Squirrel-tail grass or wild barley.

L. H. Pammel

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Squirrel-tail Grass or Wild Barley.
(Hordeum jubatum L.)

BY L. H. PAMMEL.

For nearly fifteen years the writer has been familiar with the subject of this paper. It has always appeared to me to be an aggressive weed and hence most undesirable for the farmer. During the last few years I have at various times received the weed from correspondents in this and other states, but during the past season the demands for information about this grass have been more frequent. It would therefore seem a public duty to describe and give an account of the weed so that farmers may better be able to cope with it. Farmers annually lose many millions of dollars because of the presence of noxious weeds in their fields, hence it would seem a part of our duty to inform the public as to how to destroy them.

DESCRIPTION.

An annual or winter annual from six inches to two feet high producing fibrous roots. It forms solid and compact bunches. (Plate I.) Leaves not unlike those of Blue Grass, but paler in color, from two to four inches in length margins scabrous. Flowers in a dense spike from two to four inches long, pale green or purplish in color. The spike consists of a number of one-flowered spikelets, three occurring at each joint, (Fig. B, 1, 2 and 3) only one is perfect (bearing stamens and pistil.) [Fig. B, 3] The two other spikelets are awl-shaped and rudimentary, these are borne on short stalks. One of these sterile spikelets occurs on each side
Plate I-Squirrel-tail Grass (*Hordeum jubatum* L.) From the Colorado Agricultural Experiment Station. [Prof. Crandall.]

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of the perfect flower which bears a long awn. At each joint will be found six empty long-awned glumes spreading at maturity. These give to the plant the bristly appearance at maturity. When mature the spike breaks up into joints consisting of the rudimentary spikelets and a perfect flower, so that each joint has one “seed.” The number of “seeds” in a spike varies from thirty-five to sixty. A single cluster of plants may therefore produce from three hundred to two thousand mature “seeds.” The plant has a wonderful capacity for “stooling.” From a single plant as many as forty spikes may be produced and the number no doubt often exceeds this.

GERMINATION OF SEED.

During germination the palet and flowering glume remain in situ. The embryo occupies only a small portion of the “seed.” The scutellum (cotyledon) lies close to and on the side of the endosperm. The plumule pushes out from the upper while the caulicle arises from the lower end. The latter bears the rootlets that anchor the plant to the soil and enables it to take up water and mineral elements. [Fig. A]

MANNER OF DISSEMINATION.

The plant is admirably adapted to be scattered by animals, also by wind and currants of water. Nature howeverchiefly scatters the plant by means of animals. The awns, sterile glumes, are barbed upwardly [Plate II, Fig. 3] and where the joint breaks the lower part is somewhat pointed. This more or less sharpened point readily clings to the fleece of animals and any woolly object.

The projecting barbed awns help to hold it until rubbed off. The joints are sufficiently light to allow the wind to carry them, but more especially when they become attached to other plants, which roll about and are scattered by the wind. Where it was mown I have seen it collected in large quantities in fence corners. When cut just before maturity the whole spike may be carried away. The seed though not
mature at this time is still capable of germination, many seeds having shown this power. Water too helps to scatter the “seed,” especially freshets in the spring and autumn. It may also float on the surface of the water for some distance. We cannot omit the part that man has played in scattering the “seed”. Railroad cars in transit having live stock often carry the “seed,” leaving it along their right of way. Occasionally it occurs in other seed, but seldom as the “seed” is light and is removed by the fanning mill, and yet an instance has been recorded by Prof. Lazenby, where it has been transported in this way.

**DISTRIBUTION IN IOWA.**

How long has the weed occurred in Iowa? Is it indigenous to the state? These are questions of interest to the scientist and incidentally to the farmer.

