—THE—

STATE AGRICULTURAL COLLEGE.

The Agricultural Experiment Station.

BULLETIN NO. 12.

Some Colorado Grasses

AND THEIR CHEMICAL ANALYSIS.

1889.

FORT COLLINS, COLORADO.

JULY, 1890.

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The Agricultural Experiment Station.

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INTRODUCTION.

This bulletin is the result of work undertaken early in 1889 by the Experiment Station, to study the grasses of the arid region, and more particularly of Colorado, in order to find, if possible, some varieties which would furnish more and better forage than those now cultivated. The chemical work was undertaken to show the comparison in composition of these species as grown in their native habitat, and afterward under cultivation; first, without irrigation, and second, under irrigation. The botanical work has been almost exclusively performed by our late Professor James Cassidy, and the chemical work by Dr. David O'Brine, Chemist.

The results of the work, as herein published, are of a two-fold character; first, scientific, and second, practical. Because the Hatch law contemplates both lines of work, we must necessarily have the descriptions of the several species in technical language, while the observations in the field are of a very practical nature, and are intended for the direct benefit of the farmers and those interested in agriculture in this region. The bulletin deals with grasses almost exclusively; however, a few rushes

(*Juncæ*) and sedges are mentioned, as well as two lupins, all of which are eaten by stock while grazing, and are sometimes cut for hay.

There are mentioned: 122 species of grasses; 3 species of sedges and rushes; 2 species of lupins; 1 species of clover.

Hoping that the subject matter of this bulletin will be but the beginning of a valuable work, which may be carried forward to completion, we submit the same for the benefit of the public.

C. L. INGERSOLL,
Director.

SOME COLORADO GRASSES

AND THEIR CHEMICAL ANALYSIS.

By JAMES CASSIDY, *Botanist and Horticulturist.*
AND
Dr. DAVID O'BRINE, *Chemist.*

The grasses are, without doubt, the most important order of plants in the vegetable kingdom. A technical knowledge of them is, however, difficult of acquirement, owing to the complexity of the details of their structure. Stockmen in this region invariably confound the rushes and sedges with grasses, but no plant can be called a grass that is not a member of the order *Graminæ*, no matter what its common name may be.

The sedges resemble, more or less, the grasses, as do some members of the rush family (*Juncus*), but it is not very difficult to distinguish between them on close inspection.

The more obvious distinctions between grasses and and sedges are as follows:

The stems of grasses and rushes are hollow and commonly round, while the sedges have, usually, angled and solid stems. The sheaths of grasses are split down the entire length, but in sedges the sheaths are united

above the joint. The flowers of sedges are in a solid spike, while in grasses they are displayed in spike racemes or panicles.

Grasses are classified as follows:

I. The cereal grasses, comprising wheat, oats, barley, corn and rice.

II. Hay and pasture grasses, including the well-known orchard grass and timothy.

III. Cane grasses, as sorghum, sugar cane, etc.

IV. Ornamental grasses, such as the pampas grass.

V. Weedy grasses, represented in burr grass, (*Cenchrus tribuloides*), pigeon grass, chess, etc.

The number of known species is about thirty-five hundred, widely distributed the world over, being especially predominant in temperate regions, where they carpet the surface of the earth with a soft green turf, but in tropical countries, their habit disappears, the grasses growing in isolated tufts, having broader leaves and more showy flowers.

All the grasses contain, in a greater or less degree, especially before blooming, a sugary mucilage. The creeping root stocks, too, are generally demulcent and mucilaginous, besides being invaluable in securing the stability and permanancy of shifting sands.

And every tiller of the soil recognizes their importance in the production of hay and pasturage. In the United States, we have a great variety of conditions, of both soil and climate, with which to contend, and the number of species of grass in cultivation is less than a dozen.

The following characteristics of grasses are explained here, that observing persons may be the better prepared to recognize the leading species without great difficulty:

The root consists of many strong fibres branching through the soil in various directions, often binding it

into a matted turf. Its function is the appropriation of food from the soil, to be conveyed to the stem and leaves.

The stem is technically called a culm, because hollow between the joints. It is divided, at intervals, by thickened portions called nodes, which give it additional strength. The stem is sometimes horizontal and subterranean, when it is botanically known as a rhizoma. In a few cases the stem exhibits a bulbous enlargement at its base, in which is stored nutriment for the plant's use under adverse circumstances.

The leaves are in two vertical ranks, parallel veined, the lower portion of the leaf sheathing the stem, but with the edges free. The expanded portion above is the blade. It is either filiform, linear or lanceolate.

At the junction of the sheath and blade is a short membrane, called the ligule or tongue, answering to stipules in the higher plants.

The inflorescence may be in the form of a spike, more or less dense or more spreading, as in the receme, or still more branching, as in the panicle. It is sometimes of importance to note whether these branches are in 1s, 2s, 3s or 5s.

The flowers are collected in little clusters called spikelets. One of the latter, separated into all its parts, would be found to consist of two scales at the base, standing opposite each other, of equal or unequal length, called the outer glumes, and one or more such is a spikelet.

The flower consists of two scales standing opposite each other. The largest is called the flowering glume, and is of a coarser texture than the smaller, called the palet.

Between these two scales there are usually three stamens, with delicate filaments and versatile anthers, and the pistil, with its two feathery stigmas.

Fertilization is effected in grasses by the wind wafting the pollen to the feathery stigmas.

To secure this end, grasses occur in great areas, and owing to the great superabundance of pollen, the pistils are certain of fertilization, either from their own or from foreign pollen.

On the treeless plains a set of conditions obtain not paralleled elsewhere, to meet which, by clothing them with plants showing some adaptation to these conditions, and at the same time be more productive than such as naturally exist there at present, has long been a leading factor in the work of the Department of Agriculture.

In fact, the possible agricultural value of some of our native species has been a subject of interest and inquiry for some time, especially to the people of the West and South.

Some of the native species yield an excellent growth of herbage when not over-fed or tramped out. Others, however, are too meagre of top to admit of their successful cultivation, as against more thrifty kinds.

The plains grasses are of a dwarf, spreading habit, and present a magnificent sight in June, clothed in the richest green. These grasses are cured during late summer, the result of a high temperature, and the absence of rain dissipating the stems and leaves of their surplus moisture. The absence of wet snows, the high day temperature and the protection afforded by the hills, renders the wintering of stock a safe problem.

In order to collect some information in regard to the distribution of particular kinds, their behavior under irrigation in the native meadow, and to collect seeds in quantity of such as were deemed of possible value in the plains region, an expedition was undertaken by the writer, at the instigation of the Department of Agriculture and of the State Experiment Station, accompanied by Mr.

Holmes, agent of the department, and by Mr. Hoag, of Fort Collins, who has given considerable attention to the native grasses.

The route traversed was a northerly one, through the Virginia Dale country to the Laramie plains. The irrigated and non-irrigated meadows were carefully examined. Thence by Fort Halleck to North Park by Pass plains and Big Creek, to Middle and Ægeria Parks by the Arapahoe, Muddy and Gore Passes.

Haying had begun when we started, and was continuous until we reached higher mountain meadows.

Whatever of open range there is is very much overdone, and in many cases the native grasses have given way to *Chenopodium Fremontii* and the varieties.

Cattle ate so plentifully of these plants that, in the "round-ups" many cases of hoven resulted, all of which were fatal unless the animals received attention. On the Laramie plains the native meadows consist of *Agropyrum glaucum*, the type with glaucous leaves and one with dark green leaves; *Kœleria cristata*—the latter, when irrigated, is fully three feet high; *Poa andina* and sparsely leaved forms of *tenuifolia*. In very wet spots are found *Aira caespitosa* and *Poa laevis*; in alkaline soils *Sporobolus airoides* and *Distichlis maritima* are the prevailing species. At high elevations *Poa tenuifolia* is at its best in two forms, the glaucous-leaved form being especially desirable; also, two forms of *Agropyrum violaceum*, a magnificent hay grass. *Elymus Americana*, four to seven feet high, occurs in large patches in openings in the timber. The dry plains and high parks abound in *Artemesia tridentata*, *Bigelovia albicaulis* and "greasewood."

Willows of several species—the aspen, alder, birch, *Rhus aromatica*, var. *trilobata*, mountain mahogany, serviceberry, *Amelanchier* and *Heuchera*, with some species of currant and gooseberry—abound in the bottoms along

streams. *Cowania* (the cliff rose) abounds on the banks of the Poudre. Among the rocks, in good soils, growing in tufts, are *Elymus Sibericus*, *Agropyrum divergens* in two forms. *Bouteloua racemosa*, on the east face of the mountains. At one place only was *Festuca Kingii* seen.

The several species of "loco" occur at all elevations. *Oxytropis Lamberti* occurs at all elevations in a variety of forms. *Sophora sericea* most abundant at 5,000 feet, and in heavy soils. It is affected with a fungus in this locality. *Astragalus bisulcatus*, with flowers of various shades of red and white, abounds in moist ground. *Astragalus caespitosa* was seen only in one place. *A. Haydenianus* and *Drummondii* are abundant in the foothills of the Medicine Bow range.

The best mountain meadows seen were, in all cases, those but recently cleared of under-brush and irrigated but one or two seasons, but owing to the very imprudent use of water in all of the meadows seen, these desirable species are drowned out and their places taken by foxtail (*Hordeum*), *Agrostis scabra*, and by many species of rushes and sedge.

The method of irrigating seems to be to turn on the water early in the season and allow it to run until within a few days of haying. Applying water to plants should be managed so as to occur while the plants are in active growth. When a sufficient irrigation has been given the water should be taken off, as all the finer grasses and useful plants are impatient of standing water about their roots. The number of irrigations and the quantity can only be determined by the owner. His judgment will be based upon the rainfall during the early part of the season, when hay is made, and the character of the soil and subsoil.

All the sedges seem to be known to ranchmen as wire grass. The species most highly valued is *Carex*

rupestris. Of the rushes (*Juncus*), the species most valued are *Balticus* and *Mertensiana.* The last mentioned is thought to be the most desirable. This rush is considered by stockmen as being more valuable for hay than any of the grasses. Stock certainly relish the heavy-seeded capsules of this species.

Seeds were collected of 120 species, but in quantity only of kinds thought to be profitable.

The most promising grasses for pasture are *Festuca scabrella, Oryzopsis cuspidata, Elymus sibericus, Agropyrum divergens, Stipa viridula,* of some of the finer forms.

For hay: *Agropyrum glaucum* and *violaceum, Poa tenuifolia, Sporobolus depauperatus, Elymus Americanus, Deyeuxia stricta, D. Canadensis, Hilaria Jamesii.*

While many of the native species are very deficient in top, still it must be acknowledged that they improve wonderfully in vigor with irrigation. This is notably so in the case of buffalo grass (*Buchloe dactyloides*), which more than holds its own in meadows where alfalfa has been thinly seeded and which are irrigated two or three times a year.

Some of the grasses collected must prove valuable in regions having a sufficient rainfall, or where irrigation can be had. Nothing can be finer, in the way of a hay grass, than the glaucous-leaved form of *Poa tenuifolia*, or the two forms of *Agropyrum violaceum.*

Of the species most likely to succeed on the dry plains, the following are the most promising: *Elymus Sibericus, Agropyrum divergens* in two forms, *Hilaria Jamesii, Festuca scabrella, Oryzopsis cuspidata, Koeleria cristata, Sporobolus airoides, Muhlenbergia Wrightii, gracilis, Bouteloua oligostachya* and *B. racemosa*, and a few others.

Faithful experiment is needed to determine the agricultural value of all the species collected, both with irrigation and on the dry plains, where the kinds will be sustained by the limited rainfall alone.

The following is a list of the kinds of grasses and forage plants and the quantities of seeds secured. The difficulties and labor attending the collecting of seeds in quantities of some of the native grasses can be appreciated only by those who have made the attempt. The more rare species are to be had only in the most limited quantities, and even this is affected by the character of the season, in regard to rainfall and the number of stock on the ranges to be worked over. The past four seasons have been disastrous to the ranges west of the Medicine Bow, owing to lack of rain or sufficient snow. As a result, grasses are scant, except in places difficult of access, and the number of stock of all kinds effectually prevents their seeding:

POA LÆVIS (Vasey).

Stems wiry, geniculate at base; leaves linear to filiform, scabrous, striate above, pubescent below; ligule elongated, lacerate; panicle diffuse, 4 to 8 inches long, branches capillary, in 3s or 5s, finely scabrous; spikelets small, appressed, three to five-flowered; outer glumes very unequal, the upper three-nerved at base; flowering glume rounded on the back, obscurely five-nerved, somewhat webby below the middle, and with broadly scarious apex; palet shorter than the glume, acute or truncate.

This grass grows in stout tufts in wet meadows, on the plains and in the mountains, and while stock eat it with avidity, it must be considered as having but little agricultural value.

POA ALPINA (L.).

(ALPINE MEADOW GRASS.)

Stems very smooth and scaly, growing in short tufts 6 to 12 inches high; stem leaves smooth, flat; panicle short and broad, branches solitary or in pairs, spreading; spikelets three to nine-flowered; glumes scarious and bronzy purple at apex.

Occuring at high elevations and in exposed situations. It is to small to have much agricultural value.

POA COMPRESSA (L.).

(FLAT-STEMMED MEADOW GRASS; WIRE GRASS.)

Stems much flattened, decumbent, pale, wiry, about 1 foot high; leaves finely pubescent, striate on the upper surface; ligule truncate, hairy; panicle narrow, contracted; branches solitary or in pairs; spikelets nearly sessile, about five-flowered, finely pubescent; glumes with purplish apex; palet equal, obtuse.

This grass is too small to have much value.

POA CAESIA (Smith).

Stems slender, wiry, rigid, 6 to 20 inches high; leaves very small, involute, scabrous; ligule short-pointed; panicle oblong or pyramidal, loose; branches in 2s, 3s or 5s, very scabrous; spikelets bronzy, three-flowered; outer glumes unequal, very acute, three-nerved, finely scabrous, rough on the keel; flowering glume obtuse, with broadly scarious apex, sparsely hairy on the mid-rib and margins; palet smaller than the glume; apex truncate, finely ciliate.

This grass is well distributed in the mountains. It occurs in the shade of rocks along water courses, and is a constituent of native meadows in Middle Park.

POA ANDINA (Nutt).

Culms tufted, wiry, smooth, 6 to 18 inches high; radical leaves half as long as the stem; stem leaves about 2 and the blade about 1 inch long, or almost wanting; panicle 2 or 3 inches long, one sided, very slender; branches in pairs, scabrous, erect; spikelets three to seven-flowered; outer glumes acute, rough on the keel, scarious margined, the lower one-nerved, the upper three-nerved at base; flowering glume obtuse, five-nerved at base, softly pubescent below the middle, and with a broadly scarious erose, sometimes purplish apex; palet as long as the glumes, pubescent on the nerves.

Abundant at 6,000 feet in the mountains, where it forms a chief constituent of the native meadows, when not too wet. Its agricultural value has not been determined.

ANALYSIS.

Moisture	3.22
Ash	8.41
Fat	1.80
Albuminoid nitrogen	4.06
Crude fiber	22.78
Nitrogen-free extract	62.95
Total	100.00

Poa Andina.

POA CÆSIA, var. STRICTA (Gray).

This variety occurs with the species, and is about 12 inches high, with a slender, purplish-red panicle, 3 to 4 inches long; leaves small, especially on the culm; ligule short, truncate or pointed; outer glumes very acute, especially the lower; flowering glume hairy on the margins, and mid-rib below the middle; apex bronzy, scarious; palet about equalling its glume, ciliate on the nerves.

Too small to be of value.

POA ALSODES (Gray).

(TALL SPEAR GRASS; WOOD GRASS; WOOD SPEAR GRASS.)

Culms very slender, erect, 2 to 3 feet high, acutely two-angled at base; sheaths loose, retrorsely scabrous; leaves about three on the stem, broadly or narrowly linear, 3 to 4 inches long; panicle 1 foot long, branches chiefly in 4s, whorled, widely spreading, capillary, pendent, flowering toward the apex; outer glumes acute; flowering glume keeled, apex scarious, acute, cob-webby below the middle on the nerves; palet shorter than its glume, two-toothed.

This species in rich soils in the shade of willows along water courses, at 6,000 feet. Probably of no agricultural value.

ANALYSIS.

Moisture	8.72
Ash	9.73
Fat	2.13
Albuminoid nitrogen	3.32
Crude fiber	23.30
Nitrogen-free extract	61.52
Total	100.00

POA PRATENSIS (L.).

(JUNE GRASS; KENTUCKY BLUE GRASS, ETC.)

Stems slender, smooth, 1 to 3 feet high, somewhat geniculate below, from running rootstocks; sheaths loose, very smooth; ligule truncate; panicle oblong or pyramidal, sometimes one-sided; spikelets about three-flowered, nearly sessile; outer glumes very acute, obscurely three-nerved at base, nearly equal, rough on the keel; flowering glume acute, distinctly three-nerved, densely woody for two-thirds its length, the apex especially; the keel scabrous.

This is the mountain type of this well-known grass. It occurs in North Park in quantity, at an altitude of 9,000 feet, in the shade of *Pinus balfouriana*, var. *aristata*. It is always much inferior to *Poa tenuifolia*.

[See cut on opposite page.]

POA LAXA (Haenke).

(WAVY MEADOW GRASS.)

Stems erect, slender, wiry, 10 inches high, the lower joints geniculate; leaves narrowly linear, about two on the stem, smooth; sheaths shorter than the nodes, smooth; ligule elongated, pointed; panicle oblong, 1 to 3 inches long; branches smooth, ½ to 1 inch long, erect; spikelets purplish, three or four-flowered; outer glumes glabrous, very acute, unequal, one-nerved; flowering glume puberulent all over, five-nerved, apex acute, scarious, bronzy; palet equal, purplish, two-toothed.

This species in the mountains on dry hillsides. Too small to be of much value.

POA FLEXUOSA (Muhl), var. OCCIDENTALIS (Vasey).

