Tall Fescue

(*Festuca arundinacea* Schreb.)

D. Hannaway, S. Fransen, J. Cropper, M. Teel, M. Chaney, T. Griggs, R. Halse, J. Hart, P. Cheeke, D. Hansen, R. Klinger, and W. Lane

Tall fescue (*Festuca arundinacea* Schreb.) is a perennial, cool-season bunchgrass that is grown for pasture, hay, and silage. Native to Europe and North Africa, it was introduced from Europe to North and South America.

Tall fescue was introduced into the United States in the late 1800s. Early performance tests were conducted at the Utah and Kentucky Agricultural Experiment Stations and in Washington, DC. Tall fescue did not become a prominent forage grass in the United States, however, until the 1940s.

Tall fescue is important in forage/livestock systems and forms the forage base for beef cow-calf production in the east-central and southeastern United States. In this region alone, it supports more than 8.5 million beef cows on nearly 25 million acres. Throughout the world, it is valued for its tolerance of a wide range of soil and climatic factors and its high yield potential.

Tall fescue closely resembles meadow fescue (*Festuca pratensis* Huds.). Both are closely related to perennial and annual ryegrass, and improved varieties sometimes are created by crossing these species with tall fescue.

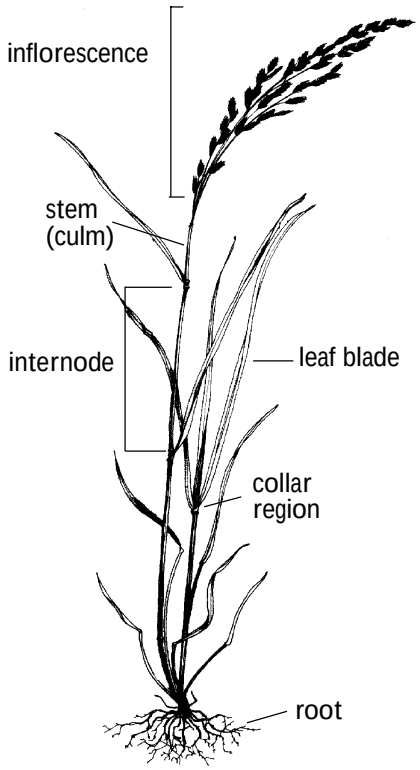

Figure 1.—Tall fescue plant.

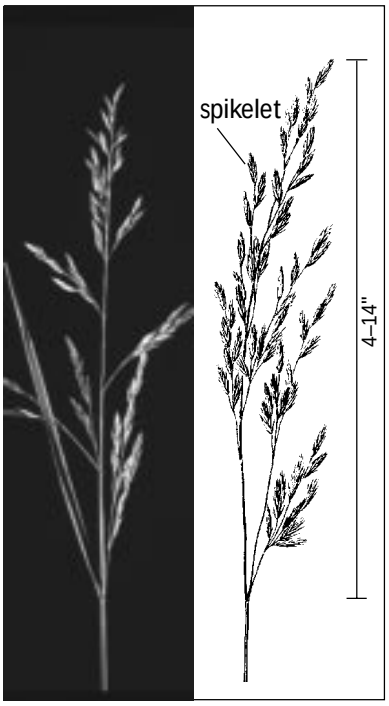

Figure 2.—Inflorescence.

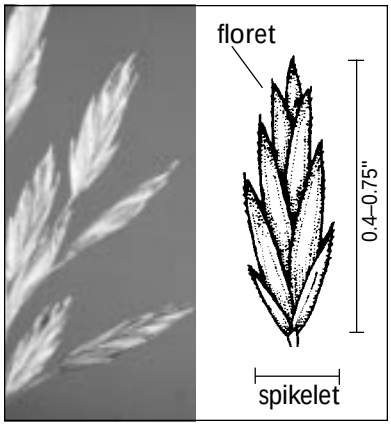

Figure 3.—Spikelets and florets.

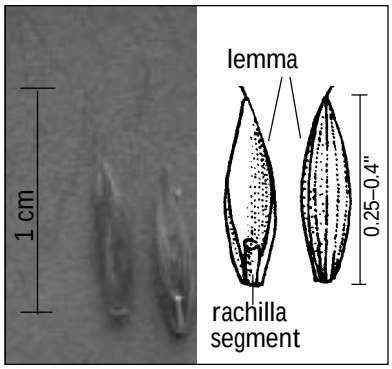

Figure 4.—Seed.

Identification

Tall fescue, like other grasses, may be identified by floral parts (inflorescence, spikelet, and seed) or vegetative parts (leaf, stem, collar, and root). See Figures 1-6.

Inflorescence (seed head)

The branched *inflorescence* is a panicle up to 20 inches long (50 cm). Typically, it is 4 to 14 inches (10 to 35 cm). Heads range from broad and loosely branched to rather narrow. Short branches bear several *pedicellate spikelets.* (See Figure 2).

