Effect of Clipping Date on Loamy Upland Bluestem Range[1]

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Highlight

The effects on herbage yield and botanical composition of different clipping dates and subsequent removal or return of forage to bluestem range were studied. Yield of herbage was greatest under August 1 clipping. Removing clipped herbage reduced yields. Desirable species decreased under mid-summer clipping. Increaser species were favored by removing clipped forage.

Much hay is harvested from bluestem range in eastern Kansas. Removing approximately a ton of herbage per acre per year should deplete vital plant nutrients and herbage yields. Fertilizers may be justified to replace nutrients removed. A large portion of nutrients grazed are redeposited as animal wastes. Much more nitrogen, phosphorus, and potassium are removed by haying than by grazing. Net removal of nitrogen from grazed land is approximately 1 lb/A/yr, while haying removes 31 lb/A/yr. Only a trace of phosphorus and potassium is removed by grazing, while haying removes about 10 lb/A/yr of phosphorus and 2.5 lb/A/yr potassium (Dyksterhuis, 1961).

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Plant composition trends reflect preferences of grazing animals. Haying is nonselective so species not harvested under grazing are cut. Growth habits, causing differences in percentage of the photosynthetic area above or below the mower cutting height, will partially determine changes in botanical composition over a period of years under mowing.

Carbohydrate storage is intimately related to time of mowing. If a particular date of mowing comes at an inopportune time for carbohydrate storage, yields should suffer in subsequent seasons.

This study attempted to determine effects on yield and botanical composition of mowing loamy upland bluestem range at different dates in combination with return or removal of herbage after clipping.

Materials and Methods

Study Area.—The study area is in the northern Flint Hills near Manhattan, Kansas. Vegetation in the region is dominated by big bluestem (*Andropogon gerardi* Vitman) and little bluestem (*A. scoparius* Michx.). Indiangrass (*Sorghastrum nutans* (L.) Nash), switchgrass (*Panicum virgatum* L.), and sideoats grama (*Bouteloua curtipendula* (Michx.) Torr.) are also important members of True Prairie. The frost free season is approximately April 20 to early October. The loamy upland range site has a 1 to 2% slope. The soil is a well drained silty clay loam with a silty clay texture in the "B" horizon.

Experimental Design.—A triplicated split-plot design on 5 × 40 ft plots was used from 1962 through 1967. Main plots were harvested on six dates (June 1, July 1, August 1, September 1, October 1, and November 1). Plots were divided into two subplots; one with clipped herbage removed, and the other with clipped herbage returned after being weighed. Herbage was clipped at 3 inches from a 3 × 14.5 ft strip in each plot. The remainder of the plot was clipped after the yield plot was harvested. Regrowth on all plots was

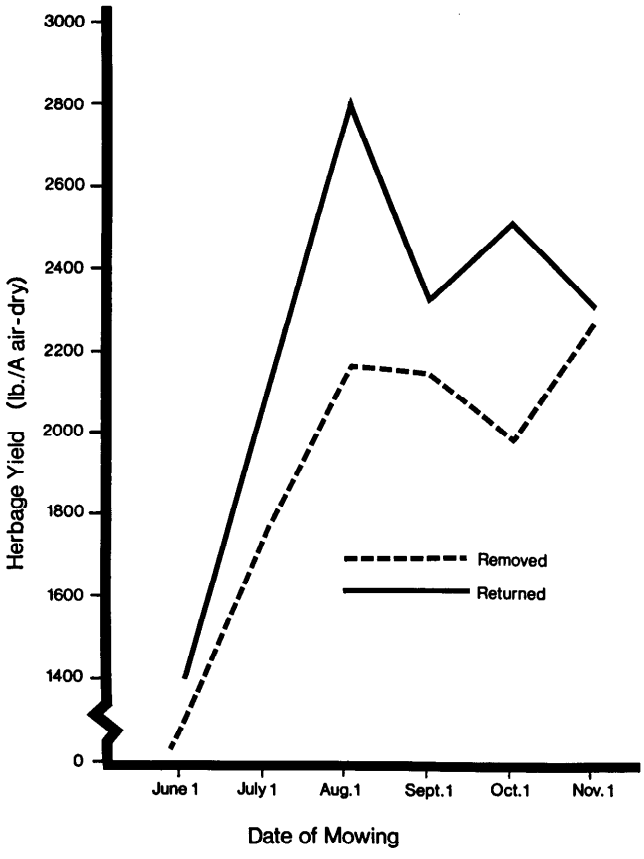

FIG. 1. Herbage yields (lb/A air-dry) from plots clipped at indicated dates with clipped herbage removed or returned (6 yr. avg.).

harvested November 1. Yields reported here do not include regrowth herbage.

