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Wheatgrasses of Wyoming

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Photographic illustrations by Dwight Kimsey*

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.

Two previous Wyoming Agricultural Experiment Station bulletins have borne the title “Wheatgrasses of Wyoming”. The first, published in 1903, reported that “the wheatgrasses are the most nutritious hay and pasture grasses we have” and covered seven native species. The second, published in 1952, treated 17 species, 10 native and 7 Old World introductions. In this third edition no new natives have been discovered, but for Wyoming the promise of new introductions of value, coming from both the New World and the Old, is bright.

The most promising Old World newcomer is amur wheatgrass, Agropyron amurense, although this species needs more testing and is rarely available commercially. The annual report for the calendar year 1949 of the Rocky Mountain Forest and Range Experiment Station reports that this plant appears “to have considerable merit” for seeding “in depleted parks in the aspen and spruce-fir zone (8,500 to 10,000 ft. elevation).” Amur wheatgrass has shown promise in test plantings at both Sheridan and Laramie.

Most promising of the New World wheatgrasses now on trial is the Argentine Agropyron scabriglume. In addition to these sources of material the 11 western states have recently (April 1955) voted Agropyron the genus most likely to yield results from domestic exploration.

AGROPYRON AND THE HORDEAE

In the generally accepted family tree of the grasses, Agropyron as a genus falls into the tribe Hordeae, a distinctive group of closely related (as indicated by their crossability) and valuable cereals and forage crops. Here Agropyron bridges completely the gap between the primitive, rhizomatous perennials of Elymus and the advanced, large-grained annuals of Triticum. Within Agropyron are closely related groups, sometimes given sectional standing and sometimes made into genera. Chief among these groups are the annuals, two types of tufted perennials (Eu-Agropyron and Roegneria), and the rhizomatous species of the section Holopyron.

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—2—
As more is known about the Hordeae, older divisions seem more and more artificial; *Agropyron* itself may be known in the future in a form greatly modified from that we recognize today. Research in this tribe is progressing more rapidly than in any other group of grasses. The reticulate pattern of evolution will be unravelled slowly but already it is possible to visualize the over-all pattern of progression from rhizomatous types to tufted perennials to annuals.

**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*.

*AGROPYRON* Gaertn. The Wheatgrasses

Ours spiked perennials; 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

Plants with long, creeping rhizomes (Sect. Holopyron and Sect. Elytrigia)

Lemmas pubescent

Lemmas awned

Lemma awn long, strongly divergent

1. Typical *A. albicans*

Lemma awn short, straight or absent

Lemma awnless, hirsute

2. *A. trichophorum*

Lemma with short awn, puberulent

3. *A. smithii* var. *molle*

Lemma awnless

Plants glaucous, glumes large, spikelets many-flowered

3. *A. smithii* var. *molle*

Plants not glaucous, glumes small, spikelets few-flowered

4. *A. dasystachyum*

Lemmas glabrous

Lemmas awned, the awn strongly divergent

1. *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

5. *A. riparium*

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

3. Typical *A. smithii*

Plants not glaucous, leaves 5-10 mm. broad, flat

Glumes tapered, short-awned

6. *A. repens*

Glumes oblong, truncate

7. *A. intermedium*

Plants essentially caespitose, the innovations at most very shortly stoloniferous

Spikelets appressed to axis of the spike (Sect. Roegneria)

Plants alpine; lemmas pubescent

8. *A. trachycaulum* var. *latiglume*

Lemmas not pubescent (rarely scabrous)

Awn on lemma straight or absent
Awns if present, short, at most $\frac{1}{2}$ length of lemma
All spikelets on same side distant
Glumes $\frac{1}{2}$ or less length of spikelet; leaves strongly involute; dry, sterile open ground

9. *A. spicatum* f. *inerme*
Glumes about equaling the spikelet; leaves mostly flat
Florets 1-3, moist streambanks or woods

8. Typical *A. trachycaulum*
Florets 5-11, cultivated in fields

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

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

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

3. *A. trachycaulum* var. *andinum*
Spikelets distant, blades 2-3 mm. broad

9. *A. spicatum*
Glumes long-awned
Culm prostrate spreading, alpine

11. *A. scribneri*
Culms erect, rocky slopes and plains at low elevations

12. *A. saxicola* and *A. saundersii*
Spikelets strongly reflexed from the axis of the spike (Sect. Eu-Agropyron)
Glumes twisted, the margin very narrow, wide-headed

13. *A. cristatum*
Glumes straight, the hyaline margin broad and conspicuous narrow headed

14. *A. desertorum*

1. *Agropyron albicans* Scribn. & Smith.

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. (Plate II, Fig. 1.)

Plains and dry slopes, South Dakota to Alberta and Colorado.
Plate I. The Annual Wheatgrasses

FIG. 1—Agropyron triticeum or Eremopyrum triticeum, the only one of the group occurring spontaneously in Wyoming.

FIG. 2—Agropyron orientale or Eremopyrum orientale, which has been reported introduced into the Montana flora.

FIG. 3—Agropyron buonapartis or Eremopyrum buonapartis, which is now under observation at the Wyoming Experiment Station.

FIG. 4—Agropyron buonapartis var. pilosum or Eremopyrum buonapartis var. pilosum (E. hirsutum), a very hispid form.
1a. *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. (Plate II, Fig. 2.)

North Dakota, South Dakota, Wyoming, and Colorado.

Both *A. albicans* and its variety are indicators of sagebrush ranges in the highest condition class.

2. *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. (Plate III, Fig. 4.)

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 liked by cattle.

Experiences with this grass have been disappointing in Wyoming. In general it may be said that it produces uneven stands. It can only be recommended for the same situations under which intermediate wheatgrass may be expected to give superior performance.

Plate II

![FIG. 1—Typical *Agropyron albicans*; note the unawned pair of glumes at the top.](image1)

![FIG. 2—*A. albicans* var. *griffithsii*, differing in lacking strongly pubescent glumes and lemmas.](image2)
(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. (Plate III, Fig 1.)  
Mostly on alkaline soil below 7,500 ft. elevation; Wyoming to Utah, south to New Mexico and Arizona.

3a. *Agropyron smithii* var. *molle* (Scribn. & Smith) Jones  
Pubescent Wyoming 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. (Plate IV, Fig. 2.)  
Wyoming 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 Sect. Holo-pyrum in North America and the Sect. Eu-Agropyron in the Old World, none of the South American species possess this character.  
Wyoming wheatgrass sometimes invades cultivated fields. In such cases the same control measures as given for *Agropyron repens* (quackgrass) are recommended. Like all other wheatgrasses, Wyoming wheatgrass 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.  
Wyoming 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. Sands are rarely dense except on swale bottoms at elevations above the natural range of buffalo grass.  
In 1951 Wyoming wheatgrass was chosen the Wyoming state grass by the Wyoming Section of the American Society of Range Management.

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 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-awned; lemmas 8-12 mm. long, obscurely nerved, densely to sparsely pubescent, acute or rarely mucronate or short-awned. (Plate IV, Fig. 4.)
Plate III. Old World Wheatgrasses

FIG. 1—A. elongatum, tall wheatgrass, for alkaline soils.

FIG. 2—A. repens, quackgrass, a weed eastward, but less aggressive in Wyoming.

FIG. 3—A. intermedium, intermediate wheatgrass, excellent for reseeding at middle elevations in Wyoming.

FIG. 4—A. trichophorum, stiffhair wheatgrass, not differing markedly from intermediate wheatgrass except for the hirsute glumes and lemmas.
Plains, and deserts in sandy and gravelly soil, Michigan to British Columbia, south to Illinois, Nebraska, Colorado, Arizona, Nevada, and Oregon.

5. *Agropyron riparium* Scribn. & Smith.

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. (Plate IV. Fig. 3.)

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

Streambank wheatgrass is listed as a seed crop approved for certification in Idaho. There it is recommended mainly for protection of newly disturbed ditch banks, canals, and road cuts but may also be used for airfield runways in dry areas. Its thick sod keeps itself weed-free.


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.). (Plate III, Fig. 2.)