Nearly a quarter of a century ago this weed was mentioned as occurring near Ames by Prof. Bessey.* He says: “Found along railroads, perhaps introduced.” The locality given is Ames, but it undoubtedly occurred in other parts of the state, but not abundant for the fact would have been noted. In 1876 Dr. J. C. Arthur† listed the plant from Iowa without locality. Prof. Halsted‡ refers to the weed as common but not excluding valuable plants. He considered it an introduced plant. One other botanist, Prof. A. S. Hitchcock|| listed the plant from Ames and remarks: “Waste places: common.” The plant was certainly abundant about Ames in 1889 when I came here, but it has not spread quite so alarmingly as Prickly Lettuce (*Lactuca Scariola* L). Early in July a circular was sent out to some correspondents in every county in the state inclosing a specimen and requesting information in regard to its introduction, weedy nature, diseases, &c. Replies were received from most of the correspondents. From

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*Contributions to the flora of Iowa. Fourth Biennial Report of the Board of Trustees of the Iowa Agricultural College and Farm, December, 1871 (1872) p. 129.

†Contrib. to the flora of Iowa, Charles City 1856. p. 36.

‡Bull. from the Botanical Department of the State Agricultural College 1888. p. 47


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From these statements it will be seen that the weed has occurred in Iowa for many years and several correspondents report that it is indigenous. It was not however generally distributed in the state. The weed has, however, shown wonderful aggressive powers, occurring now without doubt in every county in the state. It is most abundant in northwestern, central and western counties and rapidly spreading in other portions of the state. It is more than likely that the weed has spread from three sources in this state. (1) indigenous plants scattered in western and northwestern counties. (2) from the great lakes, where it is indi-
genous. (3) from the western plains, where it no doubt was indigenous. Before giving its distribution in other parts of the world we give in detail the condensed replies to circular sent out. It should be borne in mind however that in many counties the plant no doubt occurred but it was not abundant and did not attract attention.

The distribution by counties is as follows:

Adair, (Greenfield, M. R. Stewart, 12 or 15 years); Adams, (Corning, John N. Bixby, 20 years); Allamakee, (Postville, F. L. Williams, several years; Rossville, F. B. Wiley, 30 years); Appanoose, (Centerville, H. E. Reister, "all my life"); Benton, (Shellsburg, Prof. J. L. Budd, 25 years, Belle Plaine, H. W. Van Dike, 1890); Blackhawk, (Cedar Falls, R. P. Speer, 40 years); Boone, (Madrid, G. B. Heaton, 1893); Buchanan, (Rowley, J. B. Hermann); Calhoun, (Rockwell City, Cooper, 18 or 20 years); Carroll, (Dedham, J. W. Kay, 20 years, Coon Rapids 16 years); Cass, (Atlantic, G. W. Franklin, 3 years); Cedar, (Mechanicsville, Geo. W. Hubbard, 1890); Cerro Gordo, Clear Lake, E. P. Carpenter, Mason City, Wm. Nettleton, 30 years); Cherokee, (Larrabee, H. B. Strever, 1884 or 1885); Chickasaw, (New Hampton, C. L. Gabrilsen, Lawler, Peter Obyrne, 30 Clark. (Hopeville, M. F. Ashley); Clinton, (Clinton, F. J. Luke Roberts); Davis, (Belknap, A. W. Parkin, "long known"); Bloomfield, Geo. Duffield, 15 or 16 years); Decatur, (Garden Grove, M. Wemple "here when I came 1893"); Fayette, (Hawkeye, J. W. Bopp, 25 years); Franklin, (Hampton, E. C. Grenelle 22 years; Geneva Wm H. Thompson 5 years); Frontier, (Hampton, A. C. Rice 1884 or 1885); Green, (Jefferson, Dr. Chas. Enfield, 25 years); Guthrie, (Casey, F. F. Benedict); Hardin, (Iowa Falls, J. B. Parmlee "few years"); Hamilton, (Williams, A. C. Fuller, Jr, 19 years); Henry, (Mt. Pleasant, W. T. Wright, 1876); Howard, (Cresco, G. Marshall 20 years); Humboldt, Humboldt, Henry S. Wells); Ida, (Battle Creek, A. Preston, Galva, W. A. Crowley "in 1883 when I came"); Iowa, (South Amana. John Cow- nie, Amanda Conrad Schadt 10 years); Jasper, (Newton, J. P. Beatty 20 years, Newton, A. Lufkin 20 or 25 years, Newton, Ira J. Mead 20 or 25 years); Johnson, (Unity, Edwin Hummer 20 years, Iowa City, Prof. T. H. McBride, 15 years); Keokuk, (Jerome Smith, several years. What Cheer, Dr. O. D. Lawrence 3 years); Lee, (Mooar, T. G. Thomas, 3 or 4 years); Louisa (Wapello, A. J. Miller); Lucas, (Chariton, C. C. Burr, 4 years); Lyon, (Little Rock, C. R. Ball, 10 years) Madison, (Winterset, H. A. Kinsman, 2 years); Mahaska, (Oskaaloosa, Joseph Boyd, 3 years, Oskaaloosa, Hardin Tice, 10 years); Marshall, (Marshaltown, C. H. Eckles 4 to 5 years); Monona, (Mapleton, Abjah Lamb, 10 years); Montgomery, (Villisca, J. T. McCartney, a number of years); Page, (Shenandoah, B. Mollison, 70 years); Pottawattamie, (Neola J. E. Hemsworth, over 30 years, Council Bluffs, J. L. Williams, 2 years); Poweshiek, Grinnell, A. O. Price); Rock, (B. G. Richardson, 10 years); Sac, (Sac City, Caleb Brown, 12 years); Story, (Ames, S. B. Mills); Tama, (Traer, J. W. Wilson, for 8 years, Traer, Prof. James Wilson, 5 years); Taylor, (Lenox, J. L. Hurley, 12 years); Van Buren, (Pittsburg, J. C. Duffield, Williamsville, H. C. Taylor, abundant in 1895); Wayne, (Seymour, J. F. Wagner, 10 years); Webster, (Fort Dodge, R. W. Blaine, 35 years); Winniebago, (B. F. Banta, 13 years, Forest City, Eugene Secor 10 yrs) Woodbury, (Sioux City, U. G. Purcell and W. E. Skinner, 6 or 7 years).