Stems erect, tufted, from running root-stocks, 1 to 2 feet high; leaves flat, 1 to 4 inches long, hairy above; sheaths scabrous, the upper one enclosing the base of the panicle; ligule short, with broad, rounded apex; panicle slender, spreading with age; branches mostly in 5s, from ½ to 2 inches long, scabrous, flower-bearing about half their length; spikelets two to three-flowered, purplish; outer glumes nearly equal, acute, the lower one-nerved, the upper three-nerved; flowering glume distinctly three to five-nerved, webby at the base, villous on the keel and margins below the middle, scabrous above; apex acute, scarious, and somewhat bronzy; palet narrow, shorter than its glume, distinctly two-toothed.

This species in the shade of rocks in the foothills, flowering early in May.

ANALYSIS.

Moisture	7.42
Ash	5.91
Fat	2.58
Albuminoid nitrogen	7.05
Crude fiber	17.45
Nitrogen-free extract	67.01
Total	100.00

POA SEROTINA (Ehrh).

(FALSE RED TOP; FOWL MEADOW GRASS.)

Culms slender, smooth, 2 to 3 feet high; leaves narrowly linear, smooth, about six on the stem, 2 to 4 inches long; sheaths shorter than the nodes; ligule elongated, pointed; panicle slender, nodding, 4 to 10 inches long; branches in 5s, capillary, scabrous, 1 to 3 inches long; spikelets two to four-flowered; outer glumes narrow, very acute, rough on the keel; flowering glume obscurely five-nerved, pubescent on the keel and margins, apex bronzy, obtuse; palet equal, acute.

The species is abundant on the plains, especially near irrigating ditches. It is considered valuable where cultivated.

[See cut on opposite page.]

POA (Species ?).

Stems tufted, smooth, erect, from fibrous roots, about 1 foot high; leaves flat, scabrous only on the margins, 3 to 6 inches long, the sheath of the upper leaf enclosing the base of the panicle; ligule conspicuous, pointed; panicle slender, loose, 6 inches long; branches capillary, smooth, in 2s or 3s, distant, widely spreading, flower bearing only at the apex; spikelets three to four-flowered; outer glumes unequal, lanceolate, acute, rough on the keel, scarious margined, the lower one-nerved, the upper and larger three-nerved; flowering glume three-nerved, sparingly webby on the mid-rib and margins, apex obtuse, scarious; palet equalling the glume, obscurely two-toothed.

This species occurs in the foothills in the shade of rocks, blooming in May and June. It probably has no value.

POA SYLVESTRIS (Gray).

Culms erect, flexuous, flattish, leafy; leaves smooth, 3 to 6 lines long; ligule elongated; panicle close; branches very scabrous; spikelets two or three-flowered; glumes purple tipped, scabrous on the mid-rib, nearly equal, acute; flower glumes obscurely nerved, hairy on the lower half of mid-vein and margin, webby at base; palet acute, two-nerved, margined, ciliate, but little shorter than its glume; panicle pale green, slender, branches mostly in 5s.

This is a pale green, slender grass, growing in meadows. It is worthy of trial.

POA EATONI (Watson).

Stems tufted, purplish at base, 2° high, from fibrous roots; ligule elongated; sheaths and upper surface of leaves minutely scabrous; panicle close, narrow; branches solitary or scabrous, in 2s, rarely in 3s; outer glume acute, rough on the keel; flower glumes with broad, scarious, bronzy apex below, purple and very hairy on the nerves, especially the mid-rib and at the margins.

POA ARCTICA (R. Br.).

Culms slender, wiry, purplish, glabrous, 1° high; ligule elongated, sheath almost smooth; leaves linear, smooth, small, 2 or 3 on a stem; panicle of 3 or 4 long branches, capillary, in 2s, scabrous; spikelet three-flowered; florets large; outer glumes ovate, keeled, scabrous, purplish apex, acuminate, scarious; flower glume five-nerved, acute, scarious, brownish apex; palet equals glume, toothed, scarious.

This species would be worthy of trial. Found in dense shade on Gore Pass, with a fungus on it. A tufted *Poa* from running root-stock.

POA TENUIFOLIA (Nutt).

(BUNCH GRASS.)

Stems slender, tufted, 2 to 4 feet high; leaves glaucous or green, narrowly linear, finely scabrous in the glaucous type, and glabrous in the green-leaved type; ligule elongated, pointed; panicle narrow, loose, few to many-flowered, nodding; branches slender, scabrous, in 2s or 3s, flower bearing for about half their length; spikelets about five-flowered; outer glumes unequal, very acute, rough on the keel; flowering glume lanceolate, with broadly erose or acute, bronzy apex; puberulent in one type; silky, hairy on the margins and mid-rib, below the apex, in another; palet about equalling its glume, bidentate at apex.

This valuable hay grass occurs in two well-marked forms in the mountain meadows. It is the finest of the *Poas*, and should prove valuable under cultivation.

ANALYSIS.

Moisture	8.30
Ash	9.45
Fat	2.92
Albuminoid nitrogen	8.76
Crude fiber	19.40
Nitrogen-free extract	59.47
Total	100.00

Poa Tenuifolia.

PANICUM DICHOTOMUM (L.).

(PANIC GRASS.)

Stems robust, widely spreading, almost cæspitose; leaves lanceolate, flat, somewhat hairy on the upper surface; ligule a fringe of hairs; lateral panicles included in the sheaths; terminal panicle usually free, equalled by the upper leaf; spikelets oblong; outer glumes unequal, the outer broadly ovate, scarious; upper equalling the flowering glume, which is seven-nerved; palet shorter than its glume.

This species on adobe soil near Pueblo. Not generally distributed in the State.

ANALYSIS.

Moisture	8.06
Ash	9.55
Fat	3.20
Albuminoid nitrogen	9.45
Crude fiber	16.24
Nitrogen-free extract	61.56
Total	100.00

PANICUM VIRGATUM (L.), var. GLAUCEPHYLLA.

Not so plentiful as the species from which it differs in the glaucous leaves and sheaths; hairy on the margins.

PANICUM VIRGATUM, (L.).

(TALL PANIC GRASS; SWITCH GRASS.)

Stem stout, smooth, unbranched, growing chiefly in stout clumps in moist soils on the plains, 1 to 5 feet high; leaves ample, flat, hairy at base above, sometimes rough on the margins; ligule a fringe of hair; sheaths longer than the nodes; spikelets distant, purplish; outer glumes very unequal, pointed, the lower five-nerved, the upper seven-nerved; male flower seven-nerved; palet smaller, two-nerved; perfect flower, small, smooth, obtuse.

This species is one of the most promising of the native hay grasses. It yields heavily to the acre, but should be cut young, as the ripened stems become woody and are then unpalatable to stock. Depauperate forms are met with in the mountains up to 7,000 feet.

ANALYSIS.

Moisture	8.75
Ash	9.63
Fat	3.58
Albuminoid nitrogen	12.36
Crude fiber	19.50
Nitrogen-free extract	54.93
Total	100.00

PANICUM VIRGATUM.

PANICUM CAPILLARE (L.).

(OLD WITCH GRASS.)

Culms erect or spreading, 6 inches to 2 feet; sheaths and leaves hairy; the upper sheath enclosing the base of the panicle; the latter very diffuse, compound, with long capillary branches.

Abundant in cultivated ground late in summer. A bad weed.

ANALYSIS.

Moisture	8.50
Ash	9.70
Fat	2.78
Albuminoid nitrogen	12.34
Crude fiber	18.71
Nitrogen-free extract	56.47
Total	100.00

PANICUM CAPILLARE (L.), var. MINIMUM (Engel).

Culms 3 to 4 inches high; leaves less than 1 inch long, scarious and ciliate on the margins; sheaths smooth, striate, twisted; ligule truncate, erose; branches of the panicle very rough, spreading; spikelets on long pedicels; outer glumes linear, acute, whitish, about equal, rough on the mid-vein; sterile flower, keeled, mucronate; fertile flower, obtuse or bidentate.

Common on the plains on moist, alkaline meadows; flowering late in June. Of no value.

PANICUM GLABRUM (Gaudin).

Stems prostrate, ascending, branching from the base; leaves glabrous, very short, flat; sheaths—the lower hairy at the throat; spikes 2 to 4 in pairs, slender; spikelets in 2 rows, ovate; glume and palet pubescent, becoming purplish with age; ligule purplish.

This species flowers in the latter part of August and through September, and occurs chiefly in lawns, where it quickly affects the stand of blue grass, with its spreading, dense stems and leaves. This grass is persistent and widely distributed in lawns in Northern and Southern Colorado.

ANALYSIS.

Moisture	7.40
Ash	12.50
Fat	4.58
Albuminoid nitrogen	10.80
Crude fiber	16.11
Nitrogen-free extract	56.01
Total	100.00

PANICUM CRUS-GALLI (L.), var. ECHINATUM (Torr).

(Barn-Yard Grass.)

This form has the glumes blackish, and beset, especially on the margins, with stiff hairs; glumes blackish, the margins clothed with stiff hairs; one of the outer glumes awned.

It is considered to be of value. There are two forms here, those with green glumes and those with black. In wet places it attains a height, late in summer, of 6°. It is readily eaten by horses. In gardens, it proves a formidable weed among slender rooted plants.

PANICUM SANGUINALE (L.).

(CRAB GRASS; FINGER GRASS.)

Culm 1 to 2 feet, smooth, geniculate and rooting at the lower joints, bearing 4 to 12 slender, spreading, purplish spikes.

An introduced annual grass, seen occasionally in cultivated ground. Said to be valuable at the South.

FESTUCA MICROSTACHYS (Nutt).

(SMALL FESCUE; WESTERN FESCUE.)

Culms about 1° high, slender, growing in tufts, smooth or pubescent; leaves short and narrow; ligule very short and small; panicle 1 to 4′ long, spicate, purplish; branches in pairs, one of them nearly sessile; glumes pulverulent, the outer acute, keeled; flower glume rounded on back, keeled at apex and terminated by a short, scabrous awn; palet equal to the glume, short awned.

This grass is too small to be of any value.

FESTUCA TENELLA (Willd).

Culms filiform, about 1 foot high; leaves filiform, 1 to 4 inches long, panicle contracted, somewhat one-sided; outer glumes subulate, unequal; flowering glume rough, involute, awned.

This species occurs in company with *Festuca scabrella* and *Festuca ovina*. It is not abundant, so that but a small amount of the seed was procured. It cannot have much value, owing to its lack of size and leaves.

FESTUCA OVINA (L.), var. BREVIFOLIA (Watson).

(SHEEP'S FESCUE.)

Culms and sheaths smooth, erect, tufted, from numerous fibrous roots; leaves setaceous, the radical 2 inches long, those of the culm smaller; ligule two-lobed; panicle racemose; spikelets about four-flowered; outer glumes unequal; flowering glume pubescent, purplish at apex, tipped with a short, rough bristle; palet equal, toothed at apex.

This dry land Alpine form from Ægeria Park. It has no agricultural value.

[See cut on opposite page.]

FESTUCA KINGII.

Culms about 2 feet high, stout, leafy, from running root-stocks, the bases of the culms clothed with the sheaths of dead leaves; leaves ample, glaucous, striate above, glabrate below, the upper leaf usually enclosing the base of the rigid, narrow, spicate panicle; ligule truncate, lacerate; branches of the panicle in 2s or 3s, appressed and flower bearing for about half their length; spikelets about three-flowered; outer glumes lanceolate, acute, with broadly, scarious margins; flowering glume prominently five-nerved, finely pubescent under the lens; apex very acute, the keel scabrous; palet shorter than the glume, acutely two-toothed.

This grass grows in broad patches in broken ground on hillsides, in company with *Elymus Sibericus* and *Agropyrum divergens*. It was seen in one place only, at about 8,000 feet, on the North Poudre, and was out of bloom August 1st. It is a promising species.


H.H.NICHOLSEN

FESTUCA ELATIOR (L.).

(TALL FESCUE GRASS.)

Stems smooth, erect, from a geniculate base, 3 feet high; leaves narrow, rough on the margin, 3 to 10 inches long; ligule very short; panicle slender, narrow, branches solitary; outer glumes narrow, long pointed; upper five-nerved, lower one-nerved; flowering glume faintly five-nerved, obtuse; palet thinner, obtuse or acute.

An introduced grass occasionly seen in cultivated fields. It often attains a height of $2\frac{1}{2}$ feet, with irrigation.

AGROSTIS ALBA (L.).

(WHITE BENT GRASS.)

Stems slender, smooth, about 3 feet high, geniculate, at base; leaves linear, rough, those of the culm 2 or 3 inches long; ligule elongated, pointed; panicle slender, spreading in bloom, purplish in all the mountain specimens, greenish white at lower altitudes; outer glumes lanceolate, acute; flowering glume shorter, thinner, obscurely three to five-nerved.

Found abundantly all over the State, in cultivated regions. *A. vulgaris* (red top) differs from *A. alba*, chiefly in the former having a truncate ligule.

ANALYSIS.

	DURANGO.	FORT COLLINS.
Moisture	8.31	8.12
Ash	10.80	10.80
Fat	2.31	2.09
Albuminiod nitrogen	5.45	7.10
Crude fiber	19.74	20.29
Nitrogen-free extract	61.70	59.72
Total	100.00	100.00

AGROSTIS EXARATA (Trin).

(NORTHERN RED TOP: MOUNTAIN RED TOP.)

Stems tufted, root fibrous, 1 to 2 feet high, clothed at base with many broadish leaves; sheaths loose and smooth; ligule elongated, lacerate; leaves flat, scabrous, especially on the upper surface; panicle slender, narrow, loose, purplish; outer glumes of about equal length, acuminate, rough on the keel; flowering glume one-third shorter than the outer ones, scarious, five-nerved, the apex about four-toothed; the palet, if present, very minute.

This species in moist places in the mountains, and exceedingly variable. Not abundant in the region traveled over. Its value is not known, but it can hardly prove superior to *Agrostis vulgaris*.

ANALYSIS.

Moisture	7.84
Ash	8.98
Fat	2.85
Albuminoid nitrogen	8.25
Crude fiber	20.22
Nitrogen-free extract	59.70
Total	100.00

AGROSTIS EXARATA

AGROSTIS SCABRA (Willd).

(Hair Grass.)

Stems tufted, slender, decumbent, pale green, 1 to 2 feet high; leaves narrow, scabrous, the lower becoming involute; sheaths shorter than the nodes; ligule short, truncate; panicle loose, spreading, purplish; branches scabrous, capillary, flower-bearing near the apex; outer glumes equal, linear, acuminate, rough on the keel; flowering glume hyaline, three to five-nerved at base; palet absent or very small.

This worthless species is abundant in wet meadows, at all elevations.

ANALYSIS.

Moisture	9.50
Ash	6.03
Fat	2.41
Albuminoid nitrogen	7.66
Crude fiber	19.78
Nitrogen-free extract	64.12
Total	100.00

AGROSTIS CANINA (L.).

(Brown Bent Grass.)

Culms three-leaved, slender, very smooth, bearing a spreading, slender panicle, not very scabrous, of small flowers; leaves mainly clustering at the ground, short and narrow, those of the culm about 1′ long; branches of the panicle capillary, in pairs or even solitary; spikelets on short, hair-like pedicels; outer glume very acute, membranous or scarious, nearly equal; flowering glume three-nerved, straight, awned from the apex or near it; palet very minute.

This is abundant in the mountains, and exhibits a great variety of forms where it makes a sod, but it is so small as not to be considered of agricultural value.

LOLIUM PERENNE (L.).

(RYE GRASS.)

A native perennial grass of Europe. Stems are 2 to 3 feet high, leafy, carrying a spike-like panicle 6 to 8′ in length; spikelets $\frac{3}{4}$′ long, seven to eleven-flowered, placed edge-wise to the stem; outer glume half as long as the spikelets, inner one usually absent.

Worthy of trial here. Considered a valuable grass by those who have tried it at the East.

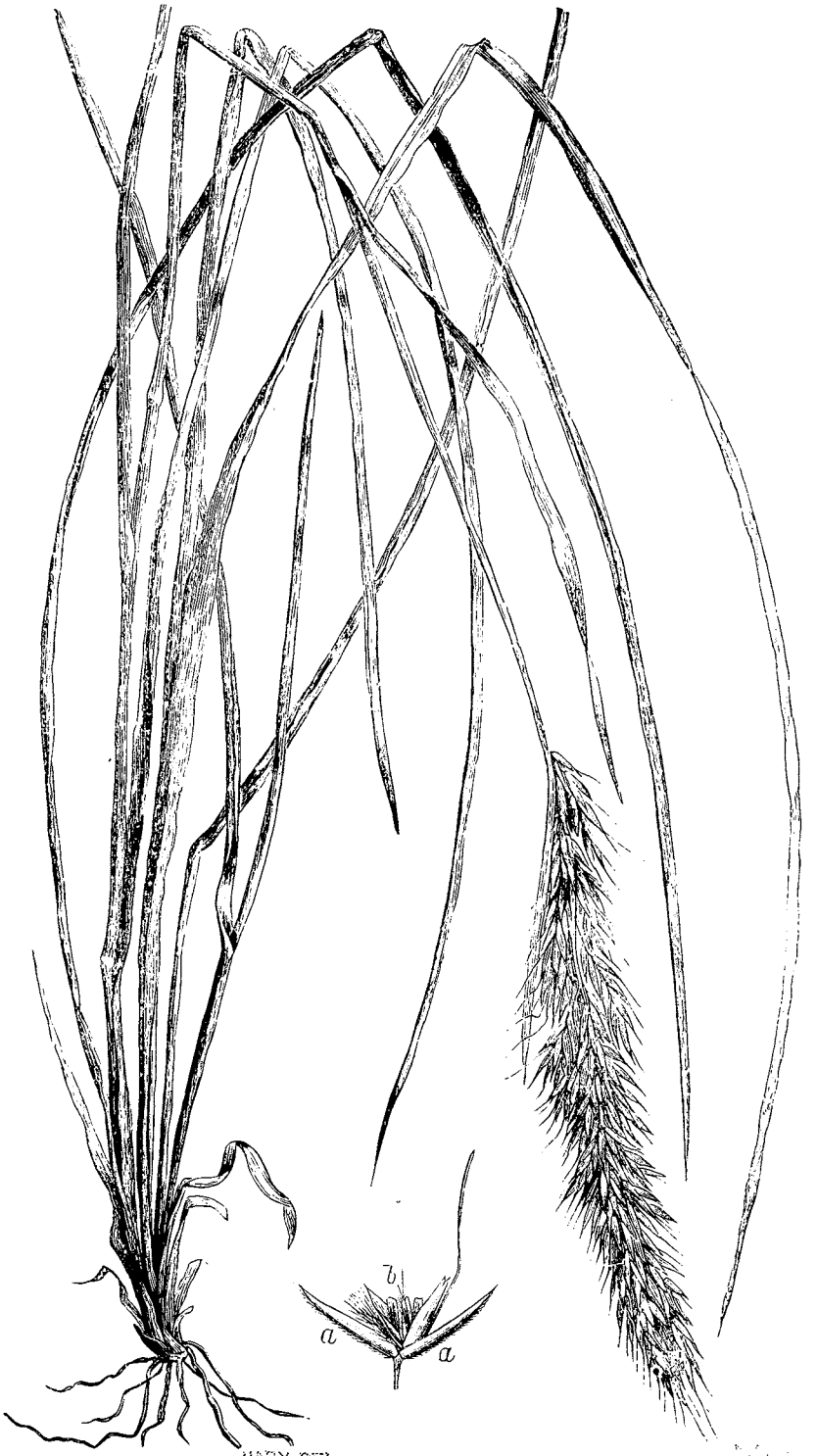
ANALYSIS.