- *Inflorescence*—Flowerhead terminating the stem
- *Panicle*—Branched flowerhead, with main axis, divided branches, and stalked spikelets
- *Pedicel*—The stalk of the spikelet
- *Peduncle*—The stalk of the inflorescence, uppermost culm internode segment
- *Spikelet*—Unit of the grass flowerhead, generally composed of two glumes and one or more flowers, each borne between a lemma and a palea

Spikelet

Spikelets are elliptical to oblong, 0.4 to 0.75 inch long (10 to 19 mm). Each spikelet has 3 to 10 *florets.* (See Figure 3.) However, only about half of the florets produce seed.

Florets within the spikelet are interconnected by a central axis called the *rachilla*. Segments of the rachilla are found on each mature floret (seed). (See Figure 4.)

- *Floret*—Lemma and palea and the enclosed flower
- *Rachilla*—Main axis of the spikelet

Seed

The lemmas have *awns* 0.04 to 0.16 inch long (1 to 4 mm). Seeds per pound average 220,000 (484,000 per kg), with a range of 176,000 to 261,000 per pound (387,000 to 574,000 per kg). Tall fescue seeds are 0.25 to 0.4 inch long (6 to 10 mm) and 0.04 to 0.06 inch wide (1 to 1.5 mm) at the midpoint. See Figure 4.

- *Lemma*—The lower of two bracts enclosing the flower
- *Palea*—The upper of two bracts enclosing the flower
- *Seed*—A ripened ovule containing an embryo with a seed coat, often with additional storage tissues

Stem

Flowering shoots produce hollow stems comprised of distinct nodes and internodes collectively called the culm. Culms usually are erect, stout, smooth, and up to 6 feet (2 m) tall. The uppermost culm segment supporting the panicle-type inflorescence is the peduncle. See Figure 5. The stem base commonly is reddish.

- Culm—Stem of grasses comprised of nodes and internodes, each node bearing a leaf

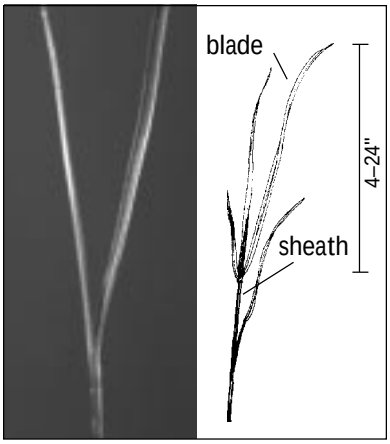

Figure 5.—Leaves and stems.

Leaf

Leaves of tall fescue are rolled in the bud (rolled *vernation*). *Blades* are 0.1 to 0.5 inch wide (3 to 12 mm) and 4 to 24 inches long (10 to 60 cm). They are prominently ridged on the upper surface and glossy on the lower surface. Leaves taper to the tip, and margins are rough and cutting to the touch.

Leaf *sheaths* are smooth, split (overlapping at the top), and reddish at the base.

- *Blade*—Part of the leaf above the sheath, also known as the lamina
- *Leaf*—The main lateral appendage of a stem, usually flattened, serving as the main organ for photosynthesis
- *Sheath*—Lower part of the leaf, encloses the stem
- *Vernation*—Arrangement of leaves in the bud

Collar

The *collar* is a narrow band of *meristematic* tissue accounting for increasing blade length. Once the blade has achieved its maximum length, cells in the collar cease dividing.

The collar region of tall fescue is distinctive. *Auricles* are blunt with fine hairs. The *ligule* is short and membranous, up to 0.08 inch (2 mm). See Figure 6.

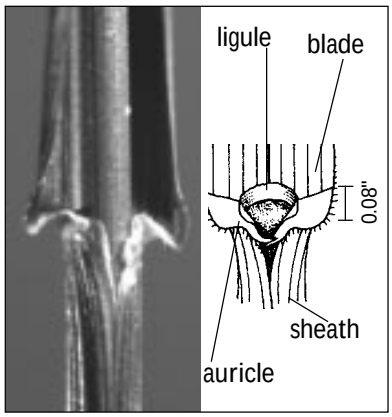

Figure 6.—Collar region.

- *Auricle*—Small claw- or ear-like outgrowths at the junction of the leaf sheath and blade
- *Ligule*—Outgrowth at the inner junction of the leaf sheath and blade, often membranous, sometimes a fringe of hairs
- *Collar*—Zone of meristematic tissue at the junction of the sheath and the blade
- *Meristem*—Group of actively dividing cells from which roots, shoots, leaves, and flowers) are derived

Root

Tall fescue produces a large number of coarse, tough roots. Tall fescue has no *stolons*. It generally has short *rhizomes*, although there is wide variation in rhizome characteristics and sod-forming ability.