It will be seen from the above and the list of counties below that it is reported from more than half of the counties in the state. It is generally reported as occurring in low meadows, streets, roadsides and pastures.

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From personal observations it has been noted in the following counties in Iowa: Polk, Story, Hamilton, Wright, Humboldt, Pocahontas, Buena Vista, Clay, O'Brien, Sioux, Plymouth, Woodbury, Monona, Crawford, Harrison, Pottawattamie, Ida, Sac, Marshall, Carroll, Green, Boone, Dallas, Linn, Cerro Gordo and Franklin. Mr. G. W. Carver has observed it in Johnson, Iowa, Poweshiek, Jasper, Cedar, Jefferson, Keokuk, Washington, Mahaska, Marion, Muscatine, Louisa, Des Moines, Henry, Warren, Madison, Boone, Marshall, Wapello, Story, Tama, Clinton, Benton, Linn. This shows a general distribution throughout the state.

SPREAD OF THE WEED IN IOWA.

We are without exact data of its early appearance in the state, though it was probably native in portions of western and northwestern Iowa, especially where the soil was somewhat broken up. From answers received it would seem that this grass has been known in parts of Iowa for thirty years but it is only during the last ten years that it has made much headway in Iowa. Though possibly native it is more than probable that this weedy grass has come into our state from the west as well as the east. It has become so thoroughly at home in many parts of Iowa, that no one will be able to say.
PLATE II—Squirrel-tail Grass, (Hordeum jubatum) L. 1—General habit of leaf and stalk. 2—Awns. 3—Barbs on awns.
except for the records we have, but that it has always been indigenous.

