Bulletin No. 312 - Wheatgrasses of Wyoming

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WHEATGRASSES of WYOMING
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Wheatgrasses of Wyoming
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Both native and introduced wheatgrasses (species of the genus *Agropyron*) rate high in importance in Wyoming. The native species are often both abundant and widespread. They are persistent, drought-resistant, and, even if not always palatable, at least high in nutritive value. None of the introduced species is a serious pest; many have specialized uses for which they are better suited than the indigenous vegetation.

**INTRODUCTION**

Western wheatgrass, slender wheatgrass, and crested wheatgrass have long been respected names among range and hay-meadow grasses. Tall wheatgrass, intermediate wheatgrass, and stiffhair wheatgrass are respected among the introduced newcomers. As early as 1903 (13) the Wyoming Agricultural Experiment Station reported that “the wheatgrasses are the most nutritious hay and pasture grasses we have. Stock given a generous supply of such hay are often turned off fat enough for the butcher without having been fed grain.”

This early station bulletin listed 11 species of wheatgrass as follow:

1. *Agropyron occidentale*, western wheatgrass. This species is still referred to as western wheatgrass but is scientifically now called *A. smithii*.
2. & 3. *Agropyron dasystachyum*. Then called bench-land wheatgrass and northern wheatgrass but now referred to as thickspike wheatgrass.

Acknowledgment:

The assistance of Chester Conard, Francis Smith, and Marvin Shoop, students enrolled in range management at the University of Wyoming, is appreciated. They searched much literature for pertinent facts concerning some of the species mentioned.
(4) *Agropyron pseudorepens*, western couchgrass. Now, as then, a seldom collected and little understood member of the genus.

(5) *Agropyron spicatum*. Then called bunch wheatgrass but now more commonly referred to as bluebunch wheatgrass or spike wheatgrass.

(6) *Agropyron vaseyi*, Vasey’s wheatgrass. A smaller form of *Agropyron spicatum* with smaller spikelets but not usually recognized as distinct.

(7) & (8) *Agropyron tenerum* and *A. violaceum*, slender wheatgrass. Also for many years referred to as *A. pauciflorum* but now scientifically called *A. trachycaulum*.

(9) *Agropyron caninum*, bearded wheatgrass. Now referred to as *A. subsecundum*; in reality only an awned phase of *A. trachycaulum* and therefore in this bulletin referred to as *A. trachycaulum* var. *unilaterale*.

(10) *Agropyron scribneri*, Scribner’s wheatgrass. The common alpine species.

(11) *Agropyron gmelini*, Gmelin’s wheatgrass. Now called *A. pringlei*, Pringle’s wheatgrass, which was mistakenly referred to Wyoming on the basis of misidentified specimens.

Bulletin No. 59 (13) covered seven native species and referred incidentally to the introduced, European *Agropyron acutum*, not then or now an important agricultural species for Wyoming. The steady progress accomplished through the intervening fifty years of study is emphasized by contrasting this list of seven species then considered highly important for Wyoming with those of the present bulletin, wherein are treated 17 species of *Agropyron*, 10 of which are native and 7 of which are introduced from the Old World. In addition 6 variations below specific rank, which are either morphologically conspicuous or ecologically distinct, are mentioned.

It is of first importance to understand these grasses, the extent of their morphological variation, of their ecological adaptability, and of their geographical distribution that they may be properly included in intensive range-management programs.

**CONFUSION IN THE NOMENCLATURE**

The first step in understanding of any biological group is clear and comprehensive scientific nomenclature for the species. When
changes in name have occurred, they have buried much useful information in unsuspected places, since these names often take hold more regularly in botanical fields than in applied agriculture.

Confusion in the nomenclature for the western species of wheat-grasses is the reflection first of insufficient field work, a handicap the worker cannot always overcome, and secondly an absence of easily recognized characters on which a good artificial key to the species may be constructed. General reluctance to use really deep-seated characters that are not easily recognized by non-specialists has led many into the false notion that good species in *Agropyron* may be based on easily recognized characters (e.g., awnless blue-bunch wheatgrass, often treated as a species, is but a botanical form of sporadic appearance throughout the range of the species).

Other names have arisen through transfers necessitated by (1) realignment of species (e.g., the restriction of *A. caninum* to Europe); (2) more thorough application of the rule of priority (e.g., recognition of identity of types of *Triticum trachycaulum* Link, 1833, and *T. pauciflorum* Schwein., 1824; (3) misapplication of names, e.g., *A. cristatum* long used for *A. desertorum*; (4) multiplication of genera; and (5) reduction of genera. The current view of many authorities, both conservative taxonomists and experimental geneticists, has been that *Elymus* and *Agropyron* as currently treated by American authors represent parts of one genus, other parts of the same genus being *Sitanion* and *Hystrix* (Gould, 7). Another point of view, likewise in conflict with current American usage which has stemmed largely from work done at the U. S. National Herbarium, divides into three the genus *Agropyron*: i.e., into *Agropyron*, *Roegneria*, and *Eremopyron* (Nevski, 15).

