Index of Species Information

SPECIES: Schedonorus arundinaceus

Introductory

SPECIES: Schedonorus arundinaceus

AUTHORSHIP AND CITATION :
Walsh, Roberta A. 1995. Schedonorus arundinaceus. In: Fire Effects Information System, [Online].
U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station,
Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2007, September 24].

ABBREVIATION :
SCHARU

SYNONYMS :
Festuca arundinacea Schreb. [28,32,33,79].
Lolium arundinacea (Schreb.) S.J. Darbyshire [80]

SCS PLANT CODE :
FEAR3

COMMON NAMES :
tall fescue
reed fescue

TAXONOMY :
The scientific name of tall fescue is Schedonorus arundinaceus (Poaceae) [82,82].

LIFE FORM :
Graminoid

FEDERAL LEGAL STATUS :
No special status

OTHER STATUS :
NO-ENTRY

DISTRIBUTION AND OCCURRENCE

SPECIES: Schedonorus arundinaceus

GENERAL DISTRIBUTION :
Tall fescue occurs throughout the continental United States [4,28,31,75,77] and southern Canada [76]. It was introduced to North America from northern Europe where it is native [31,61,65]. It has also been introduced to South America [76], Australia [9,10,24], and New Zealand [20.].

ECOSYSTEMS :
Tall fescue occurs in most ecosystems.

STATES :

AL	AK	AZ	AR	CA	CO	CT	DE	FL	GA
HI	ID	IL	IN	IA	KS	KY	LA	ME	MD
MA	MI	MN	MS	MO	MT	NE	NV	NH	NJ
NM	NY	NC	ND	OH	OK	OR	PA	RI	SC
SD	TN	TX	UT	VT	VA	WA	WV	WI	WY
DC	AB	BC	MB	NB	NF	NS	ON	PE	PQ
SK									

BLM PHYSIOGRAPHIC REGIONS :
1 Northern Pacific Border
2 Cascade Mountains
3 Southern Pacific Border
4 Sierra Mountains
5 Columbia Plateau
6 Upper Basin and Range
7 Lower Basin and Range
8 Northern Rocky Mountains
9 Middle Rocky Mountains
10 Wyoming Basin
11 Southern Rocky Mountains
12 Colorado Plateau
13 Rocky Mountain Piedmont
14 Great Plains
15 Black Hills Uplift
16 Upper Missouri Basin and Broken Lands

KUCHLER PLANT ASSOCIATIONS :
NO-ENTRY

SAF COVER TYPES :
Tall fescue occurs in most SAF Cover Types.

SRM (RANGELAND) COVER TYPES :
Tall fescue occurs in most SRM Cover Types.

HABITAT TYPES AND PLANT COMMUNITIES :
Tall fescue is listed as a codominant in the following publication:

Plant associations within the interior valleys of the Umpqua River Basin, Oregon [64]

Tall fescue is found in tallgrass prairie [56], salt desert shrub, and sagebrush (Artemisia spp.) [76]. It is also found in pine (Pinus spp.)-Douglas-fir (Pseudotsuga mesziesii) forest, ponderosa pine (Pinus ponderosa) forest, juniper (Juniperus spp.)-pinyon (Pinus spp.) woodland, mountain mahogany (Cercocarpus spp.)-oak (Quercus spp.) scrub, and saltbush (Atriplex spp.)-greasewood (Sarcobatus spp.) communities [16].

MANAGEMENT CONSIDERATIONS

SPECIES: Schedonorus arundinaceus

IMPORTANCE TO LIVESTOCK AND WILDLIFE :
The herbage of mature tall fescue tends to be coarse, but it is taken by all livestock when it is young, green, and succulent [57]. Tall fescue is a commonly planted cool-season forage grass [27].

Songbirds consume tall fescue seeds; both seeds and foliage are used by small mammals [75].

Animals grazing tall fescue infested with the endophytic fungus Acremonium coenophialum [5] may develop "fescue foot," a serious disease which affects cattle, horses, and sheep. All parts of the plant, whether green or dry, may contain the alkaloid poison at any time of year. Symptoms include poor weight gain, lower pregnancy rates, and decreased milk production. Lameness and gangrene in the extremities occur in infected cattle [5,66]. No alkaloids have been found in meat or milk from animals eating endophyte-infected tall fescue [5].

