Response of Big Sagebrush and Three-tip Sagebrush to Season of Clipping[1]

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Highlight

An 80% clipping treatment reduced yields of big sagebrush (*Artemisia tridentata*) most when applied during July, moderately when applied during spring, and least when applied during late summer through winter months. Three-tip sagebrush (*Artemisia tripartita*) responded similarly during July, but it was most tolerant to clipping during April and May. During the fall and winter months, three-tip sagebrush appears less tolerant to clipping than big sagebrush.

Paddock grazing studies conducted on spring-fall range at the U.S. Sheep Station Experimental Range have shown that fall-grazed pastures contain significantly less three-tip sagebrush (*Artemisia tripartita*) and more grasses and forbs than spring-grazed pastures (Laycock, 1961 and 1967). This contrast suggests either that spring deferment favors grass and forbs at the expense of sagebrush, or that fall grazing damages sagebrush directly, or both.

To find out if fall grazing could damage sagebrush directly, I began a clipping study. The aim of the first phase of the study was to determine whether sagebrush responds differently to clipping in relation to season. Along with three-tip sagebrush, big sagebrush (*Artemisia tridentata*), was included in the study.

Seasonal response to clipping has been investigated by Cook and Stoddart (1960), who conducted a clipping study on big sagebrush in central Utah in early spring before active growth was apparent. They found that clipping all the previous year's growth on one-half of a plant resulted in death of that half after 3 years of treatment. However, the unclipped half increased in vigor and almost compensated for the loss of the treated half. Cook and Stoddart also clipped one-half of the previous year's growth over the entire plant. This treatment reduced plant vigor, but only small, isolated twigs or branches died.

Later Cook and Stoddart (1963) tested the response of big sagebrush to three intensities of clipping during four seasons. They found that big sagebrush could withstand 30% use at any one time during winter, early spring, or late spring, but could not tolerate 30% use during both winter and late spring (60% total use). Fifty percent use of big sagebrush was too severe during spring. Moreover, a greater loss in vigor and more dead plants resulted from late spring use than from early spring use. Since data on the effect of clipping in relation to season of the year are incomplete for big sagebrush and totally lacking for three-tip sagebrush, this study was designed to determine the seasonal response of both species to clipping during all months of the year.

Methods

The study was conducted at the U.S. Sheep Station Experimental Range near Dubois, Idaho. Both species of sagebrush were studied on a single site of approximately 1 acre at an elevation of 5,600 feet. Average annual rainfall is 11 inches. Broken lava-bed material is within 4 inches of the soil surface.

One hundred and ten plants of each species growing on fair-condition sagebrush-bunchgrass range were selected for treatment. These plants were randomly divided into 11 groups of 10 plants each. One group was assigned for clipping in each of 10 months, May through January and the following April, and one group was reserved as a check. (Snow was too deep to clip plants in February and March.)

Production before treatment was determined by weight estimates on all plants in October 1964. These data served as covariants for data on plant responses following treatment.

Clipping began in May 1965. A group of 10 plants was clipped between the 10th and 15th of each month. Eighty percent of the current growth of each living twig and leaf rosette on the entire plant was clipped off.

This extreme clipping treatment was chosen to magnify response differences between seasons, if they existed. No more than 80% of the current growth was removed so as to not destroy all potential resprouting buds.

After one full growing season in 1966, 100% of the current growth was clipped in August 1966. To facilitate interpretation of these data, phenological observations were recorded on control plants in 1965 from the time growth began until seed cast.

Results

Clipping reduced yields of big sagebrush most during July, somewhat less during spring, and least from late summer through winter (Fig. 1). The reductions in yields after clipping from August through January were mostly nonsignificant, although they all bordered on significance at the 0.10 level of probability. However, it is interesting that an 80% clip of current growth during the fall reduced the following year's growth of big sagebrush by only 25%. This suggests that big sagebrush can, at least occasionally, tolerate considerable use during the fall and winter months.

[1] Received October 9, 1968; accepted for publication January 9, 1969.