It is of little interest to agriculturists what names are given to various morphological variations, or again what taxonomic rank is assigned. On the other hand the tendency of any particular morphological character to be associated with such agronomically important factors as cold tolerance is of first importance in selection of range grasses (see Vavilov, 22, for a classic demonstration).

Thus in highly variable species such as *A. trachycaulum* considerable judgment may be exercised as to choice of strain. Often too little attention is paid to the source of seed, and a purchase of long-spiked lowland *A. trachycaulum* var. *typicum* may far too frequently be recommended for upland areas suited only to the short-spiked *A. trachycaulum* var. *majus*. 5
AGROPYRON Gaertn. The Wheatgrasses

Our spiked perennials (except a single annual, *A. triticeum*) of the tribe Hordeae: ligule seldom over 1 mm. long, membranaceous; spikelets single at the nodes of the rachis; about half and half tufted and rhizomatous; also about half and half with flat blades and blades involute; variably 3- to many-flowered; spikelets about half and half awned and unawned; glumes 2; lemma firm, several-nerved; palea prominent, 2-keeled, stamens 3; the short, distinct style with two plumose stigmas.

As a genus, ubiquitous, ranging from the alpine zone to the river bottoms, in woods and on open slopes, and in all soil types, occurring around the world and divisible into more than one hundred specific units.

KEY TO THE SPECIES

Spikelets strongly reflexed from the rachis

Perennial; glumes membranaceous and not fused  
(§Eu-agropyron)

Glumes twisted, the margin very narrow

1. *A. cristatum*

Glumes straight, the hyaline margin broad and conspicuous

2. *A. desertorum*

Annual; glumes with margins which in time become more or less thickened, horny, to some extent fused at base (§Eremopyrum)

3. *A. triticeum*

Spikelets appressed to rachis

Plants with long, creeping rhizomes (§Holopyron and §Elytrigia)

Lemmas pubescent

Lemmas awned

Lemma awn long, strongly divergent

4. Typical *A. albicans*

Lemma awn short, straight or absent

Lemma awnless, hirsute

5. *A. trichophorum*

Lemma with short awn, puberulent

6
6. *A. smithii* var. *molle*

Lemma awnless
Plants glaucous, glumes large, spikelets many-flowered

6. *A. smithii* var. *molle*
Plants not glaucous, glumes small, spikelets few-flowered

7. *A. dasystachyum*

Lemmas glabrous
Lemmas awned, the awn strongly divergent

4. *A. albicans* var. *griffithsii*

Lemma awns, if present, short and straight
Plant usually strongly glaucous, leaves 2-4 mm. wide, the margin often somewhat curled
Glumes 5-6 mm. long, spikelets distant, plant not glaucous

8. *A. riparium*
Glumes 8-12 mm. long, spikelets imbricate, plant very glaucous

6. Typical *A. smithii*
Plants not glaucous, leaves 5-10 mm. broad, flat
Glumes tapered, short-awned

9. *A. repens*
Glumes oblong, truncate

10. *A. intermedium*
Plants essentially caespitose, the innovations at most very shortly stoloniferous
Plants alpine; lemmas pubescent

11. *A. trachycaulum* var. *latiglume*
Lemmas not pubescent (rarely scabrous)
Glumes awned

12. *A. saundersii*
Glumes not awned
Awn on lemma straight or absent
Awns if present, short, at most 1/2 length of lemma
All spikelets on same side distant
Glumes 1/2 or less length of spikelet; leaves strongly involute; dry, sterile open ground
13. *A. spicatum f. inerme*
Glumes about equaling the spikelet; leaves mostly flat; moist stream banks or woods
Florets 1-3

11. Typical *A. trachycaulum*
Florets 5-11

14. *A. elongatum*
At least the upper spikelets strong imbricate

11. *A. trachycaulum var. majus*
Awns long, as long or longer than the lemma

11. *A. trachycaulum var. unilaterale*
Awns on lemma present and divergent
Glumes awnless or awn pointed
Spikelets imbricate, blades 3-8 mm. broad

11. *A. trachycaulum var. andinum*
Spikelets distant, blades 2-3 mm. broad
Divergent awn of lemma 1-2 cm. long

13. *A. spicatum*
Divergent awn of lemma 1-4 cm. long

15. *A. bakeri*
Glumes long-awned
Culm prostrate spreading, alpine

16. *A. scribneri*
Culms erect, low rocky slopes and plains

17. *A. saxicola*

1. *Agropyron cristatum* (L.) Gaertn. Crested Wheatgrass

Perennial, occasionally with short rhizomes but characteristically densely tufted, strictly erect (to 1 m.), glabrous, or scabrous, the leaves 2.5 mm. broad, more or less involute, the basal up to 2 dm. long, the culm leaves much shorter, pale green, hairy on the upper surface; a short (0.5 mm. long) membranaceous ligule present; spikelets rigidly spreading; spikelets 5-15 mm. long, 4- to 8-flowered, the upper usually sterile; first glume 4-5 mm. long, second glume 5-6 mm. long, both twisted, narrow margined, and short awned; lemmas 4-6 mm. long, mucronate, often ciliate.
Distribution of the Native Wheatgrasses

Agropyron spicatum, the typical form of Agropyron trachycaulum, and Agropyron smithii are known throughout Wyoming. One has only to seek the proper habitat to find them.

