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Introduced Forage Grasses for Nebraska

F. D. Keim

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JANUARY 1955

CIRCULAR 95

*Introduced
Forage Grasses
for Nebraska*

The Experiment Station, University of Nebraska College of Agriculture
W. V. Lambert, Director; M. L. Baker, Associate Director

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¹ The grass family, *Gramineae*, consists of 14 tribes. Five of these tribes are represented by grass species introduced into Nebraska from other parts of the world.

DEFINITION OF BOTANICAL TERMS

- AWN**—A protruding midrib of a glume or lemma, forming a beard or bristle.
- BLADE**—That part of the grass leaf which is expanded.
- BRACT**—A reduced or modified leaf.
- COLLAR**—The junction between the leaf blade and sheath.
- CULM**—The jointed, usually hollow stem of grasses.
- FLORET**—A grass flower with two bracts or glumes normally surrounding the reproductive organs.
- INFLORESCENCE**—Part of the plant which bears the flowers or reproductive organs.
- LEMMA**—The lower (outermost) of the two bracts which enclose the grass flower.
- LIGULE**—A small structure, either hairy or membranous, located on the inner side of the junction of the leaf blade and the sheath.
- OUTER GLUMES**—The two outer bracts which usually enclose the grass spikelet.
- PALEA**—The upper (innermost) of the two bracts which enclose the grass flower.
- PANICLE**—The inflorescence of a grass arranged into a loose head, with the spikelets borne on branches.
- PERENNIAL**—Plants that normally live more than two years.
- RACHILLA**—The central stalk of a spikelet which bears the florets.
- RACHIS**—The extended portion of the stem, bearing the floral parts.
- RHIZOME**—Any prostrate underground stem commonly rooting and sending up new shoots at the nodes or tips.
- SHEATH**—The part of the grass leaf which envelopes the stem.
- SPIKE**—The inflorescence of a grass arranged into a compact head, with the spikelets attached directly to the rachis.
- SPIKELET**—A unit of the grass inflorescence consisting of one or more florets enclosed by two outer glumes.

Introduced Forage Grasses for Nebraska

F. D. KEIM and L. C. NEWELL²

Interest in grassland agriculture has reached an all-time high in Nebraska. Approximately 58 per cent or about 29,000,000 acres of the land area of the state is occupied by permanent pasture or range grasses. Grasses are playing an ever increasing role in the development of successful soil conservation practices. The value of grass vegetation in crop rotations, the part it plays in dealing with grain surpluses and the relatively low-cost animal gains obtained from pasture and range all add to the importance of grassland farming.

In addition to their use for soil conservation and feed purposes, grasses are now being grown as cash crops. The development of grass seed production has grown rapidly in the past ten years. For instance, Nebraska leads other states in brome grass seed production and is one of the foremost states in production of Kentucky bluegrass seed. Most of the grasses grown for seed were introduced from other lands.

The perennial grasses that have been introduced into the state vary greatly in importance and description. For example, compare the common and easily identified Kentucky bluegrass and brome grass with the relatively uncommon reed canarygrass. Many of the grasses described in this circular are adapted mainly to the eastern part of Nebraska or to the irrigated and subirrigated valleys, but a few, such as the wheatgrasses, are grown extensively in low rainfall areas. All are cool-season grasses.

This circular presents illustrations, descriptions and recommended usage of fourteen introduced cultivated grasses that are worthy of practical consideration in Nebraska. Most of them can easily be identified by comparing plant specimens with the illustrations and descriptions.

This circular has been prepared for use by farmers, county agricultural agents, teachers and others who are interested in our most important grasses. Station Circular 59 contains information and illustrations of the more common native perennial grasses of Nebraska.

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SMOOTH BROMEGRASS

Bromus inermis Leyss.

Smooth bromegrass is an erect, leafy, sod-forming perennial which propagates by seed or rhizomes. It grows 2 to 4 feet tall and has more or less open panicles with green or purplish spikelets which turn brown to tan at maturity. The large spikelets contain 5 to 10 florets. Its closed leaf sheaths are prominently veined, sometimes with hairs, and are tissue-like when dry; the leaves have short membranous ligules.

Native to northern and central Europe, bromegrass was first introduced into the United States in 1884. Because of its cold and drought resistance, bromegrass is used more commonly for pasture, particularly in eastern and central Nebraska, than any of the other introduced grasses. It is harvested for hay and seed, a common practice being to cut off the seed heads at a height of 12 to 15 inches and then utilize the vegetative growth either for pasture or hay. Bromegrass seed is a profitable cash crop, with yields commonly ranging from 200 to 500 pounds per acre. The seed is usually harvested with a combine. Directions for combine-harvest should be followed closely, with the air blast of the combine cut down to a minimum.

Highly productive adapted strains such as Lincoln, Lancaster, Lyon or Achenbach should be planted. Bromegrass plants resume growth early in the spring and furnish fair quantities of feed during the summer. The forage is palatable and reasonably nutritious, especially in the spring and fall. Yields of forage and seed usually decrease as the stand of grass becomes older. Investigations have shown that this so-called sod-bound condition results from lack of fertility. Planting legumes with the grass will delay this effect and annual applications of commercial nitrogen fertilizer and/or manure (60 pounds of nitrogen per acre) will increase yields. Tillage such as grooving or furrowing the sod is of some value in increasing water intake.

The legal weight of bromegrass seed is 14 pounds to the bushel and there are approximately 175,000 seeds to the pound. Recleaned seed of good quality should exceed 85 per cent purity and 90 per cent germination. Bromegrass is difficult to plant because its seed is light and chaffy. Broadcasting with a lime or fertilizer spreader mounted over a treader and followed by thorough packing is a satisfactory method. If the seed is constantly stirred in the drill box with an agitator or by hand, bromegrass can be seeded with a grain drill. The seed should be planted at a depth of $\frac{1}{2}$ to $\frac{3}{4}$ inch and at a rate of about 15 pounds per acre. Bromegrass is one of the most frequently used grasses in pasture mixtures; 12 pounds of bromegrass seed and 4 pounds of alfalfa is one of the most popular. Bromegrass should be planted during the cool seasons of the year. If planted in the spring, it should be seeded early to avoid the competition of summer annual weeds. For fall establishment, August 20 to September 10 is a satisfactory range of planting dates.



Smooth bromegrass. 1, entire plant, shown $\frac{1}{2}$ actual size; 2, seed (x 4); 3, collar area (x 3); 4, closed spikelet (x 3); 5, open spikelet (x 3).

ORCHARDGRASS

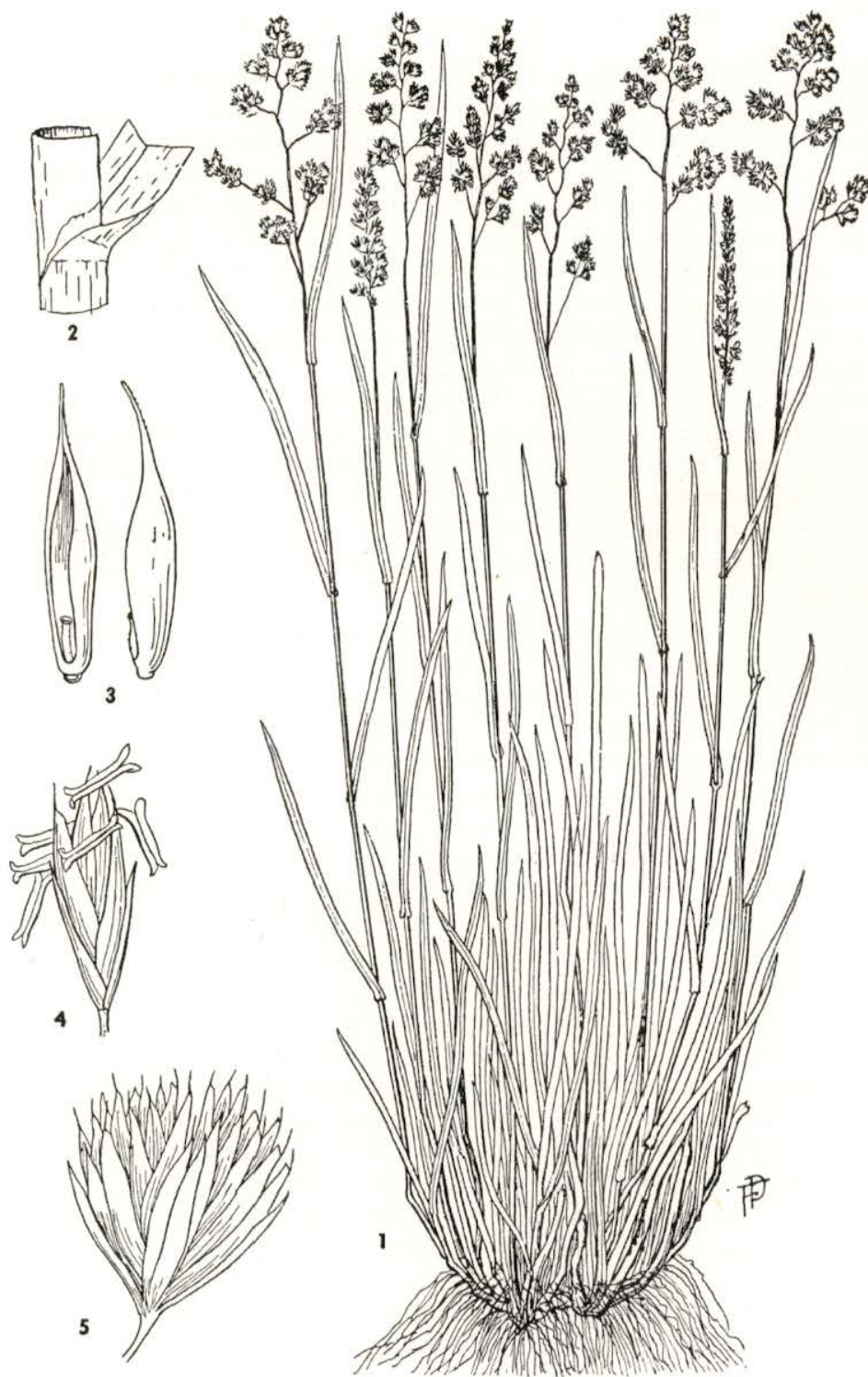
Dactylis glomerata L.

Orchardgrass is a long-lived perennial bunchgrass. It forms an irregular sod of tufted shoots held together by short rhizomes. Although individual plants do not make much spread, orchardgrass reproduces readily by seed. The leaf blades are folded and the leaf sheaths are compressed. Vegetative growth is light green. Orchardgrass has a panicle type of inflorescence with the spikelets in compact groups so that the panicle appears as a dense mass of flower clusters. The individual spikelets consist of 5 to 8 florets each. This grass withstands considerable shade, hence its name. In Europe, orchardgrass is commonly called cocksfoot because of the shape of the inflorescence.

Orchardgrass has been a relatively unimportant grass in Nebraska. It has been included in many pasture mixtures with the result that it is found in midwestern pastures but seldom west of the three eastern tiers of counties in Nebraska and then only where moisture conditions are favorable. It has escaped from cultivation in some instances and occurs occasionally along roadsides, in waste places and woodlands. Superior performing varieties are becoming available and the selection of hardy adapted strains for Nebraska is a good possibility.

Orchardgrass starts growth early in the spring and its characteristic regrowth after being grazed makes it especially valuable in pasture mixtures. Since it is a bunchgrass it should be used with sod-forming grasses such as brome grass or Kentucky bluegrass. It can be recommended for permanent pasture mixtures for the eastern fourth of Nebraska, but it should not comprise more than 25 per cent of a general pasture mixture. In favorable locations and especially under irrigation a mixture of orchardgrass and ladino clover has much promise. Because of its tolerance to shade, orchardgrass is the best grass to use in open wooded areas. It is not as palatable as many other grasses and may be lower in quality.

The seed of orchardgrass weighs 14 pounds to the bushel, and there are approximately 450,000 seeds to the pound. If seeded alone, a rate of 15 pounds of seed to the acre is recommended, while 4 to 6 pounds is ample in pasture mixtures. The short awn attached to the seed has a peculiar twist, a character which makes it easily identified. Orchardgrass mixes well with other seeds and can be seeded in mixtures with a drill. It responds to spring seeding, but to avoid the competition of summer annual weeds it should be seeded not much later than April 1. If late summer planting for fall establishment is desired, orchardgrass should be seeded on a moist fertile seedbed any time from August 15 to September 10. If moisture is available, orchardgrass, like most of the other cool-season grasses, becomes better established at the earlier dates.



Orchardgrass. 1, entire plant, shown $\frac{1}{2}$ actual size; 2, collar area (x 3); 3, seed (x 6); 4, spikelet (x 3); 5, cluster of spikelets (x 3).

MEADOW FESCUE

Festuca elatior L.

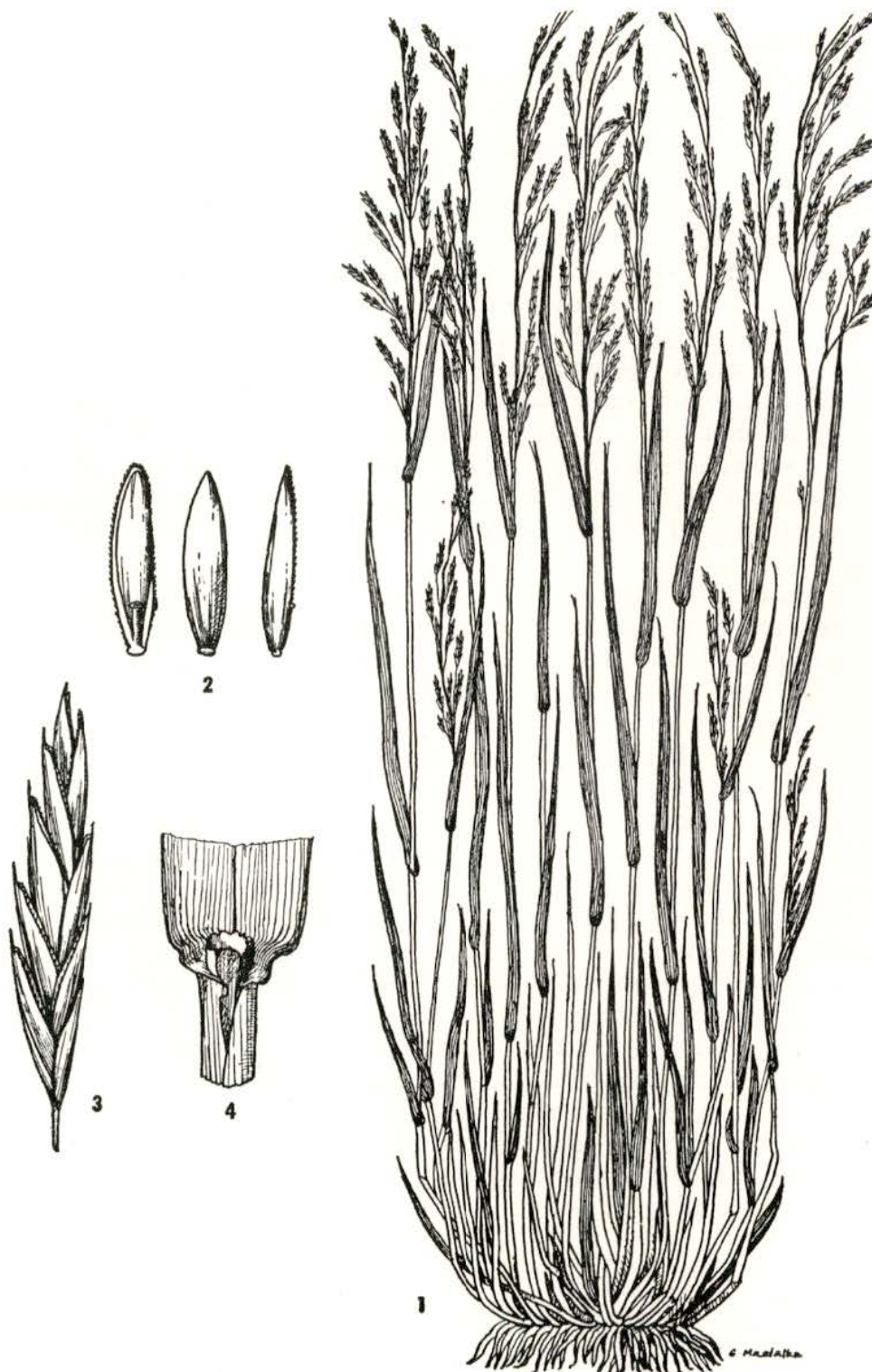
Meadow fescue, also called English bluegrass, is a perennial which lives three to five years under average Nebraska conditions. It usually grows 1 to 3 feet tall. Although it does not propagate by rhizomes, meadow fescue forms a smooth sod, being superior in this respect to orchardgrass. The plant has bright green leaves. The leaf sheaths are smooth and reddish purple at the base and the leaf blade is glossy on the upper surface. The inflorescence is characterized by an open type of panicle, with the spikelets usually containing six to eight florets. The glumes are awnless. This grass commonly matures seed during late June and early July.

Meadow fescue has a limited distribution in Nebraska. The seed was introduced into Kansas from England about 1880. Eastern Kansas and the surrounding area has produced much of the seed of meadow fescue grown in the United States. It has been re-introduced largely through the seeding of permanent pasture and lawn mixtures. Occasionally it has escaped from cultivation and it may be found along roadsides and in waste places. This grass has been confined almost entirely to the eastern third of the state.

Meadow fescue is reasonably tolerant to high temperatures and drought, but is not well adapted to extremely cold weather. It thrives best on fertile, moist soils, and is not well adapted to sandy or thin upland soils. It grows fairly well in shaded areas, but not as well as orchardgrass. Meadow fescue grows rapidly after planting. It starts growth early in the spring and grows late in the fall, but languishes during dry weather.

Meadow fescue provides succulent pasture and the hay is of fairly good quality. It is not generally recommended for hay in Nebraska because of its inferior yield in comparison with other grasses. Meadow fescue may be used advantageously in mixtures. It takes rapid possession in the mixture and furnishes early feed while the longer-lived but slower starting grasses are becoming established. It may also be used in turf mixtures to provide an early ground cover. This helps to subdue weeds and improves the appearance of the turf while the slower growing, fine-leaved grasses, such as the bluegrasses and others, are becoming established. Usually not over 15 per cent of the mixture should consist of meadow fescue.

The seed weighs 24 pounds to the bushel and there are approximately 230,000 seeds in a pound. The seed has a rounded rachilla joint with a slight rim around the tip, in contrast to the rachilla of perennial rye which is flat and has a blunt end. It should be seeded at the rate of 20 pounds to the acre and 4 to 5 pounds per acre in pasture mixtures. Like all cool-season grasses, the best time for seeding is early spring or early fall. Being only moderately tolerant of cold, meadow fescue responds well to spring seeding. March 25 to April 15 are satisfactory dates in Nebraska. If enough moisture is available, meadow fescue may be planted alone or in mixtures during the last half of August.



Meadow fescue. 1, entire plant, shown $\frac{1}{4}$ actual size; 2, seed (x 4); 3, spikelet (x 3); 4, ligule area (x 4).