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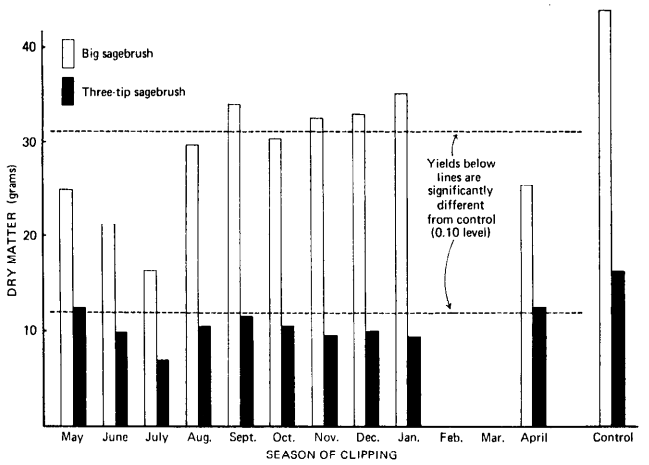

FIG. 1. Average yields of big sagebrush and three-tip sagebrush one growing season after a clip of 80% of current growth.

Table 1. Dates of phenological changes for big sagebrush and three-tip sagebrush.

Stage of phenology	Big sagebrush	Three-tip sagebrush
Leaf growth started	5/1	4/25
Twig growth started	5/15	5/12
Flower buds evident	7/1	6/20
Twig growth stopped	7/10	7/5
Flower stalk growth stopped	7/25	7/20
First bloom	9/5	9/1
Blooming over	9/25	9/20
Seed ripe	10/18	10/12
Seed disseminating	11/15	11/5
Previous year's leaves beginning to drop	8/10	8/5
Previous year's leaves off	9/10	9/2

The response of three-tip sagebrush to clipping was similar to that of big sagebrush, but there were differences. Clipping in April and May did not significantly reduce the yield of three-tip sagebrush, but it reduced the yield of big sagebrush. Clipping in late summer, fall, and winter significantly reduced the yield of three-tip sagebrush but reduced big sagebrush only slightly.

Discussion

The most detrimental time of clipping for both species of sagebrush, July, correlates with the termination of flower stalk and twig growth (Table 1). This stage of phenology may be related to a low accumulation of carbohydrates. McConnell and Garrison (1966) found that lowest levels of total carbohydrates occurred in bitterbrush at this growth stage.

Following termination of twig and flower stalk growth, sagebrush apparently begins translocating carbohydrates rapidly from the current growth to the roots and older stems. This seems logical since (1) sagebrush increases tolerance to clipping by mid-August, and (2) in other shrubs such as bitterbrush about 90% of the carbohydrates are stored in roots and older stems (McConnell and Garrison, 1966), which would not be removed by clipping current growth.

With only a 34% reduction in yield of three-tip sagebrush one growing season after an 80% fall clipping treatment, we might question whether light fall grazing can damage sagebrush to the extent suggested by the fall grazing treatments at the U.S. Sheep Station Experimental Range. At the Range, three-tip sagebrush accounts for only 11% of the total vegetation in fall-grazed pastures, whereas it accounts for 39% of the vegetation in spring-grazed pastures. Laycock (1967) attributed part of the lower percentage of sagebrush in fall-grazed pastures to damage by grazing, since sheep eat from 6 to 26% of the sagebrush in the fall. However, when his data on the fall-grazed pastures are compared with that on the exclosures, fall grazing does not appear to damage sagebrush directly.

The fall-grazed pastures and exclosures, upon which Laycock based his interpretation, appear to have different amounts of sagebrush. And as can be seen in the tabulation below, there was less sagebrush in the fall-grazed pastures than in the exclosures at the end of the study. However, these differences, as shown in pounds per acre, partly reflect differences present in 1950, before the study began.

	Fall-grazed pastures	Exclosures
1950	116	181
1964	96	146

When the 1950 data are used as a covariant, the yield of sagebrush declines 17% in fall-grazed pastures and 19% in the exclosures. These percentages, based on 14 years of data, do not support the argument that fall grazing damages sagebrush directly. Moreover, with only a 34% reduction in yield following a very heavy clipping treatment (80%), I doubt whether a 6 to 26% fall-utilization treatment can damage sagebrush. In my opinion, the lesser amount of sagebrush in fall-grazed pastures compared with spring-grazed pastures is caused almost exclusively by competition from healthy grasses and forbs.

Nevertheless, there is some evidence to indicate that fall grazing may cause a direct reduction in sagebrush. Several possibilities are recognized. Although grazing may not have serious impact in any one year, cumulative effects of even light utilization might cause significant reductions in sagebrush. Also, the palatability of three-tip sagebrush is so variable that some plants may be completely killed by overuse, while others suffer no damage because they are scarcely touched.

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