- *Rhizome*—Underground stem bearing scalelike leaves, rooting at the nodes
- *Stolon*—Prostrate or creeping stem, rooting at the nodes

Area of adaptation

Tall fescue is well adapted to humid, temperate areas. See Figure 7. In the United States, it is particularly adapted to the area referred to as the transition zone. This area lies between the zones where cool- and warm-season grasses are cultivated successfully. It includes eastern Nebraska, Kansas, and Oklahoma; Missouri and Arkansas; southern Iowa, Illinois, Indiana, and Ohio; Kentucky, Tennessee, Virginia, West Virginia, North and South Carolina; and Mississippi, Alabama, and Georgia.

Secondary use areas include north-central and northeastern states, areas south of the transition zone extending into northern Louisiana, irrigated intermountain regions, the coastal Northwest, and irrigated regions of the Pacific Northwest.

Use in the more northern latitudes is limited to conservation seedings in grassed waterways and dams. In these areas, other cool-season forages, with more desirable palatability and quality characteristics, are preferred for pastures and hay.

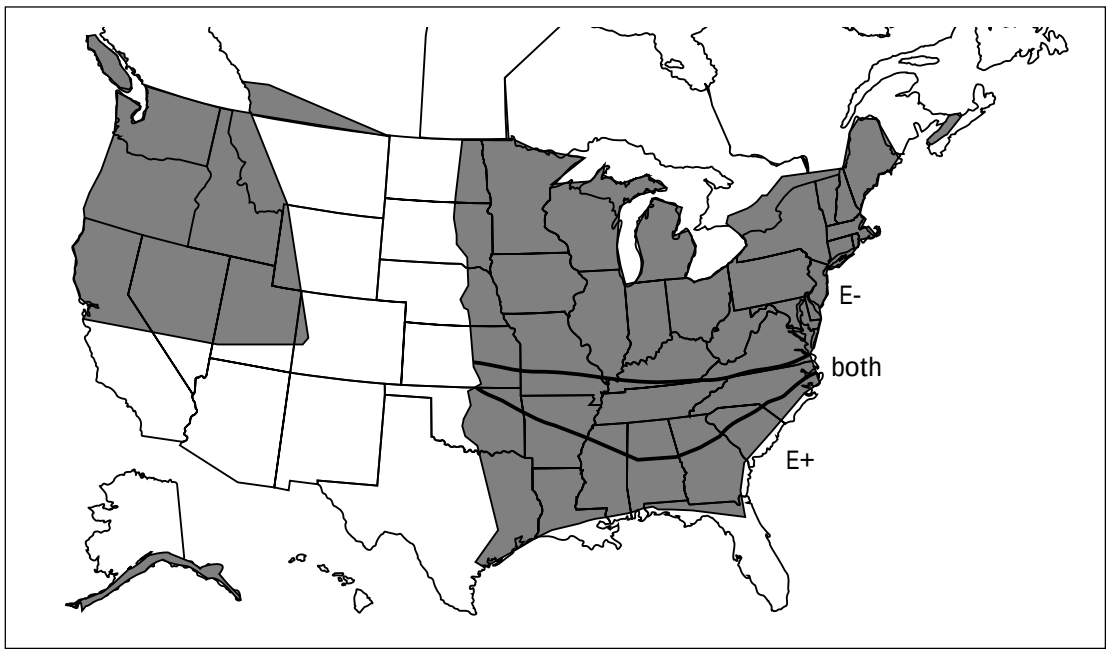

Figure 7.—Adaptation and production areas of tall fescue in North America. Endophyte infection (E+) may improve survival in southern regions, but is not recommended in areas north of the transition zone (E- areas).

Tolerance of warmer southern climates is determined mainly by soil moisture availability. Under heat and drought stress, growth often stops. When moisture is adequate, however, tall fescue remains green and continues some growth through warm weather.

Endophyte infection (E+) improves tall fescue survival in southern regions (south of the transition zone). Thus, E+ varieties should be considered in these areas. See Figure 7. However, use E+ varieties with care for livestock feed. (See "Animal Health/Forage Antiquality Issues.")

Tall fescue grows best on deep, moist soils that are heavy to medium in texture and high in organic matter. It grows on soils that vary from strongly acidic (pH 4.7) to alkaline (pH 9.5). Best growth occurs when soil pH is maintained between 5.5 and 8.5. Tall fescue is suitable for use in soil drainage classes ranging from excessively drained to poorly drained. It tolerates long periods of flooding (24 to 35 days) when temperatures are below 81°F (27°C). A minimum precipitation range typically is 15 to 18 inches (375 to 450 mm), although in areas of high evapotranspiration, up to 36 inches (900 mm) may be required.

Typical of cool-season grasses, peak growth occurs in spring during the period of reproductive growth. In many production areas, nearly two-thirds of annual growth occurs at this time. A secondary peak of vegetative growth occurs in autumn.

Uses

Tall fescue is grown primarily for pasture, silage, and hay. It also is used for reducing soil erosion, recycling nutrients from manure and biosolids, and turf. Under grazing and mowing, tall fescue develops a mature sod in 3 to 4 years.