TALL FESCUE

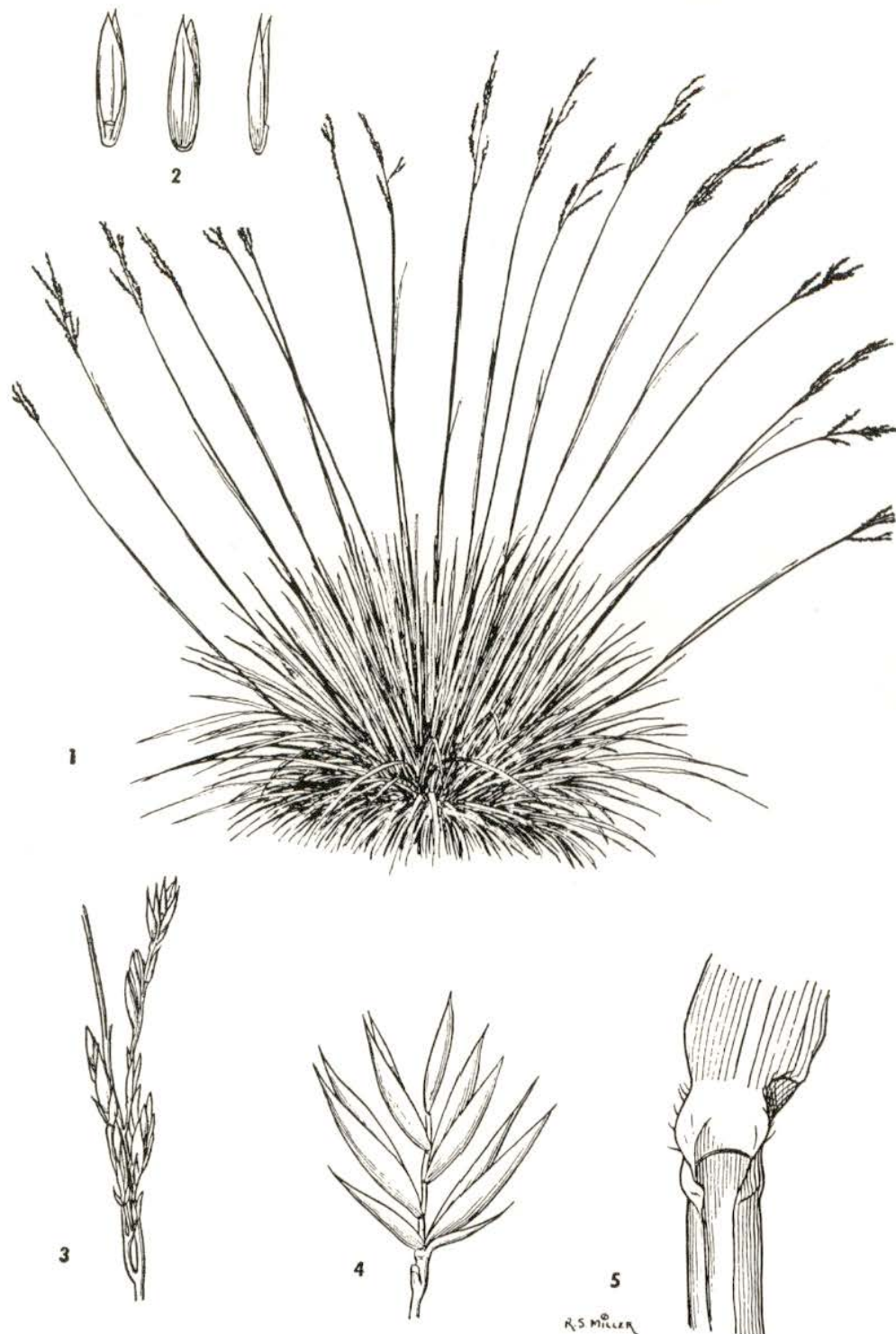
Festuca arundinacea Schreb.

Tall fescue is a deeply rooted, tufted perennial which grows 3 to 4 feet high. The stems are erect, rather coarse, and smooth. The typical nodding panicle is 4 to 12 inches long and has long, narrow spikelets that are $\frac{1}{2}$ inch or more in length, containing numerous florets. Tall fescue grows taller and has broader, more prominently veined and coarser leaves than meadow fescue. Its leaf differs in having a few hairs on the margin of the collar. Meadow fescue has brighter, glossy green foliage. Like meadow fescue, tall fescue matures seed during late June and July.

Tall fescue was introduced from Europe, probably during the 1880's or about the same time as meadow fescue. It is not yet common in Nebraska. It appears to have a wider range of adaptation than meadow fescue, but its pasture and forage value need further study for Nebraska conditions. It is adapted to rather wet, deep valley soils, and it may have a place on sloping, shallow, low fertility lands of southeastern Nebraska. It shows some promise for subirrigated or irrigated lands which tend to be alkaline, but it is not adapted to the drier upland soils of central and western Nebraska.

Two strains of tall fescue, Alta and Kentucky 31, have been developed and widely tested by experiment stations in the United States. Alta fescue is a selection made in Oregon in 1923 from a four-year-old stand of tall fescue. Kentucky 31 is an increase from tall fescue found in 1931 on a Kentucky farm where it was thought to have been growing for about 50 years. From the data available it appears that Alta and Kentucky 31 fescues will largely supplant meadow fescue, since both of these strains are hardy, disease resistant, and productive. Kentucky 31 is grown extensively in the southern states. Large amounts of Alta fescue seed are produced in Oregon and the seed is in plentiful supply. The tall fescue varieties are aggressive but less drought resistant and less palatable than brome grass or intermediate wheatgrass.

Recommendations on the time, rate, and methods of seeding for tall fescue are the same as for meadow fescue. The seed weighs 22 to 27 pounds per bushel, depending on quality. A pound of seed contains approximately 230,000 seeds. Kentucky 31 and Alta fescues are usually grown in pure stands for the purpose of harvesting a seed crop and to provide the best management for grazing. The tall fescues can be grown in mixtures with other grasses and legumes but their relatively low palatability will affect the uniformity of the mixture.



Tall fescue. 1, entire plant, shown $\frac{1}{9}$ actual size; 2, seed (x 3); 3, section of panicle (x $1\frac{1}{3}$); 4, spikelet (x 4); 5, ligule area (x 4).

KENTUCKY BLUEGRASS

Poa pratensis L.

Kentucky bluegrass is a perennial that forms a dense sod and grows 6 inches to 2 feet tall under natural conditions. It has a panicle-type inflorescence with spikelets that contain three to five florets. The lemmas within a spikelet are copiously webbed at the base, which causes difficulty in threshing and cleaning. The leaf blades are V-shaped in cross section, the tips resembling the bow of a boat. This grass reproduces readily by seed and vegetatively by creeping underground stems. The latter method enables bluegrass to spread rapidly if it is not handicapped too severely by close clipping or competition of other vegetation.

Kentucky bluegrass ranks second to brome grass in distribution among the cultivated grasses in the state. Many eastern Nebraska pastures have consisted almost entirely of bluegrass. The prolonged drought of the thirties destroyed the bluegrass in most pastures, but it has become re-established with favorable weather. As a constituent in pastures, bluegrass is very palatable to livestock and furnishes considerable quantities of feed during the spring and fall. Bluegrass as a pasture plant lapses in growth during dry, hot seasons. It is not generally seeded alone, but may be recommended as a component in permanent pasture mixtures.

The native bluestem pastures and hay meadows in the eastern half of the state have been invaded with bluegrass. Its natural invasion of prairie hay meadows in the Elkhorn River valley and other Sandhill valleys of north central Nebraska has lowered the yield and quality of the hay, because of the early maturity of the bluegrass. The loss in hay has been partially compensated by the value of the Kentucky bluegrass seed crop.

The seed yield from these invaded meadows has made Nebraska one of the most important Kentucky bluegrass seed producing regions of the world. The seed is especially difficult to harvest with ordinary farm equipment, so a bluegrass stripper is used. It consists of a large cylinder with teeth which strips the heads from the plants and throws them onto a platform. The stripped heads are cured in ricks for two or three weeks and then are shipped to seed houses which have special processing equipment for threshing and cleaning the seed.

The legal weight of the seed is 14 pounds to the bushel, but it weighs 20 pounds when carefully processed. A pound of seed contains approximately 2,200,000 seeds. It is generally seeded at the rate of 20 to 30 pounds per acre alone, 1 to 3 pounds per acre in pasture mixtures, and 1 to not more than 2 pounds per 1000 square feet in lawns. Kentucky bluegrass is the principal grass used for seeding or sodding lawns throughout the state where supplemental water is available. It should be seeded on a well compacted seedbed between August 15 and September 15 or in very early spring and kept watered until the bluegrass is at least 2 inches high. Bluegrass lawns should be watered judiciously and fertilizer applied in late fall or in early spring to provide adequate growth and to help in controlling annual weeds.



Kentucky bluegrass. 1, entire plant, shown $\frac{1}{2}$ actual size; 2, spikelets (x 3); 3, seed (x 7); 4, open spikelet and floret (x 3); 5, collar area of leaf (x 3).

CANADA BLUEGRASS

Poa compressa L.

Canada bluegrass closely resembles Kentucky bluegrass. It grows 6 to 12 inches tall, is a perennial and reproduces by both creeping rhizomes and seed. Its foliage is dark blue-green and the inflorescence is a panicle. It is distinguished from Kentucky bluegrass by its shorter growth, darker and bluish green foliage, compressed instead of rounded stems, and the smaller, more compact panicles.

Canada bluegrass is not so generally distributed over the state as is Kentucky bluegrass. It occurs rather commonly but usually in small patches in lawns, pastures, native hay meadows, and waste areas. It has been introduced in some instances as an unrecognized seed in lawn grass mixtures and in other cases it is intentionally seeded because of its superiority to Kentucky bluegrass under dry or adverse conditions.

