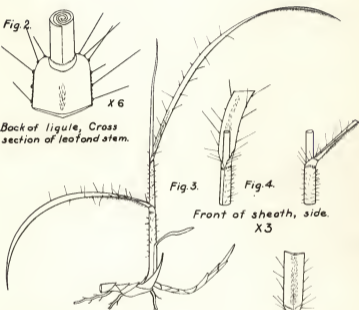


Fig. 1. Young Plant X1

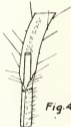


Fig. 3.



Fig. 4.

Front of sheath, side. X 3



Fig. 5.

Back of collar X 3

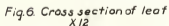


Fig. 6. Cross section of leaf X 12

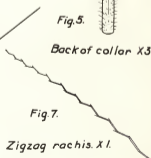


Fig. 7.

Zigzag rachis. X 1.

DESCRIPTION OF PLATE 7

Bouteloua gracilis, (H. B. K.) Lag., (Blue Grama)

General Description. A slender, erect perennial with strong root stocks, numerous basal leaves, forms a dense sod, withstands considerable trampling. Not as common as Hairy Grama. Growth begins approximately March 20.

Habitat: Well drained ridges and slopes.

Association: Side-oats, Hairy Grama, Little Bluestem.

Forage Value: Very good forage. Most important grass of the Great Plains. Cures and makes good winter forage under arid conditions.

Character of New Growth:

Leaf in bud: clasping. Fig. 6.

Plant: hairy.

Blade: hairy, rare 2 to 5 on margin, rough dorsally, soft.

Blade ribs: upper, indistinct.

Blade: width 1-1½ mm.; length 1-3". Narrower and longer than Hairy Grama.

Blade margin: toothed, glandular (rare, very small).

Blade: flat, drooping, narrow pointed. Fig. 1.

Ligule: hairy, small 1/8 - 1/4 mm. Fig. 6.

Collar: hairy margin. Fig. 6.

Sheath: smooth, papery margin, round.

Growth: erect to semi-erect, extravaginal.

Roots: fibrous.

Vegetative reproduction: rhizomes.

Veins: 4 each side midrib, lens by transmitted light.

Blade margin: without ribs by transmitted light, veins not ribbed along blade margin.

Outstanding Characteristics.

Blades usually smooth except at collar and ligule.

Blades narrow, long drooping with glands none to rare on blade margin.

The rachis on old flower stalks does not extend prominently beyond the spikelets as that of Hairy Grama. Fig. 7.



Rachis X1

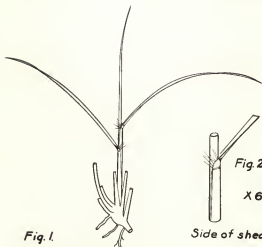


Fig. 1.

Young Plant X2

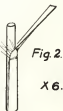


Fig. 2.

X6.



Fig. 3.

Side of sheath, Front.



Fig. 4. Back of collar. X6.



Fig. 6.

Back of ligule
Cross section of
leaf and stem. X12



Fig. 5. Cross section of leaf. X20.

Bouteloua gracilis-Blue Grama

DESCRIPTION OF PLATE 8

Bouteloua hirsuta, Lag., (Hairy Grama)

General Description. An erect fibrous rooted perennial, numerous basal leaves with conspicuous glands on margin. May form a tuft or sod. Drought resistant. Growth begins March 20.

Habitat: Dry slopes and ridges.

Association: Side Oats, Blue Grama, Little Bluestem.

Forage Value: Excellent forage. Makes good winter feed in arid regions.

Character of New Growth:

Leaf in bud: clasping. Fig. 6.

Plant: hairy.

Blade: hairy 1-3 mm., rough dorsally, soft.

Blade ribs: indistinct, (6-8).

Blade: width 1-2 mm.; length 2-5", average 3".

Blade margin: toothed, conspicuously glandular near base. Fig. 6.

Blade: flat, curled, drooping, narrow pointed. Fig. 1.

Ligule: hairy, small $\frac{1}{2}$ mm. Fig. 6

Collar: hairy (1-3) on glandular margin, also frequently wrinkled, occasionally divided.

Sheath: smooth, papery margin, veined, round.

Midrib: not prominent.

Growth: erect, semi-erect to decumbent, extravaginal.

Roots: fibrous.

Veins: 3 each side of midrib with lens by transmitted light. Fig. 7.

Dorsal ribs: on blades frequently not separated along margin.

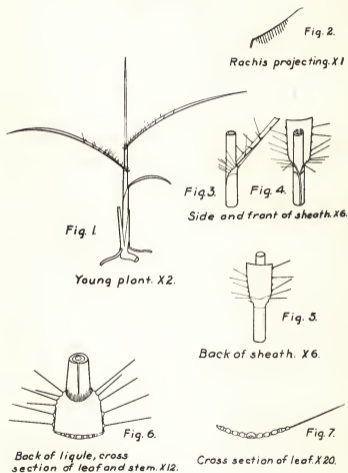
Glands: conspicuous on collar and blade margin, $\frac{1}{4}$ to $\frac{1}{3}$ of length from ligule. Fig. 6.

Outstanding Characteristics.

Conspicuous marginal, glandular hairs on blade and collar and occasionally on lower blade surface.

Leaves flat, short and drooping.

The rachis on old flower stalks extends prominently beyond the spikelets. Fig. 2.



DESCRIPTION OF PLATE 9

Sulbilla dactyloides, (Nutt.) Raf., (Buffalo Grass)

General Description. A creeping or stoloniferous perennial with stems bearing staminate and pistillate flowers, leaves flat, drooping and pubescent, forms a dense mat and sod. Growth begins approximately March 20.

Habitat: Plains, prairies and river bottoms. Principal grass in middle Great Plains.

Association: Grama Grasses.

Forage Value: Excellent and unsurpassed for winter forage in Great Plains.

Character of New Growth:

Leaf in bud: clasping. Fig. 6.

Plant: hairy. Fig. 1

Blade: hairy $1\frac{1}{2}$ -2 mm. long, rough dorsally. soft.

Blade rib: ventrally and dorsally indistinct.

Blade: width $1\frac{1}{2}$ -3 mm.; length 2-4".

Blade margin: toothed, glandular (with lens).

Blade: flat, drooping, narrow pointed.

Ligule: hairy, small $1\frac{1}{2}$ mm. tall. Fig. 6.

Collar: hairy, rare ventrally, on margin $1\frac{1}{2}$ -2 mm. long.

Sheath: smooth, rarely hairy, veined, round.

Midrib: not prominent.

Growth: erect, semi-erect to decumbent, extravagant.

Roots: fibrous.

Vegetative reproduction: stolons. Fig. 5.

Veins: usually two, each side of midvein on older leaves with lens by transmitted light. Fig. 6.

Outstanding Characteristics.

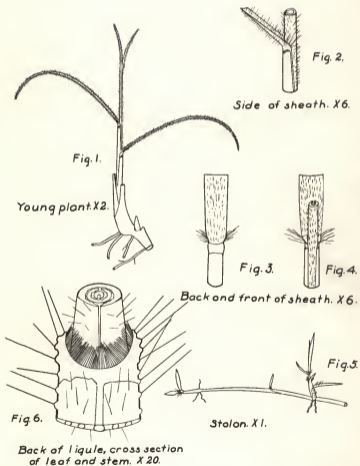
Conspicuous pubescent on both surfaces of blades, sheaths usually smooth.

Blades narrow, long and drooping.

Conspicuous stolons on old growth.

Old blades have conspicuous marginal glands on blade and especially on the collar. Usually the hand lens is necessary to see the glands.

Plate 9.

*Bulbilis dactyloides*-Buffalo Grass

DESCRIPTION OF PLATE 10

Chaetochloa glauca, (L) Scribn., (Yellow Foxtail)

General Description. An annual, usually semi-erect, spreading, branching at the base, blades soft, drooping, pubescent near collar, frequently colored sheath and leaves. Common in overgrazed native pastures. Growth begins March 10.

Habitat: Fields, roadsides, overgrazed pastures.

Association: Green Foxtail, Squirrel Tail, Texas Crab.

Forage Value: Good when young, not important in pastures.

Character of New Growth:

Leaf in bud; curled. Fig. 5.

Plant: hairy.

Blade: few haired, dorsally, 2-5 mm. long, twisted, and soft.

Blade ribs: none.

Blade: width base 3-5 mm.; middle 6-10 mm.; length 2-3".

Blade margin: smooth.

Blade: flat, wide, drooping, and pointed.

Ligule: hairy, small, $\frac{1}{2}$ mm., Fig. 6.

Collar: smooth, (hairs rare if present and on margin).

Sheath: smooth, elliptical, frequently colored, reddish below.

Midrib: prominent ventrally. Fig. 6.

Growth: erect to semi-erect, intravaginal.

Roots: fibrous.

Color: light green.

Veins: usually 2 each side (occasionally 3) of mid-vein with lens by transmitted light. Fig. 6.

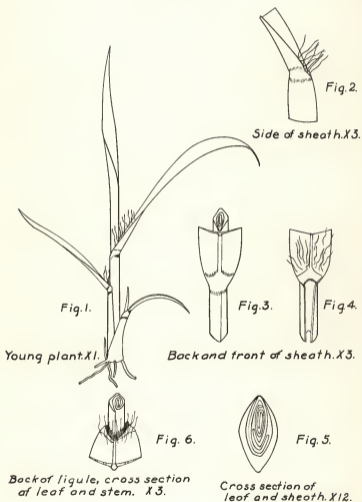
Outstanding Characteristics.

Conspicuous crooked hairs dorsally on blade near ligule.

Light green color.

Blades soft, flat, wide, drooping.

Sheaths elliptical frequently bright red below.



DESCRIPTION OF PLATE 11

Chaetochloa viridis, (L) Scribn., (Green Foxtail)

General Description. An erect smooth annual, branching at base, leaves soft, drooping, frequently colored sheaths and leaves. Comes in on overgrazed pastures. More common than Yellow Foxtail. Growth begins March 10.

Habitat: Fields, roadsides and overgrazed pastures.

Association: Foxtails, Texas Crab, Annuals.

Forage Value: Good when young, unimportant in pastures.

Character of New Growth:

Leaf in bud: curled. Fig. 5.

Plant: hairy.

Blade: smooth, soft.

Blade ribs: none.

Blade: width base 2-4 mm.; middle 6-10 mm.; length 2-5".

Blade margin: smooth.

Blade: flat, concave, drooping and pointed.

Ligule: hairy, medium 1/3 to 1 mm. on margins. Fig. 6.

Collar: not hairy on margin. Fig. 2 and 3.

Auricle: none.

Sheath: hairy on margin $\frac{1}{2}$ - 1 mm., round. Fig. 2 and 3.

Midrib: conspicuously greenish white ventrally and dorsally.

Growth: erect, intravaginal.

Roots: fibrous.

Veins: usually 3 (occasionally 2) each side of midrib with lens by transmitted light. Fig. 6.

Color: light green.

Outstanding Characteristics.

Blades smooth, flat to concave, soft and drooping.

Short pubescence on sheath margin.

No hairs on upper blade surface as on Yellow Foxtail.

Plate II.

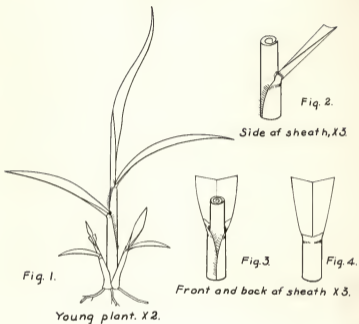


Fig. 6.
Back of ligule, cross section
of leaf X6.



Fig. 5.
Cross section of leaf. X6.

DESCRIPTION OF PLATE 12

Chloris verticillata, Nutt., (Windmill Grass)

General Description. A decumbent spreading perennial, leaves folded to boatshaped, decumbent flower stalks break away from plant and rolls as a tumble weed. Growth begins approximately March 1.

Habitat: Cultivated fields, roadsides, weedy areas in pastures.

Association: Crab Grass, Foxtails, Texas Crab, Annuals.

Forage Value: Usually none. Weed rather than forage plant.

Character of New Growth:

Leaf in Bud: folded. Fig. 2 and 3.

Plant: hairy, (usually few haired).

Blade: hairy ventrally $\frac{1}{2}$ mm., rough dorsally, soft.

Blade rib: indistinct.

Blade: width 1-2 mm.; length 1-4; average $2\frac{1}{2}$ "

(Texas Crab average 1" long.)

Blade margin: lightly toothed, narrow white margin.

Blade: folded, semi-erect to drooping, pointed,

flat, V shaped, tip boatshaped, blunt.

Ligule: collar-like, fringed, small $\frac{1}{2}$ -1 mm., almost divided into halves, sides higher than back.

Collar: occasional hairs dorsally 1-2 mm. long, ventrally near sheath margin, almost divided.

Sheath: smooth, papery margin, flat, 2-4 mm. wide, 1 mm. or less thick. Fig. 4.

Midrib: prominent ventrally, growth semi-erect to decumbent, extravaginal.

Roots: fibrous.

Vegetative reproduction: roots at nodes. Fig. 1.

Veins: usually 3 (occasionally 4) each side of mid-vein with lens by transmitted light (Crab

Grass in threes, not distinct).

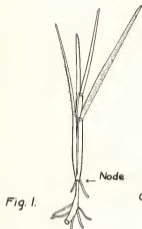
Growth: frequently from old nodes.

Outstanding Characteristics.

Stems flat, smooth, semi-decumbent to decumbent.

Blades folded at base, midblade V shaped and usually light pubescent ventrally.

Blades and sheath twice as long as Texas Crab.



Young plant. X 1.



Back of collar and ligule.
Cross section of leaf and stem, X 6.



Side of sheath X 6.



Cross section of
leaf and sheath. X 6.



Cross section of leaf, X 12.