Since the early 1970s, tall fescue has been the predominant cool-season perennial grass in the United States, occupying nearly 35 million acres. Its wide use is due to several favorable characteristics:

- Adaptation to a wide range of soil conditions
- Good forage yield
- Long grazing season
- Excellent persistence
- Tolerance of low-input management
- Excellent seed production

Pasture

Tall fescue commonly is grown in the Pacific Northwest (PNW) and in irrigated pastures of the western intermountain valleys. Most frequent PNW use is for beef cattle and horse pastures, although newer, improved varieties also are used for sheep and even dairy cattle pastures.

The principal use of tall fescue in the United States is in cow-calf enterprises in the transition zone. Tall fescue provides abundant forage for spring-born calves. Calves can be kept on pastures until fall weaning by including legumes in pasture mixtures, feeding energy or hay supplements, or stocking on irrigated cool-season or warm-season grasses during the summer. Dry cows also can be overwintered on tall fescue pastures with supplemental hay.

Stockpiling

Throughout the eastern portion of tall fescue's adaptation area, producers can stockpile summer and autumn vegetative growth for deferred grazing in late fall and winter. Stockpiled tall fescue loses less quality than other cool-season grasses. It remains relatively green and of acceptable quality into early winter throughout its eastern adaptation range.

Stockpiling is less successful in the Pacific Northwest due to autumn and winter rainfall and nonfrozen soil conditions. Under these conditions, stockpiled tall fescue is of lower quality than actively growing forage.

Hay and silage

Tall fescue routinely is conserved as hay or silage for late fall and winter feed. Harvesting excess spring growth for storage as hay or silage is typical.

High yields of high-quality forage are obtained through the use of timely mechanical harvest techniques and nutrient management. Yields of 6 to 7 tons of dry matter per acre (dm/a) (13.5 to 15.7 metric tons/hectare) are possible with a high level of management and with irrigation or on subirrigated deep soils west of the Cascades. Higher elevation areas have a short growing season, and yields of 5 tons dm/a (11.2 metric tons/ha) are typical.

As with all forage species, the quality of tall fescue is influenced greatly by maturity stage at harvest. For dairy or sheep, cut forage grasses in the early boot stage.

For beef cows, harvest can be delayed until heading stage. Yields are higher than in the boot stage, and forage is of acceptable quality for nonlactating livestock. Ensiling allows harvesting at an earlier stage than typical hay harvest, resulting in higher nutritive value.

Manure and biosolids application systems

Municipal and food-processing wastes and animal manures often are applied to tall fescue as an environmentally safe means of nutrient recycling, providing an economical fertilizer.

High growth rates under high fertility and an extensive root system make tall fescue valuable in nutrient recycling systems. For example, if a forage is 3 percent N (18.75 percent crude protein), 5 tons contain 300 lb of N (136 kg N). Thus, highly productive grasses such as tall fescue can utilize 300 pounds of N per acre per year (336 kg N/ha/yr) from livestock manure or biosolids. The result is high-quality forage and protection of groundwater from nitrate contamination.

Tall fescue yields well in these systems. It does not accumulate high levels of heavy metals with moderate applications of N from sewage sludge (240 lb N/a, or 269 kg N/ha).

Soil conservation

Tall fescue often is planted on marginally fertile slopes to stabilize soil and promote water infiltration. At the same time, it provides an economically sustainable forage base for livestock production.

Its extensive, deep, fibrous root system makes it effective for reducing surface soil erosion by anchoring the plant in the soil. Even when clipped at 3-week intervals, tall fescue can produce 5,000 pounds of roots per acre (5,600 kg/ha). These roots decrease soil density, improve soil structure, and prevent erosion.

Tall fescue also is planted for reclaiming and stabilizing strip-mined soils and on land set aside for long-term soil conservation such as in the Conservation Reserve Program. The high density of plant tillers makes tall fescue

effective in protecting the soil from erosion and filtering surface water flowing over the crop.

Good stands of tall fescue often are grazed with sheep in the wet winter months. The dense root system resists treading damage by livestock during extended periods of wet weather.

Turf

Tall fescue is recognized as a valuable turf species in the transition zone of the United States and in similar climate zones around the world. It recently has been recognized as the turf species of choice in central-eastern China.

Wide acceptance of tall fescue as a turf species is due to the development of low-growing, high-tiller density types. Improved management practices, including proper fertilization and mowing practices, also contribute to its wide use as a turf species.

Be aware, however, that a fungal endophyte often is added to "turf-type" varieties (E+) of tall fescue for increased pest resistance. The endophytic fungus produces toxins that can cause serious health problems for livestock. Use endophyte-infected varieties with caution, if at all, for livestock feed. (See "Animal Health/Forage Antiquality Issues.")

Varieties

The first tall fescue variety developed in the United States was Alta, selected in 1918 in Oregon. Kentucky-31 was collected in Kentucky in 1931 and was the major seed source for tall fescue during its rapid adoption in the 1950s and 1960s. It still is the predominant tall fescue variety in transition zone pastures.