This grass is comparable to Kentucky bluegrass in adaptability. It thrives somewhat better on heavy clay and thin soils and is considered more tolerant to acid, low phosphate, low nitrogen and other nutrient deficient soils. It is generally a little better adapted as a lawn grass for the less favorable conditions. Even then the use of Canada bluegrass as a lawn grass is limited except in areas with favorable moisture relations. This grass is inferior either as a pasture or lawn grass where Kentucky bluegrass grows successfully. It matures later than Kentucky bluegrass and when grazed off makes little recovery during the remainder of the season.

Canada bluegrass is recommended only for lawns or golf-course fairways where Kentucky bluegrass does not thrive well. It must be used judiciously for it is but slightly more tolerant to dry conditions. It may be seeded alone or in a mixture with Kentucky bluegrass and other lawn grasses.

The seed weighs 14 pounds to the bushel but with special cleaning operations it can be made to weigh 20 pounds. A pound of seed contains approximately 2,400,000 seeds. It should be seeded at the rate of 1 to 2 pounds per 1000 square feet if alone and should comprise 20 to 50 per cent of the mixture when seeded with Kentucky bluegrass.

Time and method of seeding are about the same as for Kentucky bluegrass



Canada bluegrass. 1, entire plant, shown $\frac{1}{2}$ actual size; 2, seed (x 7); 3, closed spikelet (x 6); 4, open spikelet (x 6); 5, ligule area of leaf (x 6); 6, collar area of leaf (x 3).

CRESTED WHEATGRASS

Agropyron desertorum (Fisch.) Schult.

Standard crested wheatgrass is a hardy perennial bunchgrass which develops into an open sod. The plants attain a height of 1 to 3 feet, and the stems are fine and erect. The inflorescence is a spike 2 to 3½ inches long and less than ½ inch wide, with the spikelets compressed, giving the spike a flat appearance. The spikelets contain several florets with or without short awns.

Crested wheatgrass was introduced from the dry plains of Russian Turkestan to the Northern Great Plains of the United States in 1898. Because of its outstanding resistance to cold, dry conditions it is well adapted in Montana and the Dakotas. It is now commonly grown also in the northern and western parts of Nebraska. It yields only about three fourths as much forage as brome grass where conditions favor the larger grass.

Crested wheatgrass offers its greatest promise as a pasture crop, but it will also produce satisfactory hay. It begins growth in early spring but does not grow much during the long, hot, dry periods of summer. Crested wheatgrass is palatable when in the green vegetative stage of growth and produces high quality hay and forage where it is adapted.

A supply of crested wheatgrass seed is usually available. It is one of the best grasses to use in revegetation of land that has been abandoned from crop production in the cold, dry areas of the Northern Great Plains. A new variety, Nordan, produced at the Northern Great Plains Field Station, Mandan, North Dakota, is recommended for this area.

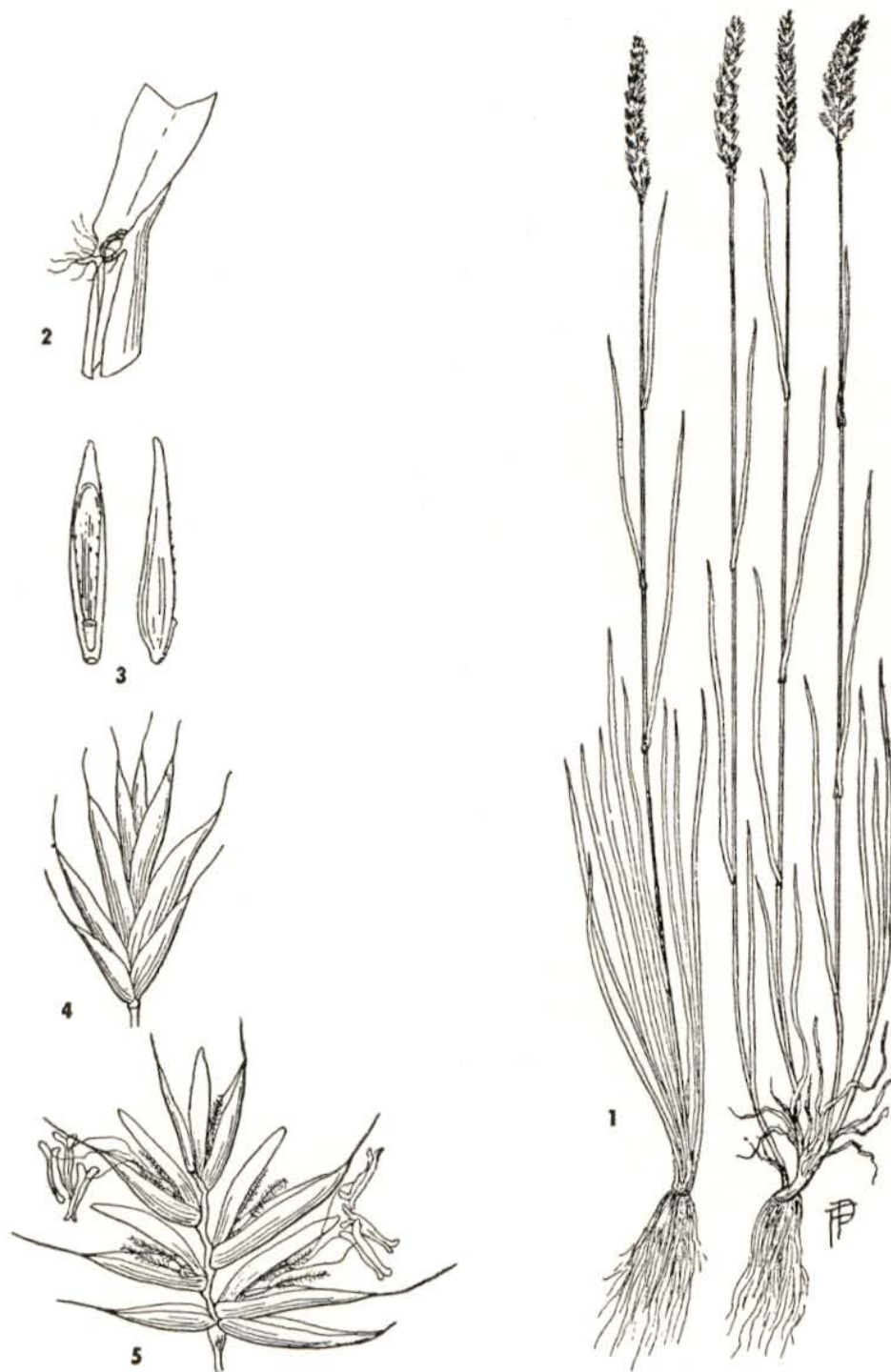
Under favorable conditions crested wheatgrass usually produces a profitable seed crop. Seed yields range from 100 to 300 pounds per acre. The ordinary combine with proper screen and air adjustments may be used for threshing the seed. As with many other light, threshed grass seeds, it may be necessary to use the hammermill and fanning mill to break up the spikelet clusters and clean out the dirt, chaff, broken straw and other foreign material. There are approximately 190,000 seeds per pound, and a bushel of high class seed of standard type weighs 24 to 26 pounds.

It should be planted on a firm seedbed at the rate of 8 to 10 pounds of seed per acre. If seeded in rows for seed production, seeding rates can be reduced 2 to 4 pounds per acre. Early spring seeding or winter seeding for spring germination with wind erosion controlled by residues is recommended in the High Plains. Fall establishment is more successful in other parts of Nebraska.

Agropyron cristatum (L.) Gaertn.

Crested wheatgrass of the Fairway type has more widely spreading spikes, 1 to 3 inches long, with the glumes gradually tapering into curved awns. It is found mixed with the standard type in commercial crested wheatgrass seed. The variety Fairway was selected in Canada where it is most commonly grown.

Fairway has smaller seeds than the Standard type, with a lower test weight (about 22 pounds per bushel). It is more desirable for turf plantings in Nebraska than for grazing and hay.



Crested wheatgrass. 1, entire plant, shown $\frac{1}{4}$ actual size; 2, collar area (x 3); 3, seed (x 3); 4, closed spikelet (x 3); 5, open spikelet (x 3).

INTERMEDIATE WHEATGRASS

Agropyron intermedium (Host) Beauv.

Intermediate wheatgrass is a tall, somewhat coarse, tufted grass, blue-green to green, which spreads to solid stands by means of slender rhizomes. It exceeds 3 feet in height, the culms bearing rather large robust spikes. The spikelets contain 6 to 8 florets which are arranged close to the rachis, the glumes being awnless. The palea is edged with regular, coarse hairs. Most of the intermediate wheatgrass in the United States is derived from P. I. 98568, obtained at Maikop, Caucasus, U.S.S.R. by the U. S. Department of Agriculture in 1932.

This grass is considered a valuable pasture, hay, and conservation crop in Nebraska. Its tough roots and rhizomes make it desirable for waterway seedings. It begins growth early in the spring and may have a more prolonged early summer growth than smooth brome. Like the other cool-season grasses, it lags in growth in midsummer but usually makes abundant growth again in the fall if moisture is available. It is considered more productive in dry weather than brome grass but less winter hardy and drought resistant than crested wheatgrass. The range of adaptation to soil conditions is similar to that of brome grass but it may be grown in somewhat drier regions. It is not adapted to wet, salty, or alkali soils.

Nebraska 50 is a selection that combines the excellent seed character, seedling vigor, and ease of establishment of common intermediate wheatgrass with an improved uniformity of plant color and good seed and forage quality. Ree wheatgrass is a variety produced in South Dakota.