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. According to Wyoming Agricultural Experiment Station Circular 59, the latest recommendations for control are: "Intense cultivation is the cheapest, most effective method of control. Where long periods of non-productivity can be tolerated, sodium chlorate at 800 lbs. to 1200 lbs. per acre may be used. TCA applied as a foliage spray at 90 to 120 lbs. per acre, or ground applications of 40 to 50 lbs. per acre, may be applied for eradicating quackgrass along ditchbanks and in fence rows. Dalapon at 40 lbs. per acre applied as a foliage spray in mid-June has given good control, but repeated applications may be necessary."
Plate IV. North American Sod-forming Wheatgrasses

FIG. 1—Typical A. smithii, most prevalent of the wheatgrasses at lower elevations, and especially on alkaline soils.

FIG. 2—the pubescent form of A. smithii, usually referred to as A. smithii var. molle.

FIG. 3—Streambank wheatgrass, A. riparium, until recently mostly overlooked as an agronomic crop.

FIG. 4—A. dasystachyum, strongly resembling A. riparium, but separated by the fine puberulence on the lemmas.
7. *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.

(Plate III, Fig. 3.)

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 1000 to 3000 ft. On prairie soils at higher elevations such as are found in Teton County it is well adapted even at 6000 ft. 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 in. apart with one-half lb. to three-fourth lb. per acre on heavy soil and 1½ lbs. per acre on sandy soils. Under favorable conditions the seedlings will emerge in about one week. When planting for other uses, experiments show that 6 to 10 lbs. 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 lbs. of seed per acre in solid stand as contrasted to 400 lbs. per acre when cultivated in rows. Early spring plantings are desirable. Where climatic conditions are favorable the grass will become well established the first year. Under Wyoming conditions fall planting is not very satisfactory because the weather conditions 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 from 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.

—12—
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 lbs. of field-cured hay per acre. The hay was palatable.

8. **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. (Plate V, Fig. 1.)

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 meadowgrass but is well adapted to reseeding of sagebrush areas or on forest burns.

8. **Agropyron trachycaulum** var. **majus** Fernald.

**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. Both awned and unawned forms occur. Smaller, shorter-glumed plants have been separated (as var. *novaeangliae* (Scribn.) Fern.) but in Wyoming have neither habitat nor distributional difference. (Plate V, Fig. 3.)

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

8. **Agropyron trachycaulum** var. **majus** f. **pseudorepens** (Scribn. & Smith) Beetle.

**Stoloniferous Slender Wheatgrass**

All of the wheatgrasses that are characteristically bunchgrasses occasionally produce stolons. 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.
Plate V. Slender Wheatgrass and Its Relatives

FIG. 1—Typical A. trachycaulum, and typical also of Primar slender, a commercial variety.

FIG. 2—The type with awned lemmas, frequently referred to as A. subsecundum, but here thought part of the slender wheatgrass complex and named A. trachycaulum var. unilaterale.

FIG. 3—A. trachycaulum var. majus, characterized by its unawned and closely overlapping spikelets.

FIG. 4—A. trachycaulum var. majus f. andinum, again closely overlapping spikelets, but also with long and divergent awns on the lemmas.
Plate V (continued)

FIG. 5—A. trachycaulum var. latiglume, the plant with pubescent lemmas and conspicuously broad glumes.

Plate VI

FIG. 1—Agropyron spicatum (bluebunch wheatgrass) with strongly divergent awns.

FIG. 2—A. spicatum f. inerme (awnless bluebunch wheatgrass) of frequent occurrence in all stands of bluebunch wheatgrass in Wyoming.
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. (Plate V, Fig. 2.)

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

8. *Agropyron trachycaulum* var. *unilaterale* f. *andinum* (Scribn. & Smith)

**Beetle.**

**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. (Plate V, Fig. 4.)

One of the alpine forms of slender wheatgrass, mistakenly labeled *A. trachycaulum* var. *violaceum*, a name which does not have botanical standing, has been reported good for high elevation seedings (cf. Jour. Range Management 6:242,1953). This report is interesting because it suggests untapped potentialities within the species.

8. *Agropyron trachycaulum* var. *litiglume* (Scribn. & Smith)

**Beetle.**

**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. (Plate V, Fig. 5.)

An arctic entity, extending southward in the Rocky Mountains, where rare. Wyoming localities include Medicine Wheel in the Big Horn Mountains, Green River Lake in the Windriver Mountains, and Clay Butte in Park County. The only Colorado locality known is in Lake County at 12,000 ft.

9. *Agropyron spicatum* (Pursh) Scribn. & Smith

**Bluebunch Wheatgrass**

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 in-
distinct, glabrous or scaberulous. the awn strongly divergent. (Plate VI. Fig. 1.)

