# Annual Broomweed [*Gutierrezia dracunculoides* (DC.) Blake] Response to Burning and Mulch Addition

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## Abstract

**The influence of artificial mulch additions and mulch removal with fall, winter, and spring burning on annual broomweed [*Gutierrezia dracunculoides* (DC.) Blake] density in the Kansas Flint Hills was studied. Removing mulch, either by fall and winter burning or by fall mowing, significantly increased ($P<.03$) annual broomweed density compared to untreated plots. As mulch thickness increased, the number of emerging broomweed plants decreased. Cyclic infestations of annual broomweed appear to be favored by the lack of an overwintering mulch in closely grazed or denuded areas.**


Annual broomweed [*Gutierrezia dracunculoides* (DC.) Blake][1] populations fluctuate widely from year to year in Kansas rangelands. Whether real or imagined, dense broomweed stands are usually considered to have a detrimental effect upon forage production and are esthetically undesirable. Although herbicides have controlled broomweed in Texas (Scifres et al. 1971), they are not generally recommended and infrequently applied to stands in the Kansas Flint Hills. An alternative measure is mowing broomweed prior to seed formation, but that practice is impractical for large scale areas and is detrimental to carbohydrate reserve storage in the perennial grasses (Owensby et al. 1970).

Cyclic infestations of broomweed have usually been attributed to climatical factors, primarily drought or mild winters. Heitschmidt (1979) reported that broomweed abundance in Texas was closely correlated with above-average precipitation in May and below-average temperature in April. However, in the Kansas Flint Hills, dense broomweed stands are commonly observed adjacent to pastures devoid of broomweed, suggesting nonclimatic influences.

Since broomweed infestations often persist in heavily grazed or physically disturbed areas, we believed that denuded soil may play a role in broomweed establishment. The objective of this study was to investigate the response of annual broomweed to different rates of artificial mulch additions, and to mulch removal with fall, winter, and spring burning.

## Study Area and Methods

A heavily infested broomweed pasture in the northern Kansas Flint Hills 10 miles southeast of Manhattan was selected for the study area. Soil on the loamy upland range site was a Typic Argiudoll formed in material weathered from noncalcareous micaceous shale. The pasture had been annually burned in mid-April and moderately grazed by steers from May through October. In addition to broomweed being the aspect dominant, vegetation was primarily big bluestem (*Andropogon gerardii* Vitman), indiangrass [*Sorghastrum nutans* (L.) Nash], tall dropseed [*Sporobolus asper* (Michx.) Kunth var. *asper*], and little bluestem (*A. scoparius* Michx.).

To study the effects of mulch removal with fire, the site was partitioned into 6 m × 6 m plots separated by 1-m alleys. Dates of burning were 19 October 1981, 13 November 1981, 19 January 1982, and 20 April 1982. There were 3 replications for each burning treatment and 4 unburned control plots in the completely randomized design.

An area adjacent to the burned plots was subdivided into 3 m × 3 m plots separated by 1-m alleys to study the effects of mulch additions on broomweed density. Treatments consisted of applying 2,240, 3,360, 4,480, 5,600, or 6,720 kg/ha wheat straw uniformly over each plot in mid-October 1981. In addition to untreated control plots with residual herbage, another treatment consisted of mowing and removing all plant material. The completely randomized design had 3 replications for each of the 7 treatments.

Broomweed density in all mulched and burned plots was determined at the beginning of the study in September 1981 and at the end of the study in July 1982 by averaging the number of plants in 4 0.4-m$^2$ quadrats. Both sets of data were statistically analyzed by standard analysis of variance and treatment means segregated by Duncan's multiple range test ($P<.05$).