Three well-known Wyoming wheatgrasses of more restricted range are illustrated here, namely Agropyron scribneri, Agropyron dasystachyum, and Agropyron trachycaulum var. unilaterale.

Of the remaining species there are three, namely, Agropyron triticeum, Agropyron saxicola, and Agropyron bakeri, which are known only from single localities.

The remaining are known from scattered localities and should be further collected to determine more about their exact distribution and habitat preference.
Commonly established in Wyoming, best adapted up to 6,000 ft.; a native of Russia.

Crested wheatgrass, both hardy and drought-resistant, is readily established on any but the most alkaline soils in Wyoming. No competitor of smooth bromegrass or timothy for rich meadow bottoms, the grass nevertheless finds ample use as a replacement for sagebrush in the improvement of dry range, as a soil binder on road cuts where the State Highway Department shows foresight in protecting the banks, and as a filler in the pitting renovation of the shortgrass plains. On favorable locations up to one ton of hay may be expected for a period of up to 15 years. The hay is palatable and of high quality.

Although crested wheatgrass should not be recommended now for alkaline soils, it seems probable that the species as we know it is a mixture of several types some of which have considerable alkali tolerance. Further selection of these strains for use in Wyoming shows great possibilities but still lies ahead. This species is often confused with *Agropyron desertorum*. It is possible that other entities are likewise involved but presence of the Iron Curtain forecloses full understanding that can come only from studying the material in its native land. Two commercial strains are available—Standard (a hay grass) and Fairway (for pasture, lawns, or soil binding). More detailed information on crested wheatgrass is readily available in a United States Department of Agriculture leaflet (23).

2. *Agropyron desertorum* (Fisch.) Schult.
   Mountain Crested Wheatgrass

   Perennial, densely tufted, the habit like that of crested wheatgrass but the leaves usually broader, less involute, and darker green, usually not hairy. Spikes broader at the base, often twisted, the imbricate spikelets rigidly spreading from a short-jointed, sometimes pubescent rachis; glumes untwisted, with a broad hyaline margin; lemmas often ciliate, with an awn up to 3 mm. long.

   Commonly established in Wyoming, best adapted above 6,000 ft.; a native of Russia.

   Many Wyoming plantings now passing as crested wheatgrass are in reality *Agropyron desertorum*. The common name “desert wheatgrass” which has been applied to *A. desertorum* in spite of its similarity to the scientific name is unfortunate from an agronomic viewpoint inasmuch as this species prefers higher, wetter, and cooler
Crested Wheatgrass Plants Resulting from a Fall Seeding on Abandoned Cultivated Land
sites than the crested species. It is likely that conservative taxonomic treatments will continue to combine *A. cristatum* and *A. desertorum* and for that reason the common name Mountain Crested Wheatgrass is here adopted for *A. desertorum*.

With regard to the apparently unconservative splitting of species by Nevski (15), Mashtakov, F. M. (1939), says “P. N. Konstantinov considers that in all the diversity of variations found in crested wheatgrass only two forms are definite and constant. These are the wide-headed crested wheat (*A. cristatum* Bess.) and the narrow-headed crested wheat (*A. desertorum*). These two main forms may well be considered as species, subdivided into ecotypes. In the near future investigators will clarify this situation.”

3. *Agropyron triticeum* Gaertn. Annual Wheatgrass

Annual branching vigorously at the base, the culms up to 4 dm. tall, the sheaths and blades short, 1.5-5 cm. long, 1-3 mm. wide and scabrous; spikes numerous, 1-1.5 cm. long, the spikelets crowded, rigidly spreading, 6-10 mm. long, 3- to 6-flowered; glumes 5-6 mm. long, lanceolate, acuminate; lemmas 5-6 mm. long, indistinctly nerved, scabrous, awn-tipped; palea shorter than the lemma.

Already found in Washington and Idaho, Montana, and Colorado; now reported for Wyoming (Fremont County only).

There are not many annual grasses adapted to the climate of Wyoming, and many of those that are, for example the famed cheatgrass brome (*Bromus tectorum*), are not particularly desirable; *i.e.*, they are poor producers, are often indicators of overgrazing, are low in feed value, and frequently have harmful awns.