No initial botanical composition data were collected. The area was initially uniform so differences shown in the 1967 plant census probably reflect treatments. Two 2.5-meter line transect samples (Canfield, 1949) were taken in each subplot to estimate basal cover. Species were grouped according to behavior under grazing pressure (Dyksterhuis, 1949).

Results and Discussion

Herbage Yield.—Plots with herbage removed yielded less than those with herbage returned; the difference was greatest under annual August 1 clipping but existed also under annual July 1, September 1, or October 1 clipping (Fig. 1). Early in the growing season, yields did not differ significantly. That suggests that the removal effect may be partially from mulch. Plots clipped early in the season regrew quickly compared with plots clipped later. Less regrowth late in the season leaves the surface less protected during summer, so rain runoff and evaporation are greater. Herbage removal, and thus nutrient removal, was greatest from plots harvested from August to November, which may account for greater differences between herbage-removed and herbage-returned plots under high production.

Table 1. Herbage yields[1] (lb/A, air-dry) on plots clipped at different dates, 1962–1967.

Year	Date of clipping					
	June 1	July 1	Aug. 1	Sept. 1	Oct. 1	Nov. 1
1962	1738	2263	2623	2608	2253	2428
1963	2290	2696	2606	2133	1904	2260
1964	825	1852	2708	2113	2023	2215
1965	1798	1940	3596	2408	2603	2982
1966	897	1124	1219	1529	1548	1251
1967	630	1670	2203	2621	3168	2642

[1] LSD: .05 = 363 lb; .10 = 282 lb.

Herbage production was highest on plots clipped in August. Reductions in yield caused by clipping later (September 1 and October 1) were greatest on plots where the herbage was returned. Vogel and Bjugstad (1968), working with glade grassland of the Missouri Ozarks, found that any herbage removal in summer reduced forage yields. Yields reported here on herbage-removed plots were highest with clipping during winter dormancy; but on plots where herbage was returned, yields were greater under summer clipping. Cook (1966) pointed out that if warm season grasses are clipped only once, late season (August and September) clipping was most harmful.

A year × clipping date interaction existed and is shown in Table 1. That interaction was due primarily to fluctuations in weather and was mostly due to a change in magnitude of yield difference as opposed to changes in rank. In 1967 fall clipping date plots yielded more than the late summer clipped plots which represents a reversal from previous years results. Precipitation was the lowest on record in 1966, and yields from all plots were low and differed little.

Forage quality is highest during the early growing season and declines rapidly during late summer. Work in true prairie by Briggs et al. (1948) and Conard and Arthand (1957) indicates that early July cutting would yield the most total digestible nutrients. In our study, plots clipped August 1 yielded 405 lb/A more than plots clipped July 1, but forage quality was lower in August. Bluestem range probably should be mowed in early to mid-July for prairie hay. Forage quality then would be fairly high and forage production near maximum.

Herbage yield data should be accompanied by botanical composition data since undesirable, low quality, unpalatable species may dominate. Bluestem prairie is highly resistant to botanical change, even under heavy pressure, but changes in yield potential come fairly rapidly.

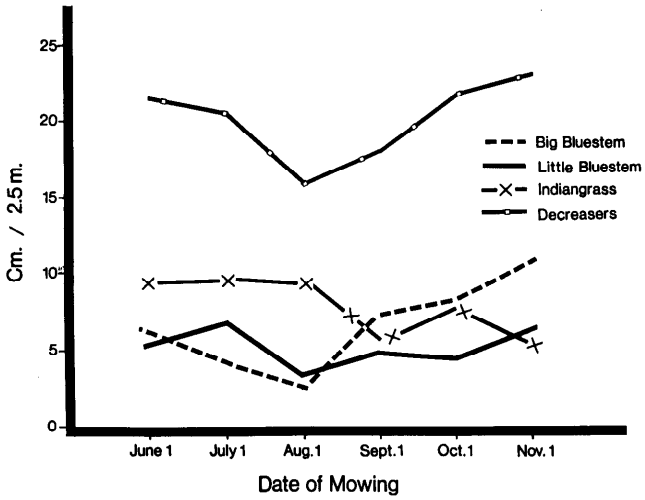

FIG. 2. Basal cover for indicated species and clipping dates, 1967.