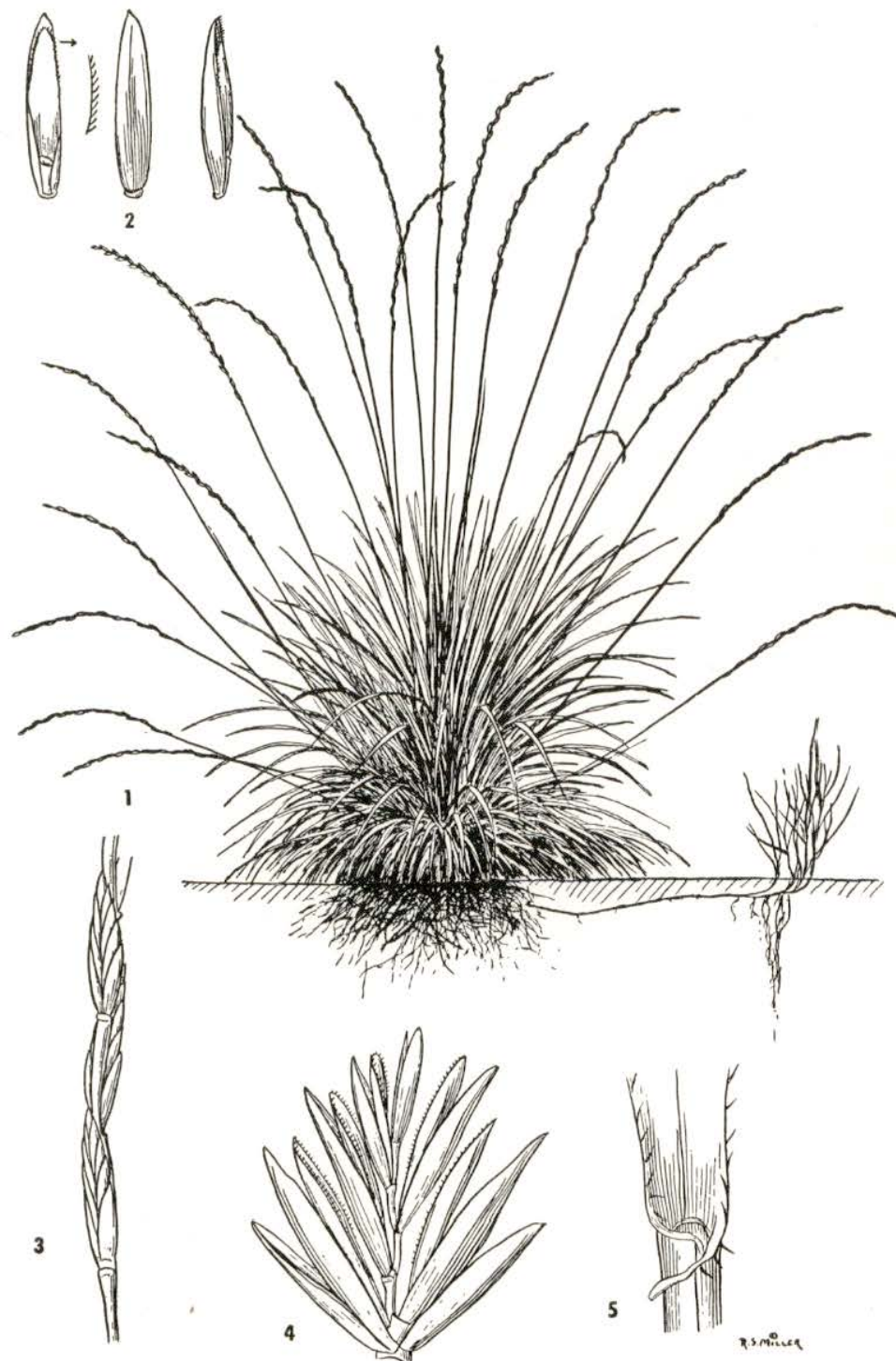
Seed of intermediate wheatgrass is usually available in commercial quantities. Its production is dependable for several years from stands grown in cultivated rows on fertile soils. Yields may range from 200 to 400 pounds per acre. Low fertility caused by limited nitrogen availability or failure to keep the rows from spreading together will greatly limit seed yields.

Intermediate wheatgrass is easily sown with an ordinary grain drill, different spacings being obtained by using different numbers of the grain spouts. It may be planted deeper than smaller seeded grasses. If planted in rows for seed production or in mixtures, 5 to 6 pounds per acre is adequate, whereas 10 to 14 pounds should be used if planted alone. The seed weighs 20 to 22 pounds per bushel; if reasonably clean, there are approximately 90,000 per pound. Early September is the best time for planting in eastern Nebraska but seeding should be somewhat earlier in the west.

PUBESCENT WHEATGRASS

Agropyron trichophorum (Link) Richt.

This grass is similar in growth habit and general appearance to intermediate wheatgrass with which it intercrosses. It has conspicuously downy or pubescent glumes. Pubescent wheatgrass is adapted to soils of lower fertility and to more droughty conditions than is intermediate wheatgrass.



Intermediate wheatgrass. 1, entire plant, shown 1/12 actual size; 2, seed (x 2); 3, section of spike (x 1); 4, spikelet (x 2); 5, ligule area (x 4).

TALL WHEATGRASS

Agropyron elongatum (Host) Beauv.

Tall wheatgrass is an erect, very coarse, perennial bunchgrass. Its leaves are deeply ridged on the upper surface, allowing leaf rolling under drought conditions. The plants do not spread by means of rhizomes and the stems are more erect and coarse than those of intermediate wheatgrass. The seed is borne on coarse spikes, the lower internodes of which are usually elongated. The spikelets contain 6 to 8 florets which are arranged close to the rachis internodes. The glumes are awnless and the palea of each floret is edged with irregular fine, short hairs or bristles.

This cool-season grass starts growth early in the spring. It is later maturing than bromegrass or the other wheatgrasses. Like many of the cool-season grasses it also makes a good growth in the fall, and it produces large total yields.

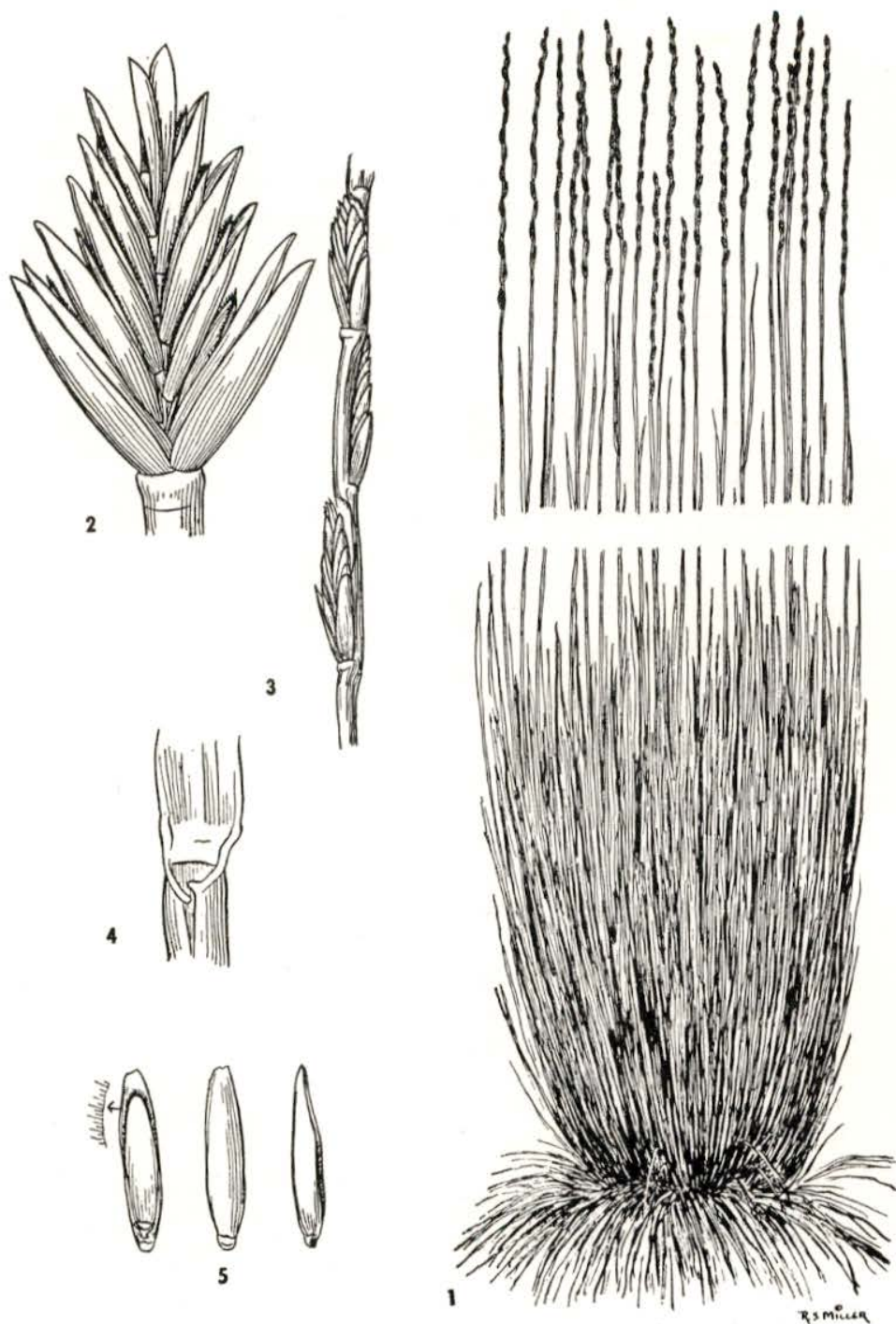
Tall wheatgrass is native to the saline meadows and along the seashores of southern Europe and Asia Minor. It will grow in a wide range of soil conditions and climates. It withstands flooding, grows under seepy conditions along irrigation ditches, and tolerates a water table that approaches the surface of the soil. It is particularly adapted to wet, saline or alkali soils, and its chief use in the United States is for reclaiming such lands.

Plantings of tall wheatgrass in the United States are derived principally from two introductions made by the U.S. Department of Agriculture. Because of its cold tolerance, P. I. 98526 introduced from Russia in 1932 is used principally in the North Central States and the Pacific Northwest. P. I. 109452, more recently introduced from Turkey, is being grown in the southwestern and southern Intermountain States.