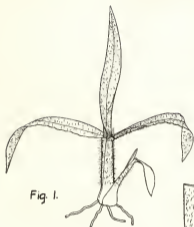


Fig. 1.

Young plant, X 2.

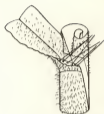


Fig. 2.

Side of sheath, X 3.



Fig. 3.

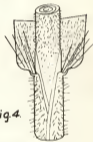
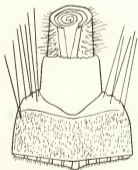


Fig. 4.

Back and front of sheath, X 3.



Back of ligule, cross section
of leaf and stem. X 12.



Fig. 5.

Root at node, X 1

Fig. 6.

DESCRIPTION OF PLATE 14

Distichlis spicata, (L) Greene, (Salt Grass)

General Description. A short erect, wiry perennial which forms a dense sod, conspicuously hairy, leaves short, sheaths overlapping. Grown where considerable alkali present. Growth begins March 1.

Habitat: Alkali soils. Common in arid regions.

Association: Alkali Sacaton.

Forage Value: Good when young.

Character of New Growth:

Leaf in bud: clasping. Fig. 6.

Plant: hairy, 1 mm. long.

Blade: hairy dorsally, generally more numerous dorsally than ventrally, stiff.

Blade ribs: dorsally and ventrally prominent.

Blade: width base 3-4 mm.; length 1-3".

Blade margin: toothed.

Blade: flat, semi-erect, narrow pointed.

Ligule: collar-like, small, 1/3 mm. tall, finely toothed. Fig. 6.

Collar: hairy, dorsally, ventrally, margin 2 mm. long.

Auricle: none.

Sheath: hairy, veined, round, colored reddish green to white.

Midrib: not prominent.

Growth: erect, intravaginal.

Vegetative reproduction: rhizomes. Fig. 1.

Color: dark green.

Veins: usually 4 each side of midvein with lens by transmitted light.

Leaf surface: dorsally appears as white crystals.

Outstanding Characteristics.

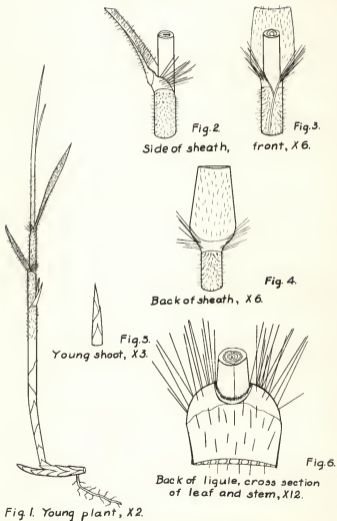
Growth erect, sodlike.

Blades short, wide at base and tapering to tip.

Usually crystal-like substance on dorsal blade with lens.

Conspicuous pubescence.

Plate 14.

*Distichlis spicata* - Salt Grass.

DESCRIPTION OF PLATE 13

Digitaria sanguinalis, (L) Scop., (Crab Grass)

General Description. A decumbent hairy, spreading annual, often taking root at the nodes, stems elliptical, blade margin frequently wrinkled. Begins growth approximately March 1.

Habitat: Fields, roadsides and overgrazed pastures.

Association: Foxtails, Texas Crab, and Annuals.

Forage Value: Probably of slight value when young.

Character of New Growth:

Leaf in bud: curled.

Plant: hairy. Fig. 6.

Blade: hairy, $\frac{1}{2}$ mm., both surfaces, dorsally few haired, 3-5 mm., soft. Fig. 6.

Blade ribs: indistinct.

Blade: width 4-6 mm., middle 6-10 mm.; length 1-3", average 2".

Blade margin: toothed, margin wavy, especially older leaves, occasionally glandular.

Blade: flat, drooping, pointed.

Ligule: collar-like, large 1-2 mm. high, conspicuously thin and almost transparent, frequently reddish color. Fig. 6.

Collar: hairy ventrally 1 mm., margin 3-5 mm., divided.

Sheath: hairy 1-3 mm., papery margin, veined, elliptical, frequently colored red, nodes hairy on older plants.

Midrib: prominent ventrally, frequently colored.

Growth: usually erect when young, decumbent when older, extravaginal.

Roots: fibrous.

Vegetative reproduction: frequently rooting at nodes.

Color: frequently reddish midrib, lower leaves, sheath and ligule.

Veins: usually 4 each side of midvein with lens by transmitted light. Fig. 6.

Outstanding Characteristics.

Conspicuous hairs over all the plant.

Frequently blade margin wavy, puckered, wrinkled.

DESCRIPTION OF PLATE 15

Eleusine indica, (L) Gaertner, (Goose Grass)

General Description. A decumbent flat stemmed annual, blade short and generally not flat. A few conspicuous, crooked hairs on collar and leaf. Spreading at base. Scattering in overgrazed pastures. Begins growth April 15.

Habitat: Fields, roadsides, vacant lots.

Association: Foxtails, Crab Grass, Texas Crab.

Forage Value: None.

Character of New Growth:

Leaf in bud: folded. Fig. 5.

Plant: hairy, crooked 1-3 mm. long. Fig. 4-5.

Blade: generally smooth, thick, hairs rare dorsally, 1-3 mm.

Blade ribs: indistinct.

Blade: width 3-4 mm.; length 1-5 cm.

Blade margin: smooth.

Blade: boatshaped, blunt, pointed, flatlike at tip.

Ligule: Collar-like 1 mm., medium, lightly toothed.

Collar: hairy 1-3 mm. on margin. Fig. 5.

Auricle: none.

Sheath: hairy 1-3 mm. on margin, margin papery, flat.

Midrib: not prominent.

Growth: decumbent, intravaginal.

Roots: fibrous.

Color: light green.

Nodes: conspicuously white.

Veins: 3 to 4, each side of midrib with lens by transmitted light. Fig. 5.

Outstanding Characteristics.

Sheaths flat, decumbent, few haired on margin.

Blades boatshaped, blunt pointed.

Hairs few and crooked.

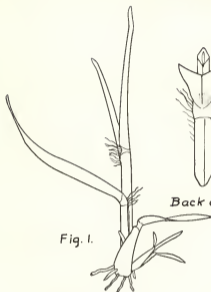


Fig. 1.

Young plant, X 2.



Fig. 2.



Fig. 3.

Back and front of sheath, X 6.

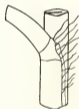


Fig. 4.

Side of sheath, X 6.



Fig. 5.

Back of collar, cross section of leaf and stem, X 12.

DESCRIPTION OF PLATE 16

Hordeum pusillum, Nuttall, (Little Barley)

General Description. A short hoary annual, erect, short lived. Common on overgrazed pastures. Growth begins approximately March 1.

Habitat: Fields, roadsides, vacant lots.

Association: Foxtails, Crab Grass, Annuals.

Forage Value: none. A pasture weed.

Character of New Growth:

Leaf in bud: curled. Fig. 5.

Plant: hairy. Fig. 1.

Blade: hairy ventrally and dorsally, slightly rough dorsally, soft.

Blade ribs: dorsally indistinct, 10-14.

