

Vigor of Idaho Fescue in Relation to Different Grazing Intensities

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The English word, vigor, is from the Latin "vigere," which, according to Webster's dictionary, means "to be lively or strong." The vigor of an individual plant or group of plants, then, may be expressed by some measurement that is indicative of plant health and robustness. Many parts of plants are considered to be indicative of plant vigor although leaf height, culm height, basal area and numbers of leaves and flower stalks are most often used. Relationships between grazing intensity and vigor of Idaho fescue (*Festuca idahoensis* Elmer), as expressed in terms of leaf height, basal area, and herbage weight, are discussed in this paper.

Several workers have established relationships between plant vigor and grazing use. Short and Woolfolk (1956) found that a definite correlation exists between range condition and leaf heights of bluestem wheat-

grass (*Agropyron smithii* Rydb.) Parker (1954) maintains that changes in grazing intensity are first reflected in plant vigor and later by changes in density, composition, and soil stability. In the meadows of eastern Oregon and eastern Washington, deterioration of rangelands is first shown by a decrease in leaf and culm height, sparsity of leaves and loss of color (Reid, 1946). After eight years at Manitou Experimental Forest, average height growth of Arizona fescue (*Festuca arizonica* Vasey) was 40 percent less on heavily used range than on moderate- and light-use range (Johnson, 1953).

Area and Methods

The study was carried out on six pastures, each approximately 85 acres, located on grass-forb ranges of the Tongue Ranger District of the Bighorn National Forest. Idaho fescue was the dominant forage producer on all pastures although numerous other species were found. Measurements were restricted to residual soils formed from gigantic parent materials (called granitic soils) and from sedimentary parent materials (called sedimen-

tary soils). Soils formed from shales predominate in the sedimentary areas, although soils formed from limestone and sandstone are also present. The principal soil series were Burgess gravelly loam and Owen Creek silt loam.

Beginning in 1951 the pastures were grazed with steers at 3 different intensities. The dates the cattle were placed on and taken off the pastures varied each year: entering dates ranging from June 19 to July 2 and removing dates ranging from September 9 to 24 depending on when the desired grazing intensities were obtained. Grazing intensities were assigned at random to the pastures. Two pastures were grazed lightly (less than 25 percent of the current annual height growth of Idaho fescue); two were grazed moderately (approximately 50 percent); and two were grazed heavily (approximately 75 percent).

An enclosure, 150 x 150 feet, was located in each pasture. The enclosures in 3 pastures were placed on soils of granitic origin, in one pasture on deep soil formed from shale, and in 2 pastures on thin soils of sandstone and shale origin near granitic outcrops.

In 1955, differences in height growth of Idaho fescue plants were noticeable between the pastures grazed at different intensities. To measure these differences, one hundred Idaho fescue plants were selected at random on the granitic soils, and one hundred plants were selected on

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Table 1. Leaf height, basal area and weight per plant in relation to grazing intensity¹ on the Bighorn experimental pastures, 1955 and 1956.

Degree of Use	Leaf Height		Basal Area		Weight per Plant	
	Granitic Soils	Sedimentary Soils	Granitic Soils	Sedimentary Soils	Granitic Soils	Sedimentary Soils
	inches	inches	cm ²	cm ²	grams	grams
No use (exclosures)						
1955	7.5	7.9	7.1	7.4	1.37	1.44
1956	8.1	8.1	8.2	13.3	2.77	2.74
Average	7.8	8.0	7.6	10.4	2.07	2.09
Light grazing (less than 25%)						
1955	4.7	9.0	4.6	9.7	0.81	1.85
1956	4.4	9.1	7.7	10.4	1.00	3.30
Average	4.6	9.0	6.2	10.0	0.90	2.58
Moderate grazing						
1955	4.0	6.9	4.3	5.8	0.69	1.22
1956	5.2	7.4	6.3	7.8	0.78	1.74
Average	4.6	7.2	5.3	6.8	0.74	1.48
Heavy grazing						
1955	3.3	6.2	3.2	4.4	0.50	1.14
1956	3.7	6.3	5.1	7.0	0.45	1.22
Average	3.5	6.2	4.2	5.7	0.48	1.18
L.S.D. ²	1.0	1.1	1.0	.9	.36	.53

¹ Grazing intensities were based on the percent removal of the current annual height growth of Idaho fescue.

² Least significant difference for averages at the 5 percent level.

the sedimentary soils of each pasture. Twenty plants were also selected in each of the six exclosures. Leaf height in inches, basal area in square centimeters and air-dry weight in grams of each plant were measured as an evaluation of vigor. Leaf height was the measurement of the longest leaf; basal area was computed from the average of two diameter measurements taken at right angles across the center of the plant; and air-dry weights were obtained by clipping, drying and weighing the plants. All measurements were repeated in 1956 on another group of randomly selected plants.