Moisture	8.50
Ash	8.81
Fat	3.44
Albuminoid nitrogen	10.44
Crude fiber	21.26
Nitrogen-free extract	56.05
Total	100.00

DEYEUXIA SYLVATICA (Kth.).

Culms 1 to 2 feet high, rigid, leafy; radical leaves as long as the panicle, stem leaves becoming gradually shorter, scabrous, involute, acuminate, pointed; panicle dense, spike like, 3 to 6 inches long; rays usually in 5s, rough; outer glumes nearly equal, lanceolate, pointed; the upper three-nerved, the lower one-nerved; rough on the keel, longer than the floret; flowering glume three or four-toothed, grooved on the back; the divergent rough, stout, awn bent and twisted below the middle; hairs copious, silky, unequal, longest at the sides.

[See cut on opposite page.]



MARY DEL.

Deyeuxia Sylvatica

DEYEUXIA LAPPONICA (Kth.).

Lower glume scarious, almost equal, alternate at apex, scabrous on keel and purplish below; flowering glume of similar texture, shorter than glume, two-toothed at apex; furnished with a yellowish, twisted awn, bent about the middle, and purplish; palet very narrow, two-toothed, hyaline; anthers purplish; rhachis protruding beyond the flower, into a villous bristle. In this plant the outer glumes are very much shorter than the flowering glume; sheaths and leaves finely sulcate, scabrous; ligule lacerate, oblong, rounded and truncate; outer glume lanceolate, very acute, scabrous on keel; flowering glume two or three-toothed, perhaps lacerate, with awn; lower outer glume three-nerved, upper one-nerved; flowering glume with lacerate, two-cleft apex, shorter than glume, furnished on back with a bent, diverging awn, a tuft of silky hairs on each lower margin; a silky bristle standing opposite the palet, which is narrow, thin and 2 to 4′ long; panicle close, spicate, branches in 5s; plant 1 foot high.

Found near Little Muddy in unirrigated meadow.

DEYEUXIA STRICTA (Trin).

Culms 3 to 5 feet high, stout, leafy; sheaths loose and smooth; leaves narrow, involute, pale, finely scabrous; ligule elongated, lacerate; panicle loose, densely flowered, 3 to 6 inches long; branches erect, appressed in 5s or 7s, very scabrous; outer glumes nearly equal, scabrous all over, very acute, the lower three-nerved, the upper and longer one-nerved; flowering glume prominently five-nerved, two to four-toothed at apex, shorter than the glumes; a slender, straight awn—little, if at all, exceeding it, from near the middle; the ring of fuscous hairs copious and nearly the length of the glume; palet small, narrow, two-nerved.

This very robust species is found at high elevations in the mountains, growing in moist, but not shady, situations. It is a promising hay grass, but it is difficult to procure seeds in quantity, because of its scarcity.

DEYEUXIA CANADENSIS (Beauv.).

(BLUE JOINT; SMALL REED GRASS.)

Culms 3 to 6 feet high, and with the sheath finely scabrous; leaves very rough, 6 to 15 inches long; sheaths shorter than the nodes, hairy at the throat; ligule elongated; panicle oblong or pyramidal, spreading, purplish, 6 inches to 1 foot long; branches in 5s, very scabrous; outer glumes equal, lanceolate, scabrous; flowering glume hyaline, toothed at apex, bearing a slender awn, about the length of the glume; hairs at base copious, equaling the glume; palet shorter than its glume.

This is one of the most robust and leafy of the native grasses. It is confined chiefly to the mountain regions, where it grows in isolated clumps along streams or in moist meadows. Its agricultural value is not known.

ANALYSIS.

Moisture	7.98
Ash	13.20
Fat	3.46
Albuminoid nitrogen	7.80
Crude fiber	18.85
Nitrogen-free extract	56.69
Total	100.00

DEYEUXIA CANADENSIS.

MARX-DEL.

BROMUS CILIATUS (L.).

Stems 2 to 4 feet high; leaves pale green, somewhat rough; sheaths loose, shorter than the nodes, densely wooly; ligule truncate; panicle nodding, branches in 3s or 5s, widely spreading; lower outer glume narrow, one-nerved, upper three-nerved, mucronate; flowering glume silky, villous on the margins, the mid-rib terminating in a short, rough awn; palet equal, obtuse or two-toothed.

This grass occurs in shade or among rocks, in stout tufts, at nearly all elevations. [Varies to old variety *B. purgans, L.*].

ANALYSIS.

Moisture	8.07
Ash	7.19
Fat	3.10
Albuminoid nitrogen	4.73
Crude fiber	28.66
Nitrogen-free extract	56.32
Total	100.00

BROMUS BREVIARISTATUS (Thurb).

Culm 2 to 3 feet high; leaves flat, scabrous above, often 8 inches long on the stem; sheaths shorter than the nodes, the lower ones downy, the upper smooth; ligule elongated; panicle slender, loose, erect; branches solitary or in pairs; spikelets scabrous, compressed, sharply two-edged, six to eight flowered; outer glumes narrow, acuminate, five to seven-nerved; flowering glume obscurely nine-nerved, tipped with a bristle 1 line long.

Abundant along the east face of the Rocky Mountains.

BROMUS UNIOLOIDES (Willd).

(SCHRADER'S GRASS. SYN.—B. SCHRADERI; FESTUCA UNIOLOIDES.)

Culms erect, smooth, 3 feet high; sheaths loose and glabrous; leaves flat, linear, scabrous on both sides; ligule very short; panicle loose, rigid, compound; branches in 2s or 3s, very scabrous; spikelets two-edged, very flat, about ten-flowered; outer glumes unequal, acute, the lower four or five-nerved, the upper about seven-nerved, canescent with silky, spreading hairs, both with scarious margins; flowering glume similar, about nine-nerved, the keel terminating in a rough, straight awn; palet equal, acutely two-toothed.

This species in a natural meadow at Virginia Dale.

ANALYSIS.

Moisture	8.00
Ash	7.58
Fat	4.70
Albuminoid nitrogen	8.26
Crude fiber	26.00
Nitrogen-free extract	53.46
Total	100.00

BROMUS MEXICANA (Beal).

Culms 2° high; nodes frequently geniculate; leaves almost smooth; sheaths and leaves silky, villous; panicle nodding, loose and open; branches in 5s, rough; 1 to 2 spikelets on extremity of each branch, 1′ long on longish, flexuous, slender pedicels; glumes all strongly nerved; outer glume three-nerved; upper glume seven to nine-nerved; flowering glume cleft at apex, rough and short. The diverging awn is the most noticeable feature of the florets.

BROMUS KALMII (Gray), var. PORTERI.

(BROME GRASS.)

Stems slender, smooth, 1 to 2 feet high; leaves and sheaths scabrous; panicle compound, drooping; spikelets silky, hairy, seven to nine-flowered; outer glumes obtuse, three-nerved; flowering glume about seven-nerved, terminating in a straight awn about 2 lines long.

This species was procured at Del Norte, where it is said to be abundant and valuable for winter feed.

ANALYSIS.

Moisture	7.91
Ash	7.68
Fat	2.30
Albuminoid nitrogen	9.40
Crude fiber	15.19
Nitrogen-free extract	65.43
Total	100.00

BROMUS SECALINUS (L.).

(CHESS OR CHEAT.)

Culms erect, 2 to 4 feet high, rough below, hairy at the nodes; leaves linear, hairy above; sheaths shorter than the nodes, rough; ligule short, laciniate; panicle spreading, with nodding spikelets; outer glumes unequal, the lower five-nerved, the upper seven-nerved, finely scabrous all over; flowering glume five to seven-nerved; apex two-toothed; awn straight, rough or absent; palet slightly exceeding its glume, two-toothed.

This ornamental, but worthless, grass is now common on the plains, in waste places.

ANALYSIS.

Moisture	7.00
Ash	10.86
Fat	2.27
Albuminoid nitrogen	8.89
Crude fiber	19.20
Nitrogen-free extract	58.78
Total	100.00

ELYMUS CONDENSATUS (Presl.).

(GIANT RYE GRASS.)

Culms large, coarse, 6 to 12° high; sheaths rough; also, leaves on both sides; flowers in a rigid spike less than 10′; spikelets three to five, sessile at each joint, three to five-flowered; outer glumes scabrous, bristle like, shorter than the glume; flowering glume five-nerved, mucronate, having palet shorter than its glume.

A coarse grass; cut early for hay, otherwise of but little value.

[See cut on opposite page.]

ELYMUS SIBERICUS (L.).

Stems tufted, very leafy, 2 to 3 feet high; leaves large, glabrous or scabrous; spike erect, nodding with age; spikelets in pairs or rarely solitary; ligule very short; sheaths shorter than the nodes; outer glume subulate, setaceous, rough; flowering glume five-nerved, scabrous above and terminating in a rough, straight awn; palet obtuse or two-toothed at apex, ciliate on the nerves.

This grass grows in stout tufts in rocky soils and arid situations. It is considered to be valuable, by dairymen, for winter feed.

ANALYSIS.

Moisture	7.93
Ash	10.25
Fat	2.62
Albuminoid nitrogen	5.24
Crude fiber	20.85
Nitrogen-free extract	61.04
Total	100.00

ELYMUS CONDENSATUS.

ELYMUS AMERICANUS (V. & S.).

Culms erect, leafy, smooth, 3 to 7 feet high; leaves ample, scabrous, glaucous; ligule short, truncate; spike dense, cylindrical, 3 to 5 inches long; spikelets two at each joint of the rhachis, each three-flowered, 2 of them on short pedicils, the upper one imperfectly developed; outer glumes nearly equal, scarious margined, three-nerved, scabrous, apex bristle tipped; flowering glume rounded on the back, obscurely five-nerved above, finely scabrous, apex terminating in a rough, straight awn, much longer than the glume; palet equal, narrow, ciliate on the margins, apex obtuse.

This promising species is abundant on the Arapahoe Pass, in rich soils where it is partially shaded by pines and quaking asp.

ANALYSIS.

Moisture	8.87
Ash	8.06
Fat	2.32
Albuminoid nitrogen	12.86
Crude fiber	19.79
Nitrogen-free extract	56.97
Total	100.00

ELYMUS CANADENSIS (L.).

(WILD RYE; LYME GRASS; TERRELL GRASS.)

Culms 1 to 4 feet high, leafy; leaves lanceolate, very rough; ligule very short; spike loose, cylindrical, nodding above; outer glumes subulate, two to four-nerved, terminating in a short, rough awn; flowering glume five-nerved, two-toothed, rough, hairy, terminating in a scabrous, spreading awn, longer than itself; palet shorter than its glume, two-toothed, ciliate on the margins.

The variety *glaucifolius, Gr.*, is less common than the species in this locality.

This grass is common in this region, except at high altitudes. It should be cut young, as the whole plant becomes very harsh and rough when mature.

ANALYSIS.

Moisture	8.03
Ash	10.75
Fat	2.03
Albuminoid nitrogen	7.09
Crude fiber	19.88
Nitrogen-free extract	60.25
Total	100.00

ELYMUS CANADENSIS.

ELYMUS (Species ?).

(LYME GRASS.)

Culms smooth, 2 to 3 feet high; geniculate at base and at some of the upper nodes; leaves flat, finely scabrous, especially above; sheaths smooth, shorter than the nodes; ligule nearly obsolete; spike slender, densely flowered, nodding or very rigid; spikelets in pairs, about three-flowered; outer glumes three, subulate, finely scabrous, terminating in an awn the length of the spike; flowering glume glistening, rounded on the back, obscurely nerved, tipped with a rough, straight awn; palet minutely toothed.

Along streams, east face of Rocky Mountains and at Canon City.

ANALYSIS.

Moisture	7.39
Ash	5.34
Fat	2.54
Albuminoid nitrogen	10.33
Crude fiber	21.99
Nitrogen-free extract	59.80
Total	100.00

ELYMUS SITANION (Schult).

Stems in tufts, very smooth, growing in moist meadows or in the shade of woods, where it attains a height of 3 feet; leaves ample, sharp pointed, glaucous or hairy, the upper leaf often enclosing the base of the panicle; spike rigid, purplish when young; glumes long awned, much reflexed with age.

This grass resembles *Hordeum jubatum* in a general way, and with it is a worthless weed. It is found in all of the mountain meadows, but is not abundant anywhere.

ANALYSIS.

Moisture	8.00
Ash	6.95
Fat	2.29
Albuminoid nitrogen	4.98
Crude fiber	19.10
Nitrogen-free extract	66.68
Total	100.00

CATABROSA AQUATICA (Beauv.).

Culms 6′ to 2° high, very smooth and leafy to the panicle; leaves flat and glabrous, except on margin; ligules large, membranous; panicle close, thin, of five or more, distant, divided branchlets; outer glumes unequal, scarious; flowering glume four-nerved; apex scarious, truncate, erose.

This is an aquatic, creeping grass; flowers jointed at base; soon deciduous.

AGROPYRUM VIOLACEUM (Beauv.).

Culms 2 to 5 feet high, densely tufted, geniculate below, fibrous rooted; leaves flat, glaucous or green, scabrous, especially on the upper surface; spike 2 to 6 inches long, rigid; spikelets three to five-flowered, purplish; outer glumes strongly five-nerved, equal, both short, pointed and rough; flowering glume short awned, obscurely five-nerved, two of the latter extending into short teeth; palet equal, truncate or two-toothed.

There are two forms of this species, differing chiefly in the color of the leaves and stems. Both are valuable hay grasses, enduring more moisture than *Agropyrum glaucum*.

ANALYSIS.

Moisture	8.30
Ash	5.74
Fat	2.24
Albuminoid nitrogen	7.10
Crude fiber	21.14
Nitrogen-free extract	63.78
Total	100.00

AGROPYRUM UNILATERALE.

Culms erect, smooth, 3 to 4 feet high; leaves ample, very scabrous; ligule truncate, very short; panicle slender, spicate, secund, nodding; spikelets three to four-flowered; rhachis hairy; outer glumes linear, four to six-nerved, tipped with a rough awn $\frac{1}{2}$ inch long; nerves scabrous; flowering glume finely scabrous, flattened and obscurely nerved below; apex rougher, acutely two-toothed, the mid-nerve terminating in a rough, straight

awn 2 inches long; palet shorter than the glume, obtuse or retuse, ciliate on the nerves.

This species grows in stout tufts along the banks of streams, at from 7,000 to 8,000 feet. The culms are very leafy and robust; hence, perhaps of some value.

ANALYSIS.

Moisture	8.41
Ash	4.21
Fat	3.13
Albuminoid nitrogen	5.69
Crude fiber	17.90
Nitrogen-free extract	69.07
Total	100.00

AGROPYRUM TENERUM (Vasey).

(WHEAT GRASS; CLUMP WHEAT GRASS.)

Stems from fibrous roots, smooth, slender, geniculate at the lower joint, often 4 feet high; leaves flat, scabrous, 3 to 6 inches long, about four on a stem; sheaths smooth, shorter than the nodes; ligule nearly obsolete; spike slender, nodding, 4 to 8 inches long; spikelets about five-flowered, appressed to the rhachis; outer glumes equal, prominently five to seven-nerved, obtuse; flowering glume obscurely five-nerved above, rounded below, very scabrous all over; palet shorter than its glume, truncate.

A hay grass maturing early. Common in this region in moist meadows and in waste places.

ANALYSIS.

Moisture	7.86
Ash	6.28
Fat	2.04
Albuminoid nitrogen	6.15
Crude fiber	20.20
Nitrogen-free extract	65.33
Total	100.00

AGROPYRUM DIVERGENS (Nees).

Stems wiry, slender, erect or sometimes geniculate, 2 to 3 feet high, from running root-stocks; sheaths loose, striate, shorter than the nodes; ligule very short, truncate; leaves narrowly linear, glaucous or green, numerous; panicle slender, nodding; spikelets about five-flowered; outer glumes nearly equal, scabrous, three-nerved, short, rough awned; flowering glume scabrous, rounded on the back, obscurely five-nerved, the apex terminating in a rough, divergent awn; palet shorter than its glume, truncate.

This species grows in stout clumps in the clefts of rocks in exposed situations, in company with *Elymus Sibericus* and *Festuca Kingii*.