I cannot in this connection give in detail the distribution of the weed in the various states and territories, although most interesting to a botanist. I may say that this plant was made known to science by Linnaeus, from specimens found in Canada. Dr. Asa Gray in his Manual of Botany of Northern United States in 1856 gives its distribution as marshes and moist sands of the sea shore and the northern lakes. In 1868 its distribution was not extended but Watson and Coulter who revised the manual (1890) add to the above "and westward." Its present distribution is as follows: Mexico, Tacuboyu, Orizaba, San Luis Potosi and Southern Mexico, (Hemsley) Texas, Rio Grande (Coulter), Southern California, Rhells Lake, (Newberry) not common, abundant in northern California, (Thurber,) Mojave (Tracy) Nevada, abundant (Watson, Tracy, Rothrock, Hillman, Coville), Utah (Watson), New Mexico (Tracy), Kansas (Carleton, B. B. Smythe), Missouri (Pammel, Tracy), Arkansas (Coville), Colorado, (Rothrock, Crandall, Cassidy, Coulter, Porter) Montana (Lamson-Scribner), Nebraska (Webber, Pammel), South Dakota (Williams, G. D. Gunn, Pammel), North Dakota (Upham), Minnesota (McMillan, Upham, Pammel) Wisconsin (Wheeler, Cheney and True, Bruhin, Pammel), Illinois (Brendel, Higley and Raddin, Pammel), Indiana (Van Gerder, Bitting), Michigan (Smith and Wheeler, Beal and Wheeler), Ohio (Newberry, Beardslee), New York (Day, Dudley,), New Jersey (Britton), Massachusetts (Collins and Dame, Beck), Maine (Fernald). Canada on the sea coast and saline soil of the prairie region Nova Scotia, New Brunswick, Peace River, Lake Athabasca, Van Couver Island, Lewis River latitude 61, Fort Yukon, Plains of the Saskatchewan to McKenzie River (Macoun). Nor is this plant confined to North America. It is reported from Europe by Richter and
Ledebour in his Flora Rossica. It also occurs in Siberia. At some future time I shall give a more extended account of its distribution as well as references to the literature.

From this general account it is very evident that this weed in North America was chiefly distributed in the Rocky Mountain region occurring in saline soils of the plains, the great lakes and along the sea coast extending far northward. Its extension eastward and westward has taken place in more recent times. It does not occur as far as I can learn in the south eastern states. It is spreading in Missouri, and has some foothold in Arkansas. It is not reported from Tennessee by Prof. Lamson-Scribner in his monograph of Tennessee grasses. In Wisconsin it has spread north, south and west and before many years will become general in the state.

Its distribution as given above shows that it is adapted to a wide range of climatic conditions. Not only does it occur in a climate where there is not sufficient moisture to produce ordinary crops, but it also occurs in a climate in which there is more than enough moisture to produce the most luxuriant of crops.

**Weedy Nature of the Plant.**

This grass has exerted itself with great force in parts of the west where irrigation is practiced. Originally a plant that occurred in more or less saline soil, hence its abundance around the Great Lakes where many saline plants occur, and in the west where other plants likewise appear as salt grass, *Distichlis maritima, Scirpus maritimus, Salicornia herbacea* and *Atriplex patula*.

At least twelve years ago I noted its habitat in low swamps and swales, that used to dry up in late summer about Madison, Wisconsin. In Iowa, at least it is no longer confined to low grounds and swamps but occurs on the highest land, highways, in streets and lawns. It is also a most troublesome weed in pastures. I noted it as abundant early in July in every county and town between Ames and Omaha, the dry
spikes showing conspicuously since cattle avoided it from the middle of June and occasionally earlier. Pastures appeared to be made up of little else than this weedy grass. The purple spikes were conspicuous from a distance. This grass has not been considered so troublesome in the meadow because it may be cut, however this year it caused much annoyance because of the poor stand in many cases of timothy and blue grass. This grass matures so early that it is more than likely to cause some trouble in either blue grass or timothy meadows.

As to its pernicious character in other states Prof. Crandall* says: "It is one of our worst weeds, spreading rapidly in lands wet from seepage and also troublesome in cultivated grounds. It is especially bad in meadows; its presence greatly lessens the value of hay on account of its injurious effect upon stock of the long rough awns."

