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Collection

Effects of Height
And Frequency of Clipping
On Pure Stands of

RANGE GRASSES

In North Central Oklahoma

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Effects of Height And Frequency of Clipping On Pure Stands of Range Grasses In North Central Oklahoma

by Don D. Dwyer, W. C. Elder and G. Singh

Clipping vegetation at different heights and frequencies is often used in experiments to simulate grazing and to determine productive abilities of different grass species. Knowledge of the clipped (or grazed) height at which a species yields the most forage and how often the plant can be clipped and still maintain its vigor is important for proper grassland management. This study was conducted to evaluate the response of some important range and pasture grasses to various clipping regimes.

Four of the species studied, little and big bluestems (*Andropogon scoparius* Michx. and *A. gerardi* Vitman), indianguass (*Sorghastrum nutans* (L.) Nash), and switchgrass (*Panicum virgatum* L.) are the most important native grass species in the eastern prairie region of Oklahoma. Sideoats grama (*Bouteloua curtipendula* (Michx.) Torr.) and King Ranch bluestem (*Bothriochloa ischaemum* (L.) Keng) are frequently planted for pasture in Oklahoma.

Considerable work has been done on response of native grasses to clipping. Production and vigor of vegetation appear to be inversely related to frequency of clipping (1, 2, 4, 5, 6, 8, 18). Working in Kansas, Aldous (1) has shown that annuals will increase to the point that they comprise 50 percent of a native mixed grass pasture when clipped at two-week intervals, whereas vegetation clipped less frequently will maintain its original composition. Other workers have also noted that clipping frequency will affect vegetative composition (3, 10, 12, 14, 15, 17).

A decline in the production of roots of native grasses has been shown with frequent clipping (2, 4, 7, 11, 16).

METHODS AND PROCEDURES

Pure stands of El Reno and Tucson selections of sideoats grama, big and little bluestems, indiagrass, switchgrass, and King Ranch blue-stem were planted in 1949 in plots 12 ft. by 15 ft. The plots were located on the Norge loam soil series with 1 to 3 percent slope, 13 miles west and 4 miles north of Stillwater, Oklahoma.

Clipping studies were initiated on the plots in 1955 with two replications for each clipping treatment. All treatments were clipped at both 2-inch and 4-inch heights as follows:

Clipped annually the last of January.

Clipped annually the middle of July.

Clipped twice, first part of July and first part of September (60-day interval).

Clipped four times, first parts of June, July, August, and September (30-day intervals).

The plots were clipped with a Jari sickle-bar power mower and the total forage of the plots weighed and converted to ovdry forage on a pounds per acre basis.

Three soil cores 1½ in. by 1½ in. by 4 in. deep were removed from each replication. Each core was carefully washed to remove soil and foreign material and the roots remaining were then oven-dried to determine weight production for each treatment.

The last year of the study, 1960, the percent of the original grass stand remaining was determined using the point quadrat method of vegetation analysis of Levy and Madden (9).

RESULTS

Effect of Clipping on Forage Production

The data presented in Table 1 represent six years clipping from 1955 to 1960. These years include two extremely dry years, 1955-1956, and four years of average or above average rainfall. The production figure for each species represents the total amount of vegetation produced on the plots under each clipping treatment.

The greatest forage yield for all species occurred under the annual July clipping at the two-inch level. In this treatment, indiagrass yielded the most forage. Although the data in Table 1 show that switch-

Table 1. Effect of height and frequency of clipping on total forage production of seven range grasses.