Blade: width 2-5 mm.; length 3-12, average 6".

Blade margin: toothed, hairy.

Blade: boatshaped, drooping, narrow pointed, frequently edges rolled when dry.

Ligule: collar-like, small, $\frac{1}{2}$ mm. high, lightly toothed.

Collar: hairy dorsally, occasional ventrally and on margin, divided, greenish white.

Auricle: none.

Sheath: hairy, papery, margin, round, colored bluish pink.

Midrib: prominent ventrally.

Growth: erect to semi-erect, intravaginal.

Roots: fibrous.

Color: conspicuously pinkish when young.

Veins: 3 veins each side of midvein with lens by transmitted light. Fig. 6.

Outstanding Characteristics.

Conspicuously hoary over all the plants.

Growth erect, pinkish on lower sheaths.

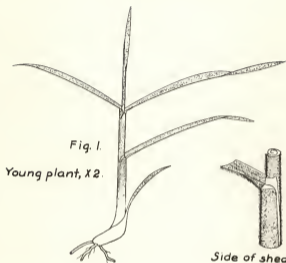


Fig. 1.

Young plant, X2.



Fig. 2.

Side of sheath, X6.



Fig. 5.

Back of ligule, cross section of leaf and stem, X12.



Fig. 4.

Front and back of sheath, X6.



Fig. 3.



Fig. 6.

Cross section of leaf, X12.

Hordeum pusillum - Little Barley

DESCRIPTION OF PLATE 17

Koeleria cristata, (L) Persoon, (June Grass)

General Description. A perennial with leafy semi-decumbent shoots at the base, blades numerous at base and usually finely pubescent with conspicuous ridges dorsally. A bunch grass. Not very abundant. Growth early, February 15.

Habitat: Open ridges and slopes.

Association: Bluestems, Grama, Buffalo.

Forage Value: Good forage, especially in early season.

Character of New Growth:

Leaf in bud: folded. Fig. 2.

Plant: hairy. Fig. 1.

Blade: hairy, short ventrally and dorsally, longer on margins; slightly rough dorsally, stiff.

Blade ribs: prominent dorsally (6-8). Fig. 2-6.

Blade: width base $1\frac{1}{2}$ -2 mm., middle 2-4 mm.; length 2-6", average 4".

Blade margin: lightly toothed, short, pubescent (1 mm.) along narrow white margin.

Blade: flat, drooping, pointed, margins frequently curled downward. Cross section convex.

Ligule: collar-like, small $\frac{1}{2}$ mm., toothed.

Collar: hairy margin, divided usually greenish white.

Sheath: smooth, veined (frequently continuous down thru collar into sheath), round, colored light green below to occasionally reddish.

Growth: flower stems erect, leaf decumbent, extravaginal.

Roots: fibrous.

Veins: indistinct, 2 each side of midvein with lens by transmitted light. Fig. 6.

Blade cross-section: when young flat to convex, older growth flat to concave.

Nodes: generally pubescent, also above and below.

Outstanding Characteristics.

Blades above conspicuously ribbed, frequently convex.

Color conspicuously dark green.

Growth semi-decumbent in early spring with sedges.

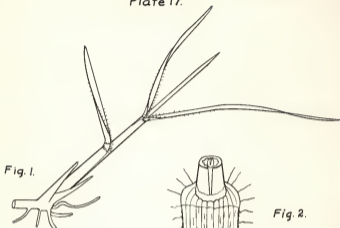


Fig. 1.

Young plant, X2.



Fig. 2.

Back of ligule, cross section of leaf and stem, X6.

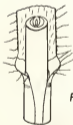


Fig. 3.

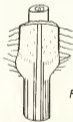


Fig. 4.

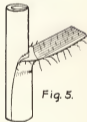


Fig. 5.

Front, back and side of sheath, X6.



Fig. 6.

Cross section of leaf, X12.



Fig. 7.

Node, X2.

DESCRIPTION OF PLATE 18

Panicum virgatum, (L), (Switch Grass)

General Description. A stout perennial with scaly root-stocks, plants erect, blades ascending, stems in large to small clumps, unbranched, tough and hard, narrowed at base. Forms a thick sod. Begins growth April 1.

Habitat: Common in meadows, along banks of streams, roadsides.

Association: Big Bluestem, Side oats, Indian Grass.

Forage Value: Good when young.

Character of New Growth:

Leaf in bud: curled. Fig. 2.

Plant: hairy.

Blade: first smooth, second hairy dorsally near ligule, rough dorsally, stiff.

Blade ribs: indistinct, numerous.

Blade: base 3-5 mm., middle 5-8 mm., length 4-12".

Blade margin: toothed.

Blade: flat, erect, wide, pointed.

Ligule: hairy, large 3-5 mm., long. Fig. 2.

Collar: hairy above 1-2 mm. long. Fig. 3.

Auricle: none.

Sheath: hairy on margin $\frac{1}{2}$ -1 mm. long, round; color, first brownish red, second greenish red, pinkish below surface. Fig. 3-4.

Midribs: prominent, pinkish white dorsally.

Growth: erect, extravagant.

Roots: fibrous.

Vegetative reproduction: rhizomes.

Veins: 5 veins each side of midvein in groups of threes with lens by transmitted light. Fig. 6.

Sheath: frequently colored on margin.

Color: light green on lower sheath and sheath margin.

Outstanding Characteristics.

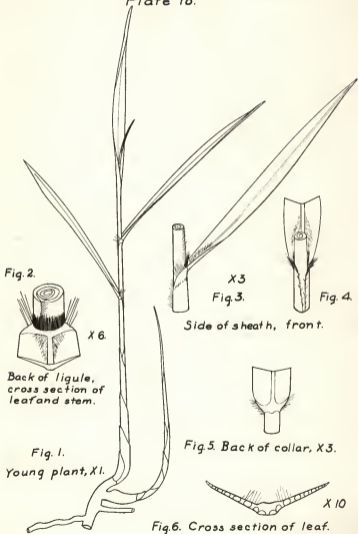
Pubescent dorsally on blade near collar.

Midvein conspicuously pinkish white dorsally.

Marginal hairs on sheath.

Blades stiff, wide and tip frequently inrolled.

Plate 18.



Panicum virgatum-Switch Grass R.F.C. 1930

DESCRIPTION OF PLATE 19

Poa pratensis, (L), (Kentucky Blue Grass)

General Description. A conspicuously dark green perennial, smooth, forms a dense sod by creeping rootstocks; ligule collar-like, small; blades long, narrow, folded to boatshaped. Does well on lined soils. One of the first grasses to start growing in spring.

Habitat: Lawns, moist ravines, slopes and ridges in pastures. Is replacing some of the native grasses.

Association: Bluestems, Gramas, Wheat Grass.

Forage Value: Very palatable and nutritious. Provides little forage in Kansas during summer months.

Character of New growth:

Leaf in bud: folded. Fig. 4.

Plant: smooth.

Blade: smooth, soft.

Blade ribs: indistinct.

Blade: base width 1-1½ mm., middle 2-3 mm., length 2-7".

