

Herbage Production on Bluestem Range in Central Louisiana

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THIS paper reports a study of herbage production on bluestem range, the forage type that dominates the cut-over longleaf pine lands of central and south-west Louisiana and east Texas (Cassady, 1951). The principal objectives were to determine the average cumulative seasonal herbage production on ungrazed bluestem range, the effect of repeated removal of herbage on total seasonal production, and the influence of herbage removal during the growing season on nutritive qualities of the grass.

STUDY AREA

The study was made during 1947, 1948, and 1949. The experimental range was in Grant Parish, