Effects of Early Spring Burning on Yields of Native Vegetation[1]

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Part of a lightly grazed native pasture located on the Fort Hays Branch of the Kansas Agricultural Experiment Station at Hays, Kansas, was burned by wildfire March 18, 1959. The heavy accumulation of dormant vegetation as well as the soil surface were extremely dry, and the fire consumed the plant material to ground level. A ravine running at right angles to the wind direction caused the fire to divide into two fronts, resulting in an unburned area between two burned strips on upland with two to three percent slope. The arrangement of unburned areas in relation to the burned afforded an opportunity to make a replicated study of the effects of the fire on herbage yields on a clay upland range site supporting a mixture of shortgrasses, buffalograss *(Buchloe dactyloides* [Nutt.] Engelm.) and blue grama *(Bouteloua gracilis* [H.B.K.] Lag. ex Steud.) with frequent stands of western wheatgrass *(Agropyron smithii* Rydb.) in the shortgrass matrix. The site is part of the shortgrass habitat described by Albertson (1937). The physical characteristics of the area and vegetative composition under light grazing are discussed in a previous report (Launchbaugh, 1957).

Burned and unburned vegetation were protected from grazing and yield measurements were made in late summer each year during 1959, 1960, and 1961 using ten 3.1 square-foot, clipped subsamples per treatment in each of the two grass mixtures. The central unburned strip and nearby burned area made up one replication. The nearest unburned margin and adjacent burned area were considered another replication. Yields were measured separately in the shortgrass alone and in the western wheatgrass-shortgrass mixture. Weeds were separated from the subsample clippings and composition estimates were made of the remaining plot material into categories of buffalograss and blue grama combined, western wheatgrass, and old growth. The harvested material was oven-dried at 170° F. for 72 hours prior to being weighed. Plant

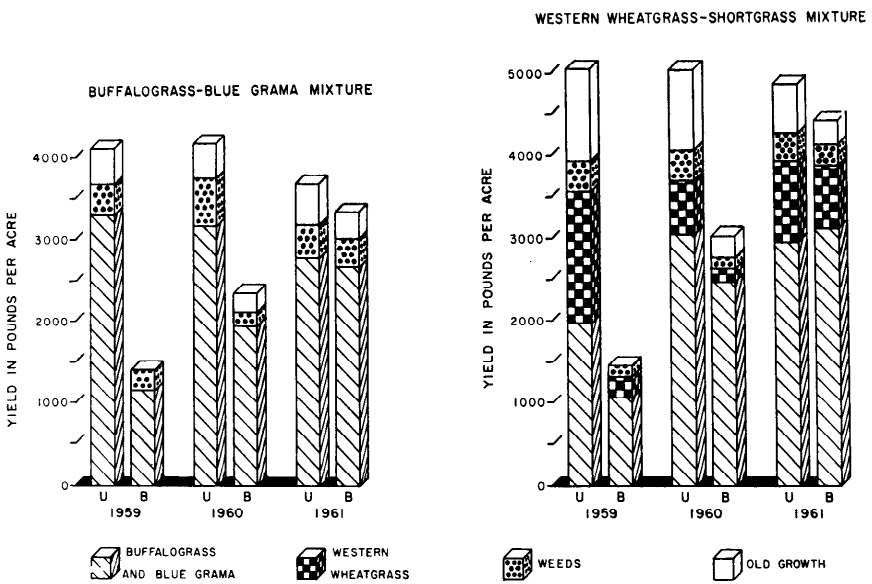

FIGURE 1. Vegetation yields in two native grass mixtures on a clay upland range site during three growing seasons following a March 18, 1959, wildfire. U—unburned; B—burned.

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Table 1. Average heights of important plant species at the end of the first growing season on early-spring burned and unburned plots in shortgrass and western wheatgrass-shortgrass mixtures combined.

Species	Treatment	
	Burned 3-18-59	Unburned
	(Inches)	
Western wheatgrass	11.0	17.0
Blue grama	6.7	11.9
Buffalograss	4.1	6.9
Western ragweed	6.1	9.7
Horseweed	10.3	14.2

heights and number of weeds were recorded with the first-season sampling. Subsample plots were relocated each year.

Figure 1 shows mean yields from burned and unburned plots. The 1959 grass yields in the buffalograss-blue grama mixture were reduced 65 percent by the fire. First-season yields of western wheatgrass and shortgrass were reduced 82 and 48 percent, respectively. Second-season grass yields were 39 percent below the check plot yields in the shortgrass alone and 73 and 19 percent lower respectively for western wheatgrass and shortgrass in combination. Third-season herbage production on the previously burned areas was not significantly different from that on unburned sites.

Weeds consisted primarily of western ragweed *(Ambrosia psilostachya* DC.) on both the burned and unburned areas, and yields were relatively low each year regardless of treatment. Lowest yields, however, were on the burned areas. First-season weed numbers averaged 9.9 western ragweed and 0.7 horseweed *(Conyza canadensis* [L.] Cron.) per square foot in the burned plots compared with 8.5 western ragweed and 1.9 horseweed per square foot in the unburned plots. The differences in weed numbers between treatments were not significant. Old growth increased annually on the burned areas, but did not equal amounts present on the unburned areas by the end of the third growing season.

The reductions in vegetation yields during the first and second growing seasons following the fire were significant at the one percent level and apparently were caused by two main effects of burning. First, there were obviously fewer first-year grass tillers compared with numbers of dead remnants, indicating partial killing of plants. Second, plant heights recorded at the close of the first growing season (Table 1) indicated stunting of growth in the burned areas, which might be attributed to lower vigor of the perennials brought about directly by fire damage—or to lower amounts of moisture entering the soil in the burned areas.

Previous studies by Hopkins *et al.* (1948) on the effects of late fall and early spring burning on a similar upland shortgrass site showed that where litter accumulations were heavy at the time of burning, ground cover of living vegetation and subsequent yields were greatly reduced. Also western ragweed plant numbers and yields were increased considerably by early spring burning. Such weed increases were not observed in the present study.

That horseweed, an annual, was reduced in stature on the burned areas suggests that soil moisture conditions were not so favorable in the burned as in the unburned plots. Several studies have shown that a cover of vegetation both living and dead enhanced moisture intake in grassland soils, and removal of the cover reduced soil moisture infiltration (Duley and Domingo, 1949; Hopkins, 1954; and Rauzi, 1960). Thus when yields of perennial vegetation are reduced by burning, it appears that recovery is brought about jointly by revegetation to reclaim ground cover losses and accumulation of a protective cover to increase soil moisture intake.

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