Prof Hillman† says: "This is considered the worst weed in Nevada. Its spreads easily and rapidly. Its presence in the meadow depreciates the feeding value of hay as the barbed awns lodge in the mouths and throats of animals and produce angry sores."

Prof. Aven Nelson‡ says: "Wet lake and sea shore meadows and cold, wet alkaline plains are rarely free from it. This will in part explain its rapid spread in this and neighboring states, for with the extension of our irrigation systems the above conditions are being multiplied and the means for the rapid distribution of the seed are furnished. The land immediately adjoining irrigation ditches and low places, wet from seepage, as well as land flooded early in the season or on which the water has been allowed to stand throughout the winter and spring are particularly liable to be infested."

Prof. Brewer|| notes that in California over pasturing has killed the nutritious bunch grass and this weed has come in.

Mr. A. G. Lucas writes me concerning the grass in northwestern Wyoming, as follows: "While recently in Wyoming, I saw a great deal of Squirrel-tail Grass, and they tell

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†Nevada weeds, Nevada Agr'l Ex. Station, Bull. No. 22 p 6.
‡Squirrel-tail grass, Wyoming Agr'l Exp. Station, Bull No. 19.
me there that it is indigenous to the country. I found it in localities where it would seem almost impossible for it to appear as result of accidental seeding. It comes up among the blue stem and promises to be very troublesome. One ranch man had quite a large patch of it, and had a hand employed for ten days on it with a view of extirpating it, but he was obliged to give it up as a hopeless task."

Hon. L. B. Packard says: "The grass has been in small patches about the sloughs for a year or two but this year it is spreading over the pastures and I am told that it has covered some of them largely south and west of here. It is just showing over my large pasture on the Iowa river bottom."

**THE BEARDS ARE INJURIOUS TO CATTLE.**

There can be no question in regard to its injury to meadows and pastures but many farmers are not aware that it is injurious to stock. This fact has been commented upon by Profs. Crandall, Hillman and Nelson. It is well known to Veterinarians that the awns of cultivated barley may adhere to the mucus membranes and cause serious injury at times.

I have no personal knowledge of Squirrel-tail affecting cattle and horses as described by Prof. Nelson. Dr. M. Stalker informs me he has not observed any, but Dr. S. H. Johnson* of Carroll, makes the following statement in the Carroll Herald:

"**EDITOR HERALD:**—In your issue of the 21st I notice an article from the pen of the Hon. James Wilson, pertaining to Hordeum, jubatum, or Squirrel-tail Grass, which has spread so fast over the country in the last two years.

This grass when found in hay and allowed to ripen, if in any quantity, is very injurious to horses' mouths. The small awns seem to work in and cause deep ulcerating sores which form under the tongue and lips. The writer has seen a large number affected, and made a careful examination and found them deep in the flesh, where they had remained for three months or more. Have seen lips eaten completely

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*Carroll Herald June 28, 1895.
through and tongues eaten almost off by the grass. As to
cattle, I have seen some affected, but not to any extent, be­
cause the mucus membranes are much thicker. If the grass
can be eradicated early, the sooner the better."

And again, Mr. C. E. Keeler*, of Lake Mills says: "When
mature the beards are hard and sharp, piercing and making
very sore the mouths of stock that undertake to eat the hay."