Tall wheatgrass produces good yields of large seed, which may be harvested with a combine and cleaned with an ordinary fanning mill. Purity and germination both exceeding 90 per cent are not uncommon. The seed weighs 18 to 22 pounds per bushel and there are approximately 80,000 per pound.

Seed may be handled easily in any kind of grain drill. If close-drilled, 12 to 15 pounds of seed should be planted per acre but if planted in rows, 4 to 5 pounds will suffice. Tall wheatgrass should be planted in late August or early September for fall establishment or it may be planted in early spring. A small seed crop may be produced in the first summer following establishment in the fall. The seedlings of tall wheatgrass become established slowly, so a well prepared, moist, weed-free seedbed is especially important.

The native slender wheatgrass may be confused with tall or intermediate wheatgrass. Its spikelet is characterized by outer glumes which exceed the length of the lower florets.



Tall wheatgrass. 1, entire plant, shown 1/7 actual size; 2, spikelet (x 3); 3, section of spike (x 1); 4, ligule area (x 3); 5, seed (x 2).

PERENNIAL RYEGRASS

Lolium perenne L.

Perennial ryegrass usually lives only two or three years in Nebraska. It is a bunchgrass and is propagated only by seeds. The plants normally attain a height of 1 to 2 feet. The leaves are distinctly glossy on the lower surface which gives this species a characteristic appearance, particularly noticeable while the plants are in the early vegetative stage. The inflorescence is a spike. This grass is easily identified since the spikelets are set edgewise to the central stem as contrasted with other species in which the usual position is an arrangement of the spikelets flatwise to the central stem. The spikelet has only one of the two outer glumes commonly present in other species of grasses.

Italian or domestic ryegrass, which is an annual, closely resembles perennial ryegrass. The seed of Italian ryegrass may easily be substituted for the latter. Commercial seed of either of these grasses frequently consists of a mixture of the two. The annual ryegrass is easily identified by the presence of awns on the seed, or on the spikelets of the mature plants, while perennial ryegrass is awnless. Italian ryegrass is similar in requirements and plant characteristics to perennial ryegrass, but since it is an annual and has no advantages, it is not generally recommended. It may be substituted when the seed is decidedly cheaper than that of perennial ryegrass.

Perennial ryegrass is of minor importance in Nebraska. Due to its limited adaptation and usage it has been seeded sparingly. Being inherently a short-lived perennial, ryegrass has even a shorter span of life in the severe environment of Nebraska than under more favorable conditions. It thrives best on fertile soils with ample moisture but does not do well on sandy soils, nor will it withstand hot, dry weather. Perennial ryegrass produces very palatable and nutritious forage, particularly as pasture, but it cannot be depended upon for large yields.

Perennial ryegrass is used extensively as a rapid starting grass in mixtures for lawns and fairways of golf courses. It takes rapid possession of the ground, and largely occupies the lawn while the slower bluegrass is becoming established. Ryegrass is similar to meadow fescue in its adaptability for lawns. It has some value as a short-lived grass in shady lawns where bluegrass has difficulty in surviving.

The seed weighs 24 pounds to the bushel. There are approximately 280,000 seeds to the pound. It is seeded at the rate of 20 to 25 pounds per acre alone, and 4 to 5 pounds in pasture mixtures. It should not exceed 20 per cent of the seed as a component in lawn mixtures. It should be seeded from the middle of August to September 15 for fall establishment or from April 1 to 15 in the spring.



Perennial ryegrass. 1, entire plant, shown $\frac{1}{4}$ actual size; 2, seed (x 4); 3, section of spike (x 1); 4, ligule area (x 3); 5, open spikelet (x 3).

TALL OATGRASS

Arrhenatherum elatius L.

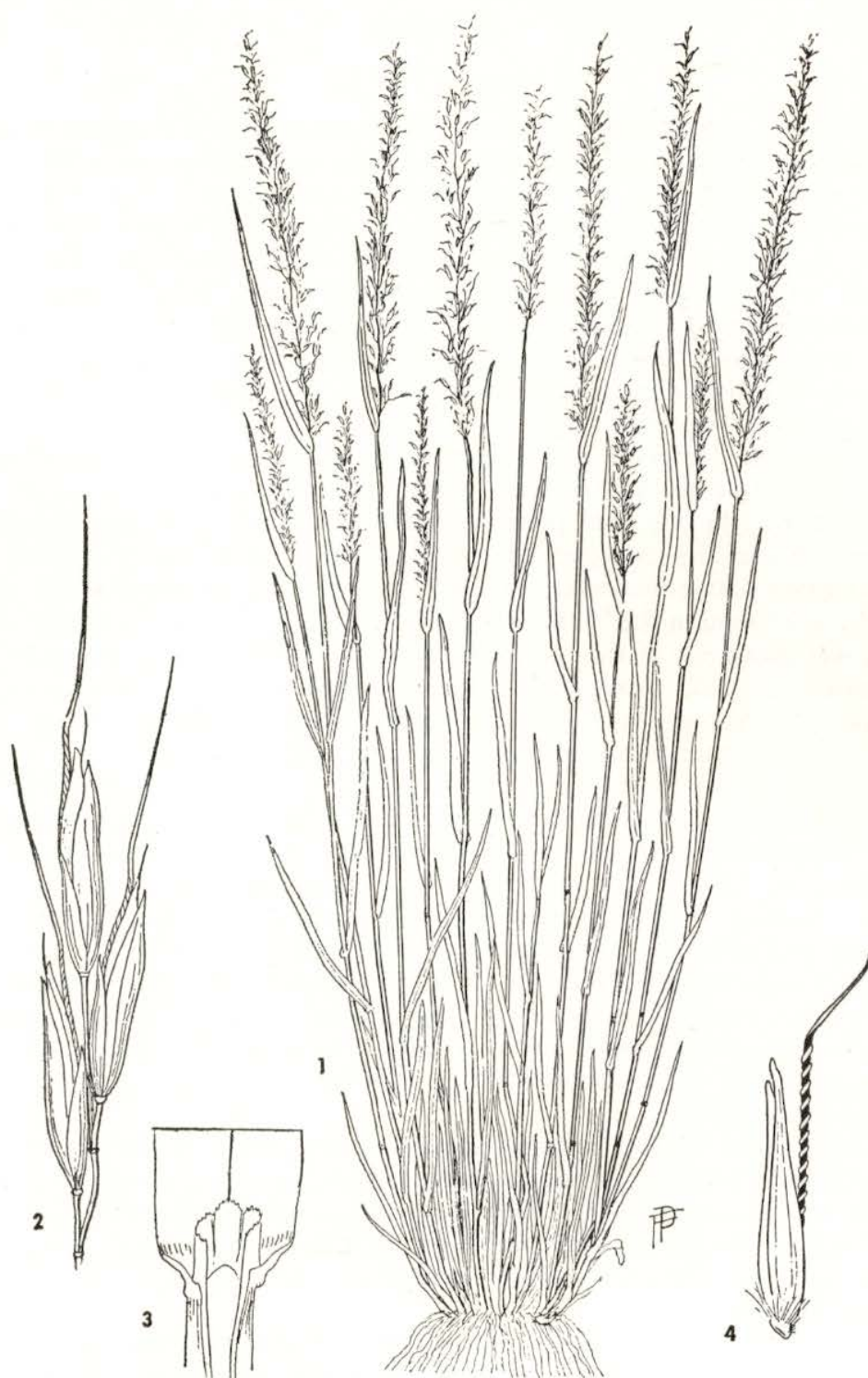
Tall oatgrass is a long-lived perennial that grows 2 to 5 feet high. It is a typical bunchgrass, producing large tufts. The seed is produced in large open panicles resembling those of common cultivated oats. The seeds and spikelets of oatgrass are only one half to two thirds as large as those of common oats. Each spikelet contains two florets; the upper is fertile and is enclosed within the lower one which may be sterile. This causes the spikelet to appear as having just one fertile floret. The prominent, twisted, bent awns furnish a good means of identification and give the inflorescence a bushy appearance.

This grass is of minor importance in Nebraska. It has been seeded infrequently and seldom escapes from cultivation, largely because it does not propagate vegetatively and seedlings are not established easily on untilled land. Oatgrass produces a fairly good yield of hay and pasture, but it is only of mediocre palatability and quality. It stands pasturing well and provides a rather long season of grazing.

Tall oatgrass is hardy and withstands drought and heat fairly well, but it is not adapted on the dry uplands of central and western Nebraska. It grows best on well-drained loam soils and seems to be especially well adapted to light sandy or gravelly land. It does not grow well in shade, where it rapidly disappears. It is inferior to brome grass in most respects. In the Pacific Northwest it is common practice to use a mixture of tall oatgrass and sweetclover for a short-rotation hay or pasture combination. Its most promising use is in pasture mixtures, particularly under irrigation, but this practice is not common in Nebraska because the seed is difficult to handle. It is difficult to purchase seed of this grass locally, which further discourages farmers from using it.

Oatgrass seed weighs 14 pounds to the bushel and there are approximately 150,000 seeds to the pound. The awns remain on the seeds after threshing and make seeding especially difficult. Sowing by hand or mixing with heavier seeds such as oats or barley are practical methods of seeding. When combined with heavier seeds, the mixture must be stirred frequently. Seed may be broadcast with a gravity-flow type fertilizer spreader.

Germination of tall oatgrass seed is usually rather low and viability declines rapidly with age. The seed is fairly large and chaffy. For these reasons 40 to 50 pounds of seed should be planted per acre at a depth of 1 to 1½ inches. Like most of the cool-season grasses, tall oatgrass may be seeded in either the early fall or the spring. It should not be seeded with a nurse crop because of competition and shading effects.