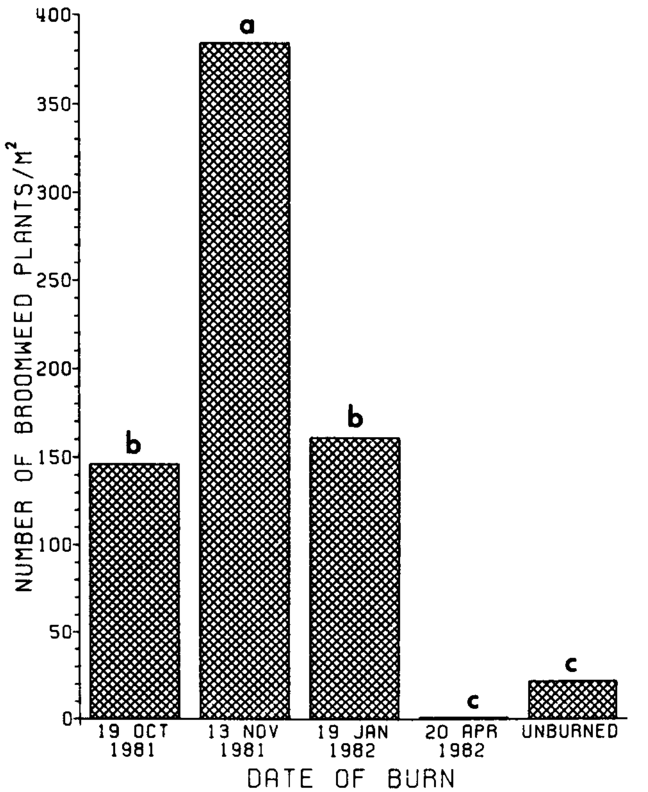


**Fig. 1.** *Effects of burning on annual broomweed density. Plots burned on indicated dates and plants counted in July 1982. Means with the same letter are not significantly different (P<.05).*

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[1]Scientific names follow McGregor and Barkley (1977).

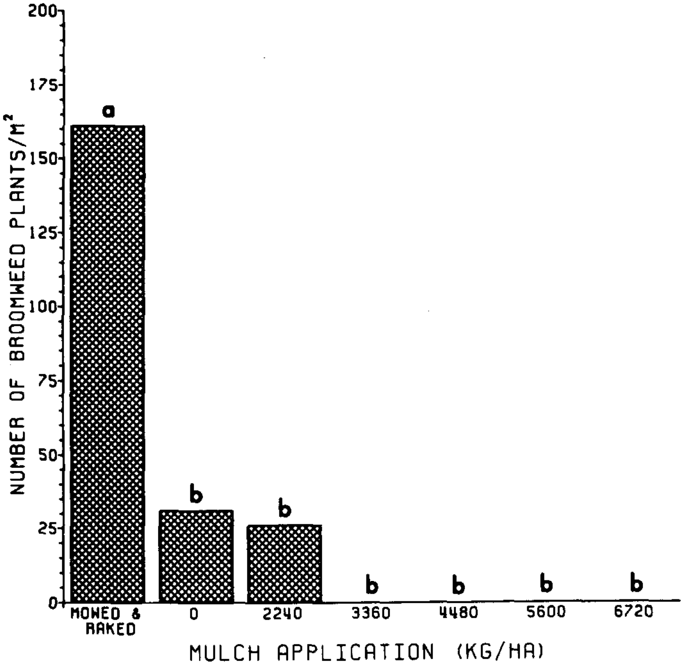


**Fig. 2.** *Effects of artificial mulch accumulations on annual broomweed density. Mulch added in October 1981 and plants counted in July 1982. Means with the same letter are not significantly different (P<.05).*

## Results and Discussion

Fall and winter burning significantly increased ($P<.03$) the number of broomweed plants compared to unburned plots (Fig. 1). Removing the protective ground cover with fire, particularly in mid-November, apparently produced favorable conditions for broomweed establishment. Plots burned in April had significantly lower ($P<.02$) density than fall or winter burned plots. The April fire, however, did not kill broomweed seedlings because they had not yet germinated. Unburned plots were not significantly different ($P = .68$) from plots burned in April, indicating that an overwintering mulch layer was a critical factor in impeding broomweed establishment.

The presence of any mulch significantly reduced ($P$=.0001) broomweed density compared to denuded plots (Fig. 2). Although untreated plots with residual mulch were not significantly different from heavily mulched plots ($P = .15$), the number of emerging broomweed plants decreased as the thickness of artificial mulch increased. No broomweed plants emerged in plots covered with more than 3,360 kg/ha mulch.

In retrospect, 1980 was a hot, dry year with below-average herbage production. By season's end, most of the study pasture had been closely grazed, and the absence of an overwintering mulch layer provided a favorable habitat for broomweed infestations the following year. In 1981, highest ever herbage yields for the Kansas Flint Hills were recorded, producing a heavy mulch at the end of the growing season. Broomweed occurrence in 1982 was localized to grazed-out spots and disturbed areas. Thus, the ephemeral nature of broomweed seems to be influenced, at least in part, by the amount of litter and standing dead remaining from the previous year.

Livestock management schemes in the Kansas Flint Hills could be manipulated to passively reduce broomweed infestations. Intensive-early stocking (Smith and Owensby 1978) allows for removing steers in mid-season after stocking at twice the normal rate. Uniform regrowth would eliminate denuded heavily grazed spots and leave an overwintering mulch unfavorable for broomweed establishment.

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