According to Burchick [7], tall fescue may present "reproductive problems" to wildlife, particularly rabbits.

PALATABILITY :
Tall fescue is palatable to livestock when the leaves are young. However, it becomes somewhat coarse, tough, and unpalatable with age [65]. Management and fertilization extend the season of palatability [77]. Some commercially available varieties are more palatable than others. Livestock prefer tall fescue uninfected with endophytic fungus and eat more of it [61,77].

Tall fescue palatability for elk has been reported as poor [75], and elk may show a preference for other grasses [61]. However, elk ate tall fescue in the Mount St. Helens area during October and November 1985. Forbs and shrub species dominated their summer diet, but grasses were selected in greater proportion than their relative abundance in the fall. Tall fescue was a predominant choice [46].

Reports of tall fescue palatability for deer vary. Some authors report poor palatability [61,75]. In the White River Basin of southern Missouri, tall fescue was widely available, but deer consumption from April through September was low [52]. However, in Madera County, California, tall fescue ranked third of 14 forage species in deer preference early in the season (March). Tall fescue remained high in preference throughout the summer months and provided year-round green feed [58].

NUTRITIONAL VALUE :

Tall fescue energy value is rated fair; protein value is rated poor [16].

Nutritive value of tall fescue for cattle is less than that of orchardgrass (Dactylis glomerata), smooth brome (Bromus inermis), or intermediate wheatgrass (Elytrigia intermedia) [29].

Tall fescue nutritive value drops during its summer dormant period. In southwestern Missouri steers eating spring-baled tall fescue in the summer gained an average of 0.70 pound (0.3 kg) per day from June to September. Steers grazing tall fescue left standing in the field lost on average almost a pound (0.45 kg) a day from June to August. In contrast, steers grazing switchgrass (Panicum virgatum) from late May to late August gained an average of 1.43 pounds (0.65 kg) per day [27].

White-tailed deer in the Ozarks of southern Missouri eat tall fescue. Tall fescue is most abundant in late spring, summer, and fall. Forage samples were collected in the White River Basin of southern Missouri from fertilized and unfertilized fescue stands during May, July, September, and November. Protein did not vary significantly with respect to fertilizer treatment. The following mean nutritive values and dry matter digestibility of tall fescue forage were reported for combined fertilized and unfertilized samples [52]:

Harvest Date	Percent				
	Protein	Ca	P	ADF*	DMD**
May	16.2	0.31	0.29	30.7	61.3
July	9.1	0.43	0.21	35.2	51.4
September	9.3	0.36	0.26	37.5	50.9
November	9.5	0.29	0.25	31.0	55.9

* ADF: acid detergent fiber
** DMD: dry matter digestibility

Tall fescue in May had a crude protein content value higher than adequate for reproduction of white-tailed deer and only slightly below that yielding good growth and antler production. The protein values in other measured months were adequate to obtain some growth but retard antler development. Tall fescue is most valuable for deer in early spring and late fall when protein, acid-detergent fiber, and dry matter digestibility are at their most desirable levels [52].

The following wildlife food values have been reported for tall fescue [16]:

	Utah	Wyoming
Elk	good	good
Mule deer	fair	poor
White-tailed deer	----	fair
Pronghorn	fair	poor
Upland game birds	good	----
Waterfowl	good	----
Small nongame birds	good	----
Small mammals	good	----

COVER VALUE :
Tall fescue cover value is reported as follows [16]:

	Utah	Wyoming
Upland game birds	good	good
Waterfowl	good	poor
Small nongame birds	good	good
Small mammals	good	good

VALUE FOR REHABILITATION OF DISTURBED SITES :
Tall fescue is useful in rehabilitation work. It produces coarse, tough roots which prevent erosion and decrease soil density [29]. Tall fescue is an excellent soil improver, especially on heavy soils; its roots open up the soil below the 6 inch (15 cm) level. The root system is partially renewed each year, leaving behind large amounts of organic matter in the soil [65].