Fawn was developed in Oregon in 1954, having increased forage and seed yield. Kenhy, released by Kentucky in 1977, was the first tall fescue variety resulting from a cross of annual ryegrass and tall fescue. It was described as being superior to Kentucky-31 in yield, color, and quality.

Since the early 1980s, tall fescue breeders have released many new varieties that contain a low level (less than 5 percent) of the tall fescue endophyte. (See "Animal Health/Forage Antiquality Issues.")

There now are many important tall fescue varieties. Most have been released by the private sector. Including both forage and turf types, more

than 100 varieties are listed in *Grass Varieties of the United States.* Information on varieties also is available from the Oregon Tall Fescue Seed Commission and through the Germplasm Resources Information Network (GRIN). (See “For more information.”)

Tall fescue varieties are grouped into three maturity categories: early, intermediate, and late. These groupings are somewhat helpful, but there is substantial overlap among them.

Recommendations

Field trials are conducted at various research and extension centers. These trials evaluate varieties for yield and/or quality based on local situations. Consult your county extension office for specific recommendations of varieties that have performed well in your area. Always use certified seed to assure a high germination percentage and freedom from noxious weeds. Request endophyte-free (E-) varieties for forage use in all areas except the southeast where extreme climate stress may dictate careful use of E+ varieties.

Establishment

Tall fescue can be seeded in spring or late summer. In addition, it may be fall seeded in areas with mild winters. In the upper Great Plains, dormant winter seedings sometimes are used. Seeding depth should be between 0.25 and 0.5 inch (0.5 and 1.25 cm). When planted with a legume, 0.25 inch (0.5 cm) is preferred.

Recommended seeding rates and suggested companion species are shown in Table 1 (page 10). When broadcasting, increase seeding rates by 50 percent or more, depending on seedbed condition. Reduce seeding rates by 30 percent for well-prepared seedbeds for irrigated production in the intermountain West (east of the Cascades). When renovating, mow or graze the existing sod short to reduce competition. This will allow new seedlings to receive the sunlight they need for establishment.

Mixtures

Tall fescue often is mixed with perennial ryegrass and/or orchardgrass. Difficulties associated with managing mixed stands, however, often lead to recommendations to not mix tall fescue with other grasses for pastures. Including legumes, however, is recommended.

Tall fescue becomes unpalatable to dairy cows and sheep if allowed to become overly mature (the heading stage of development). Intake and quality are higher if the plants are kept in a young, leafy stage of growth.

For pasture, hay, and silage production, tall fescue routinely is used in combination with white clover. On nonirrigated hill pastures in western Oregon and northern California, tall fescue frequently is seeded with subterranean clover.

Late-maturing tall fescue varieties also can be mixed with alfalfa. Recommended seeding rates are 10 to 12 lb/a alfalfa (11 to 13 kg/ha) and 6 to 8 lb/a (7 to 9 kg/ha) tall fescue.

Table 1.—Recommended mixtures and seeding rates.[a]

Use	Precipitation (inches)	Tall fescue seeding rate (lb/a)	Companion species	Companion species seeding rate (lb/a)
Pasture	20–30 and shallow soils	15–20	Subclover (in mild winter, droughty areas) and/or white clover	7–10 2–3
	30–60 or irrigated	15–20	White clover (and red clover)[b] and/or perennial ryegrass or orchardgrass[c]	2–3 (5) 5–8
	>60	15–20	Birdsfoot trefoil or white clover and/or perennial ryegrass or orchardgrass[c]	6 2–3 3–5
Hay or Silage	30–60 or irrigated	12–15 10–12	None (tall fescue alone) Hay-type white clover (and red clover)[b] and/or perennial ryegrass or orchardgrass[c]	— 2–3 (5) 5–8
		12–15	Oats or barley[d]	20–50
		6–8	Alfalfa	10–12

[a]Increase rates by 50 percent or more if seeding into a poorly prepared seedbed. Reduce seeding rates by 30 percent for irrigated production areas of the intermountain West.

[b]Red clover may be added for a 2–3 year contribution.

[c]Orchardgrass may be added for additional summer growth.

[d]Oats or smooth-awned barley may be used as a nurse/companion crop with tall fescue or tall fescue-legume seedings. Harvest the cereals for green chop, silage, or hay; and harvest the tall fescue the following year. Harvesting cereals at the milk stage minimizes competition. The higher range cereal seeding rates are more competitive with tall fescue but give more first-year yield.

In many areas, red clover is oversown into tall fescue stands to increase the quality and productivity of tall fescue pastures. Use care, however, when grazing livestock on red or subterranean clover, since the oestrogen present in these clovers reduces conception rates.

Fertility and pH requirements

Although tolerant of low fertility conditions, tall fescue requires moderate fertility levels for good production. Fertilization should be based on a soil test.

Tall fescue grows on soils with pH of 4.7 to 9.5, but forage production is best when soil pH is maintained between 5.5 and 8.5. Consult your county extension office for specific fertilization and liming rates.