Blade margin: smooth.

Blade: folded, tip boatshaped, drooping, blunt, narrow, usually erect, V shaped to flat mid-blade.

Ligule: collar-like, small, ½ mm. high. Fig. 6.

Collar: smooth. Fig. 3.

Auricle: none.

Sheath: smooth, flat.

Midrib: prominent ventrally. Fig. 6.

Growth: erect and semi-erect, branches intravaginal, rooting extravaginal.

Roots: fibrous.

Vegetative reproduction: underground stolons.

Veins: 3 each side of midrib with lens by transmitted light. Fig. 6.

Stems: usually semi-erect.

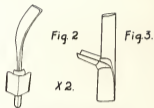
Outstanding Characteristics.

Color, dark green.

Blades, conspicuously angled with stem.

Blades, folded in bud, Blade tip boatshaped.

Plate 19.



Back of sheath, side.



Fig. 4. Cross section of leaf and sheath *



Fig. 5. Leaf tip boatshaped.



Fig. 1.

Young plant, X 1.



Fig. 6.

Back of ligule, cross section of leaf and stem.

Poa pratensis - Kentucky Blue grass. R.F.C. 19,50

DESCRIPTION OF PLATE 80

Schedonnardus paniculatus, (Nutt.) Trelease, (Texas Crab)

General Description. A decumbent annual with flattened stems and short, trough shaped leaves. Forms a dense mat, common in where the native grasses have been abused by grazing. Growth begins approximately March 10.

Habitat: Fields, roadsides, common in overgrazed pastures.

Association: Crab Grass, Windmill Grass and Foxtails.

Forage Value: Probably none.

Character of New Growth:

Leaf in bud: folded. Fig. 2-4.

Plant: smooth.

Blade: smooth, rough dorsally, moderately soft.

Blade ribs: indistinct, (18-20).

Blade: width 2-3 mm.; length $\frac{1}{2}$ -1 $\frac{1}{2}$ ".

Blade margin: toothed, white margined. Fig. 2.

Blade: folded, boatshaped, blunt pointed. Fig. 1.

Ligule: collar-like, 1-1 $\frac{1}{2}$ mm., conspicuous white folded.

Collar: smooth, conspicuously white, not divided.

Sheath: smooth, conspicuously white papery margin, $\frac{1}{2}$ to 1 mm. wide; flat and numerous veined.

Midrib: prominent ventrally colored white.

Vegetative reproduction: roots at nodes. Fig. 1.

Growth: decumbent, intravaginal.

Roots: fibrous.

Veins: usually 3, (occasionally 2) white veins each side of midvein in groups of threes. Fig. 5.

Outstanding Characteristics.

Conspicuously white on collar, ligule and margin of blade and sheath.

Ligule folded, margin almost smooth.

Blades boatshaped, V shaped to folded, short, and pointed.

Blades closely ranked on stem. (Windmill grass not).

Broad side of stems toward ground.

Veins usually 3 (with lens by transmitted light) in groups of threes. (Windmill Grass usually 3 distinct veins but not in threes.

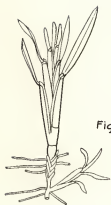


Fig. 1.

Young plant, X1.



Fig. 2.

Back of collar and ligule,
cross section of leaf and stem, X6.



Fig. 3.

Side of sheath



Fig. 4.

Cross section of
leaf and sheath, X6.

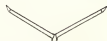


Fig. 5.

Cross section of leaf, X12.

DESCRIPTION OF PLATE 21

Sorghastrum nutans, (L) Nash., (Indian Grass)

General Description. Perennial, unbranched, erect stems, hairy nodes and sheaths. Blades long, tapering to a point. Creeping rootstocks. Ligule conspicuous. Forms a thin sod. Growth begins April 1.

Habitat: Rich soils on slopes and bottoms.

Association: Big Bluestem, Little Bluestem, Gramas.

Forage Value: Good, especially when young.

Character of New Growth:

Leaf in bud: curled. Fig. 2.

Plant: hairy.

Blade: smooth, rough dorsally, stiff.

Blade ribs: prominent dorsally, indistinct 10-24.

Blade: width base 2-3 mm., middle 4-5 mm.; length 4-12".

Blade margin: toothed, margin very light white.

Blade: generally erect, drooping, pointed, concave and thickened at base.

Ligule: 2 toothed, margins thickened, 2-4 mm. high, usually colored when young pink to brown.

Collar: smooth. Occasionally marginal hairs. Fig. 4.

Auricle: none.

Sheath: hairy, papery margin, round to elliptical, frequently colored, 2-3 mm., Fig. 2.

Midrib: prominent ventrally, dorsally conspicuously bluish green when young. Fig. 6.

Growth: erect, intravaginal.

Roots: fibrous.

Vegetative reproduction: rhizomes. Fig. 1.

Veins: indefinite, 3-4-5 each side of midvein with lens by transmitted light.

Nodes: conspicuously pubescent. Fig. 7.

New buds: pinkish red with pubescent margin.

Outstanding Characteristics.

Ligule 2 toothed with thickened margin.

Blades thickened and narrow at base, flat and wider middle.

Midvein conspicuous pinkish white dorsally and pinkish red ventrally.

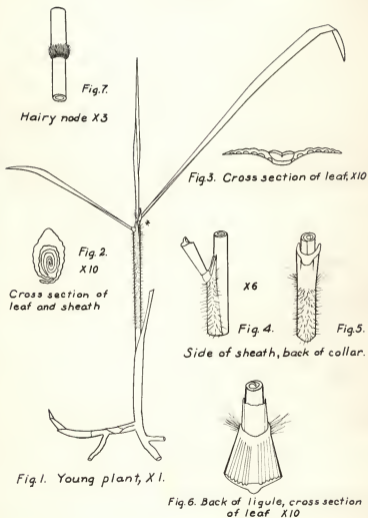


Fig. 7.
Hairy node X3

Fig. 2.
X10
Cross section of
leaf and sheath

Fig. 3. Cross section of leaf, X10

X6
Fig. 4. Fig. 5.
Side of sheath, back of collar.

Fig. 1. Young plant, X1.

Fig. 6. Back of ligule, cross section
of leaf X10

DESCRIPTION OF PLATE 22

Sphenopholis obtusata, (Muhl.) Scribn., (Blunt scaled Grass)

General Description. Erect, smooth perennial, leaves flat, soft, droopy. NOT common in native pastures. Growth begins March 20.

Habitat: Prefers moist soils on the high prairies.

Association: Little Blue, Big Blue, Indian Grass.

Forage Value: Good.

Character of New Growth:

Leaf in bud: curled. Fig. 6.

Plant: smooth, rarely hairy, margin rough.

Blade: smooth; if hairy, dorsally; soft.

Blade ribs: indistinct, numerous.

Blade: width base 3-4 mm., middle 5-8 mm.; length 3-6".

Blade margin: toothed.

Blade: flat, drooping, pointed.

Ligule: collar-like, lightly toothed, medium to large., 2-3 mm. tall. Fig. 1.