Tall fescue makes ground cover which has high "wearing ability" [29]. It provides good cover for areas where a long-lived, tenacious, deep-rooted grass is needed, such as airports, playgrounds, parking lots, cuts and fills, eroding gullies, and waterways and dikes [19,60,65,75]. Tall fescue is also used for medium to long-term watershed protection [73].

On the east slope of the Sierra Nevada, tarweed (Madia spp.) has replaced native perennial vegetation on meadow and sagebrush ranges. On moist and poorly drained areas tall fescue performed best of 40 different grasses and legumes seeded for revegetation of tarweed-infested areas [13].

Tall fescue is the most used and versatile of the grasses suited for reclamation of surface mines in the eastern United States. However, tall fescue stands usually do not thrive unless planted with a legume or fertilized occasionally [73].

In west-central Illinois tall fescue was planted on 30-year-old strip-mined coal spoils amended with dry sewage sludge and on similar unamended sites. By the end of the second growing season, tall fescue produced significantly ($p<.05$) more biomass on amended sites than on unamended sites. Amended sites averaged 625 g/sq m biomass for spring planting and 613 g/sq m for fall planting. Unamended sites averaged 313 g/sq m for spring planting and 222 g/sq m for fall planting. No significant differences occurred between spring and fall plantings [55].

Tall fescue can be used to revegetate acid mine spoils having excess manganese, but it does not tolerate high aluminum concentrations. Tall fescue was found to be tolerant of pH 4 to 6 and manganese at 4 to 64 ppm. However, concentration of 4 ppm aluminum severely inhibited top and root development of tall fescue [23].

Tall fescue produces allelopathic compounds which adversely affect many plant species. In Pennsylvania tall fescue hindered woody plant growth and survival on strip-mined sites. On low-fertility acid mine sites several years of tall fescue control was necessary to ensure adequate survival of silky dogwood (Cornus amomum) and northern arrowwood (Viburnum recognitum). Tall fescue also significantly ($p<.05$) decreased black locust (Robinia pseudoacacia) live plants per plot, average plant height, and canopy cover [34,35]. After 4 years an established unfertilized tall fescue stand on coal mine spoils in Kentucky had greatly retarded growth of planted sweetgum (Liquidambar styraciflua) and sycamore (Platanus occidentalis). However, survival of the trees was not affected [72].

Black walnut (Juglans nigra) seedling growth is reduced by tall fescue leachates; established trees suffer higher mortality and crown dieback when growing with tall fescue [71]. In Sullivan County, Indiana, tall fescue ground cover reduced survival of black walnut and northern red oak (Quercus rubra) seedlings on a reclaimed coal mine site and an unmined site. The tree seedlings suffered severe stem dieback on plots with no groundcover control. When tall fescue was chemically controlled, survival and height growth of both tree species were greater [3].

Tall fescue seed was added to the seedbank in topsoil derived from a native species forest community in Anderson County, Tennessee. The topsoil was spread in a thin layer over mine spoils from a coal seam in Campbell County, Tennessee. The resulting community produced less total biomass and less total biomass in native species than a control community without tall fescue. The community containing tall fescue also had fewer native species and lower populations of native plants than the community without tall fescue [74].

Tall fescue persistence has not been consistent in revegetation efforts. Tall fescue was seeded on tripoli quarries in the Ozark Highlands of eastern Oklahoma. Twenty years after initial establishment of a dense stand of tall fescue on newly graded and filled quarries, tall fescue had disappeared. Plant succession on the quarries had moved toward oak (Quercus spp.)-hickory (Carya spp.)/tallgrass prairie savanna. Tripoli minesoil, at pH 4.0 to 5.6, was substantially below the optimum pH for tall fescue. The tripoli soils were also deficient in nitrogen and phosphorus. Low nitrogen levels were probably a factor in the replacement of tall fescue by native prairie grasses. Tall fescue was also temporary vegetation on highway corridors in the Piedmont region; it was short-lived without nitrogen fertilization. At other sites tall fescue has been one of the most easily established and persistent cool-season grasses on mine spoils [56].

Because of the density of tall fescue root mats and because of allelopathic substances produced, tall fescue should probably not be used for wetland mitigation, reforestation, or rehabilitation with intent of managing for wildlife and plant diversity [7].

OTHER USES AND VALUES :
Tall fescue has been successfully used as a cover crop in established irrigated orchards where shade is not dense [29].

Tall fescue has been used to control musk thistle (Carduus nutans) in Virginia. The more extensive root system of tall fescue reduces musk thistle root and stem size as well as bud production [43].

OTHER MANAGEMENT CONSIDERATIONS :
Several varieties of tall fescue are available commercially [29].

Endophyte-free tall fescue seed is available. However, uninfected tall fescue is more difficult and expensive to establish and maintain than infected tall fescue, and it is prone to fail under stress such as drought. Insects prefer uninfected tall fescue and survive and reproduce better when consuming it [5]. Infected tall fescue is more widely adapted, has a longer growing season, greater resistance to pests, is more successful under adverse growing conditions including drought, poor soils, and a wider range of soil pH than is uninfected tall fescue [5].

Tall fescue is in the spring or fall in the eastern United States [73]. In the South and Midwest, tall fescue may remain productive through drought periods; its extensive root system enables it to obtain moisture from the subsoil [77]. However, tall fescue is intolerant of protracted drought [75]. Near Amarillo, Texas, tall fescue persisted under irrigation but died out under dryland conditions [59].

Tall fescue has good competitive ability against other species in mixtures; tall fescue stands are easily established and develop rapidly [61]. Tall fescue is sometimes seeded alone, but is more commonly seeded with legumes such as alfalfa (Medicago sativa), white clover (Trifolium repens), birdsfoot trefoil (Lotus corniculatus), purple crownvetch (Coronilla varia), or sericea lespedeza (Lespedeza cuneata), which supply nitrogen [75]. However, tall fescue allelopathic compounds inhibit the growth of other plants, making it difficult to maintain legumes in the mixtures. Tall fescue growth can be reduced by some other species. Sericea lespedeza residues reduce tall fescue germination, seedling growth, aboveground biomass, and nitrogen concentration [38,39].

Tall fescue responds well to nitrogen fertilization [75], although fertilization increases alkaloid production [27].

Tall fescue is used to convert tree and brush stands to grasslands in the Ozarks [51]. Tall fescue sod interferes with hardwood seedling growth through allelopathy and competition for water, nutrients, and light [70]. In Illinois old fields tall fescue produced greater height declines, dieback, and mortality among planted black walnut than occurred in fields with tall fescue removed. The effect was seen in stands with tree seedlings and in 17-year-old black walnut stands [50].

Tall fescue can be invasive in native vegetation. It is encroaching on the Clymer Meadow Preserve, a native prairie in northeastern Texas. Tall fescue typically spreads by establishing in wet or disturbed areas along roads, in eroded patches, and in damp hollows. It grows through the winter, shades out other plants, and begins spreading. It now covers as much as 40 percent of the ground in test plots at Clymer Meadow. Tall fescue has devastated many other prairie remnants in Texas and to the north [11].

Tall fescue has good tolerance to grazing. Periodic close grazing will induce regrowth and prolong the period of palatability [75]. In the Pacific Northwest and Great Basin states, sheep graze tall fescue stands in the wet winter months [29].

Tall fescue grows best in cooler seasons [77] and stays green into late fall. It withstands high temperatures and maintains some production during the summer but it does not produce good quality forage under these conditions [61,77]. Tall fescue can be grazed earlier than warm-season grass range, which lengthens grazing season and carrying capacity [42].

The level of tall fescue endophyte infection tends to increase in a field over time as infected plants outcompete uninfected plants. Management for grazing can include favoring other species to dilute the effect of the toxins on animals. The endophyte is concentrated in the seedheads of tall fescue [5].

Tall fescue does not appear to be affected by atrazine [54]. However, tall fescue can be effectively controlled with the herbicide fluazifop [7].

Tall fescue can cause hayfever [16].