Annual wheatgrass belongs to a genus in which all of the wild species are of recognized value for range forage. It has a tight head of fat seeds that should be readily taken by sheep or cattle. Being an annual and a good seeder it should spring up readily in sagebrush and other dryland areas when conditions are right in the spring. While Wyoming is not dependent on annual forage as is California, nevertheless there is no reason why annual fillers should not help out in Wyoming, particularly in dry years when slow-starting perennials find the going difficult. Discovery of annual wheatgrass on range land is encouraging and quite in contrast to the recent discovery in Wyoming of goatgrass (*Aegilops cylindrica*) in grain fields where it is persisting as a pest.

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**Montana Wheatgrass**

Perennial with creeping rhizomes, the erect culms up to 8 dm. tall, whitish; blades 1-2 mm. broad, 1-2 dm. long, rather involute, both sheaths and blades usually scabrous; spike 7-10 cm. long, the spikelets distant, 3- to 7-flowered; lemmas 8-12 mm. long tapering to a divergent awn 1-2 cm. long, pubescent.

Plains and dry slopes, South Dakota to Alberta and Colorado.


4a. *Agropyron albicans* var. *griffithsii* (Scribn. & Smith) Beetle.  
**Griffiths Wheatgrass**

Differing from typical *A. albicans* only in having glabrous lemmas and broader (up to 3.5 mm.) leaf blades.

North Dakota, South Dakota, Wyoming, and Colorado.

5. *Agropyron trichophorum* (Link) Richt.  
**Stiffhair Wheatgrass**

Perennial; culms 6-10 dm. tall, glabrous; blades flat, 3-7 mm. wide; sheaths of the lower leaves hirsute; spikes 10-20 cm. long; rachis more or less hirsute; spikelets densely hirsute, awnless, 1-2 cm. long, 4- to 7-flowered; glumes several-nerved, acutish, hirsute, 2.5-1 cm. long, 5- to 7-nerved; lemma hirsute with long white hairs on the upper surface and margins; palea slightly shorter than the lemma, long-ciliate on the keels.

Sparingly planted in Wyoming; native of Russia; on pastures in the spring and early summer well eaten by cattle and horses, not so well by sheep. The hay is coarse but well eaten by cattle.

**Western Wheatgrass**  
**Bluestem Wheatgrass**

Smooth perennial with strong, extensively creeping rhizomes; culms erect, up to 8 dm. tall, very glaucous; leaf blades conspicuously ribbed dorsally, stiff, 2-6 mm. broad, 5-12 cm. long, flat or involute, sharply scabrous, sheaths, stems, and leaves very glaucous (bluish-green); spike 7-15 cm. long, the spikelets imbricate, often somewhat divergent; spikelets 1-2 cm. long, 6- to 10-flowered; first glume 8-10 mm. long; second glume 10-12 mm. long, both glumes rigid, gradually tapering from near the base into a short awn; lemmas 8-12 mm. long, glabrous or pubescent near base, obscurely nerved, often mucronate or awn-tipped.

Mostly on low alkaline soils; Wyoming to Utah, south to New Mexico and Arizona.
6a. *Agropyron smithii* var. *molle* (Scribn. & Smith) Jones.

Pubescent Western Wheatgrass

Differs from typical *A. smithii* only in having the lemmas and sometimes the glumes pubescent. Same range as typical *A. smithii* but less common.

Western wheatgrass is probably the most alkali-tolerant of the North American species of *Agropyron* and possibly also for the genus. While alkali tolerance has been variously developed, particularly in the §Holopyrum in North America and in the §Eu-*Agropyron* in the Old World, none of the South American species (Parodi, 17) possesses this character.

Western wheatgrass sometimes invades cultivated fields. In such cases the same control measures as given for *Agropyron repens* (quackgrass) are recommended (Hume and Sloan, 8). Like all the other wheatgrasses, western is a cool-season grass, making its best growth of coarse forage from strong stolons in spring. It remains comparatively inactive during the summer but cures well on the ground.
Western wheatgrass is a poor seeder and, although slow to start from seed, is readily established in that manner. It is extremely drought-resistant and also very resistant to grazing pressure. Sheep are very fond of the heads but reproduction is largely vegetative. Stands are rarely dense except on swale bottoms at elevations above the natural range of buffalograss.

   Thickspike Wheatgrass

   Perennial with creeping rhizomes; culms up to 1 m. tall, often somewhat glaucous; blades 1-3 mm. broad, up to 2 dm. long, flat or involute, smooth or scabrous above, with a short membranous ligule; spike 6-15 cm. long, the spikelets 1-2 cm. long, 3- to 8-flowered; first glume 5-8 mm. long; second glume 6-10 mm. long, both scabrous or pubescent, 3- to 5-nerved; lemmas 8-12 mm. long, obscurely nervet, densely to sparsely pubescent, acute or rarely mucronate or short-awned.

   Plains, and deserts in sandy and gravelly soil, Michigan to British Columbia, south to Illinois, Nebraska, Colorado, Arizona, Nevada, and Oregon.