Prof. Nelson† who has carefully studied this question
says on the injury to stock: "The awned heads when taken
into the mouth break up into numerous sections, scatter
about within the mouth and everywhere adhere to the mucus
membrane, which soon becomes pierced with the long stiff
awns. As the animal continues to feed more awns are added
and those already present are pushed deeper into the flesh.
Inflammation soon results and leaves the gums of the animal
in a condition to be more easily penetrated. The awns are
particularly liable to be pushed down along side and between
the teeth. As the swelling and festering progresses the
awns are packed in tighter and pushed deeper and cause sup­
puration of the gums as well as ulceration of the jaw bones
and the teeth. Through the absorption of the ulcerated
sockets and roots the teeth become loosened and even drop
out but the animal impelled by hunger, still endeavors to eat
such hay as may be offered. If the cause continues the dis­
ease progresses till the bony tissue of the jaws is disarranged,
the ulcers extend to all parts of the jaw bone and it becomes
distorted and enlarged somewhat as in big jaw (Actinomyco­
sis). The spongy marrow filled interior of the bone is, by
the ulceration changed into great cavities, filled with the
broken awns. This condition may continue till the cavities
extend entirely through the jaw and the tightly packed awns
protrude till they may be pulled out with the forceps or fin­
gers. On the authority of a number of observent stockmen I
learned also that in many instances the awns penetrate in

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*Pammel, Grasses and weeds, Iowa State Register June 27, 1896.
†I. c. p. 76.
like manner the palate bone and work up into the passages. The throat and possibly the stomach suffer similar invasions and as the awns are heavily cutinized they do not when they have entered the tissues decay so as to admit of removal by absorption."

"It is probable that all kinds of stock suffer about the same extent, but as horses are more constantly hay fed it is more constantly remarked upon them than is the case in cattle and sheep. The latter are subject to a new danger as well, for the awns are caught in the wool about the eyes and work into the tissue surrounding the eye and even into the eyeball itself, in many instances causing total blindness. I have learned of one case in which this resulted to all of a bunch of calves that were turned into feed out of a stack of hay containing a considerable quantity of squirrel-tail."

Barbed trichomes and barbed stiff bristles have been known to cause serious injury to stock. Prof. Coville has recently called attention to some of these coming from a plant that has had considerable advertising as a forage plant, Crimson Clover (Trifolium incarnatum). Prof. Coville* says: "The crimson clover hair-balls, measuring two or three inches in diameter, were taken from the stomach of horses, whose death they had caused. They were compact and much resembled the hair-balls often found in stomachs of ruminants, but were entirely composed of the small barbed trichomes from the mature calyx of crimson clover. (Trifolium incarnatum."

EXTERMINATION OF THE WEED.

This weed is an annual or a winter annual, but Mr. R. T. Kingman of Carroll, thinks it is perennial and that it comes up from a well knit sod. The fact is the weed appears abundantly in the fall, or when cut off comes up from the lower joints. It must be kept down. In well cultivated fields

there is very little trouble, as the cultivation of garden and field crops prevents growth. To prevent its seeding in the meadow, grass should be cut early, but the seed as stated before, matures earlier than blue grass and much earlier than timothy. Grass must be cut young; much can be done in this way. In pastures it is a good plan to mow as soon as heads come out. This will not injure the meadow, and blue grass will have a chance to grow. It will not be necessary to plow up the meadow if the grass is cut in this way for a few years, but farmers and road overseers should not neglect the roadsides and out of the way places where this weed grows so luxuriantly and where it may produce seed enough to sow neighboring farms. If it becomes very thick in the pasture it should be cultivated and then sown to clover gradually letting blue grass work its way in to the pasture. It may be said that blue grass pastures will not suffer seriously from this weed but all who have seen pastures in June must admit that it destroys much of the value of the pasture.

**ANOTHER DANGER FROM THIS WEED.**

Many farmers are perhaps not aware that this weed is affected with several fungus enemies, and that they are very destructive to the pest; in fact they prevent many plants from properly seeding. But the fungus diseases are really dangerous enemies to our cultivated cereals and some grasses.
Two species of rust quite commonly occur on this grass, one the common grass rust \textit{Puccinia graminis} which produces orange colored pustules on the stem and sheath of this grass containing one-celled spores, later followed by black pustules, containing two-celled spores (teleutospores). The first stage of this rust occurs on the barberry. This rust as is well known occurs on barley, wheat and oats.