ANALYSIS.

Moisture	8.40
Ash	8.70
Fat	2.31
Albuminoid nitrogen	6.87
Crude fiber	23.52
Nitrogen-free extract	58.60
Total	100.00

AGROPYRUM STRIGOSUM (Beauv.).

About 1 foot high, growing in tufts; sheaths smooth; stem leaves narrow, strigose, pulverulent on the upper surface, smooth below, glaucous; spike 6′ long, slender; outer glumes acute; flowering glume five-nerved, with rough, divergent awn.

This species at high elevations, usually, and in dry soil. Worthy of trial, perhaps, as a dry land grass. Said not to have a running root-stock.

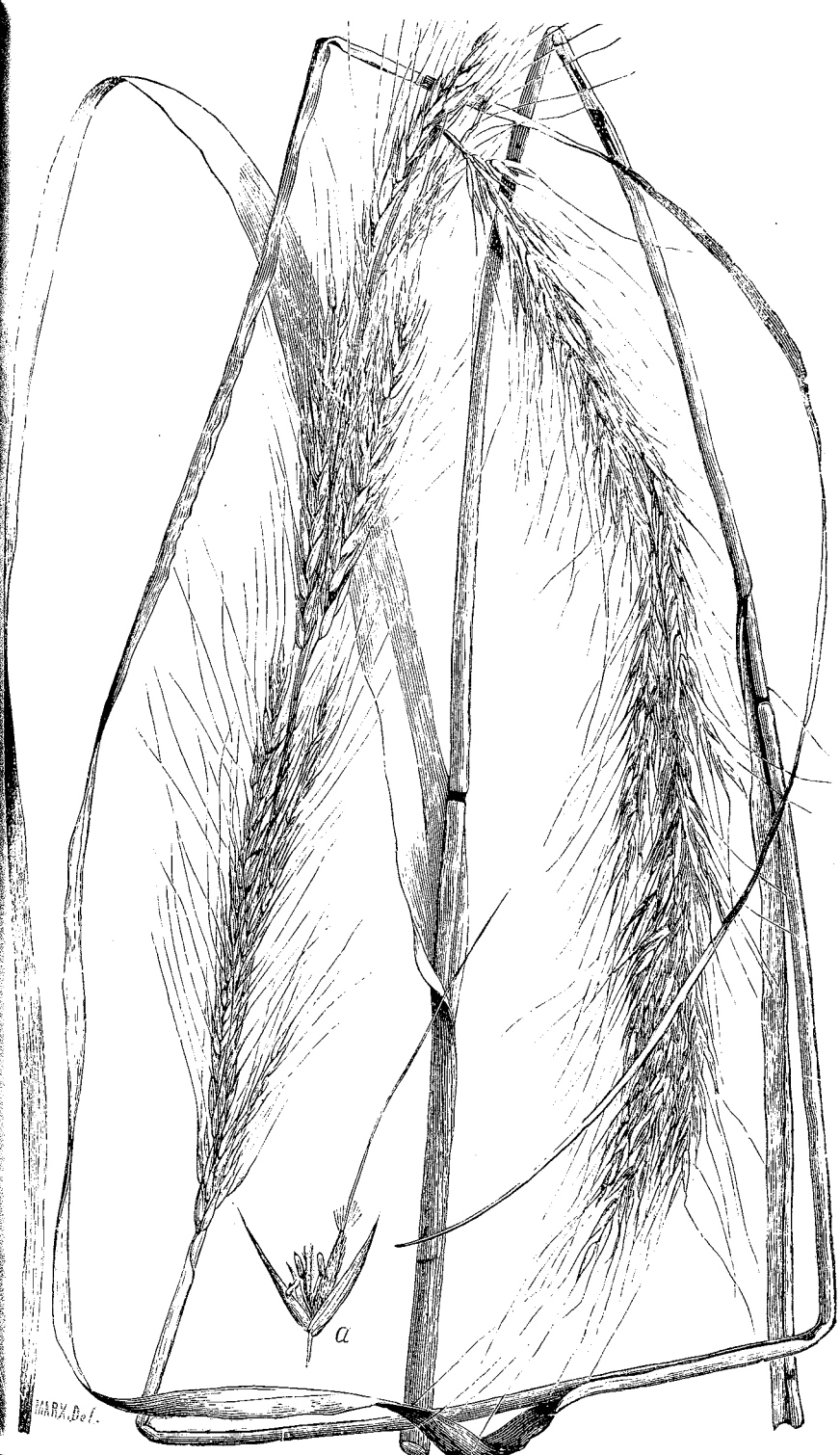
STIPA VIRIDULA (Trin).

Culms 2 to 4 feet high, leafy, clothed at base with the sheaths of dead leaves; sheaths loose, hairy on the margins, striate, the uppermost enclosing the base of the panicle; leaves linear, soon involute, glabrous, except on the margins; ligule small, truncate; panicle 4 to 12 inches long, loose and very narrow; branches usually in pairs, hairy at base, erect, appressed; spikelets one-flowered, short pediceled; outer glumes about equal, bristle pointed, membranous, three-nerved; flowering glume clothed with short hairs, which are somewhat longer at the toothed apex, terminating in a slender, twice bent, pubescent awn, which is also twisted below the middle; palet shorter than its glume, by which it is involved.

This grass grows in tufts, in dry soils, with *Festuca scabrella* and *Festuca ovina*, or, it may occupy large areas almost alone. It is eagerly sought for by stock.

ANALYSIS.

Moisture	8.30
Ash	7.75
Fat	2.28
Albuminoid nitrogen	9.47
Crude fiber	19.38
Nitrogen-free extract	61.12
Total	100.00



STIPA VIRIDULA.

STIPA SPARTEA (Trin).

(PORCUPINE GRASS.)

Stems tufted, smooth, 2 to 3 feet high; leaves 6 to 10 inches long, involute, long pointed, smooth; sheaths shorter than the nodes, loose, hairy on the margins; ligule very short, truncate erose; panicle slender, spicate, about 1 foot long; branches in 5s, erect, appressed 1 to 3 inches long; outer glumes lanceolate, bristle pointed, the lower three-nerved, the upper five-nerved, rough on the keel; flowering glume villous bearded, especially at the acute callus and apex; awn 1 to 2 inches long, bent near the middle, short appressed, hairy below, scabrous above.

This species occurs in the foothills and on the plains, along irrigating ditches. Stock seem to eat it only in winter.

ANALYSIS.

Moisture	9.00
Ash	4.78
Fat	2.46
Albuminoid nitrogen	8.34
Crude fiber	23.81
Nitrogen-free extract	60.61
Total	100.00

STIPA MONGOLICA (Turez).

Stems smooth, leafy to the panicle, purplish, wiry; leaves filiform, those of the culm 1 to 2′ long, radical 3 to 4′ long; panicle purplish, 1 to 3′ long; outer glume lanceolate, purplish, shining, glabrous, equaling the florets; flowering glume silky, hairy, especially at apex, terminating in a twisted, (1 or 2) bent awn over 1′ long.

This appears to be a tufted, dry land grass, with the remains of many dead sheaths at base.

STIPA COMATA (Trin).

Stems stout, smooth, 2 to 3 feet high, some of the lower joints geniculate; sheaths loose, finely scabrous; panicle included at base by the upper sheath; outer glumes whitish, three-nerved, about equal, long pointed; flowering glume villous at the pointed callus, appressed, silky, hairy above; awn 4 to 6 inches long, stout, twisted below, twice bent at the middle, rough.

This grass is common in dry soils and exposed situations, up to 8,000 feet. It is readily recognized in early summer by its bleached appearance.

ANALYSIS.

Moisture	7.76
Ash	8.80
Fat	3.37
Albuminoid nitrogen	4.72
Crude fiber	24.92
Nitrogen-free extract	58.19
Total	100.00

STIPA (Species ?).

Culms tufted from fibrous roots, wiry, purplish, smooth, about 2 feet in height; leaves narrow, involute, 6 to 10 inches long, scabrous above; sheaths shorter than the nodes, smooth; ligule almost none; panicle slender, erect, 2 to 3 inches long; branches solitary or in pairs, appressed to the axis; outer glumes lanceolate, very acuminate, membranous, purplish, the lower somewhat the longest; flowering glume silky, villous, callus obtuse, apex terminating in a twisted, usually twice bent, scabrous awn 1 inch long.

This *Stipa* was seen but once, near the Lulu Pass, growing among rocks in an exposed situation.

DESCHAMPSIA FLEXUOSA (Beauv.).

Stems smooth, slender, tufted, nearly naked, 1 to 2 feet high; leaves bristle like, chiefly in radical tufts, 1 to 4 inches long; ligule elongated, pointed; panicle slender, spreading; branches in 4s or 5s, very smooth; spikelets two-flowered; outer glumes ovate-lanceolate, shorter than the florets, apex scarious, bronzy, the lower glume three-nerved at base, the upper and shorter one-nerved; flowering glume four-nerved, purplish, silky, hairy below, apex scarious, four-toothed; awn attached below the middle, finely ciliate, somewhat divergent, but not bent; palet shorter than its glume, two-toothed.

This species on the east face of the Rocky Mountains, at high elevations.

DESCHAMPSIA DANTHONIOIDES (Munro).

Culms from 6 inches to 2 feet high; leaves narrow, very rough; sheaths also very rough, shorter than the nodes, twisted; ligule elongated; panicle densely flowered, spicate; branches in 5s, 1 inch long, flowered to the base; outer glumes equal, membranous, lanceolate, acuminate, much longer than the florets, the lower one-nerved, the upper three-nerved, both scabrous on the keel; flowering glume with a few short hairs at base, conspicuously five-nerved, apex two-toothed; awn exserted, attached and bent below the middle; palet hyaline, two-toothed.

This grass was seen on the Arapahoe Pass, partly in the shade of pines, but not in any quantity.

DESCHAMPSIA CÆSPITOSA (Beauv.).

(Hair Grass.)

Culms smooth, erect, tufted, from fibrous roots; leaves chiefly in radical tufts, linear, involute, 3 to 12 inches long, scabrous on the margins; ligule elongated, pointed; panicle slender, virgate, nodding, 6 to 12 inches long; branches capillary, scabrous, spreading, distant, ½ to 4 inches long; spikelets oblong, purplish, two-flowered; outer glumes about equal, lanceolate, acute, the lower one-nerved, the upper three-nerved at base, slightly exceeding the florets; flowering glume with truncate, four or five-toothed, scarious apex, and a few, short, silky hairs at base; awn straight or slightly geniculate at the middle, scabrous, inserted at the base of the glume and slightly exceeding the outer ones.

This species is confined to moist meadows and shady situations in the mountains, where it forms a large portion of the native hay. The culms are too light to make the best hay, but it affords a large amount of good pasturage, as its radical leaves are numerous and ample in the more robust forms.

ANALYSIS.

Moisture	8.15
Ash	13.86
Fat	1.77
Albuminoid nitrogen	8.05
Crude fiber	27.40
Nitrogen-free extract	48.92
Total	100.00

SPOROBOLUS DEPAUPERATUS (Vasey).

Culms slender, tufted, branching from the ground, geniculate below, 6 to 18 inches high; leaves setaceous, glabrate, 1 to 3 inches long; sheaths longer than the nodes; panicle linear, very narrow, 1 to 4 inches long, the terminal one sometimes included at base; branches in 2s or 3s, interrupted below; outer glumes nearly equal, scarious; flowering glume somewhat scabrous, blackish above, and tipped with a short mucro; palet of same texture, nearly equal.

This species grows in tufts, from numerous underground stems. It spreads rapidly in newly irrigated soils, forming a fine bottom for the taller *Agropyrums*. It is a desirable grass for meadows. On dry hill-sides it attains a height of about 6 inches.

SPOROBOLUS ASPERIFOLIUS (Thurb).

Culms 2° high, smooth, purplish, robust; leaves long, alternate, minutely scabrous on the margins; panicle spicate, purplish, included at base, 3 to 6′ long; branches in 2s or solitary; outer glumes unequal, somewhat scabrous on the strong nerve.

SPOROBOLUS AIROIDES (Torr).

Culm stout, smooth, thickened at the base, from stout, creeping root-stocks; leaves linear, soon involute, long pointed, rough on the margins; sheaths smooth, shorter than the nodes; ligule a fringe of hairs; panicle pyramidal, soon exserted, diffuse, 1 foot long; rays mostly solitary, smooth, much branched and few flowered above the middle, naked below; spikelets purplish, one-flowered; outer glumes unequal, acute, the upper and larger obscurely three-nerved; flowering glume oblong, keeled, acute; palet nearly equal, obscurely two-toothed.

This grass occurs in alkaline soils on the plains and in the mountain parks. It is abundant in North Park, Pass plains, and near Laramie City. Its is a pasture grass, the culms being too light and naked to make it valuable for hay. It grows in densely sodded, leafy patches, from underground stems. Stock of all kinds like it.

ANALYSIS.

Moisture	7.92
Ash	8.98
Fat	2.25
Albuminoid nitrogen	7.32
Crude fiber	14.80
Nitrogen-free extract	66.65
Total	100.00

SPOROBOLUS CUSPIDATUS (Torr).

Culms geniculate, erect, from running root-stocks, 2 to 3 feet high; leaves narrowly linear, flat, becoming involute, scabrous, especially on the margins; sheaths bearded at the throat and on the margins, mostly shorter than the nodes; ligule a short, ciliate fringe; panicle often 1 foot long, narrow, pyramidal, its base enclosed by the long sheath of the upper leaf, finally exserted; spikelets lead colored, small; outer glumes unequal, acute, finely scabrous; flowering glume ovate, acuminate, rough on the greenish keel; palet shorter than its glume, acute.

This grass is abundant at 5,000 feet, in Northern Colorado. It occurs in the mountain parks, but in less quantity.

ANALYSIS.

Moisture	8.16
Ash	9.43
Fat	2.66
Albuminoid nitrogen	10.88
Crude fiber	17.32
Nitrogen-free extract	59.71
Total	100.00

SPOROBOLUS CRYPTANDRUS (Gr.).

Culms 2 to 3 feet high, less purplish than *Cuspidatus*; leaves scabrous, especially on the margins, linear to filiform at apex, 1 foot or more long above, shorter at base, hairy at base; sheaths shorter than the nodes, the lower with membranous margin; ligule an extremely short, ciliate fringe; panicle lead color, enclosed in the sheath of the upper leaf; rays mostly in pairs; outer glume unequal, acute.

This in tufts, from root-stocks.

[See cut on opposite page.]

ERAGROSTIS PURSHII (Schrad.).

Stems geniculate at base, branching, about 2 feet high; leaves linear, smooth; sheaths villous at the throat; panicle slender, spreading, elongated; lower branches hairy in the axils; pedicels capillary; spikelets five to eighteen-flowered; outer glumes ovate, acute; flowering glume three-nerved.

This species is abundant in garden soils, in company with *Eragrostis poæoides*, var. *Megastachya*, at Canon City.

ERAGROSTIS POÆOIDES (Beauv.).

Growing in tufts in rich garden soils; culms geniculate, decumbent, 1 to 2° long; sheaths pilous at throat; ligule short, bearded; panicle spreading; branches capillary, solitary or mostly in pairs; spikelets about twenty-flowered; pilous in the exils.

This species has a peculiar odor. A weed in rich garden soil. Of no agricultural value.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ERAGROSTIS POÆOIDES (Beauv.), var. MEGASTACHYA (Link).

(PUNGENT MEADOW GRASS.)

Culms decumbent at base, 1 to 2 feet high; sheaths pilous at throat; ligule short, bearded; panicle spreading, oblong or pyramidal; branches capillary, solitary or in pairs, flowering nearly to the base; spikelets about twenty-flowered, pilous in the exils; outer glumes about equal, very acute, rough on the keel; flowering glume acute, smooth, strongly three-nerved; palet much shorter than its glume, hyaline, with rounded or obtuse apex and ciliate margin.

Abundant in garden soils in Northern and Southern Colorado. It has a disagreeable odor and comes to maturity late in the season. It has, probably, no agricultural value.

ANALYSIS.

Moisture	7.44
Ash	14.53
Fat	2.60
Albuminoid nitrogen	8.93
Crude fiber	17.70
Nitrogen-free extract	56.24
Total	100.00

MUHLENBERGIA GLOMERATA (Trin.).

Culms leafy, erect, wiry, much branched, 2 to 3 feet high, from underground stems, the bases clothed with the sheaths of dead leaves; leaves flat, small, 2 to 3 inches long, rough; sheaths longer than the nodes, loose; ligule a short, truncate fringe; panicle narrow, slender, lobed, spicate; spikelets sessile in the clusters; outer glumes linear, tapering to a long, rough awn, margins scarious to the rough keel; flowering glumes one-third shorter than

the outer, conspicuously three-nerved, acute; palet acute, nearly equaling the glume.

This grass is common on the plains and in the mountains, up to 7,000 feet. On the plains it favors shaded, rather moist localities, but in the mountains it occurs in exposed situations in the clefts of rocks. It is a desirable species.

ANALYSIS.

Moisture	7.24
Ash	9.31
Fat	2.37
Albuminoid nitrogen	6.80
Crude fiber	19.50
Nitrogen-free extract	62.02
Total	100.00

MUHLENBERGIA WRIGHTII (Vasey).

Stems erect, branching, pale, finely scabrous; sheaths much shorter than the nodes; ligule short, truncate; leaves involute, rigid, pungently pointed, rough; panicle spicate, 2 to 6 inches long; branches solitary, appressed, flowering their whole length, the lower two somewhat distant; outer glumes scabrous on the keel, bristle pointed, nearly equal; flowering glume finely scabrous, blackish, pungently pointed; palet acute, shorter than the glume.

This grass occurs in dry, rocky, exposed situations, at about 7,000 feet. It is a desirable species for trial.

ANALYSIS.