   Streambank Wheatgrass

   Perennial with rhizomes; culms up to 8 dm. tall, glabrous, erect; leaf blades 1-3 mm. broad, strongly involute, scabrous; spike 5-10 cm. long, the spikelets more or less imbricate; spikelets 8-15 mm. long, 5- to 7-flowered; first glume 4-6 mm. long, second glume 5-8 mm. long, both 3- to 5-nerved, broad and green with scarious margins; lemmas 7-9 mm. long, glabrous, scabrous, or somewhat pubescent on the lower edges, nerves faint, acute, or very short-awned.

   Dry, non-alkaline soils on open exposures at lower elevations; North Dakota to Alberta and Washington, south to Oregon, Arizona, and Colorado.

   Quackgrass

   Perennial with creeping rhizomes; culms soon erect, up to 1 m. tall, leaf blades 4-8 mm. wide, dark green, flat, scabrous on the margins and occasionally pilose above; sheaths glabrous or pilose, with auricles and a small membranous ligule; spikelets 8-15 mm. long, 3- to 7-flowered; glumes subequal, 8-10 mm. long, equaling about \( \frac{1}{2} \) the spikelet, 3- to 7-nerved and usually awn-tipped; lemmas 8-10 mm. long, sometimes scabrous, awnless or short-awned (to 1 mm.).

   Introduced from Eurasia, usually not mixing with the native flora but commonly persisting along ditch banks, roadsides, and near cultivated fields. In Wyoming most common and abundant along the Belle Fourche River.
Quackgrass is an efficient soil binder, for under favorable conditions it forms a dense sod of heavy, vigorous rootstocks. In cultivated fields the grass can become a weed the control of which is costly. However, in meadows and pastures, because of its nutritive value and permanency, quackgrass is of first importance, well-liked by both horses and cattle.

A small patch of quackgrass observed near a cultivated field should be removed by hand digging. Small but scattered patches may be sprayed with sodium chlorate. A 4-year rotation consisting of grain, hay, and two years of a cultivated crop will usually control quackgrass without loss of use of the land (cf. Hume & Sloan, 8).

10. *Agropyron intermedium* (Host.) Beauv.

Intermediate Wheatgrass

Tufted, glaucous perennial; culms 6-10 dm. tall, glabrous, smooth; sheaths ciliate on the margins; blades flat, 3-7 mm. wide, on the upper surface long-hirsute or glabrous; spikes straight, 1-2 dm. long; rachis scabrous on the two main angles; spikelets 3- to 5-flowered, 10-16 mm. long; glumes oblong or lanceolate, obtuse, shorter than the lower floret, smooth; lemma broad-lanceolate, ca. 1 cm. long, somewhat obtuse, glabrous; palea subequal.

Introduced around 1920 from the north shores of the Black Sea in Russia at about the same latitude as the state of Nebraska.

Intermediate wheatgrass is adapted to soils with good drainage and of medium to high fertility. In the Pacific Northwest it requires 15 inches of rainfall and does best at elevations of 1 to 3 thousand feet. On prairie soils at higher elevations such as are found in Teton County it is well adapted even at 6 thousand feet and here is superior in constance and performance. For reseeding of sagebrush land the intermediate wheatgrass is inferior on the low dry and poorly drained lands but on higher, moist sites it is adapted to the reseeding of these lands.

When planting it for seed production the best results are obtained from rows about 40 inches apart with one-half pound to three-fourths pound per acre on heavy soil and 1 1/2 pounds per acre on sandy soil. Under favorable conditions the seedlings will emerge in about one week. When planting for other uses, experiments show that 6 to 10 pounds per acre is very effective. When row-planted the grass will approximately double its seed production. Experiments in Moscow, Idaho, show that it produced 200 pounds of seed per acre in solid stand as contrasted to 400 pounds per acre when cultivated.
in rows. Winter or spring plantings are both desirable where climatic conditions are favorable; with either season of planting the grass will become well established the first year. Under Wyoming conditions fall planting is not very satisfactory because they are usually too dry for the seeds to become established. Wind erosion on the dry soil uncovers many of the seeds, thus making unsatisfactory conditions for fall planting in Wyoming.

An experiment carried out with intermediate wheatgrass and six other grasses on areas forested with ponderosa pine showed intermediate the most vigorous. Washington State College ran a test of several grasses trying to stabilize sand dunes. Intermediate wheatgrass was used but was not suited, for although it became established, it did not remain past the first season. In the Northern Great Plains, Idaho Mountains, and the Pacific Northwest intermediate wheatgrass has proved very winter-hardy. In tests made at Matanuska Station, Alaska, in 1950 it was found that intermediate suffered severe winter injury.

The plants begin growth early in spring and reach considerable height before growth ceases in midsummer because of scarcity of moisture. The return of moisture and cool temperature in late summer brings good growth recovery. This vegetative habit provides possibilities for excellent pastures.

An outstanding characteristic of the grass is its lateness in maturing, which enables it to provide succulent growth during the dry summer months. The leafy foliage produced is relished by all classes of stock.

Planting intermediate wheatgrass with alfalfa is good practice. In the western mountains solitary stands 18 years old have yielded from 1,600 to 2,000 pounds of field-cured hay per acre. The hay was palatable.