The second rust produces orange colored pustules on the leaves of this grass, the spores (uredospores) are one-celled and roughened. Where the plant ripens small elongated gray specks occur, these contain brown two-celled spores (teleutospores.) This rust also occurs on wheat. The cluster cup stage (aecidium) of this rust occurs on members of the Borage Family. Prof Bolley* however was unable to get infection results from an aecidium found on \textit{Onosmodinm Carolinianum} in North Dakota, when tried on the wheat plant. Infection results on wheat plant failed when the uredospores were taken from this grass. This weed is also affected with a Powdery Mildew, the perfect fruit of the fungus has not been observed here although Mr. Carver has looked for it very industriously, I am inclined to refer it to \textit{Erysiphe graminis}; which occurs on many grasses and also on wheat and rye. It differs somewhat from the form found on Blue grass as it has a dirty white appearance. The mildew works entirely on the surface of the leaf, the mycelium sending its haustoria into the epidermal cell. From the branched mycelium there arise erect hyphae that bear spores borne in chains. These spores are capable of immediate germination. Several imperfect fungi also occur. In the northwest a smut (\textit{Ustilago Lorentziana}) does good service in destroying much of the seed, but it has not been found in Iowa. This smut converts the ovary, palet and flowering glume into a black powdery mass as in Barley smut. I have several times tried to germinate the smut spores but without success.

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PLATE III—Fig. 1, leaf affected with rust. Fig. 2, uredospores and 3, teleuto spores of Puccinia graminis. Fig. 5, leaf showing spots of *P. rubigo-vera*. Fig. 6 and 8, teleuto spores of the same rust. 7, uredospores of the same species. Fig. 9 and 10, *Ustilago Lorentziana*. Fig 9, spike converted to a powdery Fig. 10, spores.

Pammel: Squirrel-tail grass or wild barley.
VALUE FOR FORAGE.

Wild Barley has but little value as a forage plant when it is in the flowering stage and later, but during the fall and early spring when the plants are small they are eaten and afford considerable pasturage. It comes up so abundantly from the old cut off stems that it has the appearance of being a perennial. The succulent leaves now, October 5, cover the ground in many cases, and in this condition is eaten by stock of all kinds. In considering its nutritive value one must consider its noxious qualities, and these so outweigh its good qualities that it should be kept down. Dr. J. B. Weems has made some chemical analyses of the plant in various stages of growth. His account of the plant should be consulted.
The Chemical Composition of Squirrel-tail Grass.

\[ \text{[Hordeum jubatum]} \]


The chemical section of the Experiment Station at the request of Prof. Pammel has made an investigation of the chemical composition of squirrel-tail grass. The samples were sent to the laboratory by Prof. Pammel and represented three periods of growth of the grass. The results obtained are as follows:

I

**ANALYSIS OF SAMPLE OF VERY YOUNG GRASS, FROM 3\(\frac{1}{2}\) TO 4 INCHES HIGH.**

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<tr>
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<th>DRY MATTER</th>
<th>AS RECEIVED</th>
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<tbody>
<tr>
<td>Water</td>
<td>62.29 per cent</td>
<td>62.29 per cent*</td>
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<tr>
<td>Ether extract (fat)</td>
<td>5.45 per cent</td>
<td>2.06 &quot;</td>
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<tr>
<td>Crude protein</td>
<td>24.91 &quot;</td>
<td>9.39 &quot;</td>
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<td>Crude fiber</td>
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<td>Ash</td>
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<td>Nitrogen-free extract</td>
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<td>12.62 &quot;</td>
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<tr>
<td></td>
<td>100.00 &quot;</td>
<td>100.00 &quot;</td>
</tr>
<tr>
<td>Albuminoids</td>
<td>19.96 &quot;</td>
<td>6.52 &quot;</td>
</tr>
</tbody>
</table>

*This sample was partly dry when received.