Results

Leaf Height

On soils of granitic origin, leaves of Idaho fescue were longer in exclosures than under any degree of use (Table 1). Shortest leaves were found on heavily grazed pastures, averaging less than one-half the height of leaves from exclosures. Leaf heights from lightly and moderately grazed pastures were com-

parable and somewhat taller than those from heavily grazed pastures.

Leaf heights on sedimentary soils in heavily grazed pastures were shorter than under light grazing and no use. No differences were found between non-use and light or moderate grazing. However, leaf heights on moderately grazed pastures were shorter than on lightly grazed pastures. These measurements were somewhat in contrast to those from granitic soils where leaf heights under light use were considerably shorter than under non-use. Except under non-use, plants on soils formed from sedimentary rocks were considerably taller than plants growing on granitic soils and subjected to the similar degrees of use.

Basal Area

On granitic soils, basal area of individual Idaho fescue plants was greatest within the exclosures and smallest within heavy-use pastures. Basal areas on moderately grazed pastures were somewhat larger than those on

heavily grazed pastures. The difference in basal area of plants between non-use and light use was not as striking as differences in measurements of leaf height.

On soils derived from sedimentary rocks, differences in basal area of Idaho fescue plants under non-use and light grazing were not significant. As with leaf heights, largest differences in basal area measurement between one degree of use and the next heavier degree of use was found between moderately and lightly grazed pastures. Smallest basal areas were found on heavy-use pastures. Basal areas of plants from these soils were larger than plants subjected to the same use intensity on granitic soils. This was especially noticeable in comparing exclosures with lightly grazed pastures.

Weight per plant

On granitic soils, weights of Idaho fescue plants exhibited much the same pattern as leaf height. A large difference was found between plants in exclo-

tures and those in lightly grazed pastures, but much smaller differences were found between plants on pastures grazed at the three intensities. Weights per plant were smallest on heavy-use pastures.

On soils derived from sedimentary rocks weights of Idaho fescue plants followed the same pattern as leaf heights. Weight differences between plants of lightly grazed and moderately grazed pastures were very pronounced, while those between moderately and heavily grazed pastures were not significant. On these soils, weights per plant within exclosures were comparable to weights per plant within exclosures on granitic soil. When other intensities of use were compared, however, plant weights from granitic soils proved to be approximately one-half as heavy as those from the same intensity of use on soils derived from sedimentary rocks.

Discussion

On soils of granitic origin, measurements of leaf height and weight per plant showed large differences between exclosures and lightly grazed pastures. These differences were approximately seventy-five percent as large as the difference between exclosed areas and heavily grazed pastures. The difference in basal area between exclosures and light-use pastures was 41 percent as great as the difference between exclosures and heavy-use pastures. All measurements showed that differences occurring between light use and moderate use and between moderate

use and heavy use were relatively small. Thus, even light grazing of Idaho fescue on granitic soils lowers the vigor of the plants.

On soils derived from sedimentary rocks, the greatest leaf height and plant weight were found on light-use pastures and exclosures. Differences in basal area measurements between exclosures and lightly used pastures were not statistically significant. However, all three measurements on moderately used pastures proved to be considerably lower than the same measurements on lightly used pastures but not statistically different from the measurements on heavily used pastures. Thus, vigor of Idaho fescue growing on soils derived from sedimentary rocks was little affected by light grazing, but was significantly lower on areas where 50 percent or more of the current year's height growth was utilized.

Of the three measurements, leaf height was the easiest, since only one measurement per plant was necessary in the field. Basal area required two measurements at right angles across the center of the plant. Determining weight per plant necessitated the most time since it involved clipping, air drying, and weighing each plant. All three measurements are about of equal value as a measure of vigor, hence leaf height seems the most logical to use.

Summary

1. Leaf height seems to reflect plant vigor of Idaho fescue. It is more easily measured than basal area and weight per plant.

2. In lightly grazed pastures, Idaho fescue plants on soils of granitic origin were substantially smaller than plants on the same soils within ungrazed exclosures. Even light grazing lowers the vigor of this species on this soil.

3. On soils derived from sedimentary rocks, plants within exclosures and lightly grazed pastures were of approximately the same size. Plants in moderately grazed pastures were considerably smaller. Thus, grazing approximately 50 percent of the yearly height growth from Idaho fescue, with cattle during the June-September period, lowers the vigor of plants growing on these soils.

4. On grazed areas, Idaho fescue plants used to the same intensity were larger on soils derived from sedimentary rocks than those on soils of granitic origin. Ungrazed plants within exclosures on both soils were of approximately the same size.

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