Grass species	Year	Height and frequency of clipping*							
		30-day		60-day		July		January	
		2"	4"	2"	4"	2"	4"	2"	4"
<i>(ovendry pounds per acre)</i>									
El Reno side-oats	1955	967	460	822	387	1017	569	774	472
	1956	313	183	518	230	381	218	327	251
	1957	876	604	1522	1233	2360	1255	1266	779
	1958	1154	681	1444	1086	1747	787	1392	1137
	1959	653	207	688	331	991	475	760	361
	Avg.	793	427	999	653	1299	661	904	600
	1960**	457	148	547	211	744	264	928	628
Tucson side-oats	1955	1138	713	416	851	1064	617	750	544
	1956	446	294	676	431	648	532	403	377
	1957	1456	1283	1889	1565	2318	1504	1472	980
	1958	1434	1051	1837	1379	1666	1265	959	593
	1959	813	528	1033	791	1270	808	812	660
	Avg.	1057	774	1170	1003	1393	945	879	631
	1960**	566	313	724	523	766	393	859	574
Big bluestem	1955	1403	1245	1271	932	1597	1090	932	488
	1956	619	437	988	585	985	477	643	224
	1957	1567	1105	1812	1543	2427	1904	1808	1234
	1958	1544	1127	1801	1511	2025	1282	1779	1319
	1959	886	1026	1380	1158	2251	1744	1693	1416
	Avg.	1204	988	1450	1146	1857	1299	1371	936
	1960**	716	776	837	743	1176	1120	1723	1452
Indiangrass	1955	2019	1500	2048	1515	1984	1695	1585	968
	1956	1004	685	1325	944	1070	639	839	490
	1957	1609	1319	2352	2184	2587	1857	2372	1718
	1958	1968	1313	2356	1720	2349	1492	2214	1186
	1959	1338	1197	1871	1457	2266	1801	2194	1438
	Avg.	1588	1203	1990	1564	2051	1497	1690	1311
	1960**	667	593	881	912	1028	918	1143	1161
Switchgrass†	1955	1923	1174	1453	1173	1840	1359	1247	811
	1956	742	506	1098	684	777	599	739	682
	1957	1503	1176	2219	1321	2595	1831	2229	1504
	1958	1268	663	1392	650	2254	1667	1827	980
	1959	995	724	1587	559	2729	1545	2018	1317
	Avg.	1286	849	1550	877	2039	1400	1612	1059
	1960**	752	428	987	559	1460	1385	1921	1612

Table continued on next page

Table 1. continued

Grass species	Year	Height and frequency of clipping*							
		30-day		60-day		July		January	
		2"	4"	2"	4"	2"	4"	2"	4"
Little bluestem††	1955	1308	-----	907	-----	1296	-----	605	-----
	1956	937	-----	1127	-----	853	-----	661	-----
	1957	1270	-----	1721	-----	2409	-----	1275	-----
	1958	1258	-----	1568	-----	1924	-----	1041	-----
	1959	681	-----	1077	-----	2037	-----	1131	-----
	Avg.	1091	-----	1280	-----	1704	-----	943	-----
	1960**	697	-----	895	-----	1146	-----	1582	-----
King Ranch bluestem	1955	1534	1300	1807	1258	1670	994	2274	1864
	1956	446	221	981	641	623	448	450	603
	1957	944	947	1665	1326	3199	2475	3025	2444
	1958	206	312	550	349	943	876	1089	1089
	1959	290	232	625	456	1784	1398	2212	1961
	Avg.	684	602	1126	806	1644	1238	1810	1592
	1960**	488	69	585	148	795	348	995	167

* All figures average of two replications.

** All clippings in 1960 made on one date, August 1, at the indicated height.

† Switchgrass plots were mostly indiangrass which invaded as switchgrass was damaged by clipping (see Table 2).

†† No 4-inch clipping treatment on little bluestem.

grass plots ranked second in forage production, this yield was primarily from indiangrass which had invaded from nearby plots. Switchgrass was practically eliminated under all clipping treatments. The lowest-producing species was sideoats grama. Under all clipping frequencies the two-inch clipping height yielded significantly more forage than the four-inch height.

There was a large loss of forage from every plot between the July and January clipping dates. This loss was apparently due to weathering, consumption by insects and rodents, and other causes.

In 1960, all plots were clipped on the same date, August 1, at the indicated heights (Table 1). Production from this clipping was generally less than the average yield for the previous five years, except for the winter clipping treatments.

Production figures from the extremely dry year of 1956 are markedly lower for all species than both the 1955 and 1957 data.

Table 2. Percent of the original grass stand remaining after six years of clipping treatments, 1955 to 1960.

Grass species	Frequency and height of clipping*							
	30-day		60-day		July		January	
	2"	4"	2"	4"	2"	4"	2"	4"
	(percent)							
El Reno sideoats	76.2	90.4	88.5	96.0	91.7	96.4	97.6	93.5
Tucson sideoats	65.0	41.2	47.4	57.9	70.0	54.6	90.5	55.6
Big bluestem	68.4	85.2	82.7	77.8	91.6	63.4	100.0	88.6
Little bluestem	90.0	**	91.4	**	88.7	**	96.8	**
Indiangrass	84.2	85.7	95.2	92.0	100.0	100.0	95.8	100.0
Switchgrass	4.8	11.1	0.0	8.3	4.2	14.3	10.0	20.8
King Ranch bluestem	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

* All figures average of two replications.