11. Agropyron trachycaulum (Link.) Malte.

Slender Wheatgrass

Tufted perennial, the culms erect, up to 1.5 m. tall; leaf blades 2-8 mm. broad, flat or somewhat involute, glabrous to scabrous; sheaths glabrous or sometimes pubescent; spike 1-3 dm. long, slender, the spikelets distant; spikelets up to 2 cm. long, 3- to 7-flowered; glumes 3- to 7-nerved, about equaling the spikelet, acute to awn-tipped; lemmas 8-13 mm. long, obscurely nerved, glabrous, acute, or short-awned.
Light, sandy soils and aspen woods at moderate elevations (4,000-8,000 ft.) from Labrador to Alaska and over the United States except in the Southeastern States.

Of the many variations of slender wheatgrass the typical form seems to be the only one readily available for reseeding. The Primar strain which was developed at Pullman, Washington, has proved very successful in seeding throughout Wyoming. It is particularly productive of volunteer seedlings. Slender wheatgrass is tufted and short-lived and therefore not a particularly useful hay or meadow grass but is well adapted to reseeding of sagebrush areas or on forest burns.


*Compact Slender Wheatgrass*

Similar to typical *Agropyron trachycaulum* but the spike shorter and broader; at least the upper spikelets strongly imbricate. Both awned and unawned forms occur. Smaller, shorter-glumed plants have been separated (as var. *novae-angliae* (Scribn.) Fern.) but in Wyoming have neither habitat nor distributional difference.

Rich heavy soils and pine woods, or gravelly stream banks, moderate to high elevations (4,000-10,000 ft.).


*Stoloniferous Slender Wheatgrass*

All of the wheatgrasses that are characteristically bunchgrasses occasionally produce stolons. This has been pointed out many times (Nevski, 16; Daubenmire, 4; etc.). Therefore the tendency to produce stolons is not a good taxonomic character except where correlated with other differences. Nevertheless, agriculturists often wish to pay particular attention to such minor characters, and already the stoloniferous form of *A. cristatum* has been developed into a commercial strain called Fairway. The above name is, then, important as placing the form in proper perspective. In attempting to secure a stoloniferous form of this grass for range purposes it should be remembered that, in general, stoloniferous grasses are better soil binders but are less drought-resistant than are true bunchgrasses. It is probable that within *Agropyron* the stoloniferous types are more primitive, and development of the tufted species has been the result of adaptation of the primitive types to...
the increasing aridity of both the Western United States and Central Asia during geologic time.

Awned Slender Wheatgrass
Similar to typical *Agropyron trachycaulum* but the lemmas long-awned. Smaller, shorter-glumed plants have been separated (as var. *glaucum* (Pease & Moore) Fernald) but in Wyoming have neither habitat nor distribution difference, although there is some tendency for the plants to be more common in woods habitats.

Moist meadows and open woods, Newfoundland to Alaska and south to Maryland, Indiana, Nebraska, New Mexico, Arizona, and California.

Mountain Slender Wheatgrass
Similar to var. *unilaterale* but the culms less than 5 dm. tall, geniculate at the base; awns noticeably divergent; high montane, found only at or near treeline; Montana to Washington south to Colorado and Nevada.

The original description of *Agropyron unilaterale* by Cassidy * (why not Cassidy and O’Brien?) has often been accepted as adequate (Vasey, 1893; Pease & Moore, 18; Fernald, 5), even though the publication is strictly agricultural, and no type exists (Fernald, 5). It would seem that the illustrating of *A. japonicum* Tracy would more than offset the greater detail in the description of *A. unilaterale* and take the force out of the argument by Ball (1) that Beetle (3) is incorrect in maintaining the validity of the description of *A. japonicum* Tracy.

* Often cited “Cassidy” but in original publications appears as “Cassidy and O’Brien.”

Pubescent Slender Wheatgrass
Tufted perennial similar to *Agropyron trachycaulum*; culms soon erect, up to 5 dm. tall; blades numerous, 3-5 mm. broad, flat, pubescent; spikes about 1 dm. long, with closely imbricate spikelets; spikelets 10-15 mm. long, 3- to 5-flowered; glumes ca. 10 mm. long, 3- to 5-nerved, broad, awn-tipped; lemmas ca. 1 cm. long, pubescent, mostly short-awned.
An arctic species, extending southward in the Rocky Mountains, where rare, only two Wyoming localities are known and the only Colorado locality known is in Lake County at 12,000 ft.

**Saunder’s Wheatgrass**

Tufted perennial, culms 6-10 dm. tall; blades flat or loosely involute; spike erect, 8-15 cm. long, mostly purplish, the rachis tardily disarticulating; spikelets 1-1.5 cm. long, 2- to 5-flowered, sometimes in pairs near middle of the spike; glumes variable, narrow with 2 nerves or wider with 3 to 5 nerves, the terminal awn 1-5 cm. long, sometimes with a short lateral awn near the base; lemma scabrous, the awn straight, 2-5 cm. long.

