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Role of Fire in Pasture Management

J. E. Weaver
University of Nebraska-Lincoln

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The practice of burning grass is an old one. It was extensively used by the Indians to attract game animals in early spring and to facilitate hunting. It is also highly probable that a large portion of the prairie was burned periodically during very dry years from natural causes.

Burning of bluestem pastures is a practice that is generally followed in eastern Kansas and particularly in the Flint Hill region. This great area

[1] **Aldous, A. E.** 1934. Effect of burning on Kansas bluestem pastures. *Kans. Agr. Exp. Sta. Tech. Bull.* **38**: 1–65. 12 figs.

occupies about three million acres of pasture land extending north and south across the western part of the eastern one-third of the state. It is contended that unless the dead grass remaining from the previous year's grazing is burned it will result in irregular grazing, *i.e.*, the rocky slopes will be undergrazed and the ridge tops overgrazed. Burning is also believed to promote earlier growth in spring; it destroys the dead, unpalatable grass and permits the new growth to be grazed to better advantage. It is also believed to be effective in controlling weeds. Conversely, many persons have considered burning a harmful practice since fire is usually associated with destruction. They believe there is some loss in fertility of soil as well as a decrease in the density and vigor of the desirable pasture plants.

Preliminary studies [2] on the effect of burning showed a slight decrease in the yield but an increase in the population of grasses. Since there was little difference in the vegetation of the burned and unburned areas, the conclusion was reached that burning had not been injurious.

In 1926–27 experiments were started to determine the effect of burning on (1) the yield, (2) control of weeds and brush, (3) quality of vegetation, (4) soil moisture and soil temperature, (5) composition and succession of the vegetation, (6) starting growth in spring, and (7) effect upon fertility of the soil. The experiments were conducted on two areas of bluestem pastures near Manhattan, Kansas, under a mean annual precipitation of 31.5 inches, about three-fourths of which falls during the growing season. The soil in the Casement pasture area is nontillable both because of limestone outcroppings and the presence of loose, cherty rock, which also covers the surface. The Derby silt loam of the college pasture, although deep, fertile, and arable, has never been broken.

Andropogon furcatus and *A. scoparius* are the dominant grasses of both areas. They are about equally divided in the Casement pasture, and *A. scoparius* comprises about one-half of the entire vegetation in the college pasture. Other important grasses in the two areas include *Sorghastrum nutans, Bouteloua curtipendula, Koeleria cristata, Sporobolus heterolepis, Poa pratensis,* and *Panicum virgatum.* In addition there are numerous subdominant forbs.

The experimental plots (each 33×66 feet or larger) were burned annually either in the late fall (December 1), early spring (March 20), medium spring (April 10), or late spring (May 5). Other areas were burned on alternate years. Each burned area contained an unburned check plot. Yields from at least one-half square rod samples of mature vegetation were obtained by clipping in early October.

Burning decreased the yield of the mature vegetation, and the yield was least on the plots burned late in the fall. The plot burned in early spring ranked second, and was followed by the plot burned in medium spring. Plots burned in late spring most nearly approached the yield of unburned

[2] **Hensel, R. L.** 1923. Effect of burning on vegetation of Kansas pastures. *Jour. Agr. Res.* **23**: 631–647.

plots. The yield of the unburned plots (college pasture) over a period of six years averaged approximately 48 per cent more than that of the plot burned in the late spring, and 88 per cent more than the plot burned in the late fall. Yield of plots burned on alternate years was greater than that of plots burned annually, varying from 16 to 48 per cent greater, depending upon the time of burning.

Burning had little effect in controlling weeds (forbs) or *Rhus glabra* and *Symphoricarpos* unless it was done very late in spring after growth had begun and food reserves were low. It was not an effective means of eradicating sumach since the minimum point in food reserves does not occur until about June 7. The dominant grasses on the burned plots were more leafy during the early part of the growing season than on the unburned ones. The nutritive content of the forage depended upon the amount of growth. Thus in early June protein content was highest for the vegetation obtained on the plots burned in the late spring, while the older vegetation from the fall- and early spring-burned plots had the lowest protein content.

Water content of soil on the unburned plots was higher than that of any of the burned ones. A thorough analysis of a large number of meter quadrats charted three or four times annually showed that the plant population was greatest on plots burned in late fall and least on those burned in late spring. Plots burned in late fall and early spring had a greater number of plants than the unburned plots. The greater plant population of the late fall-burned plots resulted mainly from an increase in the number of plants (stems) of *Andropogon scoparius*. While late burning in fall caused a successional trend in favor of the little bluestem, in plots burned in late spring the change was toward the coarser grasses, mainly *Andropogon furcatus*. *Poa pratensis* increased on all the unburned plots and was either decreased or eliminated in all the burned ones.

Burning stimulated early growth in spring, owing mainly to the higher soil temperatures. The mean maximum weekly temperatures at a depth of one inch in spring were 10.5° F. higher on the burned plots. Plots burned in late fall or early spring produced a greater growth of vegetation until early in June, after which moisture rather than temperature became the controlling factor in growth. During a five-year period burning caused no measurable decrease either in organic matter or total nitrogen. Accumulation of both these materials in prairie is governed more by root development than by the accumulation of surface materials.

"A properly managed bluestem pasture should be stocked according to its grazing capacity in an average year." Excess forage production may be cut for hay on very favorable years. If this is not feasible, accumulated materials on steeper slopes and other undergrazed parts of the pasture should be removed by burning. "Burning seems to be highly desirable if not essential on bluestem pastures about every other year if they are stocked about the same each year." It may be effectively used in making the utilization of

the forage possible in the less accessible places, but only those parts of the pasture with much accumulated debris should be burned.

In the experiments the burning was always done when the soil was moist, otherwise there might have been excessive burning of the soil and crowns of the plants and distinct injury to the vegetation. Accordingly the results might have been different.

This carefully planned and well executed research, extending over a period of years, adds much to an understanding of the ecology of the prairie in addition to furnishing a scientific basis for the use of fire in improving the range.

J. E. WEAVER

UNIVERSITY OF NEBRASKA