** No 4-inch clipping treatment on little bluestem.

Effect of Clipping on Grass Stand

Frequent clipping, especially at 30-day intervals, generally reduced the original grass stand (Table 2). Annual clipping in January had the least effect in reducing the stands. Switchgrass was by far the most susceptible to injury from clipping, and even showed considerable damage from clipping during the dormant season (January). King Ranch bluestem was the only species in which the stand was not reduced.

Effect of Clipping on Root Production

Big bluestem showed the greatest root production in the upper four inches of the soil under the annual July clipping at the four-inch level (Table 3). Tucson sideoats grama showed the least root production under the two-inch July clipping. There was a general trend of less root production by the various species as the clipping treatments became more severe. King Ranch bluestem was an exception to this in showing an increase in root production at the two-inch clipping height under all clipping frequencies.

DISCUSSION

The grasses showed no undesirable effects due to clipping height, but frequent clipping was detrimental to all species studied. Forage yields were less on plots clipped four times (30-day intervals) during

Table 3. Average ovendry weight of roots per 1½ in. by 1½ in. by 4 in. deep soil core in grams, and pounds per acre, respectively.

Grass species	Frequency and height of clipping*							
	30-day		60-day		July		January	
	2"	4"	2"	4"	2"	4"	2"	4"
El Reno sideoats	.245 1494.9	.252 1537.7	.265 1617.0	.362 2208.9	.249 1519.4	.362 2208.9	.225 1372.9	.333 2031.9
Tucson sideoats	.140 854.3	.213 1299.7	.177 1080.0	.218 1330.2	.122 744.4	.273 1665.8	.168 1025.1	.204 1244.8
Big bluestem	.178 1086.1	.317 1934.3	.177 1080.0	.527 3215.7	.322 1964.8	.760 4637.5	.499 3044.9	.507 3093.7
Indiangrass	.103 628.5	.225 1372.9	.108 659.0	.212 1293.6	.259 1580.4	.346 2111.3	.149 909.2	.421 2568.9
Switchgrass	.163 994.6	.211 1287.5	.162 988.5	.354 2160.1	.165 1006.8	.356 2172.3	.178 1086.1	.382 2330.9
Little bluestem	.167 1019.0	--- -----	.157 958.0	--- -----	.232 1415.6	--- -----	.216 1318.0	--- -----
King Ranch bluestem	.170 1037.3	.153 933.6	.205 1250.9	.135 823.8	.273 1665.8	.240 1464.5	.284 1732.9	.240 1464.5

* All figures average of two replications.

the growing season than on those clipped twice (60-day intervals). Plots clipped twice yielded less than those clipped annually in mid-July and January.

The two-inch clipping level generally yielded over 25 percent more forage than the four-inch level.

Switchgrass was practically eliminated under all clipping regimes during the study, indicating this species is not well adapted to clipping or mowing at regular intervals. The population of Tucson sideoats grama plants was also reduced, although not to the degree of switchgrass. This variety of sideoats appeared to be less well adapted environmentally than El Reno.

The percent of the original grass stand of big bluestem remaining after six years of clipping treatments was somewhat less than for indian-grass, but in resistance to clipping and forage producing ability these grasses appeared very similar. These two grasses showed the greatest potential of all species studied for both forage production and ability to withstand mowing.

King Ranch bluestem maintained a 100 percent stand in all plots throughout the entire study, even though the production was very low under the 30-day clipping interval. The grass tended to "flatten-out" on the ground in this treatment and did not grow. This species showed competitive ability by moving outside the plot boundaries and invading nearby stands of native grasses. During 1958 and 1959 King Ranch bluestem was seriously infested with rust, especially in the 30-day and 60-day clipping treatments.

Little bluestem was difficult to establish and probably had the poorest initial stand of the species studied. Under the 30-day and 60-day clipping treatments little bluestem occurred in fairly large and distinct clumps, while in other treatments the stand was more uniformly composed of small clumps. This species maintained a good stand under the two-inch clipping level (Table 2).

The plots receiving the severe clipping treatments (30-day and 60-day intervals) had more broadleaved weeds appearing each spring. The stand of grass was also generally more open and less vigorous in appearance. There were more annual bromes (*Bromus* spp.) in the plots clipped at four inches than in those clipped at two inches (Singh, 1959). It appeared that the bromes increased in abundance with an increase in mulch.