BOTANICAL AND ECOLOGICAL CHARACTERISTICS

SPECIES: Schedonorus arundinaceus

GENERAL BOTANICAL CHARACTERISTICS :
Tall fescue is a densely cespitose to short-rhizomatous [20,28,65], cool-season [75], long-lived [65] perennial grass [77]. Culms are hollow [30], erect [28], and 20 to 80 inches (50-200 cm) in height [30,76]. Leaves form basal tufts [61]; blades are 2 to 28 inches (5-70 cm) long [28,48] and 0.1 to 0.5 inch (3-13 mm) wide [61,76]. A tuft produces 10 to 30 flowerstalks [66]. The inflorescence is an open to narrow branched panicle [28,66] 4 to 14 inches (10-35 cm) long [31,57]. Spikelets are three- to nine-flowered [31,75]. Lemmas are awnless to short-awned. The fruit is a caryopsis [28]. Tall fescue roots are tough and coarse; they normally penetrate to a depth of at least 60 inches (150 cm) in moist soils [65].

RAUNKIAER LIFE FORM :
Hemicryptophyte

REGENERATION PROCESSES :
Tall fescue reproduces by seed and increases vegetatively [16]. It spreads primarily by seed to form dense, solid stands. The seed is often spread in animal manure [7]. Viable tall fescue seeds were found in the seedbank on revegetated roadside embankments in northern Kentucky [45].

Tall fescue spreads slowly by short rhizomes [20] and by tillering. Tall fescue produces more tillers after a cold winter. Nitrogen fertilization also increases tillering. If nutrition is adequate cessation of tillering is caused by self-shading of tiller buds. Tall fescue self-thins by this process. Cut tall fescue produces new tillers from the root crown [63].

Tall fescue endophytic fungus is maternally transmitted to the seed. The fungus can survive in stored seed for about a year. Infected tall fescue seeds have more rapid germination rates in some environments than do uninfected seeds, and infected seeds produce seedlings with greater biomass that are more likely to survive. Infected plants have been shown to be capable of higher seed production than uninfected plants [5].

Tall fescue seeds germinate within 14 days after prechilling [75]. In a germination test of tall fescue seeds, emergence was 93 percent in the year grown. The same seed lot stored in cool, dry conditions for 19 years had 4.5 percent emergence [36]. In another study tall fescue seeds had emergence of more than 80 percent at 54 to 75 degrees Fahrenheit (12-24 deg C). Emergence was less than 35 percent at 37 to 43 degrees Fahrenheit (3-6 deg C). Although the number of days to first emergence was increased and germination percentage decreased by low temperatures, when temperatures were then raised the final emergence percentage was 80 percent. Maximum emergence was from sowing depths of 0 to 1.2 inches (0-30 mm) and decreased with increasing sowing depth [10].

Tall fescue requires one growing season to establish [9,65]. Because of slow establishment tall fescue is sensitive to competition from other plants during early development [9].

When tall fescue stands become sod-bound seed production declines [77].

SITE CHARACTERISTICS :
Tall fescue is cultivated for pasture, from which it often escapes [66]. It occurs in grazed woods [7], along roads, ditches [28], and railroad tracks, in fallow and abandoned fields, [7,33], meadows [32], and marshes [22]. It is a weed of cultivated areas [76] and is found in moist, disturbed places [17,18,47,78].

Tall fescue is mesic in its moisture requirements. It is tolerant of poor drainage, winter flooding, and fairly high water tables. It has fair drought tolerance [75].

Tall fescue grows best on deep, fertile, silty to clayey loam soils but with adequate moisture it is tolerant of most soil textures [75]. Tall fescue seeds have low establishment in crusted soils; seedlings emerge only through soft soil crusts. However, tall fescue seeds germinate well and produce good forage on high saline-sodic soils as long as soils are not crusted [25]. Although tall fescue responds well to high fertility, it persists satisfactorily on infertile soils and in difficult environments if not overgrazed [77]. Tall fescue is salt tolerant and does well on heavy alkaline soils [61,76.77]. It grows at a wide range of pH. In south-central Missouri tall fescue grows on silt loam with pH 5.1 to 5.5 [15]. In western South Dakota it grows on calcareous clay with pH 7.7 [37]. Tall fescue can withstand pH values as low as 3.6 [56], but pH 4.5 is considered its lower growth limit [73]. Best growth is obtained at pH 6.2 [56].