Tall fescue is very responsive to nitrogen (N) fertilization. For each pound of N added (up to about 250 lb N/a/yr), per-acre yields of dry matter increase by 20 to 30 lb (22 to 34 kg per ha). At application rates above 250 lb/a (280 kg/ha) per year, the yield increase from each pound of additional N declines. Typically, economical levels of N fertilizer are in the range of 160 lb N/a/yr (179 kg N/ha/yr).

Applications of total yearly N should be split as evenly as possible to meet the continuing need for nitrogen throughout the growing season. Make the first application at the beginning of the season and the others after each harvest except the last. Fertilization with N (50 lb/a, or 56 kg/ha) following each harvest cycle assures rapid regrowth of leaves and roots. This pattern produces greater annual yield and better quality forage than does a single, early spring application.

Meeting but not exceeding soil, plant, and animal needs is a continual adjustment process.

Fertility requirements and harvest/grazing management must be balanced to accommodate the sometimes competing objectives of:

- High yields
- High-quality forage
- Optimum N_2 fixation by forage legumes
- Maximum recycling of animal manures and municipal biosolids

Manure and biosolids

Most dairies can supply all the nitrogen, phosphorus, potassium, and other nutrients needed for forage production by applying manure to forage crops. In fact, the annual value of nutrients in manure from 100 lactating cows exceeds $10,000.

Applying too much manure, however, results in excess plant uptake of nutrients such as potassium and can lead to animal health problems—especially in dry cows. Excess manure application also contributes to nutrients and microorganisms in runoff water and potential nutrient leaching to groundwater.

Thus, analyzing the nutrient value of manure and applying the correct amount is essential for efficient use, optimum plant growth, and proper stewardship of our natural resources. See EM 8585, *Manure Application Rates for Forage Production*, for examples of how to calculate the proper amount of manure to apply.

Legume and nitrogen fixation

The amount of atmospheric nitrogen (N_2) fixed by legumes growing in combination with grasses depends on the legume species and the environment. If inorganic (plant-available) soil N is present, legumes fix less N_2. Available inorganic N also increases the competition from the grass, which in turn reduces the amount of N_2 fixed per unit area. Thus, to maximize the nitrogen-fixing contribution of legumes, apply only moderate amounts of fertilizer N or manure.

Boron (B) and molybdenum (Mo) are important nutrients for nitrogen-fixing legumes. Monitor legumes for deficiency symptoms, particularly west of the Cascades in the Pacific Northwest. Deficiency symptoms include discoloration, streaking, or shriveling.

If you suspect micronutrient deficiencies, submit leaf samples to a certified laboratory for analysis. Your local extension agent can assist with sampling and interpretation.

Cutting and grazing management

Cutting and grazing management greatly influences forage quality, productivity, and persistence. Quality is most affected by maturity stage at harvest. To obtain high-quality preserved forage (hay or silage), harvest tall fescue at the boot stage. See Figure 8. Delaying harvest until head emergence or early bloom increases yield but reduces quality and regrowth.

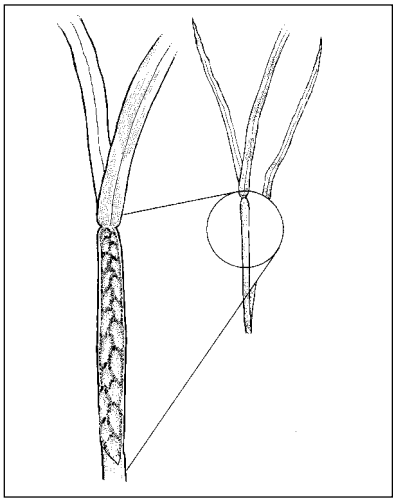

Figure 8.—Boot stage. The inflorescence is contained in the sheath of the flag (uppermost) leaf.

Later-maturing varieties may delay harvest by 10 to 14 days, but seldom enough to avoid poor haying weather in the Pacific Northwest. Alternatively, the first harvest may be grazed, green chopped, or ensiled. Using a combination of later-maturing varieties and pasturing or mechanical harvest for silage of the first cutting will increase the potential of good weather for hay harvest for the second cutting. To stimulate growth, fertilize immediately following the initial harvest.

Compared to most other cool-season grasses, tall fescue better tolerates continuous stocking. Greater forage production and higher animal gains, however, typically are obtained if management-intensive grazing techniques are used.

Palatability of tall fescue tends to be less than for other species at all phases of growth. Therefore, without carefully controlled intensive grazing to defoliate all plants equally, tall fescue tends to be left in a sward and eventually will dominate a pasture. “Topping,” the process of clipping seedhead tillers remaining after grazing, can help reduce selective grazing and increase the leafiness of the pasture.

New seedlings

Because tall fescue germinates and establishes more slowly than some other cool-season grasses, new stands can be seriously damaged by overgrazing or grazing too soon. Make sure new stands are well established and approximately 10 to 12 inches tall (25 to 30 cm) before grazing or harvesting. Plants are established when they have three or four leaves and are not easily pulled out of the ground. Test by pulling on newly established plants. If they resist your pulling, livestock won’t be able to remove plants by grazing.