Moisture	7.81
Ash	7.58
Fat	3.29
Albuminoid nitrogen	7.31
Crude fiber	19.00
Nitrogen-free extract	62.82
Total	100.00

MUHLENBERGIA GRACILIS (Trin.).

Stems rigid, 1 to 2 feet high; leaves filiform, pale, very scabrous; sheaths also finely scabrous, longer than the inter-nodes; ligule elongated, long pointed; panicle slender, 3 to 6 inches long, bronzed or blackish; rays solitary, erect; lower outer glume acute, upper three-toothed, both scarious and rough on the nerves; flowering glume scabrous above, villous at the small callus, apex terminating in a slender, rough awn; palet hairy, equaling the glume and of similar texture.

A dry land grass, of possible value, growing in the clefts of rocks in the mountains.

ANALYSIS.

Moisture	8.12
Ash	5.12
Fat	2.59
Albuminoid nitrogen	6.85
Crude fiber	25.72
Nitrogen-free extract	59.72
Total	100.00

MUHLENBERGIA GRACILIS, var. BREVIARISTATA (Vasey).

Stems tufted, growing in circular patches, which decay in the centre, the bases clothed with the sheaths of dead leaves; leaves 1 to 3 inches long, erect, narrow, involute, scabrous; sheaths loose, with broadly scarious margins; ligule large, pointed or lacerate; panicle 1 to 4 inches long; branches solitary or in pairs, each with one to three spikelets; outer glumes scarious, the lower keeled, acute, the upper three-nerved and three-toothed, both scabrous on the nerves; flowering glume three-nerved, scabrous, hairy on the nerves below the middle, apex mucronate; palet similar, acute, shorter than the glume.

This form is abundant on dry, gravelly hillsides, at 8,000 feet. Its value has not been determined.

MUHLENBERGIA GRACILLIMA (Torr.).

Stems about 6 inches high, forming ring-like patches, which kill out in the centre; leaves very fine, involute, curled at maturity, growing in tufts; panicle slender, purplish, spreading, few-flowered; branches capillary, solitary or in 3s; outer glumes unequal, very acute, rough on the keel; flowering glume glabrate, three-nerved, bifid, with a straight, slender awn; palet of similar texture, the acute apex toothed.

This grass abundant on light, dry soils on the plains. It is too small to have much economic value.

ANALYSIS.

Moisture	6.62
Ash	22.93
Fat	2.28
Albuminoid nitrogen	7.93
Crude fiber	17.60
Nitrogen-free extract	49.26
Total	100.00

TRISETUM SUBSPICATUM (Beauv.).

Stems tufted, slender, smooth, 6 inches to 2 feet in height, varying with the altitude; leaves flat and smooth, or with the sheaths very scabrous; ligule rounded, laciniate; panical slender, cylindrical, purplish, interrupted below, 6 inches long; spikelets two to three-flowered; outer glumes unequal, acuminate, rough on the keel; flowering glume acutely two-toothed at apex, bearing a stout, divergent awn, longer than its glume; palet equal, finely toothed, the nerves ciliate.

This grass grows in stout tufts in the shade of pines on gravelly soils, at high elevations. It furnishes a large amount of pasturage in some localities.

NOTE.—There are 3 species in the Rocky Mountains, viz: *subspicatum*, var. *molle*; also, *Montanum*.

TRISETUM SUBSPICATUM.

DANTHONIA INTERMEDIA (Vasey).

(WILD OAT GRASS.)

Stems smooth, not tufted, 6 to 24 inches long; leaves smooth; sheaths loose, hairy at the throat; panicle narrow, nodding; rays solitary, two to three-flowered, hairy at the points of the axis; outer glumes much exceeding the florets, acuminate; flowering glume conspicuously two-toothed and very villous below the middle, especially on the margins; the awn coarse, divergent, flat and twisted below the middle; palet scarious, acuminate, two-toothed and two-nerved.

This grass occurs at from 8,000 to 9,000 feet. At the latter elevation it is much reduced in size. Its value has not been determined.

ANALYSIS.

Moisture	8.38
Ash	4.68
Fat	2.56
Albuminoid nitrogen	9.48
Crude fiber	18.71
Nitrogen-free extract	64.57
Total	100.00

DANTHONIA CALIFORNICA (Boland).

Culms 1 to 2 feet high, with narrow, pointed, scarious leaves; sheaths hairy, especially at the throat; panicle 2 to 3′ long, of three to five, nearly sessile, erect spikelets; outer glumes unequal, three-nerved, purplish, somewhat scarious, acute, keeled above, nearly equal and exceeding the florets of the spikelet; flowering glume smooth on the base, margins below fringed with long, white hairs (silky), acutely cleft at the apex; a divergent awn, with broadish, twisted, ciliate base, from the base of the cleft.

This grass is indigenous to California, Oregon and Rocky Mountains. Probably of not much agricultural value.

PHALARIS ARUNDINACEA (L.).

(CANARY GRASS.)

Stems and sheaths finely scabrous, 2 to 5 feet high, branched or simple; leaves flat, lanceolate, finely scabrous, the margins rougher, 6 to 12 inches long; ligule short, rounded above; panicle oblong, dense, somewhat one-sided, 3 to 6 inches long, interrupted below; rays much branched, spreading in bloom, contracted, spicate with age; outer glumes whitish, equal, lanceolate, three-nerved, very acute; flowering glumes ovate, shorter than the outer glumes, obscurely nerved, hairy on the back; rudiments pilous.

This species was seen at all elevations, except the high mountain passes, growing in partial shade in moist ground. On the plains it is more abundant, occurring in quantity along irrigating ditches, regardless of shade. It is considered a desirable grass for trial.

ANALYSIS.

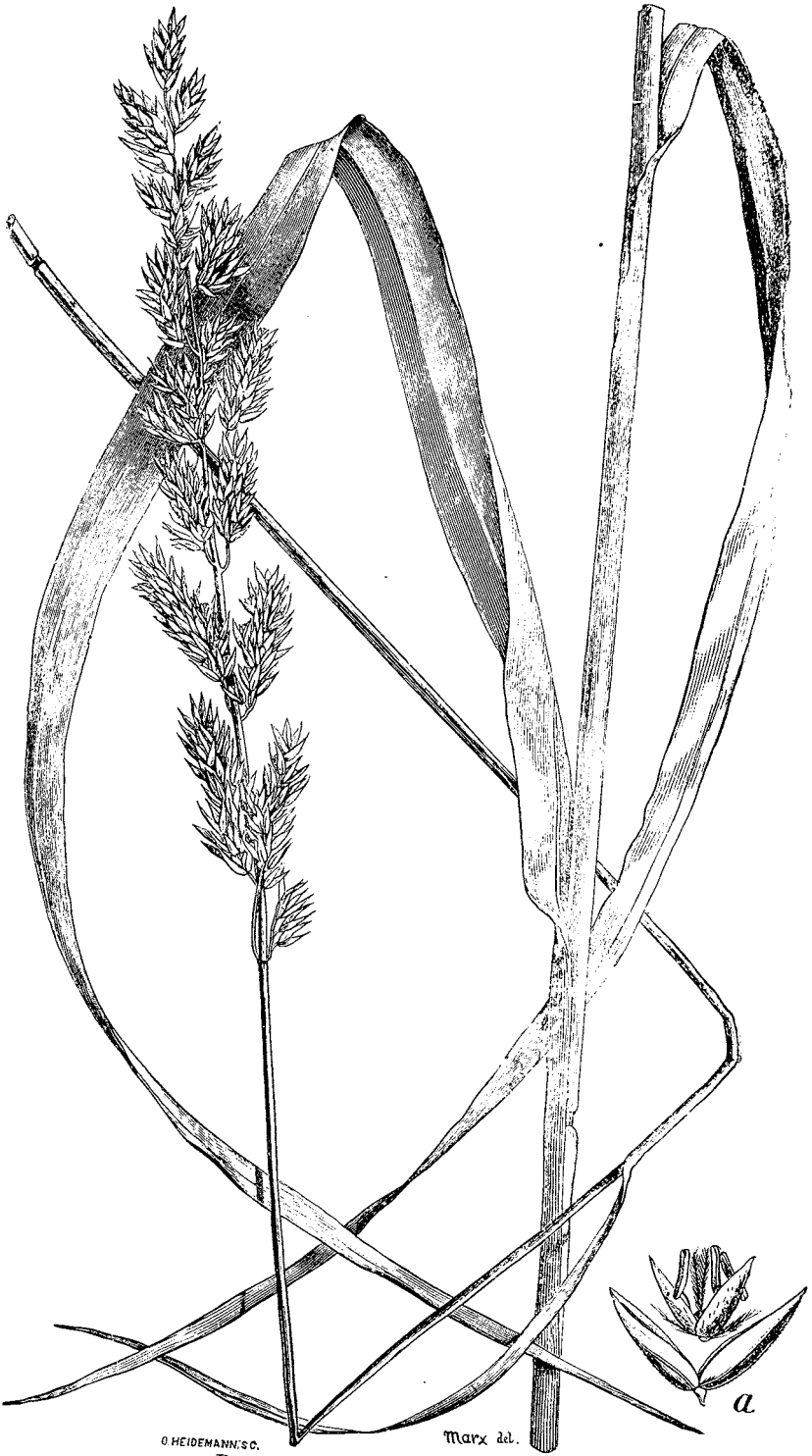
Moisture	8.44
Ash	7.16
Fat	3.40
Albuminoid nitrogen	7.12
Crude fiber	19.15
Nitrogen-free extract	63.17
Total	100.00

PHALARIS CANARIENSIS (L.).

(CANARY GRASS.)

Culms geniculate at base, striate, leafy, 1 to 2 feet high, from fibrous roots; leaves flat, lanceolate, very rough; ligule conspicuous, lacerate; sheaths loose, rough; panicle spicate, ovoid, 1 to 2 inches long; glumes whitish, greenish veined, very scabrous, strongly keeled.

Occasionally seen in cultivated ground, but not common. The seeds are the chief food of canary birds.



PHALARIS ARUNDINACEA.

PASPALUM GLABRUM.

Stems prostrate, ascending, glabrous, 8 to 12 inches long; leaves glabrous, lanceolate, linear, shorter than the sheaths; the upper sheath enclosing the base of the panicle, the lower ones hairy at the throat; ligule truncate, lacerate, enfolding the stem; spikes two to four, slender, about 2 inches long; glumes equaling the purplish flower, both hairy.

This grass is a persistent weed, and is widely distributed in Northen and Southern Colorado. In lawns it quickly takes possession, subduing all competitors for the occupancy of the soil.

ANALYSIS.

Moisture	9.10
Ash	16.98
Fat	2.17
Albuminoid nitrogen	6.68
Crude fiber	16.23
Nitrogen-free extract	57.94
Total	100.00

ALOPECURUS ARISTULATUS (Michx.).

Culms geniculate, smooth, ascending from a decumbent base, often rooting at the lower joints; sheaths inflated, loose; ligule prominent; leaves linear, acute, somewhat glaucous, rough on upper surface; spike cylindrical, very slender, pale green; glumes hairy outside, obtuse; flowering glume truncate, glabrous; anthers yellow; awn straight.

This species grows along ditch banks and is very leafy.

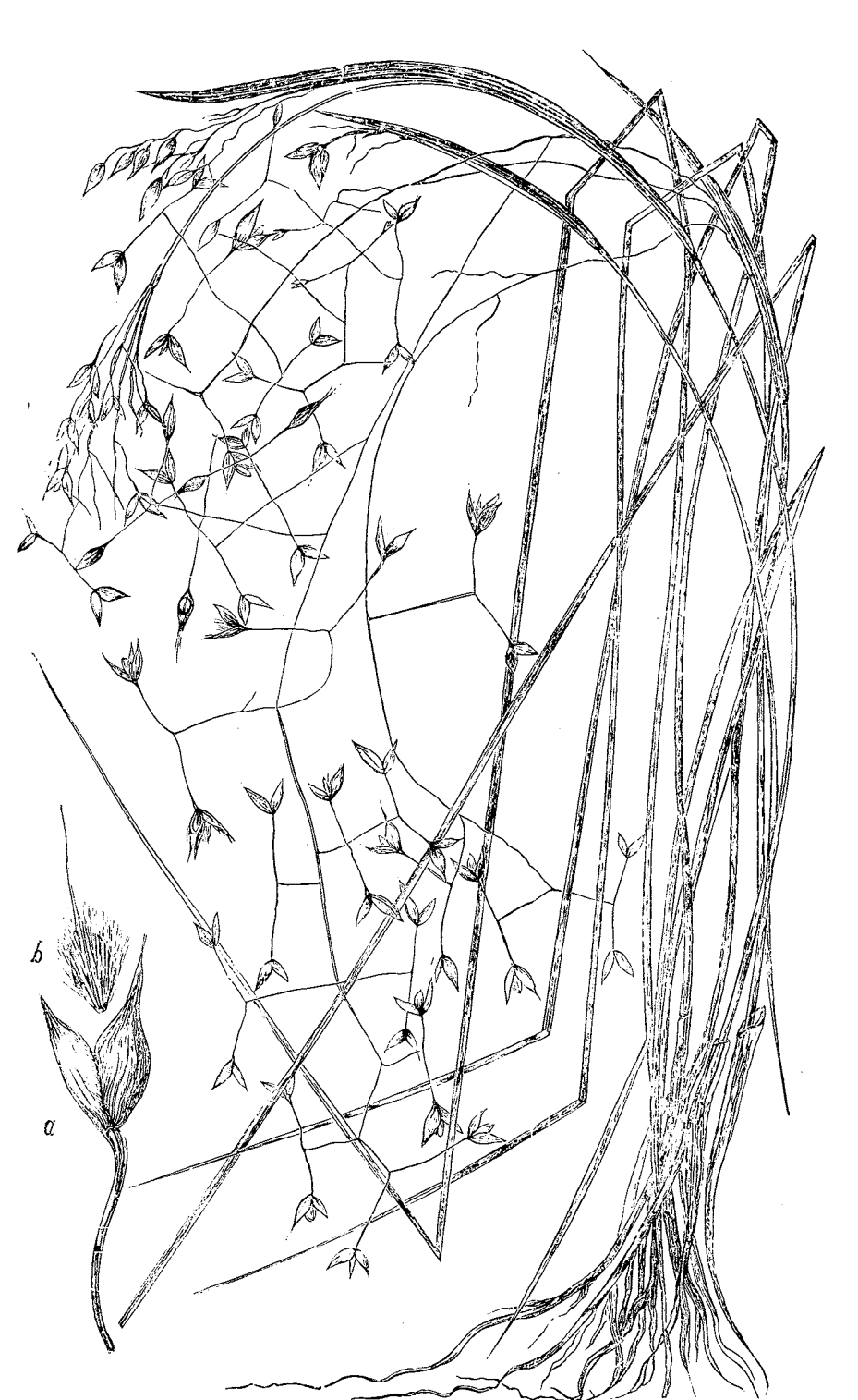
ORYZOPSIS CUSPIDATA (Benth.).

Stems about 2 feet high, smooth, growing in stout, rigid clumps, some of the lower joints geniculate; leaves linear, involute, 6 to 8 inches long, scabrous on the upper surface, the upper leaf enclosing the base of the panicle; panicle 6 to 12 inches long, loosely spreading; branches in 2s, divergent; spikelets one-flowered, on capillary pedicels; outer glumes pubescent, inflated, conspicuously five-nerved, the apex attenuate into a beak; flowering glume ovate, covered with a profusion of long, silky hairs, and tipped with a stout awn; palet smaller, of similar texture.

This grass seems to succeed best at an altitude of 5,000 feet. It occurs in the high mountain parks, but only in isolated, dwarfed specimens, and not in stout tufts. It is one of the most valuable of the dry land grasses.

ANALYSIS.

Moisture	8.60
Ash	7.83
Fat	2.72
Albuminoid nitrogen	7.36
Crude fiber	15.05
Nitrogen-free extract	67.04
Total	100.00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ALOPECURUS ALPINUS (Sm.).

Culm erect, smooth, over 1 foot high; nodes brown; leaves lanceolate, smooth; the upper sheath inflated; ligule elongated; flowers in a dense, cylindrical, soft spike; outer glumes strongly three-nerved, acute, densely silky, villous; flowering glume equals the outer one; awn nearly straight, exserted.

In moist soils only, and at high elevations.

MELICA SPECTABILE (Scribner).

Stems slender, bulbous at base, about 2 feet high, few leaved; leaves linear, smooth; panicle slender, nodding, few-flowered; branches distant, spreading, flexuous, rough; outer glumes unequal, scarious, the lower three-nerved, the upper five-brownish-nerved; flowering glume about nine-nerved, thin, with a broadly scarious, acuminate apex; palet shorter than its glume, two-toothed and purplish tipped.

This grass was seen only on the Gore Pass, at 11,000 feet, in the shade of pines. It has, probably, no agricultural value.

GRAPHEPHORUM WOLFII (Vasey).

A tufted perennial grass with culms densely pubescent, 1° or more high; leaves somewhat scabrous; panicle spicate, purplish when young; spikelets two-flowered, with a rudiment of a third; glumes with scabrous margins, the outer ones unequal, acuminate, keeled, obscurely one to three-nerved at base; flowering glume being at the base, obscurely nerved, two-toothed at apex.

This grass from a high altitude.

ANDROPOGON FURCATUS (Muhl.).

(ANDROPOGON PROVINCEALIS (LAM.).

Stems 1 to 6 feet high, terminating by two to five, usually three digitate spikes; leaves long and ample, scabrous on the margins, those of the culm 4 inches long, hairy at base; ligule ciliate; spikelets appressed, approximate; outer glumes 4 lines long, the upper ones terminating in a short awn; awn of the fertile flower long and bent.

This grass, in two forms, is abundant on the plains and in the mountains, on rocky hillsides, up to 7,000 feet. In some places it is cut extensively for winter feed. It gives promise of value.

ANALYSIS.

Moisture	8.71
Ash	4.51
Fat	2.06
Albuminoid nitrogen	3.80
Crude fiber	21.66
Nitrogen-free extract	67.97
Total	100 00

[See cut on opposite page.]

