Effect of a February Burn on Lehmann Lovegrass[1]

CHARLES P. PASE

Plant Ecologist, Forest Hydrology Laboratory,[2] Arizona State University, Tempe, Arizona.

Highlight

Density and vigor of Lehmann lovegrass were essentially unaffected by burning which resulted in a 90% topkill of shrub live oak sprouts. Some increases were noted in King Ranch and yellow bluestem and associated native forbs.

El Efecto de una Quema en Febrero Sobre "Lehmann Lovegrass" en el Estado de Arizona, E.U.A.

Resumen[3]

La densidad y el vigor de las plantas de "Lehmann Lovegrass" (*Eragrostis lehmanniana*) no fueron afectados por la quema, pero mató 90% de las partes aéreas de las especies arbustivas. Se aumentaron las zacates introducidos, "King Ranch y Turkestan Bluestem," y las hierbas nativas.

The use of light grass fires is a tempting alternative to continued use of herbicides to suppress shrub growth on brushlands converted to grass-shrub types. Grass fires are flashy, and while damaging thin-barked shrub seedlings and sprouts, probably cause little harm to soil structure and soil organic matter. If grass is burned during the winter, regrowth tends to limit erosion damage during the following summer rains. Such a treatment is beneficial, however, only if it causes little damage to the grass stand itself.

While summer burns may cause substantial mortality of Lehmann lovegrass (*Eragrostis lehmanniana* Nees) (Humphrey and Everson, 1951; Cable, 1965), the effect of winter fires has not previously been assessed. Late winter or early spring burning has been reported as beneficial on longleaf pine-bluestem ranges (Grelen and Epps, 1967), on brush prairie savanna in Wisconsin (Vogl, 1965), and on tobosa grass (*Hilaria mutica* (Buckl.) Benth.) (Wright, 1969). Burning during the hot, dry season may depress grass and shrub production for up to 3 years (Reynolds and Bohning, 1956; Cable, 1967; and Dwyer and Pieper, 1967). Although total herbage production after burning may be lowered, selective response of individual species tolerant to fire may improve composition of the range community (Trlica and Schuster, 1969).

This report presents results of a single February test burn of a chaparral area rootplowed and seeded to Lehmann lovegrass, yellow (or Turkestan) bluestem (*Bothriochloa ischaemum* (L.) Keng), and its variety, King Ranch bluestem.

Study Area and Methods

The test burn was made on a part of the Three Bar Game Management Study Area on the Tonto National Forest in central Arizona. This study area has been protected from livestock grazing since 1936, except for moderate use from 1943 to 1947. Approximately 5 acres of moderately dense oak-mountainmahogany chaparral, burned over by a wildfire in 1959, was rootplowed in November 1962 and seeded to Lehmann lovegrass and yellow and King Ranch bluestem. In the spring of 1966, surviving shrub live oaks (*Quercus turbinella* Greene) were spot treated with fenuron at 8 pounds active ingredient per acre. Some shrubs were killed, but others had largely recovered by February 1969.

Half of the area was selected for burning, and half was left for an unburned check. A 10-foot fire line was carefully burned out on the downwind side of the burn plot.

Herbage production before and 1 year after the burn was estimated by a double-sampling procedure, where field estimates are corrected by regression analysis (Wilm, Costello, and Klipple, 1944). Lehmann lovegrass density was determined by the angle-order method of Morisita (1957). Sixty living Lehmann love-

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[2] Rocky Mountain Forest and Range Experiment Station, Forest Service, U. S. Department of Agriculture, with central headquarters at Fort Collins, in cooperation with Colorado State University.

[3] Por Donald L. Huss y Benjamín López, Dep. de Zootecnia, I.T.E.S.M., Monterrey, México.

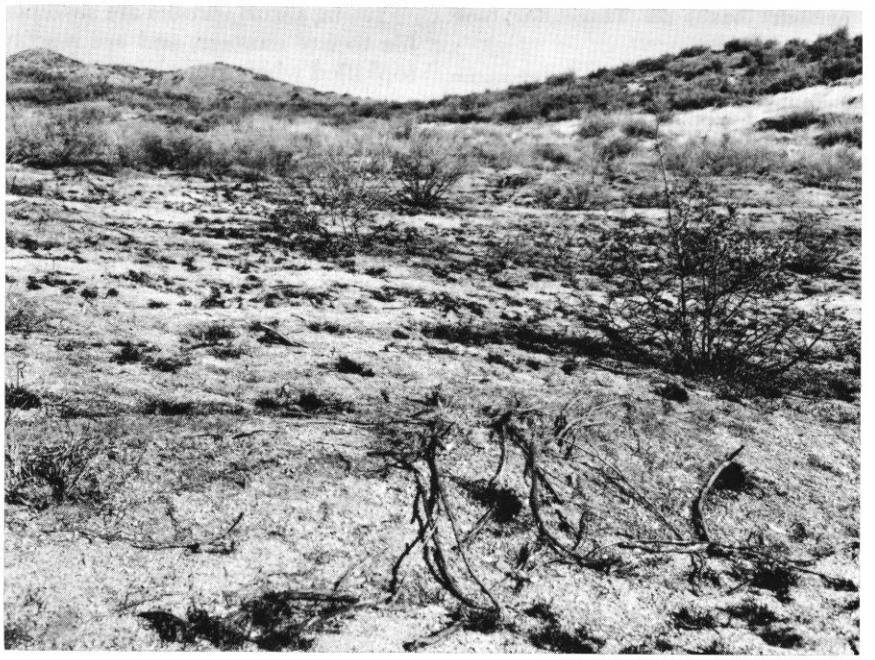

FIG. 1. February grass fire consumed most of the dead grass and light litter. Shrubs in this photo were topkilled to ground level.

grass clumps were tagged on the area to be burned, and 60 on the check area, to measure death loss directly. Twenty-one shrub live oaks were tagged, and pre- and post-fire top damage was estimated to determine response to burning.