II

**ANALYSIS OF GRASS SOMEWHAT OLDER THAN NO. 1**

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<tr>
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<th>DRY MATTER</th>
<th>AS RECEIVED</th>
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<td>64.35 per cent</td>
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<td>Ether extract (fat)</td>
<td>4.14 per cent</td>
<td>1.48 &quot;</td>
</tr>
<tr>
<td>Crude protein</td>
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<td>5.37 &quot;</td>
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<td>10.20 &quot;</td>
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<td>Ash</td>
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</tr>
<tr>
<td>Nitrogen-free extract</td>
<td>39.50 &quot;</td>
<td>14.08 &quot;</td>
</tr>
<tr>
<td></td>
<td>100.00 &quot;</td>
<td>100.00 &quot;</td>
</tr>
<tr>
<td>Albuminoids</td>
<td>13.16 &quot;</td>
<td>4.69 &quot;</td>
</tr>
</tbody>
</table>
III

ANALYSIS OF SAMPLE OF MATURE GRASS.

<table>
<thead>
<tr>
<th>Water</th>
<th>DRY MATTER</th>
<th>56.92 per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ether extract (fat)</td>
<td>3.52 per cent</td>
<td>1.52</td>
</tr>
<tr>
<td>Crude protein</td>
<td>9.04 &quot;</td>
<td>3.89</td>
</tr>
<tr>
<td>Crude fiber</td>
<td>34.08 &quot;</td>
<td>14.68</td>
</tr>
<tr>
<td>Ash</td>
<td>11.30 &quot;</td>
<td>4.87</td>
</tr>
<tr>
<td>Nitrogen-free extract</td>
<td>42.06 &quot;</td>
<td>18.12</td>
</tr>
<tr>
<td>Albuminoids</td>
<td>7.69 &quot;</td>
<td>3.31</td>
</tr>
</tbody>
</table>

This grass has been analysed by Prof. Shepherd* of the South Dakota Experiment Station and Dr. O'Brine† of the Colorado Experiment Station but nothing is stated regarding the period of growth of the samples.

If we examine the analysis of the dry matter of the samples analysed it is seen that the amount of fat or ether extract decreases as the grass matures and that the young sample contained nearly three times the amount of albuminoids as the mature sample. The crude fiber also increases as the plant matures, while the ash decreases and on the other hand the nitrogen-free extract increases. A comparison may be made with the standard plants which are in general use such as timothy, red clover and kentucky blue grass, the average analysis of which may be stated as follows, based on the dry matter:‡

<table>
<thead>
<tr>
<th>Sample</th>
<th>Fat</th>
<th>Crude protein</th>
<th>Crude fiber</th>
<th>Nitrogen-free extract</th>
<th>Ash</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timothy</td>
<td>2.9</td>
<td>6.8</td>
<td>33.50</td>
<td>51.7</td>
<td>5.1</td>
</tr>
<tr>
<td>Red clover</td>
<td>4.9</td>
<td>13.5</td>
<td>31.3</td>
<td>43.0</td>
<td>7.3</td>
</tr>
<tr>
<td>Kentucky blue grass</td>
<td>3.7</td>
<td>11.8</td>
<td>26.2</td>
<td>50.3</td>
<td>8.0</td>
</tr>
<tr>
<td>Sample No. I</td>
<td>5.45</td>
<td>24.91</td>
<td>23.07</td>
<td>33.46</td>
<td>13.11</td>
</tr>
<tr>
<td>Sample No. II</td>
<td>4.14</td>
<td>15.07</td>
<td>28.61</td>
<td>39.50</td>
<td>12.68</td>
</tr>
<tr>
<td>Sample No. III</td>
<td>3.52</td>
<td>9.04</td>
<td>34.08</td>
<td>42.06</td>
<td>11.30</td>
</tr>
</tbody>
</table>

From the above table it is seen that the chemical analysis of squirrel-tail grass indicates that when it is young it will compare favorably with timothy, red clover, and blue grass.

*Bulletin No. 40 South Dakota Experiment Station.
†Bulletin No. 12, Colorado Experiment Station.
‡Handbook of Experiment Station Work.
Pammel: Squirrel-tail grass or wild barley.