Tall fescue is adapted to a wide range of climatic conditions [65]. In the northern and mountainous West, tall fescue produces good growth in areas with over 18 inches (457 mm) mean annual precipitation; optimal growth in the East occurs in areas with over 30 inches (762 mm) mean annual precipitation. Tall fescue demonstrates good cold tolerance, making fair winter growth in southern Missouri and and the mid-South [75].

Tall fescue is reported at the following elevations:

	Feet	Meters	
California	<8,859	<2,700	[31]
Colorado	4,800-8,700	1,463-2,652	[16]
Oregon	443-1,657	135- 505	[64]
Utah	4,200-6,004	1,280-1,830	[16,76]

SUCCESSIONAL STATUS :
Tall fescue is a long-lived, aggressive perennial [7]. Tall fescue competitive ability and persistence is increased by the allelopathic compounds it produces [14]. It colonizes bare soil, and is a strong competitor in many species mixtures [34,35]. Tall fescue can invade open, natural communities and displace native species. It spreads slowly vegetatively, but once the heavy clumps of tall fescue develop they are difficult to eradicate [7].

Tall fescue grows best in open sunlight [7] but is somewhat suppressed by shade [75]. Tall fescue grew within and adjacent to staghorn sumac (Rhus typhina) colonies on revegetated roadside embankments in northern Kentucky. Both areas were dominated by tall fescue, but inside the colonies tall fescue was less prominent [45].

SEASONAL DEVELOPMENT :
Tall fescue grows best under relatively cool conditions [65]. However, growth rate was found to decline as temperatures decreased from the optimal alternate 12-hour day/night temperatures of 75/66 degrees Fahrenheit (24/19 deg C) to 59/50 degrees Fahrenheit (15/10 deg C) [1]. In the South tall fescue grows in the spring, fall, and winter. At higher latitudes it grows mostly in the spring and fall. Where summers are hot, tall fescue remains green but growth slows or stops [29]. During the hot, dry Corn Belt summers, tall fescue is dormant [27]. At high altitudes tall fescue grows in the summer [75]. Well established tall fescue withstands low winter temperatures in most of the United States [77].

Tall fescue flowering times are:

California	May-June	[48]
Colorado	May-July	[16]
Florida	April-May	[12]
Illinois	May-August	[47]
Montana	July-August	[16]
Wyoming	May-July	[16]
Great Plains	May-October	[28]

Tall fescue seeds ripen before leaves lose their moisture and green color [77]. In the Great Plains tall fescue seeds mature in late summer [4]. Seeds shatter as soon as they mature [59].

FIRE ECOLOGY

SPECIES: Schedonorus arundinaceus

FIRE ECOLOGY OR ADAPTATIONS :
Tall fescue probably sprouts from short rhizomes [28] after aerial portions are burned. Tufts formed by the leaves [61] may protect basal buds from fire damage. Tall fescue seeds have been found in the seedbank [45]; tall fescue may regenerate from soil-stored seed.

POSTFIRE REGENERATION STRATEGY :
Rhizomatous herb, rhizome in soil
Tussock graminoid
Ground residual colonizer (on-site, initial community)

FIRE EFFECTS

SPECIES: Schedonorus arundinaceus

IMMEDIATE FIRE EFFECT ON PLANT :
Tall fescue culms and leaves are probably killed by fire.

DISCUSSION AND QUALIFICATION OF FIRE EFFECT :
NO-ENTRY

PLANT RESPONSE TO FIRE :
Tall fescue is fire tolerant in the dormant state [75].