Collar: smooth, divided. Fig. 4.

Auricle: none.

Sheath: smooth, papery margin, veined, round.

Midrib: semi-prominent ventrally.

Growth: erect to semi-erect, extravaginal.

Roots: fibrous.

Color: light green. (Keeleria dark green).

Veins: 4 each side of midrib with lens by transmitted light. Fig. 5.

Outstanding Characteristics.

Plant smooth, blades wide, soft, drooping.

Blades not conspicuously ribbed nor frequently convex in cross-section as Keeleria.



Fig. 1.
Young Plant, X1.

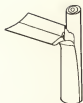


Fig. 2.

Side of sheath, X6.

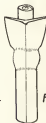
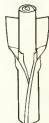


Fig. 3.

Fig. 4.

Front and back of sheath, X6.



Back of ligule, cross
section of leaf and stem, X12.



Fig. 5.

Cross section of leaf, X12.

Sphenopholis obtusata-Blunt-scaled Grass.

DESCRIPTION OF PLATE 23

Sporobolus airoides, Torr., (Alkali sacaton)

General Description. A dense perennial forming large tussocks with smooth, semi-decumbent stems, blades long, stiff and commonly inrolled. Grows in bunches or hummocks. Not common in the prairie pastures. Growth begins approximately April 1.

Habitat: Heavy alkaline soils.

Association: Salt Grass, Wheat Grass.

Forage Value: Good, especially when young.

Character of New Growth:

- Leaf in bud: clasping. Fig. 5.
- Plant: hairy.
- Blade: rough, stiff.
- Blade ribs: prominent dorsally, 8-14. Fig. 5.
- Blade margin: toothed.
- Blade: flat to frequently inrolled when young, boat-shaped, twisted, drooping, pointed, tip frequently. Cross-section concave.
- Ligule: hairy, small $\frac{1}{2}$ mm., rarely 2-3 mm.
- Collar: hairy, dorsally 2-3 mm., rare ventrally, margin 2-3 mm., usually none on back, rarely divided.
- Sheath: smooth, papery margin, round, white below soil surface.
- Midrib: prominent ventrally.
- Growth: semi-erect to decumbent, intravaginal.
- Roots: fibrous.
- Veins: usually 3 each side of midrib on younger leaves (occasionally 4 on mature plant) with lens by transmitted light. Fig. 5.

Outstanding Characteristics.

- Growth semi-erect to decumbent--flower stalk erect.
- Blades long, stiff, rough, ribbed, frequently inrolled at tip.
- Conspicuous hairs on collar.

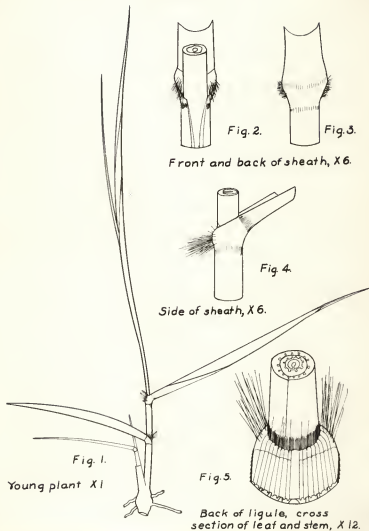


Fig. 1.
Young plant X1

Fig. 2. Fig. 3.
Front and back of sheath, X6.

Fig. 4.
Side of sheath, X6.

Fig. 5.
Back of ligule, cross section of leaf and stem, X12.

Sporobolus airoides - Alkali sacaton

DESCRIPTION OF PLATE 24

Sporobolus aspera, (Michx.) Kunth., (Long-leaved Bush Grass)

General Description. An erect perennial, smooth except at base of leaf, leaves long, narrow, drooping, with root-stocks. Scattered flower stalks. Generally forms a tuft. Growth begins March 15.

Habitat: Well drained soils on ridges and slopes. Abundance formerly very common now scarce in prairies.

Association: Big Blue, Side Oats, Hairy Grama.

Forage Value: Good when young.

Character of New Growth:

Leaf in bud: clasping. Fig. 6.

Plant: hairy.

Blade: generally smooth (hairy occasionally dorsally near collar), rough dorsally, soft.

Blade ribs: dorsally indistinct, numerous.

Blade: width 2-4 mm.; length 3-14"; average 8".

Blade margin: toothed.

Blade: flat, drooping, narrow pointed, concave.

Ligule: collar-like, small, finely toothed $\frac{1}{2}$ mm.

Collar: hairy dorsally and margin 2-4 mm., rare ventrally, generally divided. Fig. 4-6.

Auricle: none.

Sheath: smooth, papery margin, veined, round, colored below surface, white to pinkish, frequently clasping near ligule.

Midrib: not prominent.

Growth: erect to semi-erect, extravaginal.

Roots: fibrous.

Vegetative reproduction:

Veins: usually 2 each side of midrib with lens by transmitted light (usually extend thru collar into sheath). Fig. 6.

Outstanding Characteristics.

New buds white.

Blades conspicuously long, narrow and drooping.

Blade in cross-section frequently convex.



Fig. 2.

Side of sheath, X6.



Fig. 3.



Fig. 4.

Front and back of sheath, X6.

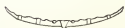


Fig. 5.

Cross section of leaf, X20

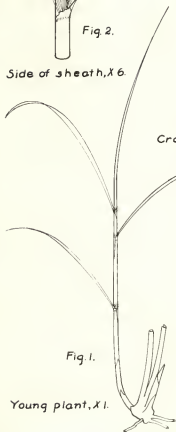


Fig. 1.

Young plant, X1.



Fig. 6.

Back of ligule, cross section
of leaf and stem, X12.

DESCRIPTION OF PLATE 25

Sporobolus cryptandrus, (Torrey) Gray, (Sand Dropseed)

General Description. A semi-decumbent perennial branching at the base, leaves short, conspicuous hairs at collar margin. Forms a small top, not abundant in native pastures. Growth begins March 20.

Habitat: Ridges and rough dry areas. Common in Blue-stem pastures.

Association: Western Wheat Grass, Kentucky Blue, Gramas.

Character of New Growth:

Leaf in bud: curled. Fig. 2.

Plant: hairy.

Blades: smooth, rough dorsally, moderately soft.

Blade ribs: indistinct, numerous.

Blade: width 3-4 mm.; length first $1-1\frac{1}{2}$ " , others 2-6" average 3.

Blade margin: toothed, margin narrow white with lens.

Blade: flat, pointed, concave, tip frequently in-rolled.

Ligule: hairy, small, $\frac{1}{3}$ mm. Fig. 6.

Collar: hairy 1 mm., ventrally 2 mm., rare on margins, rarely divided. Fig. 3-4.

Sheath: hairy on margin $1-1\frac{1}{2}$ mm., round, occasionally colored veins reddish. Fig. 3-5.

Midrib: not prominent.

Growth: semi-erect to decumbent, extravaginal.

Roots: fibrous.

Color: dark green.

Collar: hairs principally at base of collar on edge of sheath.

Veins: usually 4, (occasionally 3) each side of midrib in groups of threes with lens by transmitted light. Fig. 6.