ANDROPOGON SCOPARIUS (Michx.).

(LITTLE BLUE STEM.)

Culms 2 to 4° high; spikes in clusters, on slender pedicels; flowers in August.

A large constituent of native meadows, yielding a fair amount of hay.

AMMOPHILA LONGIFOLIA (Vasey).

Culm smooth, reed-like, 3 to 6 feet high, from running root-stocks; leaves smooth, rigid, involute, long pointed; sheaths loose, longer than the nodes, hairy on the margins; panicle slender, whitish, 6 to 10 inches long; branches erect, smooth, solitary or in 2s or 3s, about 2 inches long, flower-bearing for half their length; outer glumes about equal, obscurely nerved; flowering glume lanceolate, very acute, scabrous on the strong keel, hairs at the base copious, spreading; palet obtuse or acute, shorter than its glume.

This species occurs in isolated specimens in moist, alkaline soils on the plains and in the mountains, up to 7,000 or 8,000 feet. It is thought to be too coarse to have much value.

POLYPOGON MONSPELIENSIS (Desf.).

(BEARD GRASS.)

Culms simple, decumbent at the branching base, 1 to 2 feet high; leaves flat, acutely pointed, downy; panicle spicate, densely flowered, the long awns of the flowers being very conspicuous; spikelets one-flowered; outer glumes nearly equal, pubescent, long awned; flowering glumes shorter, with a slender awn from the toothed apex; palet small, not awned.

Very common on the plains in wet soils. An ornamental grass of but little agricultural value.

ANALYSIS.

Moisture	8.40
Ash	11.88
Fat	2.95
Albuminoid nitrogen	12.33
Crude fiber	21.89
Nitrogen-free extract	50.95
Total	100.00

GLYCERIA NERVATA (Trin.).

Culms leafy, 2 to 4 feet high; leaves flat, finely scabrous, the longest 1 foot or more long; ligule truncate, short; sheaths not closed; panicle somewhat one-sided, 6 to 8 inches long, slender and pendulous from the weight of the seeds; branches flexuous, solitary or in 2s or 3s, scabrous; spikelets five to seven-flowered, brown or purplish; outer glumes small, unequal; flowering glume seven-nerved, finely scabrous, apex convex; palet equal, elliptical in outline, finely ciliate on the nerves.

Abundant in moist, shady locations, at high elevations. The panicles are relished by stock.

ANALYSIS.

Moisture	8.10
Ash	8.65
Fat	2.59
Albuminoid nitrogen	6.44
Crude fiber	19.15
Nitrogen-free extract	63.17
Total	100.00

[See cut on opposite page.]

GLYCERIA PAUCIFLORA (Presl.).

Culms leafy, 2 to 4 feet high, from running rootstocks; sheaths smooth, split; leaves somewhat scabrous; ligules prominent; panicle 3 to 6′ long; branches in 2s or 3s, erect, flowering for more than half their length; spikelet two-flowered [book says four to six]; flowering glume seven or eight-nerved, convex near apex, finely scabrous, tip scarious and toothed; panicle sparsely flowered; sheaths split.

MARX. DEL.

GLYCERIA NERVATA.

GLYCERIA AQUATICA (Smith).

(REED MEADOW GRASS.)

Culms leafy, 3 to 6 feet high, two-angled, very stout, glabrous; leaves 1 to 2 feet long, rough on the edges; ligule truncate; panicle purplish, much branched, spreading; branches in half whorls, naked below; spikelets on capillary pedicels, five to nine-flowered; outer glumes ovate, unequal, one-nerved, whitish; flowering glumes entire at rounded apex, seven-nerved; palet equaling its glume, two-nerved, two-toothed.

This grass is found in wet places at all elevations. In the mountains it furnishes a considerable amount of rough feed during winter.

ANALYSIS.

Moisture	8.00
Ash	19.06
Fat	2.98
Albuminoid nitrogen	9.45
Crude fiber	22.21
Nitrogen-free extract	46.30
Total	100.00

GLYCERIA DISTANS (Wahl.).

(WHITE SPEAR GRASS.)

A stout, tufted, perennial grass, from running rootstocks, 1 to 2 feet high; branches in 5s below and 3s above, unusually pubescent; leaves smooth, broad; lower glumes very unequal, membranous, the smaller acute, the larger erose, rounded; flowering glume prominently four or five-nerved, scarious tipped; upper palet emarginate, lower one truncate.

This grass has but little value.

SETARIA VIRIDIS (Beauv.).

Culms smooth, leafy; sheaths loose, twisted, hairy on the margins; leaves broad and rough, margins serrulate; spike 1 to 3 inches long, cylindrical, nodding, green; outer glumes conspicuously greenish-nerved; flowering glume longitudinally striate and finely corrugated under a lens.

In cultivated and waste places everywhere on the plains, where it is a well-known weed.

ANALYSIS.

Moisture	8.00
Ash	12.15
Fat	2.87
Albuminoid nitrogen	8.67
Crude fiber	16.40
Nitrogen-free extract	59.91
Total	100.00

SETARIA GLAUCA (Beauv.).

Stems leafy, flattened, geniculate at base; leaves carinate, broad, finely scabrous above, villous at base; ligule ciliate; spike cylindrical, tawny; fertile flower, transversly rugous.

Not common in this region.

ANALYSIS.

Moisture	8.10
Ash	13.32
Fat	4.34
Albuminoid nitrogen	9.46
Crude fiber	16.97
Nitrogen-free extract	55.91
Total	100.00

SETARIA ITALICA (Kunth.).

(MILLET; BENGAL GRASS.)

Culms compressed, bent at the lower nodes; spikes 2 to 6′ long, compound, interrupted at base, purplish, nodding; bristles two or three in a cluster.

This escaped from cultivation. Somewhat common in this region.

LEERSIA ORYZOIDES (Swartz).

This species grows in very wet soils only; it has retroversely scabrous stems; leaves lanceolate, very rough on the margins: panicle branching, very diffuse, sheathed at base.

Not of much value, although sometimes cut for hay.

DISTICHLIS MARITIMA (Raf.).

(SALT GRASS; ALKALINE GRASS.)

Culms smooth, slender, leafy, from running rootstocks; 6 to 12 inches high; leaves flat, narrow, villous on the upper surface; ligule a fringe of hairs; panicle oblong, spicate; spikelets diœcious, compressed, about tenflowered; outer glumes narrow, keeled, smooth; flowering glumes larger, obscurely nerved, smooth.

This grass forms a dense, close sod, on alkaline soils on the plains. It never attains a height sufficient to justify cutting it for hay, and stock never pasture it from choice.

ANALYSIS.

Moisture	7.95
Ash	7.98
Fat	2.72
Albuminoid nitrogen	7.56
Crude fiber	22.80
Nitrogen-free extract	58.94
Total	100.00

HIEROCHLOA BOREALIS (R. & S.).

(HOLY GRASS; VANILLA GRASS.)

Stem about 2 feet high, smooth, from creeping root-stock; leaves lanceolate, flat; panicle one-sided, pyramidal; spikelets three-flowered, chestnut colored; staminate flowers pubescent on the margins; fertile flower hairy at the tip.

This species occurs in the mountains only, and in moist meadows. It is found in some quantity in Estes Park, but has not been seen elsewhere by the writer.

[See cut on opposite page.]

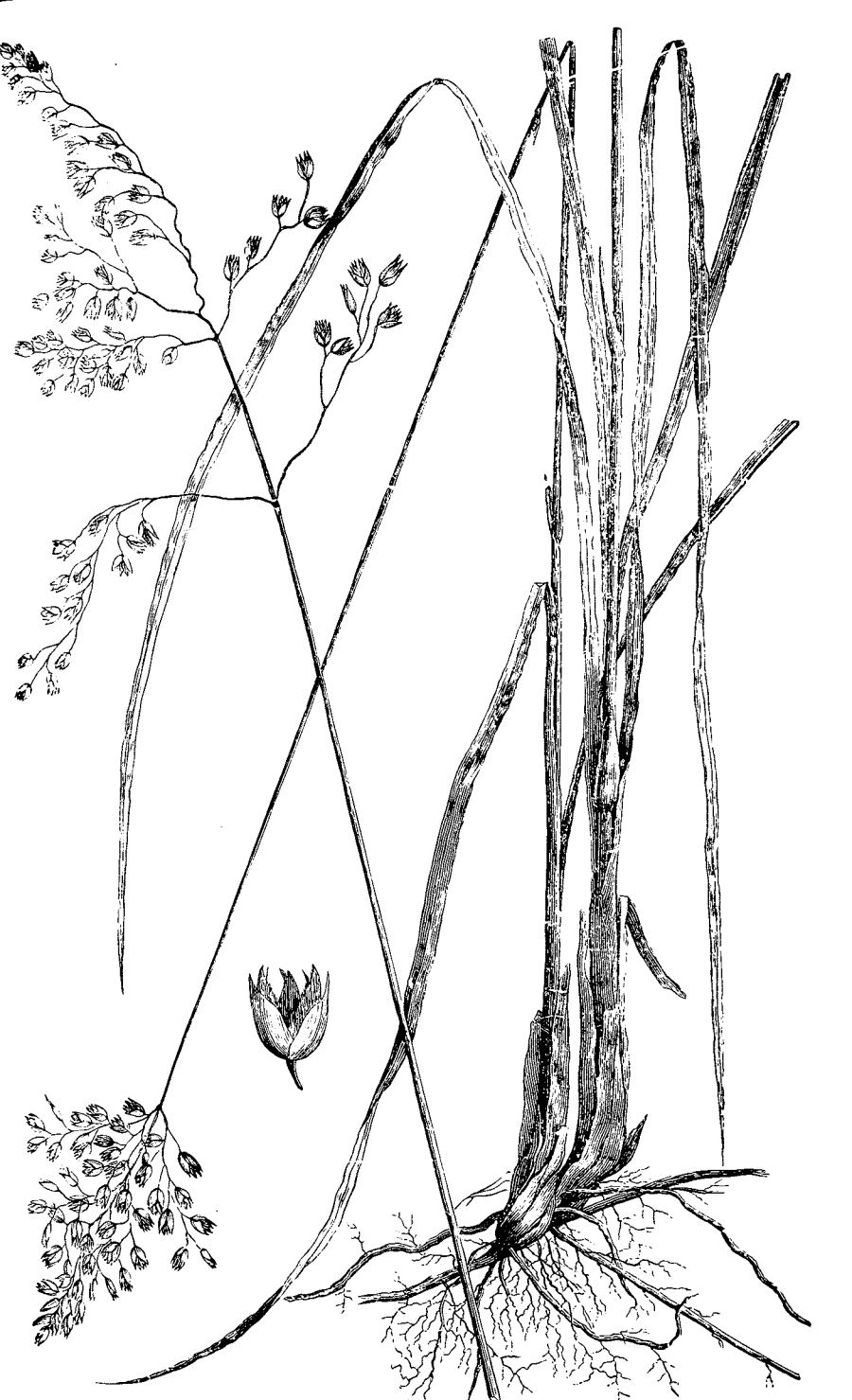
EATONIA OBTUSATA (Gray).

Stems 1 to 3 feet high, some of the lowest joints geniculate, blackish; leaves flat, 4 to 8 inches long, ½ inch wide, scabrous; sheaths shorter than the nodes, rough; ligule truncate, laciniate; panicle 6 inches long, contracted, spicate, much lobed; spikelets crowded on the very short branches; outer glumes unequal, the lower one linear, scabrous all over, especially on the keel, upper glume obovate, rounded at apex, with broadly scarious margins; flowering glume similar; palet small, hyaline, minutely two-toothed.

This species was seen at nearly all elevations, but not in any considerable quantity. It is worthy of trial.

ANALYSIS.

Moisture	8.14
Ash	12.94
Fat	3.98
Albuminoid nitrogen	6.38
Crude fiber	24.19
Nitrogen-free extract	52.51
Total	100.00



HIEROCHLOA BOREALIS.

LOLIUM PERENNE (L.), var. ITALICUM (Braun).

(ITALIAN RYE GRASS).

Culms often 3 feet high, leafy, terminating in a rigid spike-like panicle, nearly a foot long; spikelets seven to eleven-flowered, placed edgewise in a groove of the rhachis; inner and lower empty glume ovate, reduced in size or absent; upper empty glume linear, equaling the spikelet; flowering glumes five-nerved, roughish, tipped with a straight awn.

This introduced grass is occasionally seen in irrigated meadows on the plains. It is in flower about the middle of July. It is considered the most valuable of the rye grasses, standing drought remarkably well.

ANALYSIS.

Moisture	8.98
Ash	7.27
Fat	2.09
Albuminoid nitrogen	8.68
Crude fiber	20.00
Nitrogen-free extract	61.96
Total	100.00

DIPLACHNE FASCICULARIS (Benth).

Culms tufted, geniculate, branching, 1 foot high; leaves 3 to 6 inches long, rough, the uppermost enclosing the base of the panicle; sheaths loose, smoothish; panicle 6 to 10 inches long, crowded, consisting of numerous appressed, spike-like branches; spikelets five to ten-flowered; outer glumes linear, unequal, scabrous on the green mid-rib; flowering glume lanceolate, one-nerved, silky, hairy on the margins, apex rough awned, two-toothed; palet thin, two-nerved.

In alkaline soils near the foothills, but not common.

KŒLERIA CRISTATA (Pers.).

Culms erect, from a somewhat geniculate base, about three-leaved; leaves flat, 2 to 4 inches long, scabrous above; ligule lacerate, obtuse; sheaths loose, striate, exceeding the nodes, glabrous or downy; panicle narrow, spicate, interrupted below, downy at the joints of the rhachis; outer glumes unequal, scabrous on the keel, acute; flowering glume similar, apex usually mucronate; palet equaling the glume, hyaline, acutely two-toothed.

This grass is abundantly distributed in the mountains on dry hillsides; also, in the partial shade of timber and in the native meadows, when not wet. The more robust forms attain a height of $2\frac{1}{2}$ feet. It is a promising species.

ANALYSIS.

Moisture	8.15
Ash	7.96
Fat	3.93
Albuminoid nitrogen	6.85
Crude fiber	22.58
Nitrogen-free extract	58.68
Total	100.00

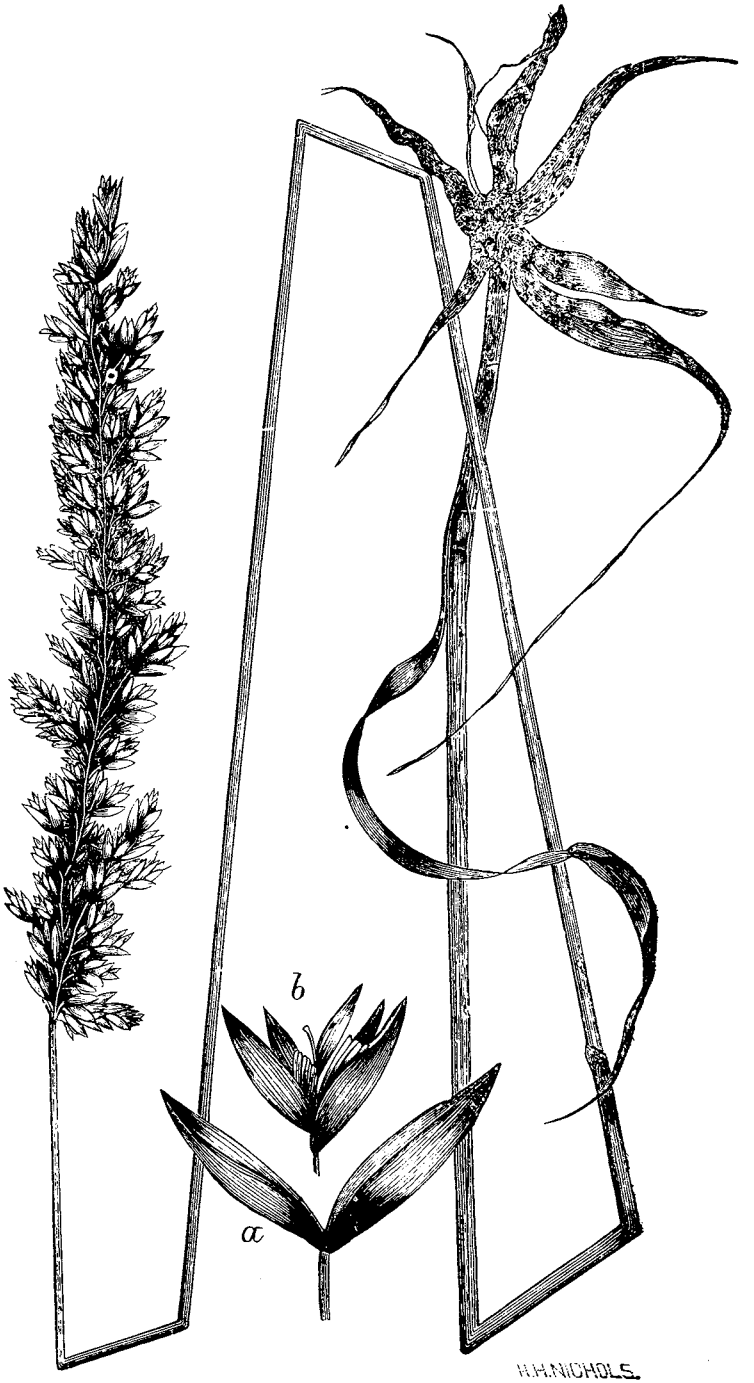
[See cut on opposite page.]

SPARTINA CYNOSUROIDES (Willd.).

(Cord Grass.)

Culms 3 to 6 feet high; leaves 2 to 3 feet long, pointed; panicle 1 foot or more long, occupied by from five to twenty spreading flower-spikes, hispid on the angles; outer glumes unequal, the lower linear, the upper broader, rough on the keel and tapering to a stout point; flowering glume rough on the keel above; palet thin, two-nerved, longer than its glume.