Uncommon in dry soil, Wyoming to California and south to Arizona.

**Bluebunch Wheatgrass**

When This Picture Was Taken, After a 1.7 Inch Rainfall, Wheatgrass Like This, Heavy Enough to Cut for Hay, and Grama Were Crowding Out Even the Sage Wherever the Range Received the Benefit of Run-off Water
Tufted perennial, occasionally under favorable conditions and particularly late in the fall, producing short innovations; culms erect, up to 7 dm. (1 to 4 ft.) tall, glabrous, green or somewhat glaucous; leaf blades 1-3 mm. broad, flat or somewhat involute, glabrous or pubescent above; spike up to 1.5 dm. long, narrow, lax, the spikelets distant; spikelets 1-2 cm. long, 4- to 8-flowered; first glume 5-8 mm. long; second glume 6-10 mm. long, both 3- to 4-nerved, acute or awn-tipped; lemmas 8-10 mm. long, the nerves indistinct, glabrous or scaberulous, the awn strongly divergent.

Michigan to Alaska, south to South Dakota, New Mexico, and California.

Bluebunch wheatgrass is a drought-resistant perennial found chiefly on dry soils in the open or in partial shade, seldom growing on wet soils and rarely in thick timber. Because of its extensive distribution and its abundance on dry sites, bluebunch wheatgrass is one of the key species on many ranges. Where abundant it frequently contributes the bulk of the spring, fall, and early winter range forage as well as a large part of the warm-season forage of ranges within the ponderosa pine belt. The Northwest regards it as its most important indigenous grass.

The palatability rating of bluebunch wheatgrass is high except for old growth. This stem wiriness and the rather troublesome awns are the chief drawbacks. The leafage remains green throughout the grazing season and is nutritious and palatable after growth ceases. At lower elevations, unless conditions are too dry, a fair amount of good seed matures but in the higher and drier portions of its range, where seed stalks are put forth irregularly and relatively late in the season, normally only a small amount of seed, of low viability, is produced.

Bluebunch wheatgrass withstands proper grazing well, but new plants are established entirely from seed and it is essential, if this species is to maintain itself, that opportunity be afforded for early seed to mature. Deferred grazing works well with this species and the trampling by grazing animals after seed has fallen materially assists in seedling establishment. On millions of acres of range land where unrestricted grazing has obtained, bluebunch wheatgrass has succumbed to overstocking and too early grazing. It has practically disappeared from much of the wheatgrass/sagebrush type, where such abuse has prevailed, being largely replaced by cheatgrass brome. Because of its great value as a forage plant, successful effort is often made to increase this species on ranges where it naturally occurs, through observance of good range-management.
principles supplemented occasionally by artificial reseeding. Attempts to extend its range to other areas, however, have usually failed.

Bluebunch wheatgrass is a favorite forage species with elk, being grazed extensively by them. On bison range in Montana it is not grazed in summer but is utilized as winter feed. This natural selection permits the grass to seed and maintain itself on bison range.

Studies made from 1938-1944 show range readiness is indicated by the occurrence of 3- to 3½-inch leaf height or over a 5.4-inch height of the plant. This species has approximately 60 percent of its maximum leaf-height growth at this time and is tall enough to be easily available forage for cattle. On or about May 20 grazing starts on the Vigilante Experimental range in Montana; this is the approximate date for grazing to begin in most of the other areas.

Sixty percent of the utilized *Agropyron spicatum* is as fully grazed as is considered safe. Heavily grazed pastures produced only 55 percent as much *A. spicatum* as the lightly grazed pasture, and this species decreased 45 percent under heavy grazing.

13. *Agropyron spicatum f. inerme* (Scribn. & Smith)

   Beetle. Beardless Bluebunch Wheatgrass

Tufted perennial, the culms erect, up to 7 dm. tall, smooth; leaf blades 1-2 mm. broad, strongly involute, scabrous and pubescent above; spike up to 15 cm. long, narrow, the spikelets distant; spikelets 1-2 cm. long, 4- to 8-flowered; first glume 4-7 mm. long, second glume 6-9 mm. long, awnless, 3- to 5-nerved, equaling about ½ length of spikelet; lemmas ca. 10 mm. long, faintly nerved, acute to awn-tipped.

Montana to British Columbia, south to Utah, Wyoming, Nebraska, and Oregon.