Outstanding Characteristics.

Growth decumbent.

Blades concave, wide, short and smooth.

Conspicuous hairs ventrally on collar and along sheath margin.

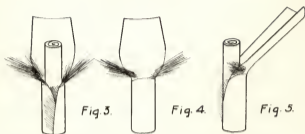


Fig. 3.

Fig. 4.

Fig. 5.

Front, back and side of sheath, X 6.



Fig. 2.

Cross section of leaf, X 12.

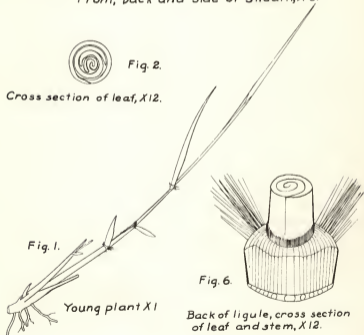


Fig. 1.

Young plant X 1

Fig. 6.

Back of ligule, cross section of leaf and stem, X 12.

DESCRIPTION OF PLATE 26

Sporobolus heterolepis, A. Gray, (Prairie Dropseed)

General Description. An erect perennial with long, dense basal leaves, generally pubescent on sheath and collar, leaves narrow, long and tapering. Forms a dense green tuft. Growth begins approximately March 10.

Habitat: Slopes and well drained ridges. Now scarce in Bluestem pastures. Appears to be killed by grazing.

Association: Side Oats, Little Bluestem, Hairy Grama.

Forage Value: Good forage, scattering in native pastures.

Character of New Growth:

Leaf in Bud: clasping. Fig. 2.

Plant: hairy, very fine, silky, crooked. Fig. 6.

Blade: smooth, rough dorsally, moderately soft.

Blade rib: ventrally and dorsally, indistinct 8-14.

Blade: width $1\frac{1}{2}$ -2 mm.; length 3-10", average 5".

Blade margin: toothed.

Blade: folded to boatshaped at the ends and flat in middle, drooping, narrow pointed. Fig. 1.

Ligule: collar-like, very small, with lens. Fig. 6.

Collar: hairy 2-3 mm., (rare dorsally), ventrally, and on margin, conspicuously white. Fig. 6.

Sheath: hairy $\frac{1}{2}$ -1 $\frac{1}{2}$ mm., elliptical, colored, pinkish white to purple below surface, swollen below.

Midrib: semi-prominent ventrally.

Growth: erect, extravaginal.

Roots: fibrous, frequently colored dark red.

Color: dark green leaves, lower sheaths lighter green nearer surface.

Blades: boatshaped near base and convex to flat toward tip.

Veins: 3 each side of midvein with lens by transmitted light.

Outstanding Characteristics.

Blades narrow, long, soft and drooping.

Sheaths hairy and swollen below surface at crown.



Fig. 3.

Back of sheath, X6.

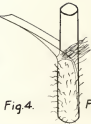


Fig. 4.

Fig. 5.

Front and side of sheath, X6.



Fig. 2.

Cross section of leaf, X12.

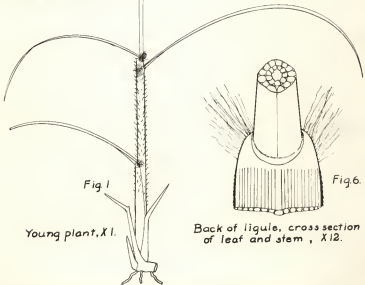


Fig. 1.

Young plant, X1.

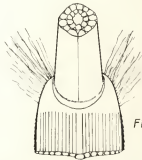


Fig. 6.

Back of ligule, cross section of leaf and stem, X12.

Sporobolus heterolepis - Prairie Dropseed.

DESCRIPTION OF PLATE 27

Stipa spartea, Trinius, (Porcupine Grass)

General Description. A tall, erect, stiff perennial with long dorsally ribbed leaves, with conspicuous chalky colored sheaths below ground. Forms a dense tuft. Begins growth approximately February 15.

Habitat: Well drained ridges and mesas where protected.

Association: Big Blue, Side Oats, Elyms.

Forage Value: Good when young--troublesome to sheep when mature.

Character of New Growth:

Leaf in bud: clasping. Fig. 6.

Plant: smooth (would be classed as hairy with lens).

Blade: rough dorsally, stiff. Fig. 5.

Blade ribs: prominent dorsally, 12-16. Fig. 5.

Blade: width 3-5 average 3 mm.; length 2-10, average 5".

Blade margin: toothed. Fig. 5.

Blade: flat, twisted, semi-decumbent, narrower at base, narrow pointed, convex crosssection.

Ligule: collar-like, large 1 mm. (in boot 3-4 mm.), regular, usually hairy margin. Fig. 5.

Collar: smooth.

Auricle: none.

Sheath: light hairs on margin, papery veined, round, color light green, young sheaths near surface occasionally purplish red color.

Midrib: none.

Growth: erect, intravaginal.

Roots: fibrous.

Vegetative reproduction:

Sheaths: below surface conspicuously chalky colored.

Veins: generally three each side midvein with lens by transmitted light. Fig. 5.

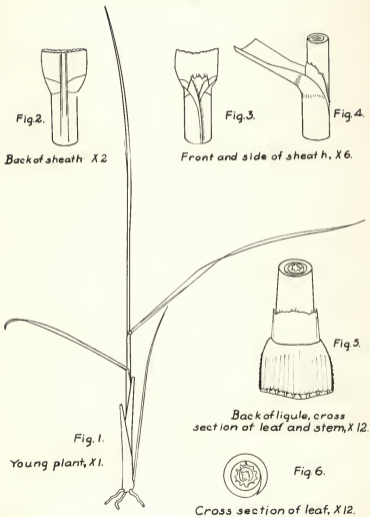
Outstanding Characteristics.

Sheaths below ground conspicuously chalky colored.

Blades long, stiff, conspicuously ribbed dorsally.

Ligule large, collar like, slightly thickened each side at base but not prominent as Indian Grass.

Plate 27.



Stipa spartea - Porcupine Grass. NPC 1930

DESCRIPTION OF PLATE 28

Tridens flavus, (L) Hitchc., (False Redtop)

General Description. A tall perennial forming an open tuft, few leaved, dark green color, stems elliptical and semi-erect. Very scattering in native pastures but common in meadows. Begins growth April 15.

Habitat: Meadows, roadsides and fields, rare in pastures.

Association: Foxtails, Crab Grass and Indian Grass.

Forage Value: probably fair.

Character in New Growth:

Leaf in bud: curled. Fig. 5.

Plant: hairy.

Blade: hairy dorsally near ligule 1 mm. high, rough dorsally, moderately soft and thin.

Blade ribs: ventrally indistinct 20-30, very small.

Blade: width 3-6 mm.; length 2-3".

Blade margin: lightly toothed.

Blade: flat, near base boatshaped, semi-erect and drooping, pointed, point frequently rolled.

Ligule: hairy, smooth, $\frac{1}{8}$ mm. Fig. 6.