Tall oatgrass. 1, entire plant, shown $\frac{1}{2}$ actual size; 2, spikelets (x 3); 3, ligule area (x 3); 4, seed (x 3).

REDTOP

Agrostis alba L.

Redtop is a perennial that grows 2 to 3 feet tall. In the vegetative stage redtop and timothy appear similar, but the leaves of redtop are smaller and more rigid. The open, pyramidal, reddish panicle of redtop is particularly characteristic during the blossoming stage. The spikelets each contain one floret as do all the grasses belonging to the Agrostideae tribe. The plants spread vegetatively by creeping underground stems, which makes this a valuable species for erosion control. Redtop makes a rather coarse, loose turf and is commonly used in mixtures for lawns and for fairways of golf courses. Because of its broad adaptation it is spread throughout the cooler parts of North America.

Redtop in Nebraska has usually been seeded on wet, poorly drained soils. Consequently it has been seeded rather sparingly and occurs for the most part in low, wet pastures and subirrigated native hay meadows. Since it is even more aggressive than timothy, redtop readily invaded the subirrigated native meadows and pastures following its introduction. As a result, it is found in the Elkhorn and Platte River valleys and in many of the low, wet meadows of the Sandhills. Seeding redtop in low, wet meadows increased the yield materially. Where the native wet meadows contained 75 per cent redtop, the yields of vegetation were increased to 63 per cent over meadows that contained only 10 per cent redtop.

Redtop is one of the best grasses for our poorly drained soils. It also tolerates considerable drought. When seeded with alsike clover, with which it is frequently paired, the two species make a desirable pasture mixture for low, wet land. This is especially true when the land is subject to frequent flooding. Redtop is not popular as a hay crop because the time for cutting quality hay is comparatively short. Unless cut early, the hay soon becomes unpalatable to livestock. Wherever timothy will grow successfully, it should be used in preference to redtop for hay and pasture, but the range of soil and climatic adaptation of redtop is broader than that of timothy. Redtop may be used satisfactorily in small quantities as a supplement to bluegrass for lawns.

Commercial seed of redtop appears in two forms on the market, the "chaffy" type which contains the outer glumes and weighs only 14 pounds to the bushel, and the "re-cleaned" type which weighs 30 to 38 pounds to the bushel. The latter is desirable since it usually is more free from mixtures and weed seeds. A pound of re-cleaned redtop contains approximately 5,740,000 seeds.

If seeded alone, 10 pounds of seed per acre will produce a good stand and in native meadows, 6 to 8 pounds is ample. Three or four pounds of alsike clover and 5 or 6 pounds of redtop make a satisfactory mixture. Redtop for lawn purposes should not exceed 20 per cent of the seed mixture. When establishing redtop or any of the other grasses and legumes in low, wet meadows, it is a good practice to tear up the native grass sod as much as possible before seeding. Early seeding for either fall or spring establishment is most successful as seedlings are small and start rather slowly.



Redtop. 1, entire plant, shown $\frac{1}{4}$ actual size; 2, seed in chaff (x 8); 3, cleaned seed (x 8); 4, open spikelet (x 8); 5, ligule area (x 3); 6, spikelets (x 8).

TIMOTHY

Phleum pratense L.

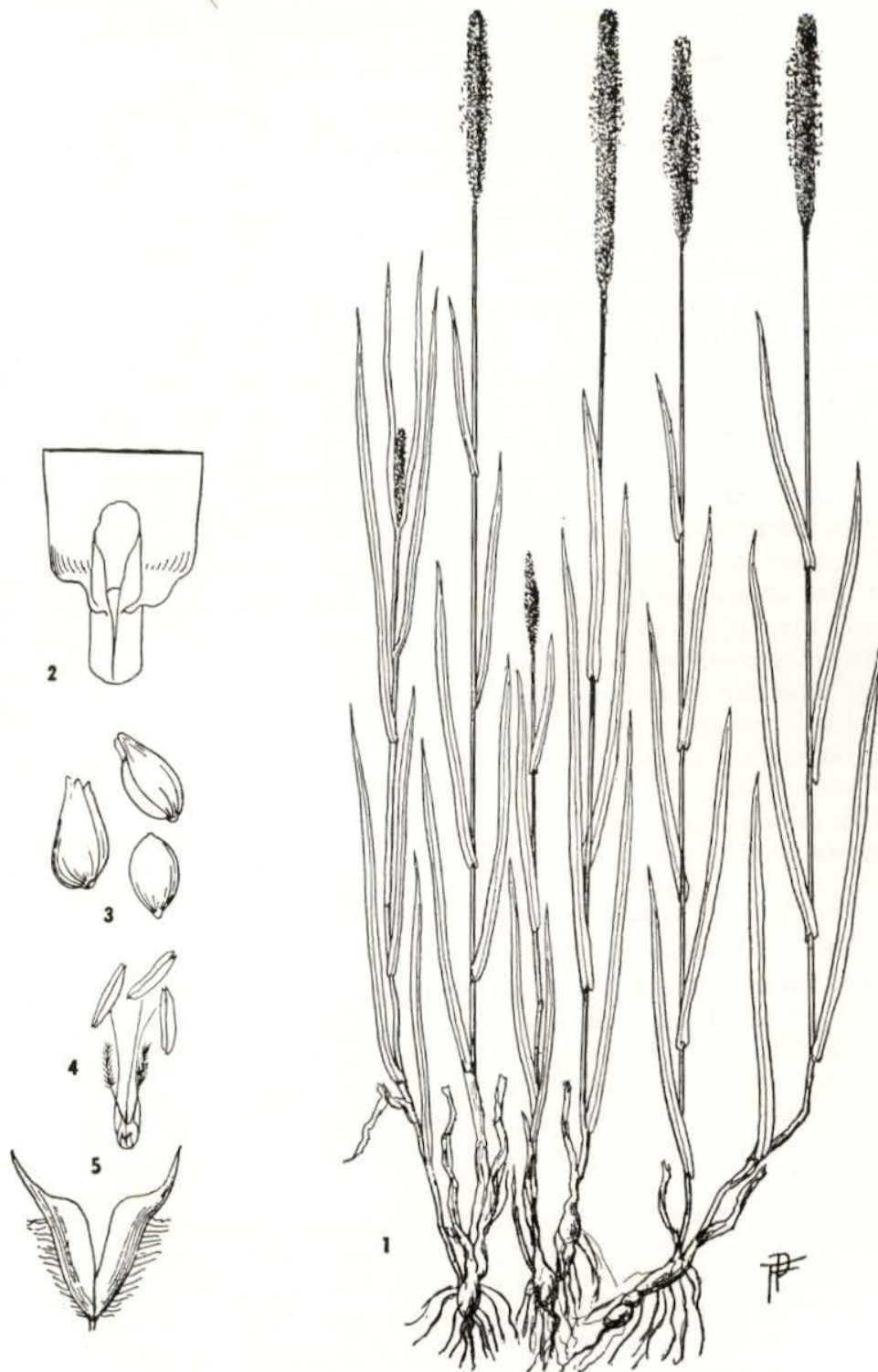
Timothy is easily distinguished from the other grasses. The plants are perennial, bunchy in appearance, and the erect stems grow 2 to 4 feet tall. The inflorescence is characterized by a spike-like panicle with each spikelet containing one floret. The plants reproduce by means of corms which are swollen bulb-like structures at the base of the stems. These are the food storage organs of the timothy plant. They are formed during the growing season and die the next year about the time the seed matures or the stored food is used by the plant.

Timothy has been seeded and now commonly occurs in many sub-irrigated prairie hay meadows. This is particularly noticeable in the Elkhorn and Platte River valleys. Investigations in the Elkhorn Valley have shown that the yield of native prairie hay was increased in direct proportion to the amount of timothy present. A heavily invaded meadow with about 50 per cent timothy yielded 45 per cent more hay than one containing only about 6 per cent of the introduced grass.

Timothy furnished much of the hay for horses in the eastern states during past years and was once considered one of the most important cultivated grasses in America. The acreage of timothy in Nebraska is small since prairie hay is so abundant and alfalfa is a more profitable crop, but it is still used to a limited extent for hay in eastern Nebraska, especially with red clover. Timothy may be used as a constituent in permanent pasture mixtures in eastern Nebraska or under irrigation. Since it is a rapid starter, it helps to control weeds and furnishes pasture while the slow starting grasses are becoming established. Commercial production of timothy seed is of little significance in Nebraska.

The seed weighs 45 pounds to the bushel, and there are approximately 1,100,000 seeds to the pound. It is seeded at the rate of 12 to 15 pounds per acre in pure stands, 10 pounds in subirrigated native meadows, and 4 to 6 pounds in permanent pasture mixture. When used with red clover, the clover should be seeded at the rate of 7 to 8 pounds to the acre, and the timothy at 5 to 6 pounds. Timothy seed is smooth and round and has no appendages that bother in seeding. It can therefore be seeded with all types of seeders and drills.

Timothy can be planted on a well prepared, compacted seedbed from August 15 to September 15 or early in the spring from March 25 to April 20.



Timothy. 1, entire plant, shown $\frac{1}{4}$ actual size; 2, ligule area (x 3); 3, seed (x 8); 4, flower (x 8); 5, outer glumes of spikelet (x 8).