Abundant in wet soils or on the banks of irrigating ditches. It is rejected by stock, unless cut when young. It has, probably, but little value.



KOELERIA CRISTATA

PHLEUM PRATENSE (L.).

(TIMOTHY; CAT'S TAIL GRASS.)

This well-known grass is cultivated to a small extent in the mountains and on the plains. It is found along roads or trails over the highest passes, sometimes in considerable quantity. It is readily recognized by its superior vigor, the upper leaf often subtending the greenish, cylindrical spike.

Stockmen unite in saying that the spike becomes much reduced in size from mountain-grown seed.

PHLEUM ALPINUM (L.).

Culms 1 to 2 feet high, smooth, leafy, geniculate at the lower joints; leaves linear, smooth; ligule short, truncate; sheaths shorter than the nodes, inflated, loose; spike oblong, 1 to 2 inches long, dark purple at high elevations, greenish when growing in partial shade, in good soil, at lower altitudes; outer glumes compressed, coarsely fringed on the mid-rib, scabrous all over; apex bristle pointed; flowering glume thinner, obscurely nerved, apex truncate and toothed; palet small, hyaline.

At high elevations only, and in partial shade. It is less vigorous than the cultivated species, but is said, by an observer in Iowa, not to rust in that State

ANALYSIS.

Moisture	7.87
Ash	6.30
Fat	2.60
Albuminoid nitrogen	10.67
Crude fiber	16.91
Nitrogen-free extract	63.52
Total	100.00

HILARIA JAMESII (Benth.).

Stems branching from the ground; nodes hairy; ligule short, laciniate; leaves glaucescent, scabrous, striate, hairy above; flowers in a strict spike; the spikelets in 3s, sessile, from a tuft of silky, spreading hairs, the lateral ones staminate, the central one perfect; outer glumes of the sterile flowers scabrous, especially on the keel, the outer half of each glume prominently three to four-nerved, sometimes with a divergent awn from near the middle; outer glume of the perfect flower narrow, cuneate, ciliate on the margins, deeply two-cleft, lobes about six-bristled, the one below the cleft the longest; flowering glume three-nerved, membranous, cuspidate from near the apex; palet nearly equaling the glume, two-toothed.

This grass grows in stout clumps from underground stems, attaining a height of from 2 to 3 feet. It occurs near Pueblo, on adobe soils, flowering as late as the first week in October. Nothing is known of its economic value.

CINNA ARUNDINACEA (L.), var. PENDULA (Gray).

Stems reed-like, 3 to 7 feet high, with prominent, brownish nodes; leaves broad and very rough; sheaths finely scabrous; ligule very prominent; panicle 1 foot long, slender, drooping at apex; rays distant, capillary, unequal, in 4s or 5s, the longest flower-bearing above the middle; spikelets one-flowered, much flattened; outer glumes narrow, rough, especially on the keel, scarious margined, acute, the upper glume longer than the floret; flowering glume usually two-toothed, terminating in a short, straight awn, from near the apex; palet one-nerved, much shorter than the glume.

This robust species was seen near Rock Creek, Wyo., at an elevation of 9,000 feet, growing in deep shade in moist ground. Its agricultural value is unknown.


a
b

ARISTIDA BASIRAMEA (Engelm).

Culms leafy, erect, slender, over 1 foot high; leaves nearly 1 foot long, sparingly hairy on the margins; sheaths softly pubescent; ligule almost obsolete; panicle loosely flowered, 3 to 4 inches long, its base enclosed by the upper sheath; outer glumes linear, one-nerved, long awned; flowering glume terete, blackish, sparingly hairy at the obtuse or acute callus, apex three-awned, the middle one 1 inch long.

Abundant near the foothills, in dry soil.

ANALYSIS.

Moisture	9.16
Ash	10.09
Fat	2.29
Albuminoid nitrogen	4.06
Crude fiber	16.28
Nitrogen-free extract	67.28
Total	100.00

CENCHRUS TRIBULOIDES (L.).

(SAND BURR: BURR GRASS.)

This weedy, troublesome grass occurs only in loose, open soils. It is particularly abundant near Canon City. The culms are spreading, 1 to 2 feet long, yielding quantities of prickly burrs, which adhere to the bodies of animals, especially sheep.

ANALYSIS.

	No. 1.	No. 2.
Moisture	9.45	7.50
Ash	9.24	10.96
Fat	3.60	2.15
Albuminoid nitrogen	10.53	6.58
Crude fiber	14.14	16.69
Nitrogen-free extract	60.49	63.62
Total	100.00	100.00

PHRAGMITES COMMUNIS (Trin.).

(REED GRASS.)

Resembles broom corn at a distance. Stems reed-like, very leafy, 5 to 12 feet high; leaves ample, smooth, 1 or 2 inches wide; panicle loose, nodding, 1 foot or more long; spikelets three to five-flowered; outer glumes unequal, strongly keeled, acute; flowering glumes narrow, membranaceous.

This very coarse grass is comparatively rare in Northern Colorado and Central Wyoming, but is very common along the banks of the Arkansas, between Pueblo and Canon City. It has no value for agricultural purposes.

HORDEUM JUBATUM (L.).

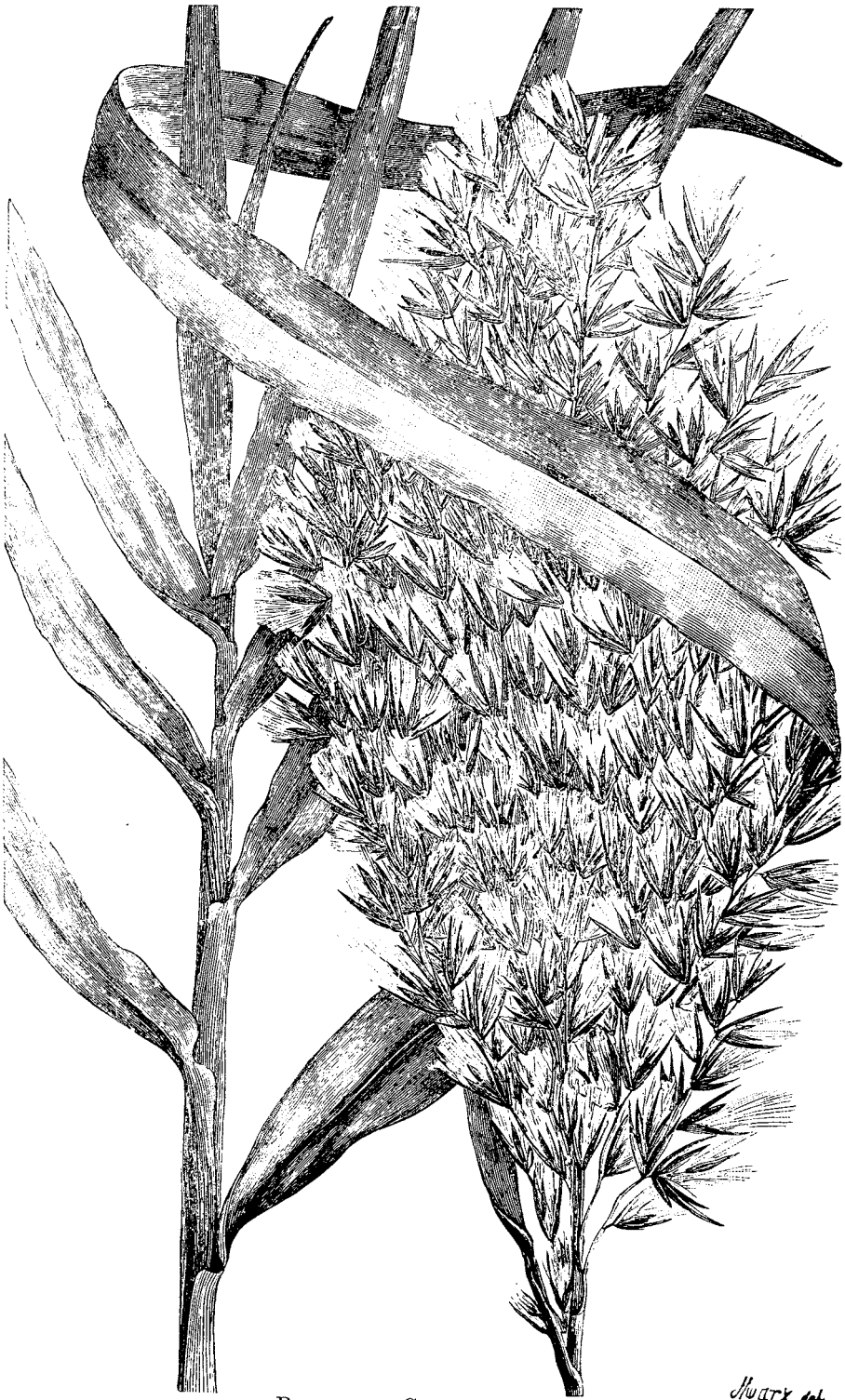
(SQUIRREL TAIL GRASS.)

Stems 6 inches to 2 feet high; leaves flat, 2 to 4 inches long, margins often scabrous; flowers in a dense spike, pale green at 5,000 feet, purplish at higher altitudes; lateral flowers abortive, short awned; perfect floret, bearing a spreading, capillary awn, 2 inches long; awns very bad for stock, in feeding, causing throat difficulties.

This grass has become a serious pest in wet, alkaline meadows in the Rocky Mountain country. Its spread is entirely the result of over irrigation.

ANALYSIS.

Moisture	7.29
Ash	13.05
Fat	2.71
Albuminoid nitrogen	7.51
Crude fiber	15.72
Nitrogen-free extract	61.01
Total	100.00



PHRAGMITES COMMUNIS.

BOUTELOUA RACEMOSA (Lag.).

(GRAMA GRASS.)

Stems tufted, smooth, from underground stems, 1 to 2 feet high; leaves 6 to 10 inches long, narrow, involute, rough on the upper surface; sheaths shorter than the nodes; ligule truncate, very short; flowers in a one-sided raceme; spikelets numerous, reflexed; outer glumes lanceolate, acuminate, the upper and larger scabrous all over, the lower very narrow, rough on the keel; flowering glume rounded below, apex two-toothed, the mid-rib terminating in a mucro; sterile flower of one or two scales, three-awned, the middle one conspicuous.

Abundant in localities in the foothills. Less common on the plains near the mountains.

BOUTELOUA HIRSUTA (Lag.).

(GRAMA GRASS.)

Stems slender, smooth, geniculate at base, 1 to 2 feet high; leaves narrowly linear, flat; ligule a hairy fringe; spikes one to four; outer glumes linear, acuminate, the lower narrower, membranous, ciliate on the acute keel, upper glume scabrous all over, dotted with dark, warty glands below the middle on the flattened keel, from each of which, occasionally, arises a short hair; flowering glume very villous below the middle, apex two-toothed and bristle-pointed; palet equal, acutely two-toothed, nerves prominent; sterile flower on a short, glabrous pedicel, exceeding the glumes and equaling the fertile flower.

This species has much greater vigor than the preceding, but is not so widely distributed. It ought to be a valuable grass.

BECKMANNIA ERUCAEFORMIS (Kost.).

(WATER GRASS.)

Stems usually very stout, smooth, 2 to 4 feet high; leaves rough, flat and broad, 6 inches to 1 foot long; sheaths loose, inflated, the upper enclosing the base of the panicle; ligule long; panicle in stout specimens, 1 foot long, rigid, secund; branches flower-bearing to the base; outer glumes boat-shaped, scarious margined; apex mucronate; flowering glume strongly keeled, apex cuspidate; palet equaling its glume, acutely two-toothed; sterile floret very minute, stipitate under a good lens.

There is no grass in the Rocky Mountain region that stock like any better than this perennial aquatic. On the plains, along ditch banks, it is always present in quantity.

It occurs, sparingly, in the mountains up to high elevations.

ANALYSIS.

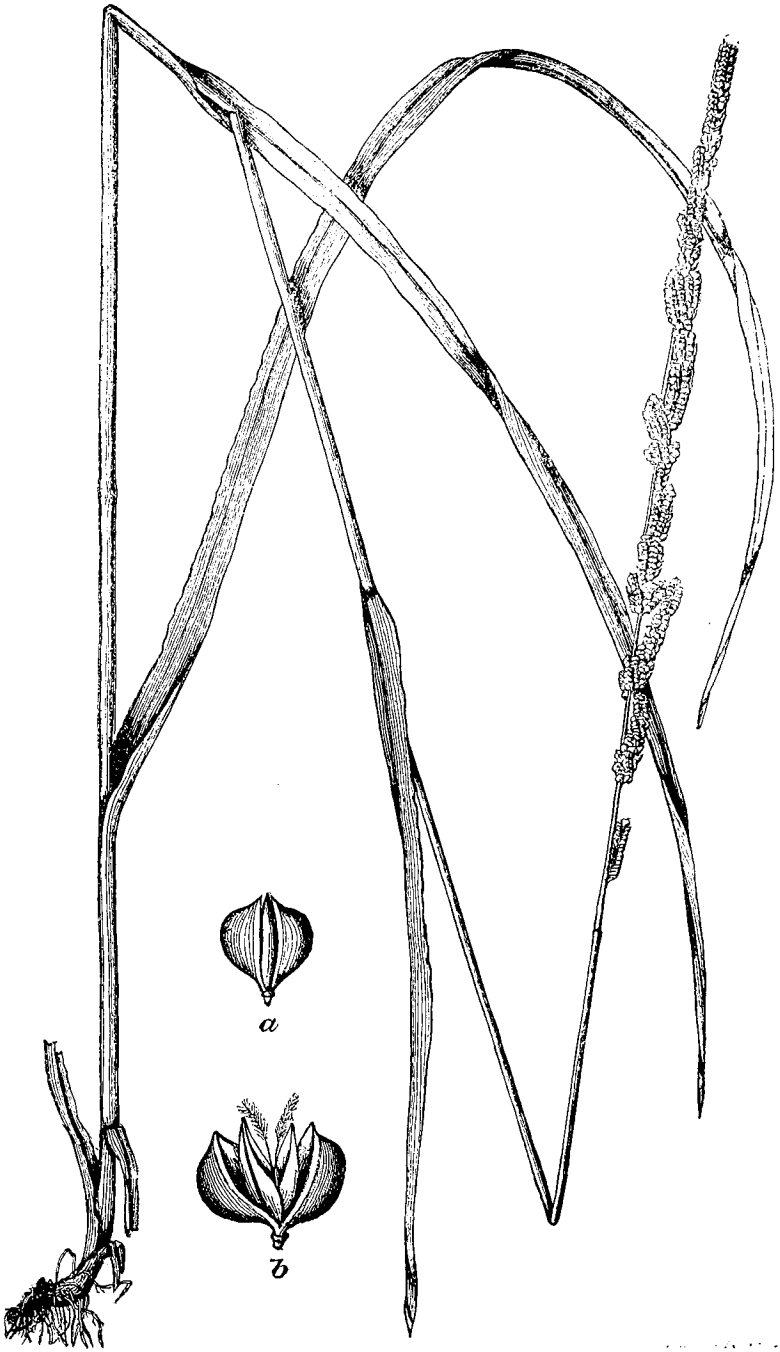
Moisture	8.36
Ash	6.21
Fat	3.05
Albuminoid nitrogen	8.53
Crude fiber	22.65
Nitrogen-free extract	59.56
Total	100.00

SCHEDONNARDUS TEXANUS (Steud.).

(TEXAS SPIKE GRASS.)

Stems branching, procumbent, curved above, 6 to 20 inches high, very rough; panicle of three to ten, recurved, distant, three-angled, naked spikes; spikelets one-flowered, partly immersed in an excavation of the rhachis; outer glumes acuminate; flowering glume linear, acuminate, keeled; palet shorter and narrower than its glume.

Abundant in dry soil on the plains, flowering late in June. Of no agricultural value.



Beckmannia Erucaeformis.

TRIFOLIUM ERIOCEPHALUM (Nutt).

(CLOVER.)

Stems 12 to 20 inches high, villous, with spreading hairs or glabrate; leaflets oblong, acuminate, glabrate, serrulate; flowers whitish, in densely-flowered heads; calyx teeth spreading, very narrow, villous; ovary hairy.

This plant is a chief constituent of the native irrigated meadows, in North Park. Stockmen consider it valuable.

ANALYSIS.

Moisture	9.96
Ash	7.29
Fat	3.96
Albuminoid nitrogen	19.25
Crude fiber	14.15
Nitrogen-free extract	55.35
Total	100.00

JUNCUS BALTICUS (Dethard).

(WIRE GRASS.)

Scapes from creeping root-stocks, naked, the basal sheath leafless and with broad, scarious margins; sepals almost equaling the triangular, mucronate capsule, the inner shorter than the outer, and with more pronounced, scarious margins; seeds ovate, three-angled.

Abundant in wet meadows and valued highly by stockmen.

ANALYSIS.

Moisture	8.68
Ash	6.38
Fat	3.15
Albuminoid nitrogen	8.55
Crude fiber	34.35
Nitrogen-free extract	47.57
Total	100.00

JUNCUS MERTENSIANUS (Meyer).

(Bog Rush.)

Stems compressed, leafy, erect, about 2 feet high, from matted root-stocks; leaves compressed and equitant, erose form; sheaths loose, scarious, margined with ligules; heads solitary, densely flowered, shining, dark brown; sepals pungently pointed with broad, scarious margins, exceeding the capsule; stamens six; capsule obovate, three-lobed.

This is highly valued in common with other species of the same genus. All are known, by stockmen, as wire grass.

ANALYSIS.

Moisture	8.30
Ash	6.15
Fat	1.95
Albuminoid nitrogen	9.00
Crude fiber	38.66
Nitrogen-free extract	44.24
Total	100.00

JUNCUS BUFONIUS (L.).

Stems tufted, slender, branching from the base, 3 to 6′ high, mostly with one-sided, dichotomous branches; outer sepals greenish, nerved, acute, longer than the three inner and entirely scarious sepals; seeds somewhat angled, very small, obtuse; pods oblong, obtuse.