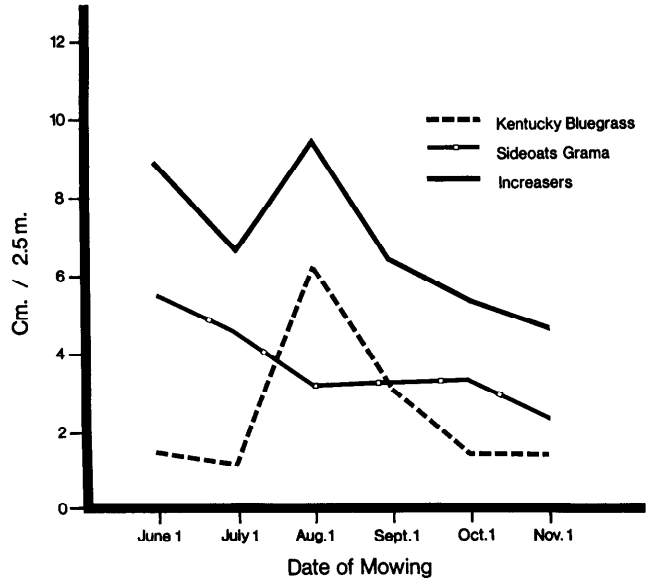

FIG. 3. Basal cover for indicated species and clipping dates, 1967.

Basal Cover.—Clipping June 1, July 1, and August 1 reduced basal coverage of big bluestem more than did clipping during the dormant season (Fig. 2). However, no difference in basal cover of big bluestem could be attributed to herbage removed. Little bluestem basal cover increased with July 1 clipping; decreased with August 1 clipping. Conard and Arthand (1957) reported increases in little bluestem under early July clipping in eastern Nebraska.

Indiangrass basal cover was relatively high under early season clipping but was considerably lower under late season clipping. Neither removing nor returning clipped herbage affected indiangrass basal cover. Decreasers (Fig. 2) were fewer with August 1 and September 1 clipping than with other clipping dates. The decreasers' basal cover reflected the influence of big and little bluestem.

Little bluestem basal cover increased substantially with removal of herbage regardless of clipping date (Table 2). Since little bluestem is characteristic of xeric sites, it may have increased due to lack of mulch, or lack of moisture.

Increasers were primarily sideoats grama and Kentucky bluegrass (*Poa pratensis* L.). Clipping dates did not affect sideoats grama basal cover but Kentucky bluegrass basal cover was greater with annual August 1 and September 1 clipping than with other clipping dates (Fig. 3). Failure of sideoats grama to behave as an increaser in the same manner as Kentucky bluegrass relates to the definition of an increaser. Increasers are defined under grazing conditions where one species is more palatable than another.

Mowing is non-selective so sideoats grama, actively growing, suffered much the same as the decreasers. Kentucky bluegrass, on the other hand, was semi-dormant so was harmed much less. Note in Figures 2 and 3 that the high point in basal cover for increasers corresponds with the low point for decreasers. August clipping obviously was detrimental to the desirable species.

Sideoats grama and Kentucky bluegrass basal cover was higher on plots where herbage was removed after clipping (Table 2). Since they normally increase with heavy removal, it is likely that the open stand created by removing mulch benefited them.

Table 2. Basal cover (cm/2.5 m line transect) of three species and total plant cover for all clipping dates.

Clipped herbage	Little bluestem	Sideoats grama	Kentucky bluegrass	Total plant cover
Removed	6.58[1]	4.50	3.53	31.06
Returned	3.81	2.83	1.33	28.36

[1] All values shown are statistically different at $P < .05$.

Conclusions

1. Herbage yield was greatest under August 1 clipping.

2. Removing clipped herbage lowered production.

3. Under annual August 1 clipping, basal cover of desirable species was lower than under other dates.

4. Increasers were favored by removing clipped forage.

5. The ideal clipping appeared to be July 1 or shortly after, since forage quality, yield, and preservation of stand were in their most desirable combination then.

LITERATURE CITED

BRIGGS, H. M., W. D. GALLUP, AND A. E. DARLOW. 1948. The yield and feeding value of prairie hay as related to time of cutting. Okla. Agr. Exp. Sta. Bull. B-320. 15 p.

CANFIELD, R. H. 1942. Sampling ranges by the line interception method. Southwestern Forest and Range Exp. Sta. Report No. 4. 28 p.

CONARD, E. C., AND V. H. ARTHAND. 1957. Effect of time of cutting on yield and botanical composition of prairie hay in southeastern Nebraska. Neb. Agr. Exp. Sta. Res. Bull. 184. 36 p.

COOK, C. W. 1966. Carbohydrate reserves in plants. Utah Agr. Exp. Sta. Resources Series 31. 46 p.

DYKSTERHUIS, E. J. 1949. Condition and management of range based on quantitative ecology. J. Range Manage. 2:104–115.

DYKSTERHUIS, E. J. 1961. Grassland Res. Notes No. 20. Soil Conservation Service. Lincoln, Neb. 2 p.

VOGEL, W. G., AND A. J. BJUGSTAD. 1968. Effects of clipping on yield and tillering of little bluestem, big bluestem, and indiangrass. J. Range Manage. 21:136–140.