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 grown 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 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 seedstalks 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 that 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 \textit{A. spicatum} as the lightly grazed pasture, and this species decreased 45 percent under heavy grazing.


\textbf{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 $\frac{1}{2}$ length of spikelet; lemmas ca. 10 mm. long, faintly nerved, acute to awn-tipped. (Plate VI, Fig. 2.)

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

10. \textit{Agropyron elongatum} Host.

\textbf{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. (Plate III, Fig. 1.)

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 wheatgrasses: namely, their hardiness and drought resistance (together with 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 ft. elevation, even though the plant will survive. Seed setting is uncertain above 6,000 ft. 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 3-4 lbs. 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 gets mixed with the seed.

Seed is often produced at a rate of 400 lbs. cleaned or more to an acre under average conditions. 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 lbs. and contains 79,000 per pound. There is good regrowth after seed harvest.


Scribner Wheatgrass

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. (Plate VII, Fig. 1.)

High montane, Montana to New Mexico, Nevada, and Arizona; common above treeline in Wyoming.


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; glume 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. (Plate VII, Fig. 2.)

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

Except for the very distinct *A. scribneri* the specimens of *Agropyron* which have awned glumes have long caused taxonomic confusion in herbaria. The cause now seems clear. They represent hybrids between various types of *Agropyron* (usually *A. trachycaulum*) and various types of *Sitanion* (usually *S. hystrix*). The hybrid specimens are intermediate and partially sterile. They are most easily recognized by the awned glumes and the tardily disarticulating rachis. It is probable that the little known *A. bakeri* (Baker’s wheatgrass) and *A. saundersii* (Saunders’s wheatgrass) represent similar hybrids.

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-marginined, and short-awned; lemmas 4-6 mm. long, mucronate, often ciliate. (Plate VIII, Figs. 1 and 3.)

Commonly established in Wyoming, best adapted above 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 1 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. 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 104. Most plantings of these commercial strains are mixtures of *A. cristatum* and *A. desertorum*.

14. *Agropyron desertorum* (Fisch.) Schult. Desert 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 below 6,000 ft.; a native of Russia. (Plate VIII, Figs. 2 and 3.)

Nordan crested wheatgrass, recently released by the North Dakota Agricultural Experiment Station, is classified under this species and is "similar in general appearance to commercial Standard but is quite different in a number of characteristics that make it superior to commercial Standard. Plants are more erect in habit of growth."

The Annuals

The annuals, in growth form and general appearance, strongly resemble the tufted perennials of the section Eu-Agropyron, which includes crested wheatgrass. In addition to their annual nature they are distinguished as a group by their hard glumes and (so far) by their lack of crossability. The annuals, all of which are known in the United States, although only *A. triticeum* is listed in Hitchcock's Manual, may be keyed as follows:

- Lemmas conspicuously awned: *A. orientale*
- Lemmas not awned
  - Glumes longer than the lemmas: *A. buonapartis*
  - Glumes shorter than the lemmas: *A. triticeum*

According to Hitchcock (1920) "The Genera of the Grasses of the United States," U. S. Dept. of Agric. Bul, 722: p. 37, the type species for *Agropyron* Gaertn. is *Agropyron triticeum* Gaertn. He says "Gaertn. describes two species, *A. cristatum*, based on *Bromus cristatus* L., and a new species, *A. triticeum*. The second species is figured." Hitchcock's choice of the second species seems wholly arbitrary and very upsetting to the nomenclature of the Hordeae. This author prefers to follow European botanists in the recognition of *A. cristatum* (L.) Gaertn. as the type species. The type species of *Eremopyrum* is *E. orientale* (L.) Jaub. & Spach. There
FIG. 1—Spike of *Agropyron cristatum* showing broad head and strongly reflexed spikelets.

FIG. 2—Spike of *Agropyron desertorum* showing narrow head and less strongly reflexed spikelets.

FIG. 3—Spikelets of *Agropyron cristatum* (left) showing twisted glumes, and of *A. desertorum* (right) showing normal glumes.
seems to be at least as much justification for treating the annual species of Agropyron as Eremopyrum as there is to treat the annual fescues as Vulpia.  

*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.
Bibliography


-24-