In North Park. Too small to be of any value.

MUNROA SQUARROSA (Torr.).

(False Buffalo Grass.)

Annual, with fasciculute branches; leaves 1′ or less in length, veiny, scarious and scabrous margined tip; spikelets mostly three-capitate; outer glume one-nerved, small; flower three-nerved, the central prolonged into an awn.

This is a weed, and widely distributed in thin pastures and native meadows.

CAREX RUPESTRIS (All.).

Culms obtusely angled, from a spreading base, 1 foot high; leaves channeled, long pointed, shorter than the culm; spike terminal, single, light brown, clavate; perigynium, upright, plano-convex, contracted above into a stout, truncate, two-toothed beak, covered by the pale brown, strongly keeled, acuminate scale; akene ovate, somewhat flattened.

A chief constituent of wet meadows in the mountains, growing in broad, conspicuous patches, and furnishing considerable winter feed.

ANALYSIS.

Moisture	8.59
Ash	9.12
Fat	1.96
Albuminoid nitrogen	8.08
Crude fiber	32.33
Nitrogen-free extract	48.51
Total	100 00

LUZULA SPADICEA (D. C.), var. SUBCONGESTA (Watson).

(Wood Rush.)

Stems 1 to 2 feet high, smooth; leaves broad, hairy at the base; inflorescence nodding, exceeding the tracts; perianth dark brown, the segments all pointed, except the two lower; capsule very acute.

Abundant in localities in the mountains, where it furnishes some of the native summer grazing.

EUROTIA LANATA (Moq.).

(WHITE SAGE OR WINTER FAT.)

An under-shrub (*stellatelty tomentose*) growing on dry, deep soils, from a stout tap-root; stems virgate, densely flowered at the apex; leaves linear to lanceolate, white tomentose, with revolute margins; flowers in spicate clusters; fruiting tracts nearly covered with four dense tufts of whitish, spreading hairs, and beaked above with two short horns.

This well-known plant grows only on the best soils and in dry situations, retaining its foliage and fruit through the winter, which are considered valuable for fattening stock.

ANALYSIS.

Moisture	9.80
Ash	9.00
Fat	4.52
Albuminoid nitrogen	12.27
Crude fiber	17.30
Nitrogen-free extract	56.89
Total	100.00

LUPINUS ARGENTENS (Pursh).

Stems tall, hoary, yellow-green; leaflets six to six, linear, lanceolate, smooth above; flowers pale or dark blue, standered with darker spots in two irregular rows; inner margin of keel villous with spreading hairs; seeds two to six.

This is a tall species; nearly out of bloom July 12th.

LUPINUS ARGENTENS (Pursh), var. ARGOPHYLLUS (Watson).

This differs from the species in the leaves being hairy on both sides, spurred calyx, and somewhat larger flowers, and by its blooming somewhat earlier.

CHEMICAL SECTION.

The following list of analyses was made, consisting mostly of selected forage plants, not elsewhere reported in this bulletin. The exceptions are the "wheat weed," the "poverty weed" and the "lemon plant" or weed. These were analyzed with a view to note the constituents and their proportions, in order, if possible, to see if this would account in part, at least, for the action of these in apparently robbing other plants of the food in the soil. These analyses seem to indicate that this is true to some extent, at least:

ANALYSES.

NAME.	Moisture.	Ash.	Fat.	Albuminiod Nitrogen.	Crude Fiber.	Nitrogen-Free Extract.
Lupinus plattensis	9.87	9.17	1.98	13.68	17.93	57.24
Lupinus leucophyllus	9.10	5.12	3.64	13.84	15.76	61.64
Lupinus leucophyllus	8.92	5.32	3.61	13.82	15.86	61.39
Lupinus ———	8.93	7.66	3.04	11.20	21.64	56.46
Millet Setaria Italica	7.78	11.66	2.36	10.61	17.48	57.89
Setaria Italica	8.00	10.80	2.26	6.14	21.89	58.91

ANALYSES—CONTINUED.

NAME.	Moisture.	Ash.	Fat.	Albuminoid Nitrogen.	Crude Fiber.	Nitrogen-Free Extract.
Lactuca ludoviciana	10.80	12.56	7.12	18.67	14.00	47.65
Lactuca ———	8.40	15.66	6.65	6.16	17.02	54.51
Sainfoin Onobrychis sativa	9.08	11.45	4.56	11.70	18.16	54.13
Melilotus alba	8.75	7.39	3.65	17.85	14.04	57.07
Medicago sativa	10.92	17.27	7.69	8.00	16.16	58.88
Trifolium Incarnatum Italian clover	9.15	14.17	3.75	10.98	15.36	55.74
Japan clover	10.10	9.38	4.60	9.15	14.20	62.67
Yellow trefoil clover	13.17	11.00	4.42	14.85	12.23	57.50
Bokhara clover	9.05	7.56	2.80	9.54	15.00	65.10
Alsike clover	11.71	12.05	4.55	13.68	14.82	54.90
Agropyrum	8.42	5.00	2.30	3.32	32.20	57.18
Agropyrum glaucum	7.91	7.09	2.57	7.32	19.65	63.37
Hordeum nodosum	7.34	6.35	2.10	5.16	22.42	63.97
Dactylis glomerata Durango, stems and seeds	7.95	8.64	1.83	5.43	18.76	65.34
Dactylis glomerata Orchard grass	7.27	7.42	2.05	5.40	20.75	64.38
Bouteloua oligastachya	7.33	7.31	1.73	7.51	14.62	68.83
Bouteloua dactyloides	7.80	10.33	2.25	7.54	14.59	65.29
Sorghum nutans	7.80	6.33	1.13	3.06	24.38	65.10
Rye grass Lolium perenne	9.50	11.48	5.75	9.82	18.60	54.35
Cleome integrifolia	8 41	10.12	9.00	16.84	17.00	47.04
Poterium Sanguisorba Burnett grass	13.40	9.33	6.26	16.86	13.60	59.95
Euphorbia	9.20	10.20	5.76	10.99	20.60	52.45
Franseria discolor Wheat weed	9.00	20.55	4.02	20.98	11.10	43.35
Iva axillaris Poverty weed	9.40	20.62	6.36	14.35	11.60	47.07
Lemon plant Weed in Southern Colorado	12.61	17.84	4.80	8.86	11.60	56.30

The methods of analyses and terms used are described in Bulletin No. 8, pages 9 and 10. For this bulletin, ninety-nine samples of grasses and forage plants were analyzed. When anything unusual in the analysis occurred, the analysis was duplicated. Eighteen samples, in part or in whole, were thus duplicated. Some of the samples were very ripe, others were at their best. Two samples were treated with petroleum ether, as a comparison with absolute ether, for fat. The petroleum ether gave, in one case, .2 per cent. too small; in the other case, .7 per cent. too small. The high ash of some samples, rivaling that of tobacco, must be due to the same cause, viz., fine sand mechanically blown upon the gummy plant. In determining crude fiber we have found that it filters quicker if it is treated, *first*, with caustic potash, and then with sulphuric acid. There is no difference in the results. It is reasonable to expect some unusual results from such grasses. The following table contains some of the extremes of the analyses:

RICH IN CRUDE PROTEIN AND CRUDE FAT, POOR IN CRUDE FIBER.

NAME.	Crude Protein.	Crude Fat.	Crude Fiber.
Franseria discolor	20.98	4.02	11.16
Trifolium ericephalum	19.25	3.96	14.15
Lactuca ludoviciana	18.67	7.12	14.00
Melilotus alba	17.85	3.65	14.04
Poterium Sanguisorba (Burnett)	16.86	6.25	13.60
Cleome integrifolia	16.84	9.00	17.00
Yellow trefoil clover	14.85	4.42	12.23
Iva axillaris (poverty weed)	14.35	6.36	11.60
Lupinus leucophyllus	13.84	3.64	15.76
Lupinus, species	13.82	3.61	15.86
Alsike clover	13.68	4.55	14.82

In the analyses the moisture had the *least* variation, ranging from a little over 3 per cent. to a little over 13 per cent., the majority ranging from 7 per cent. to 9 per cent.

The lowest ash is 4.51 per cent. There are forty-eight samples 9 per cent. and over, and seven samples over 15 per cent. of ash.

The fat ranges from 1.13 per cent. to 9 per cent. The 9 per cent. fat was duplicated and contained a large quantity of gum, etc. Thirty-eight samples contained over 3 per cent. of fat.

The albuminoid nitrogen ranged from 3.8 per cent. to 20.98 per cent. But seventeen specimens had over 12 per cent.

The lowest crude fiber was 11.10 per cent.; the highest 38.66 per cent. Fifty-seven samples were over 18 per cent.

The lowest nitrogen-free extract was 44.24 per cent.; the highest was 68.83 per cent.; the average from 50 per cent. to 60 per cent.

The average of *all* the analyses was as follows: Moisture 9.53; ash 9.43; fat 3.15; albuminoid nitrogen 9; crude fiber 19.60. In the analyses it was a singular fact that those that gave good results were plants of small size.

The following table gives the average analyses of each genus and the number in each genus analyzed:

Number Analyzed.	NAME.	Moisture.	Ash.	Fat	Albuminoid Nitrogen.	Crude Fiber.	Nitrogen-Free Extract.
5	Panicum	8.10	10.61	3.30	11.11	17.61	57.37
2	Setaria	8.05	12.74	3.60	9.07	16.68	57.91
2	Andropogon	8.77	5.08	2.10	4.19	23.58	65.05
3	Stipa	8.35	7.11	2.70	7.51	22.71	59.97
4	Muhlenbergia	7.45	11.23	2.62	7.23	20.47	58.45
2	Agrostis	8.67	7.50	2.63	7.96	20.00	61.91
2	Sporobolus	8.04	9.20	2.46	9.10	16.06	63.18
3	Eragrostis	7.96	12.04	2.34	7.16	19.24	59.22
4	Poa	6.92	8.37	2.37	5.79	20.74	62.73
4	Bromus	7.75	8.33	3.09	7.82	22.26	58.50
6	Agropyrum	8.22	6.16	2.43	6.07	22.45	62.89
2	Hordeum	7.32	9.70	2.40	6.34	19.07	62.49
5	Elymus	8.09	7.82	2.50	7.15	20.34	62.19
3	Lolium	9.00	9.19	3.76	9.64	19.96	57.45
2	Sorghum	7.90	8.56	1.70	4.60	23.14	62.00
2	Dactylis	7.62	8.03	1.94	5.42	19.75	64.86
9	Clovers	10.93	9.94	4.17	13.64	14.17	58.08
4	Lupinus	9.40	6.82	3.07	13.13	17.80	59.18
2	Vicia	8.98	7.25	2.18	12.27	18.45	59.85
3	Sedges	8.52	7.22	2.35	8.55	35.11	46.77
2	Weeds	9.20	29.58	5.20	17.66	11.35	45.21
2	Lactuca	9.60	14.11	6.88	12.42	15.51	51.08

There are three factors in the raising of grass for hay or pasture: The *ease* with which it can be cultivated, the *yield* per acre and the *value*, as determined by chemical analysis. A grass may show a very good chemical analysis, but it may be difficult to raise, or the yield may

be very small, either of which would make it worthless from an economic standpoint. It must be, then, that *all these factors* must be taken into consideration in determining the feeding value of any sample. We have determined but *one* factor in the chemical analysis, the other factors will be determined in this and the following years by the grass station.

It is eminently proper that some tribute should be made to the *last work* of the lamented Prof. Cassidy. The memory of many other treasured things in this life will grow old, fade away and be lost, long, long, ere I shall forget his kindness. His benign influence, his Christian virtues, his gentlemanly deportment and his scholarly attainments, will always find a green spot in my memory.

DAVID O'BRINE,
Chemist.

*APPENDIX.

BOUTELOUA OLIGOSTACHYA (Torr).

(GRAMA GRASS.)

Stems slender, 5 to 15 inches high, smooth; cauline leaves three or four; sheaths smooth, shorter than the internodes, very hairy at the throat below, naked above; blades 1 to $2\frac{1}{2}$ inches long, narrow, involute, edges scabrous; radical and sterile stem leaves $1\frac{1}{2}$ to 3 inches long, 1 line wide, involute; spikes one to four, usually two; rhachis flat, with the spikelets sessile in two crowded rows on one side, hairy at base, glabrous above; spikelets with one perfect flower, and one pediceled, abortive flower, consisting of two small, hyaline, empty glumes and three stiff awns, which nearly equal the glume of the perfect flower in length; the pedicel villous, tufted at the summit; empty glumes very unequal, both sparingly hairy on the back, one-nerved, the lower hyaline, the upper purple, awn-pointed; flowering glume lanceolate, trifid, the divisions subulate, copiously hairy on the back; palet two-nerved and two-pointed, hyaline, enclosed by the glume.

This grass is quite abundant in this locality, both on the plains and in the mountains. On the mountain ranges visited, it is so closely fed that I failed to find plants in bloom, but, in places on the plains, the bloom is abundant.

* Prepared by Prof. C. S. Crandall, Botanist and Horticulturist since January 1, 1890.

BUCHLOE DACTYLOIDES (Engelm.)

(BUFFALO GRASS.)

Growing in broad mats and spreading by stolons dioecious; stems of the male plant very slender, 2 to 5 inches high, smooth; sheaths, except the uppermost, nearly as long as the internodes, glabrous, striate; blades 1 to 1½ inches long, 1-20 to 1-10 inch wide, sparingly covered, both sides, with long hairs; spikes two or three, short, one-sided; spikelets alternate in two rows, sessile, usually three-flowered; empty glumes membraneous, obtuse, the lower oblong, one-nerved, the upper twice as long as the lower, broadly lanceolate, one-nerved, equaling the flowering glume; flowering glume ovate, three-nerved, convex, nearly surrounding the two-nerved, hyaline palet, which nearly equals the glume in length; anthers three, large, on long, slender filaments.

In the female plant the fertile stems are very short, usually about 1 inch, occasionally 1½ inches long; leaves as in the male plant, except that the throat of the sheath is strongly bearded, and the blades are rather more hairy; spikes capitate, surrounded and exceeded by the leaves; branches of the rhachis two to five each, bearing two spikelets; spikelets one-flowered; empty glumes large, united below, the lower bifid or sometimes trifid, the upper trifid, both becoming indurated; flowering glume ovate, lanceolate, three-nerved, nearly entire, terminating in a short, stiff awn; palet two-nerved, hyaline, enclosed by the flowering glume, the distinct styles plumose, long exserted.

This, the true buffalo grass, which once formed so large a portion of the prairie tuft, is now found in this region only in isolated patches. The largest area I have seen of it is some five miles north of Fort Collins, in a hollow on the prairie; it may cover a half acre. Small mats, of from 5 to 15 square yards, are quite common. At this season, these mats may be readily distinguished, from a distance, by their yellowish green color.

MUHLENBERGIA GLOMERATA (Trin.).

(SPIKED MUHLENBERGIA.)

Stems rather slender, 1 to 3½ feet high, leafy; cauline leaves seven to eleven; sheaths smooth; blades linear, 2 to 4 inches long, 1 to 3 lines wide, scabrous; sterile stems 4 to 8 inches long, leafy to the top; panicle 2 to 4 inches long; branches sessile, contracted into an interrupted spike; spikelets crowded, one-flowered; empty glumes equal, membranous, one-nerved, tipped with awns equaling the glumes in length, and with awns one-third longer than the flowering glume: flowering glume ovate, lanceolate, acute, entire, not awned, membranous, three-nerved, hairy near the margins, enclosing the nearly equal, hyaline, two-nerved palet.

On ditch banks and in native meadows in the valley of the Poudre. Valued as a forage grass.

FESTUCA SCABRELLA (Torr.).

(BUNCH GRASS.)

This grass forms the largest bunches of any of the so-called bunch grasses. The specimen bunch, which I have before me, measures 12 inches across at the base. It is very compact; the stems are numerous, 34 to 38 inches long, slender, smooth, two to three-leaved; the blades of the stem leaves have all fallen, leaving the naked, scabrous sheaths; radical leaves very numerous, 12 to 24 inches long, very narrow, involute, scabrous; panicle 4 to 7 inches long; branches 1 to 1½ inches long, single or in pairs, rhachis scabrous; spikelets three to five-flowered; empty glumes membranous, the lower one-nerved, one-third shorter than the three-nerved, upper one; flowering glume acute, tipped with a very short awn, five-nerved, scabrous, scarious margined; palet two-nerved, bifid, equaling the glume.

In the mountains, at 6,000 to 8,000 feet. Much valued as a range grass.

AGROPYRUM GLAUCUM (R. & S.).

(COLORADO BLUE STEM.).

Stems 10 to 30 inches high, erect, rigid, smooth; cauline leaves about four; sheaths as long as the internodes below, shorter than the internodes above, smooth; ligule short, truncate; blades 4 to 6 inches long, smooth below, scabrous above, flat or involute for half the length; the whole plant has a characteristic bluish-green color; spikes 2 to 5 inches long; spikelets compressed, arranged in two rows; flat side to the rhachis, five to eight-flowered; empty glumes nearly equal, lower three-nerved, upper, three or obscurely five-nerved, lanceolate, acuminate; flowering glume five-nerved, oblong, tipped with a short awn, scarious margined; palet two-nerved, hyaline, bifid, nearly equaling the glume.

This grass abundant on the prairies and in the mountains. In the higher mountain meadows it makes but small growth. On lower land and along streams it grows vigorously, and in many places is cut for hay. Stockmen speak highly of it.

BOUTELOUA OLIGOSTACHYA. (See page 135.)

BUCHLOE DACTYLOIDES. (See page 136.)

MUHLENBERGIA GLOMERATA. (See page 137.)

FESTUCA SCABRELLA. (See page 137).

AGROPYRUM GLAUCUM. (See page 138.)

INDEX.

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THE COURIER PRINTING & PUBLISHING CO.,
FORT COLLINS, COLO.