14. *Agropyron elongatum* Host. Tall Wheatgrass

   Perennial, blue-green or glaucous, 75-150 cm. tall, erect, glabrous, producing abundance of long basal and culm leaves; blades firm, flat, or loosely rolled and prominently nerved, from 15 to 40 cm. long and 4-7 mm. wide, scabrous on the upper surface and smooth beneath; spike erect, elongate, about 15-50 cm. long with a thickened, erect axis, concave on the side toward the spikelet, hispid-ciliate on the margins; lowermost internode on the spike 2-4 cm. long; spikelets 2-25 mm. long and 6-9 mm. wide, 9- to 11-flowered; glumes glabrous 8-9 mm. long, mostly 7- to 9-nerved, truncate, less than half the length of the spikelet; lowest lemmas ca. 1 cm. long; rounded or subtruncate at the minutely lobed apex, often mucronate, occasionally long-awned, palea short, ciliate on the keels, about as long as the lemma.
Tall wheatgrass is native to Southern Europe and Asia Minor, where it lives primarily on saline meadows and seashores. It was discovered by plant explorers during the early 1930's, growing in salt marshes in Northern Turkey, not far from the shores of the Black Sea, at approximately the same latitude that divides Nebraska from Kansas.

Tall wheatgrass has two outstanding qualities of the other wheat-grasses: namely, their hardiness and drought resistance, as well as having the properties of maturing after most other grasses have dried up, and the ability to produce excellent forage on grounds too alkaline to grow any other useful crop.

Tall wheatgrass is a blue-green or glaucous, tall, erect, glabrous perennial bunchgrass which tends to become coarse as it approaches maturity, and may become somewhat tough and harsh in some areas in late summer. Production falls off rapidly above 7,000-feet elevation even though the plant will survive. Seed setting is uncertain above 6,000-feet elevation.

Little difficulty is encountered in planting or harvesting tall wheatgrass seed. The large seeds flow freely from nearly any type of grain drill. Early fall planting on well-packed seedbeds gives the best results. In medium light-textured soil it should be planted at a depth of $\frac{1}{2}$ to $\frac{3}{4}$ inch at an even depth. More seed is produced from plants in rows (rather than in solid stands) when seeded at approximately 3-5 pounds an acre.

Seed should be harvested in the soft dough stage. It ripens evenly, generally in the latter part of August, and does not shatter readily. Harvesting with a binder gives seed of better quality than does combining, especially when growth is heavy. This is because the tough, green leaves present at harvesting will tend to "slug" a combine cylinder, and a quantity of moisture-laden bits of leaves get mixed with the seed.

Seed is often produced at a rate of 400 pounds cleaned or more to an acre under average conditions. At present there is heavy demand, and seed commands a high price. Plants are only moderately self-fertile, especially in comparison with other members of the genus. Germination percentage of the seed is high. A bushel of tall wheatgrass seed weighs 16 pounds and contains 79,000 per pound. There is good regrowth after seed harvest.

Tufted perennial, 5-10 dm. tall; green or glaucous; sheaths smooth, blades flat to involute, stiff 3-4 mm. broad, scabrous; ligule ca. 1 mm. long, membranaceous and erose; spike 5-12 cm. long, rachis continuous; spikelets subterete (i.e., nearly cylindric), more or less crowded; glumes subequal and awn-pointed; lemmas broader than the glumes with divergent awns 1-4 cm. long.

Open slopes at or near treeline; Canada, along the higher Rocky Mountains to New Mexico; in Wyoming known only from Teton County.


Tufted perennial; culms geniculate at base, up to 5 dm. long; leaf blades numerous, 2-5 mm. broad, flat or involute, puberulent on both sides; spike 3-7 cm. long, rather lax, the spikelets crowded; spikelets 8-15 mm. long, 2- to 5-flowered; glumes 4-7 mm. long with a long divergent awn; lemmas 8-10 mm. long, nerved toward the tip, more or less scabrous, tapering to a divergent awn 1.5-3 cm. long.
High montane, Montana to New Mexico, Nevada, and Arizona; common above treeline in Wyoming.

17. *Agropyron saxicola* (Scribn. & Smith) Piper.  
Foxtail Wheatgrass

Tufted perennial 3-8 dm. tall; sheaths glabrous or sometimes pubescent; blades flat to loosely involute, glabrous or sometimes pubescent, 1-4 mm. broad; spike 5-12 cm. long, the rachis tardily disarticulating; spikelets imbricate, sometimes in pairs, about twice as long as the internodes of the rachis, 4- to 6-flowered, the rachilla minutely scabrous; glumes narrow, 2-nerved, the nerves sometimes obscure, sometimes with a third faint nerve, awned, the awn divergent, 5-20 mm. long, sometimes with a tooth or short awn at base of main awn; lemmas about 8 mm. long, the awn divergent, mostly 2-5 cm. long, sometimes with 1 or 2 short additional awns; palea about as long as the lemma, obtuse or truncate.

Dry or rocky slopes and plains, western South Dakota to Washington, south to Utah, Arizona, and California; rare and poorly known in Wyoming.

NOTES ON OTHER *AGROPYRON* SPECIES


*Agropyron aegilopoides* Turcz. Reported for “Rocky Mountains” by Vasey, G., 1883, “The Grasses of the United States,” but name never identified, probably an error for *Triticum aegilopoides* Thurb., which was a misidentification of *Agropyron trachycaulum* var. unilaterale of the present paper.

THE IMPORTANT LITERATURE ON *AGROPYRON*


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