Collar: hairy, ventrally 1-2 mm., on margin 1 mm., generally divided. Fig. 2-3-4.

Sheath: smooth, papery margin, elliptical, numerous inconspicuous ribs, occasionally short hairs on lower sheaths.

Midrib: semi-prominent.

Growth: semi-erect, extravaginal.

Roots: fibrous.

Vegetative reproduction: rhizomes.

Color: dark green, shiny below.

Veins: 3 each side midrib with lens by transmitted light. Occasionally 4. Fig. 6.

Outstanding Characteristics.

Stems elliptical, smooth and semi-erect.

Collar hairy on margin and ventrally.

Blades light pubescence dorsally near ligule.

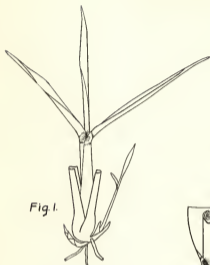


Fig. 1.

Young plant, X 2.

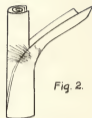


Fig. 2.

Side of sheath, X 6.



Fig. 3.



Fig. 4.

Front and back of sheath, X 6.



Fig. 6.

Back of ligule, cross section
of leaf and stem, X 12.



Fig. 5.

Cross section of stem, X 12.

SUMMARY

The better native pastures of Kansas are composed principally of grasses which vary in feeding value.

Pasture research is based on a thorough knowledge of the individual grasses during May, June, and July at which period they are making their greatest vegetative growth and are of the highest nutritive value to stock.

Composite sod samples of native grasses taken from pastures and transferred to the greenhouse show greater vigor and earlier development of vegetative characters which more nearly represent actual pasture conditions than does growth from seedlings of the same species which are grown in the greenhouse.

The earliest stage of growth at which identification by the vegetative characters appear to be most applicable is after the second leaf stage, however, some species may be identified by the character of the young root stalk.

The usual classification of grasses is based on the structure of the flowering parts, but in the absence of these parts which is usually the period when examinations

should be made, vegetative characters must be used.

A key was prepared for the identification of twenty-six pasture grasses which is based on their vegetative characters.

The initial separation of the grasses into three groups is based on the cross-section of the leaf in the bud, supplemented by the cross-section of the stem. Further separation is made possible by habit of growth as erect or decumbent; quality of surface as glabrous, toothed, ribbed or hairy; type of ligule, blade, sheath, collar and pubescence; presence or absence of auricles, stolons, rhizomes; color of roots; stems, blades, sheaths; number of veins in the blade as shown by transmitted light by cross-section; also outstanding characters of the remaining previous years growth as blade glands, rachis, and color.

The most practical key appears to be regional in scope and application.

The key is considerably simplified and made more useful by the addition of twenty-eight plates including 195 figures which supplement the descriptive data given for each species.

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INDEX TO SCIENTIFIC AND COMMON NAMES

<u>Scientific Name</u>	<u>Common Name</u>	<u>Plate</u>	<u>Page</u>
<i>Agropyron smithii</i>	Western Wheat Grass	3	29
<i>Andropogon furcatus</i>	Big Bluestem	4	31
<i>Andropogon scoparius</i>	Little Bluestem	5	33
<i>Bouteloua curtipendula</i>	Side Oats Grama	6	35
<i>Bouteloua gracilis</i>	Blue Grama	7	37
<i>Bouteloua hirsuta</i>	Hairy Grama	8	39
<i>Bulbilis decyloides</i>	Buffalo Grass	9	41
<i>Ghaetochloa glauca</i>	Yellow Foxtail	10	43
<i>Ghaetochloa viridis</i>	Green Foxtail	11	45
<i>Chloris verticillata</i>	Windmill Grass	12	47
<i>Digitaria sanguinalis</i>	Crab Grass	13	49
<i>Distichlis spicata</i>	Salt Grass	14	51
<i>Eleusine indica</i>	Goose Grass	15	53
<i>Hordeum pusillum</i>	Little Barley	16	55
<i>Koeleria cristata</i>	June Grass	17	57
<i>Panicum virgatum</i>	Switch Grass	18	59
<i>Poa pratensis</i>	Kentucky Blue Grass	19	61
<i>Schedonnardus paniculatus</i>	Texas Crab	20	63

<u>Scientific Name</u>	<u>Common Name</u>	<u>Plate</u>	<u>Page</u>
<i>Sorghastrum nutans</i>	Indian Grass	21	65
<i>Sphenopholis obtusata</i>	Blunt-scaled Grass	22	67
<i>Sporobolus airoides</i>	Alkali sacaton	23	69
<i>Sporobolus aspera</i>	Long-leaved Rush Grass	24	71
<i>Sporobolus cryptandrus</i>	Sand Dropseed	25	73
<i>Sporobolus heterolepis</i>	Prairie Dropseed	26	75
<i>Stipa spartea</i>	Porcupine Grass	27	77
<i>Tridens flavus</i>	False Redtop	28	79

INDEX TO COMMON AND SCIENTIFIC NAMES

<u>Common Name</u>	<u>Scientific Name</u>	<u>Plate</u>	<u>Page</u>
Alkali sacaton	<i>Sporobolus airoides</i>	23	69
Big Bluestem	<i>Andropogon furcatus</i>	4	31
Blue Grama	<i>Bouteloua gracilis</i>	7	57
Blunt-scaled Grass	<i>Sphenopholis obtusata</i>	22	67
Buffalo Grass	<i>Bulbilis decyloides</i>	9	41
Crab Grass	<i>Digitaria sanguinalis</i>	13	49
False Redtop	<i>Tridens flavous</i>	23	79
Goose Grass	<i>Eleusine indica</i>	15	53
Green Foxtail	<i>Chaetochloa viridis</i>	11	45
Hairy Grama	<i>Bouteloua hirsuta</i>	8	39
Indian Grass	<i>Sorghastrum nutans</i>	21	65
June Grass	<i>Keeleria cristata</i>	17	57
Kentucky Blue Grass	<i>Poa pratensis</i>	19	61
Little Barley	<i>Hordeum pusillum</i>	16	55
Little Bluestem	<i>Andropogon scoparius</i>	5	33
Long-leaved Rush Grass	<i>Sporobolus aspera</i>	24	71
Percupine Grass	<i>Stipa spartea</i>	27	77
Prairie Dropseed	<i>Sporobolus heterolepis</i>	26	75
Salt Grass	<i>Distichlis spicata</i>	14	51

<u>Common Name</u>	<u>Scientific Name</u>	<u>Plate</u>	<u>Page</u>
Sand Dropseed	<i>Sporobolus cryptandrus</i>	25	73
Side Oats Grama	<i>Bouteloua curtipendula</i>	6	35
Switch Grass	<i>Panicum virgatum</i>	18	59
Texas Crab	<i>Schedonnardus paniculatus</i>	20	63
Western Wheat Grass	<i>Agropyron smithii</i>	3	29
Windmill Grass	<i>Chloris verticillata</i>	12	47
Yellow Foxtail	<i>Chaetochloa glauca</i>	10	43