Light rains totaling 0.88 inch fell on February 6 and 7, four days before the burn. Soil moisture content at the time of burning was 12.2% by weight in the surface two inches. Soils are sandy loams of the Barkerville series, moderately deep, developed from deeply weathered granites. Fuel moisture content of the standing grass crop was 16.6%. Shrub live oak leaf moisture was 70.6%.

The plot was burned at 11:40 a.m. on February 11 by Tonto National Forest personnel. Wind was from the east, light and variable at 3 to 5 mph. Air temperature at a climatological station 600 yards away was 58 F; the maximum that day was 65, after an overnight low of 32. Relative humidity during the burn was 39%.

The plot was fired from the upwind side, upslope to increase rate-of-spread. The fire was very flashy, and most shrubs surrounded by grass burned readily (Fig. 1). At the margin of the grass plot the fire quickly dropped to the ground and was extinguished. Without grass fuel, the cool, moist brush apparently was not flammable. Burning time for the 2.5-acre plot was 10 minutes.

Results and Discussion

Lehmann lovegrass mortality by the end of the first post-burn growing season was 4.7% on the burned plot and on the unburned check, 1.6%. The difference was not significant at $P = .05$. Dead grass clumps were abundant on both plots both before and after the fire, but large amounts of grass litter on the unburned plot made them more difficult to observe.

Lehmann lovegrass decreased from 0.98 to 0.94 plants per square foot on the unburned area, but increased from 0.86 to 1.05 on the burned area. The density differences were relatively minor, however, and were not significant between years or between treatments. Seedling plants with at least one flowering culm were more abundant on the burned than the unburned area, probably due, in part, to removal of the mass of grass litter by the fire. The fire may also have briefly improved the inherently poor nutrient status of these soils.

Vigor of the burned grass plants

FIG. 2. Grass recovery was rapid, as few clumps were killed by the fire. Robust clumps of yellow and King Ranch bluestem appeared to increase in relative importance. Note rapid sprout recovery of shrub live oak in right center of photo.

Table 1. Herbage production (lb./acre, oven-dry basis) on Three Bar root-plowed plot. Treated plot was burned February 11, 1969.

Species	Pretreatment 1968		Post-treatment 1969	
	Control	To be burned	Control	Burned
Grasses				
Lehmann lovegrass	708	821	479	592
Bluestem (yellow and King Ranch)	53	82	54	95
Forbs and half-shrubs				
Dark spurge (*Euphorbia melanadenia* Torr.)	1	6		
Ground cherry (*Physalis fendleri* Gray)			4	16
Purple nightshade (*Solanum xanti* Gray)				11
Franseria confertiflora (DC) Rydb.				12
Others		6		6
Total	762	915	537	732

did not appear to suffer; in fact, number and height of seed stalks appeared greater on the burned plot (Fig. 2). The bluestems especially seemed more abundant and vigorous after treatment. While total herbaceous production declined 20% on the burned plot, bluestem production increased 16% (Table 1).

Forb production increased 33 lb./acre on the burned plot, but only 3 lb. on the unburned check. Most of this increase was in species that are important forage for mule deer.

Total herbage production was lower on both plots in 1969 than in 1968, but decrease was more pronounced on the unburned plot. Decreases were largely due to reduced summer rainfall: July–September rainfall in 1969 was only about 50% of the long-time average. There was no significant difference between the burned and unburned areas in either the pre-treatment or post-treatment years (Table 1).

The rapidly moving fire was quite effective in topkilling shrubs. Top damage on shrub live oak increased from 8% before the fire to 98% after the fire. Twenty of 21 shrubs suffered complete topkill; one shrub received 50% top damage because grass cover was too thin to carry the fire. Other severely damaged shrubs were desert ceanothus (*Ceanothus greggii* A. Gray), a non-sprouting species; skunkbush sumac (*Rhus trilobata* Nutt.); and narrowleaf yerba-santa (*Eriodictyon angustifolium* Nutt.). Shrub live oak sprouted vigorously after the fire, as did narrowleaf yerba-santa and skunkbush sumac. Only desert ceanothus was killed.

Sediment movement was not measured on the relatively gentle slopes (5 to 15%), but observations indicated that the quickly regenerated grass cover provided adequate protection by the onset of summer rains. Lovegrasses have been shown to be effective in reducing high rates of sediment movement on granitic slopes in central Arizona (Rich, 1961).

Conclusions

Burning a stand of Lehmann lovegrass under the conditions of this study has little adverse effect on lovegrass density, mortality, or vigor, unlike results reported for warm-season fires. Burning when soil moisture is high and grass leaf bases are relatively moist results in a quick, flashy top fire with little effect on the perennating buds near the cool ground surface.

Young shrub sprouts are susceptible to fire damage, and are readily topkilled when they are surrounded with highly flammable grass, even during midwinter when leaf and soil moisture contents are high.

The cost of burning under these conditions would likely be substantially less than maintenance with presently available chemicals.

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