SUMMARY

The response of little and big bluestems, indiagrass, switchgrass, Tucson and El Reno sideoats grama, and King Ranch bluestem to various clipping regimes was studied in north central Oklahoma from 1955 to 1960.

Six years of clipping data revealed the following information:

- The greatest yield for all species occurred at the annual July clipping at the two-inch level.
- Indiagrass and big bluestem were similar in response, with indiagrass having some advantage. These two species showed the greatest potential of the species studied for production in pure stands. Switchgrass and Tucson sideoats showed the least potential. Switchgrass did not appear to be adapted to regular mowing or clipping.
- Forage yield was over 25 percent greater for all species at the two-inch clipping level over the four-inch level. Root production

in the upper four inches of soil was reduced under the two-inch clipping level.

- Stand density and plant vigor decreased, and broadleaved weeds and annual bromes increased under increased frequency of clipping.

LITERATURE CITED

1. Aldous, A. E. 1930. Effect of different clipping treatments on the yield and the vigor of prairie grass vegetation. *Ecol.* 11:752-759.
2. Biswell, H. H. and J. E. Weaver. 1933. Effect of different frequency of clippings on the development of roots and tops of grasses in prairie sods. *Ecol.* 14:368-390.
3. Ellet, W. V. and Carrias Lymen. 1915. The effect of frequent clippings on the total yield and composition of grasses. *J. Am. Soc. Agron.* 7:85-87.
4. Garnet, W. B. 1936. Native grass behavior as affected by periodic clipping. *J. Am. Soc. Agron.* 28:447-456.
5. Graber, L. F. 1931. Food reserves in relation to other factors limiting the growth of grasses. *Plant Phys.* 6:43-71.
6. Harlan, J. R. 1960. Production characteristics of native range. *Okla. State Agric. Expt. Sta. Bull.* B-547.
7. Harrison, C. M. 1939. Greenhouse studies of the effect of clipping of various heights on the production of roots, reserve carbohydrates and top growth. *Plant Phys.* 14:505-516.
8. Holscher, C. E. 1945. The effect of clipping bluestem wheatgrass and blue grama at different heights and frequencies. *Ecol.* 26:148-156.
9. Levy, E. B. and E. A. Madden. 1933. The point method of pasture analysis. *New Zeal. Jour. Agric.* 46:267-279.
10. Neiland, B. M. and J. T. Curtis. 1956. Different responses to clipping six prairie grasses in Wisconsin. *Ecol.* 37:355-365.
11. Robertson, J. H. 1933. Effect of frequent clippings on the development of certain grass seedlings. *Plant. Phys.* 8:425-447.
12. Robocker, W. C. and B. J. Miller. 1955. The effect of burning, clipping, and competition on establishment and survival of native grass in Wisconsin. *Jour. Range Mangt.* 8:117-120.
13. Singh, G. 1959. Some effects of differential clipping on six native grasses and one introduced species. Unpubl. M.S. Thesis, Okla. State Univ., Stillwater.
14. Smith, C. C. 1940. The effect of overgrazing and erosion upon the mixed grass prairie of Oklahoma. *Ecol.* 21:281-297.
15. Voight, J. W. and J. E. Weaver. 1951. Range condition class of native and midwestern pasture, an ecological analysis. *Ecol. Mono.* 21:39-60.
16. Weaver, J. E. 1930. Underground plant development in relation to grazing. *Ecol.* 11:543-557.
17. —————. and W. W. Hansen. 1941. Native midwestern pastures, their origin, composition, and degeneration. *Nebr. Conserv. and Surv. Div. Bull.* 22.
18. —————. and V. H. Hongen. 1939. Effect of frequent clipping on plant production in prairie and pasture. *Amer. Mid. Nat.* 21:396-419.

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Agriculture is Oklahoma's number one industry. It has more capital invested and employs more people than any other industry in the state. Farms and ranches alone represent a capital investment of four billion dollars—three billion in land and buildings, one-half billion in machinery and one-half billion in livestock.

Farm income currently amounts to more than \$700,000,000 annually. The value added by manufacture of farm products adds another \$130,000,000 annually.

Some 175,000 Oklahomans manage and operate its nearly 100,000 farms and ranches. Another 14,000 workers are required to keep farmers supplied with production items. Approximately 300,000 full-time employees are engaged by the firms that market and process Oklahoma farm products.