REED CANARYGRASS

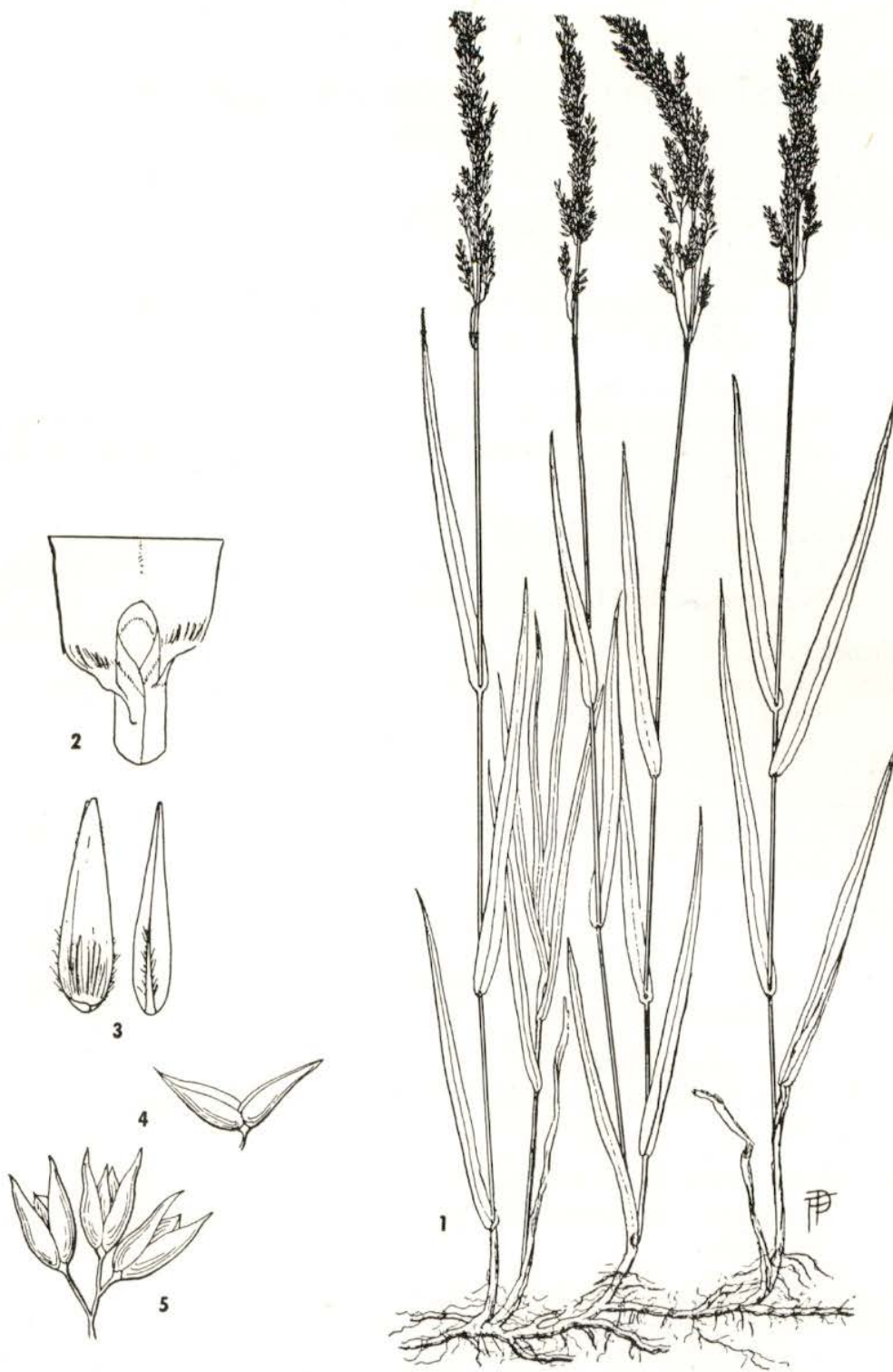
Phalaris arundinacea L.

Reed canarygrass is a coarse perennial, growing 2 to 8 feet tall. In thin stands the plants grow in large bunches, often 3 feet across, but solid seedings form a heavy, dense sod. The plants propagate vegetatively by means of large, prominent rhizomes. The leafy stems are stout and grow erect, and the leaves are broad and smooth. The inflorescence is a compact, spike-like panicle varying from 2 to 8 inches in length. Each spikelet normally bears one fertile floret with two small sterile glumes at its base. The seeds mature successively from the top of the inflorescence downward and are light gray to blackish brown. Harvesting must usually be started while some of the seeds are still green because the seed shatters badly. Therefore, timely harvesting is essential in obtaining a seed crop.

Reed canarygrass is native to the temperate regions of Europe, Asia and North America. It is one of the few species that may be considered as either a native or an introduced grass in the United States. Small areas of reed canarygrass occur naturally in many parts of Nebraska in low, wet areas that are subject to flooding. This grass has been seeded on low, wet areas in the various soil conservation districts in Nebraska. Because of the prolific top growth and underground spread of this grass, it is considered of special value for controlling eroded gullies and holding the soil. For gully control it is recommended that small pieces of sod be reset 1 to 2 feet apart in the bottom and sides of gullies when the soil is moist either in early spring or in late summer.

This grass is best suited to a cool, moist climate, but when it is planted on upland soils it shows a rather unusual adaptation and withstands long dry periods. It grows most rapidly during the cool spring and early summer. Moisture is more a limiting factor in its successful growth in the state than is temperature. Reed canarygrass is reported as very palatable by some experiment stations. It yields heavily because of its tall, luxuriant growth. Although reed canarygrass has occupied a position of relatively minor importance in Nebraska, it should have increasing value for special soil conservation and forage purposes. In the Midwest locally adapted strains should be used. The variety Ioreed, which was developed by the Iowa Agricultural Experiment Station, has proved well adapted to Nebraska.

The seed weighs 44 to 48 pounds to the bushel. It threshes clean without the glumes or chaff. There are approximately 564,000 seeds in one pound. Six to eight pounds of seed per acre is recommended. Under favorable conditions plants will thicken up through vegetative propagation if thin stands are obtained. The seed can be planted with an ordinary seeder attachment on a grain drill or in 40-inch rows if seed production is desired. Because the seed germinates slowly, early spring seeding in a well prepared seedbed is usually recommended, but if moisture is available late summer seeding is satisfactory.



Reed canarygrass. 1, entire plant, shown $\frac{1}{8}$ actual size; 2, ligule area (x 2); 3, seed (x 8); 4, empty glumes (x 4); 5, spikelets (x 3).

SELECTED REFERENCES ON THE IDENTIFICATION OF GRASSES

Beetle, Alan A.

1952. WHEATGRASSES OF WYOMING. Wyoming Agr. Exp. Sta. Bul. 312.

Carrier, Lyman

1917. THE IDENTIFICATION OF GRASSES BY THEIR VEGETATIVE CHARACTERS. U.S.D.A. Bul. No. 461.

Copple, R. F. and Aldous, A. E.

1932. THE IDENTIFICATION OF CERTAIN NATIVE AND NATURALIZED GRASSES BY THEIR VEGETATIVE CHARACTERS. Kansas Agr. Exp. Sta. Tech. Bul. 32.

Hafenrichter, A. L., Mullen, Lowell A. and Brown, Robert L.

1949. GRASSES AND LEGUMES FOR SOIL CONSERVATION IN THE PACIFIC NORTHWEST. U.S.D.A. Misc. Pub. 678.

Hitchcock, A. S.

1950. MANUAL OF THE GRASSES OF THE UNITED STATES. 2nd Edition, revised by Agnes Chase. U.S.D.A. Misc. Pub. 200.

Hoover, M. M.

1939. NATIVE AND ADAPTED GRASSES FOR CONSERVATION OF SOIL AND MOISTURE IN THE GREAT PLAINS AND WESTERN STATES. U.S.D.A. Farmers Bul. 1812.

Keim, F. D., Beadle, G. W. and Frolik, A. L.

1932. THE IDENTIFICATION OF THE MORE IMPORTANT PRAIRIE HAY GRASSES OF NEBRASKA BY THEIR VEGETATIVE CHARACTERS. Nebr. Agr. Exp. Sta. Bul. 65.

Keim, F. D. and Frolik, A. L.

1934. COMMON GRASS WEEDS OF NEBRASKA. Nebr. Agr. Exp. Sta. Bul. 288.

Morris, H. E., Booth, W. E., Payne, G. F. and Stitt, R. E.

1939. IMPORTANT GRASSES ON MONTANA RANGES. Montana Agr. Exp. Sta. Bul. 470.

Nowosad, F. S., Swales, D. E. Newton and Dore, W. G.

1936. THE IDENTIFICATION OF CERTAIN NATIVE AND NATURALIZED HAY AND PASTURE GRASSES BY THEIR VEGETATIVE CHARACTERS. MacDonald College Tech. Bul. 16.

Piper, C. V.

1934. IMPORTANT CULTIVATED GRASSES. Revised. U.S.D.A. Farmers Bul. 1254.

Piper, C. V.

1934. CULTIVATED GRASSES OF SECONDARY IMPORTANCE. Revised. U.S.D.A. Farmers Bul. 1433.

Pohl, Richard W.

1953. HOW TO KNOW YOUR GRASSES. Wm. C. Brown Company, Dubuque, Iowa.

Reitz, Louis P. and Morris, H. E.

1939. IMPORTANT GRASSES AND OTHER COMMON PLANTS OF MONTANA RANGES. Montana Agr. Exp. Sta. Bul. 375.

Semple, A. T., Vinall, H. N., Enlow, C. R. and Woodward, T. E.

1934. A PASTURE HANDBOOK. U.S.D.A. Misc. Pub. 194.

U.S.D.A. Year Book

1948. GRASSES. Supt. of Documents, Washington, D. C.

Westover, H. L., Sarvis, J. T., Moomaw, L., Morgan, G. W., Thysell, John C. and Bell, M. A.

1932. CRESTED WHEATGRASS AS COMPARED WITH BROMEGRASS, SLENDER WHEATGRASS, AND OTHER HAY AND PASTURE CROPS FOR THE NORTHERN GREAT PLAINS. U.S.D.A. Tech. Bul. 307.

Two Circulars About Grasses

If you are interested in Nebraska's grasses, you will find much valuable information in this circular about 14 species that have been introduced into the state. Another Experiment Station publication, *Common Native Grasses of Nebraska*, describes and illustrates 24 native species. Ask your county agent for Experiment Station Circular 59.