In south-central Iowa tall fescue was burned to test the effectiveness of spring fire in eliminating or suppressing cool-season grasses. Plots were within livestock exclosures constructed in 1984. A baseline inventory of plots was conducted in 1985; plot inventories were conducted after treatments were completed in 1986, 1987, and 1988. Tall fescue was burned in late March or early April. Some plots were initially burned in 1986 and some in 1987. In 1988 the plots burned in 1986 were burned again. In 1986 tall fescue relative shoot frequency increased significantly ($p<.10$) after fire in the same year; the increase did not persist in subsequent years. Fire had no significant effect on tall fescue in any other year [54].

DISCUSSION AND QUALIFICATION OF PLANT RESPONSE :
NO-ENTRY

FIRE MANAGEMENT CONSIDERATIONS :
Tall fescue is not usually decreased by burning when it is dormant [54,75].

FIRE CASE STUDIES

SPECIES: Schedonorus arundinaceus

CASE NAME :
Mark Twain National Forest, MO/Prescr. Fire/Tall Fescue Response

REFERENCE :
Probasco, G. E.; Bjugstad, A. J. 1977 [51]

SEASON/SEVERITY CLASSIFICATION :
late winter (February)/moderate
early spring (April)/moderate
mid-summer (August)/moderate
late fall (November)/moderate

STUDY LOCATION :
Prescribed fires were conducted on the Mark Twain Grazing Allotment on the Ava Ranger District of the Mark Twain National Forest in Missouri.

PREFIRE VEGETATIVE COMMUNITY :
The prefire community was a uniform tall fescue (Schedonorus arundinaceus) stand.

TARGET SPECIES PHENOLOGICAL STATE :
Tall fescue was dormant at the time of the February fire. It had just broken dormancy at the time of the April fire. Tall fescue was not growing at the time of the August fire. It was in the phase just before initiation of dormancy at the time of the November fire.

SITE DESCRIPTION :
Not given.

FIRE DESCRIPTION :
Plots on a uniform tall fescue stand were burned at four different times; a no-burn control was associated with each burning treatment. The control plot was mowed each time burning was done, so that burned and unburned stands could be compared. The burning times were selected to coincide with periods when both damage to tall fescue vegetation and the time required for regrowth and return to grazing would be minimal. Maximum fire temperatures were estimated by means of thermal sensors placed 1 inch (2.5 cm) below soil surface, at soil surface, and 2 inches (5 cm), 6 inches (15 cm), and 24 inches (61 cm) above soil surface. The sensors set below the soil surface were unaffected by the fires. The fires produced consistently higher maximum temperatures at the mid-range height of 2 to 6 inches (5-15 cm) than at other vertical locations. Maximum temperatures varied at the upper and lower heights; higher temperatures occurred at lower heights early in the year and at upper heights late in the year.

FIRE EFFECTS ON TARGET SPECIES :
Forage yields were measured on twenty 4.8 square foot (0.45 sq m) quadrats on each plot during June and October of the year following burning. There were no significant differences ($p<.10$) in forage yields after burning among the four fire treatments considered individually. However, when burning during the inactive (late winter and mid-summer) periods was compared with burning during active growth (early spring and late fall), there was a significant difference ($p<.10$). Burning during dormant seasons produced yields similar to those on unburned plots.

Burning during active growth produced lower yields than burning on dormant plots. Tall fescue seedstalk numbers were stimulated by the mid-summer fire. Tall fescue forage yields and seedstalk production following fire treatments were as follows:

Burning Season	Pounds/Acre	Seedstalks/Sq Foot
Late Winter	2,856a	20f
Early Spring	2,406a	8g
Mid-summer	3,312a	31h
Late Fall	2,651a	22f
No Burn	2,893a	16i
Active Growth	2,529b (early spring and late fall)	
Inactive Period	3,083c (late winter and midsummer)	

Note: Means followed by "a" were not significantly different at p<.05.
Means followed by "b" and "c" were significantly different at p<.10.
Means followed by "f" through "i" were significantly different at p<.05 if the letters differ.

FIRE MANAGEMENT IMPLICATIONS :
After 1 year of study it appears that when burning only for tall fescue stand maintenance, fire should be applied during a dormant or inactive period, either late winter or mid-summer. To increase tall fescue seed production, fire should be applied in mid-summer.

REFERENCES

SPECIES: Schedonorus arundinaceus

REFERENCES :

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