Established stands

Grazing and cutting management should ensure large quantities of high-quality forage, rapid regrowth, and long-lived stands. These objectives can be achieved by understanding grass regrowth mechanisms and applying these important principles.

Wise management in early spring, while the grass is in the vegetative stage, ensures rapid regrowth. When in the vegetative stage, grass shoots show no sign of seed head development in the basal zone.

For pastures, good management at this stage involves allowing plants to grow to 6 to 8 inches (15 to 20 cm), grazing to 2 inches (5 cm), and providing a regrowth period. For hay or silage, allow plants to reach the boot stage before mechanical harvest.

Progress toward seed head development is easily monitored by splitting a shoot lengthwise with a sharp blade. Tillers are in the early transition

stage when internodes at the base of the shoot have elongated and have raised the *meristematic* growing point (the potential seed head) to a vulnerable height. See Figure 9.

- *Tiller*–Grass shoot (arising from a bud in crown tissue, rhizomes, or stolons), which may become induced to flower if exposed to the necessary conditions—otherwise, it will remain vegetative

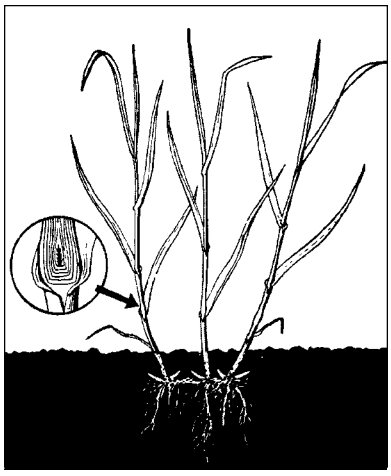

Figure 9.—Elevated meristem (growing point) in the early transition stage.

Following each grazing or mechanical harvest cycle, fertilize with nitrogen at 50 lb/a (56 kg/ha).

A recovery period after cutting or grazing that allows regrowth of 6 to 8 inches (15 to 20 cm) is a reasonable rule of thumb for tall fescue. Longer regrowth gets very fibrous, decreasing livestock intake.

In pastures, regrowth can be utilized as frequently as 14 to 21 days or may require more than 40 days, depending on grazing period, temperature, and moisture.

Under silage and green chop management systems, four to six harvests per year are common. With hay production, three or four harvests are obtained.

Stand development and persistence

Tall fescue varieties differ in their ability to produce a dense grass stand. Typically, after the first year, stands will be only average. Second year stands will be better, and third year stands will be excellent, with planted rows no longer discernible. Later-developing varieties will require more time to produce an outstanding, dense stand.

Cutting and grazing management also affects stand persistence. Improper timing or excessive duration of grazing reduces stand persistence and regrowth.

The presence of the fungal endophyte imparts insect and disease resistance, which improves persistence in some areas. Toxins produced by the plant and endophyte, however, cause animal health problems. (See “Animal health/forage antiquality issues,” page 15.)

Composition/nutritional characteristics

Properly fertilized, well-managed stands of tall fescue are capable of producing high-quality forage, with high levels of digestible energy, protein, and minerals. Tall fescue accumulates high levels of usable carbohydrate in spring and fall.

Composition, however, depends largely on maturity stage at harvest and on fertility. Thus, in order to balance rations, analyze forage samples for protein, energy (fiber), calcium, and phosphorus. "Book values" are available from the "Nutrient Requirements of Domestic Animals" series of publications from the National Research Council (Table 2).

Table 2.—Nutritional composition of tall fescue.

Feed description	TDN (%)	DE (Mcal/kg)	ME (Mcal/kg)	NEm (Mcal/kg)	NEg (Mcal/kg)	CP (%)	Ca (%)	P (%)
Fresh, early vegetative	73	3.22	2.64	1.73	1.11	22.1	0.51	0.37
Fresh, early bloom	67	2.95	2.42	1.54	0.94	16.7	—	—
Hay, late vegetative	76	3.35	2.75	1.82	1.19	21.3	—	—
Hay, early bloom	62	2.73	2.24	1.38	0.80	20.2	—	—
Hay, mid-bloom	60	2.65	2.17	1.31	0.74	16.4	—	—
Hay, full bloom	58	2.56	2.10	1.24	0.68	12.1	0.41	0.30

All values expressed on a dry matter basis. TDN=Total Digestible Nutrients; DE=Digestible Energy; ME=Metabolizable Energy; NEm=Net Energy for Maintenance; NEg=Net Energy for Gain; CP=Crude Protein; Ca=Calcium; P=Phosphorus.
TDN values are listed for ruminants. Values for horses generally are lower.

Adapted from:

National Research Council. *United States-Canadian Tables of Feed Composition*, 3rd revision (National Academy Press, Washington, DC, 1982).

National Research Council. *Nutrient Requirements of Sheep*, 6th revised edition (National Academy Press, Washington, DC, 1985).

Animal health/forage antiquality issues

Fungal endophyte

Tall fescue frequently is infected with the endophytic fungus *Neotyphodium coenophialum* Morgan-Jones and Gams (previously known as *Acremonium coenophialum* Latch). Endophyte infection and the resulting accumulation of toxins cause general unthrifty appearance and poor animal performance, especially during hot weather. The complex of symptoms includes poor weight gain and milk production, rough hair coat, excess salivation, elevated body temperature, and standing in shade and water.

Many varieties introduced since the early 1980s contain a low level of the endophyte (less than 5 percent). In addition, old varieties now are marketed without the endophyte. Thus, it's possible to utilize tall fescue safely in forage/livestock systems by requesting low endophyte varieties (E-) and by interseeding with legumes to dilute the endophyte toxin.

The endophytic fungus is present only in seed head tillers and not in basal leaves. Thus, monitoring crop development can help avoid problems.

For more information, see *Tall Fescue/Endophyte/Animal Relationships* (Ball, et al.) and *Natural Toxicants in Feeds, Forages, and Poisonous Plants* (Cheeke).

Pest control

Weeds

Prevention of weed invasion is one of the most effective weed control methods. Preventive measures include use of certified seed (to minimize introduction of weed seeds at planting) and pregermination of weed seeds prior to final seedbed preparation.

Proper harvest and fertility management encourages vigorous growth of forage species and minimizes weed invasion. Early detection and removal of invasive weeds with a shovel or spot spraying with an appropriate herbicide further reduces costs and helps maintain a weed-free forage stand.

Stands of tall fescue increase in density as they are grazed properly or are harvested for hay or silage on a proper schedule. Weed invasion is more likely when new stands of tall fescue are established. As stands mature with good management, weed invasion is reduced.

Monitoring stands on a yearly basis is helpful in early detection of weed problems. Monitoring is best done after stands have been grazed or mechanically harvested, because excessive forage growth prevents adequate monitoring. To assist in identifying weeds, color pictures of many common weeds are found in the book *Weeds of the West.*

Diseases

Most diseases of tall fescue are caused by fungi. Crown rust occurs during warm, moist periods. It often starts in July and can persist well into September. Stem rust is widespread in Oregon and reduces seed yields.

Although rust is not toxic to livestock, it can affect palatability. For horses especially, the spores from rusts can cause significant respiratory problems. Maintaining high fertility and harvesting the accumulated forage reduce rust problems.

For turf and grass seed production, chemical control measures are available. Most, however, are not registered for forage use.

Nematodes can reduce stands and persistence of tall fescue pastures in the southern United States. They cause less damage if the endophyte is present.

Insects

Foliage-feeding insects have not been a problem with tall fescue, probably because most pastures in the United States are infected with the endophyte. Numerous studies have shown that insect damage to tall fescue is reduced considerably when the endophyte is present.

Slugs

Slugs (*Agriolimax reticulatus* Müll.) are common on heavy soils. Young plants may be destroyed due to underground or soil-surface damage that occurs mainly at night in the spring or autumn. Slugs are prevalent in new sowings after peas, cereals, or brassicas, particularly when large amounts of crop residue remain. Problems also are common when new seedings are made into heavily thatched sods.

Plowing and cultivation kill some of these pests, and more will die if the interval between plowing and sowing can be extended to 4 weeks or more. When seeding into existing sod, take advantage of the fact that tightly grazed sods do not seem to have the slug populations that thatched sods do. Thus, a good cultural method of slug damage control is to heavily graze sods before planting. Another approach is to lightly disk sods to tear up thatch and expose some mineral soil.

For more information

OSU Extension publications

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World Wide Web

This publication is available as a hyperlinked document on the World Wide Web. The Web version contains color photographs and links to additional sources of information. View it at:

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Forage Information System

http://forages.orst.edu

Germplasm Resources Information Network:

http://www.ars-grin.gov/

Oregon Tall Fescue Seed Commission:

http://www.forages.css.orst.edu/Organizations/Seed/Tall_Fescue/index.html

Authors: *Forage Specialists*: David Hannaway, Extension forage specialist, Oregon State University; Steve Fransen, Extension forage agronomist, Washington State University; Jim Cropper, forage management specialist, Natural Resources Conservation Service; Merle Teel, professor emeritus, University of Delaware; Marty Chaney, pasture specialist, Natural Resources Conservation Service; Tom Griggs, forage physiologist, University of Idaho. *Botany specialist:* Richard Halse, herbarium curator, Oregon State University. *Soil science specialist:* John Hart, Extension soil scientist, Oregon State University. *Livestock specialists:* Peter Cheeke, animal scientist; Donald Hansen, Extension veterinarian; Robert G. Klinger, forage technician and sheep producer (all of Oregon State University); and Woody Lane, Lane Livestock Services, Roseburg, Oregon.

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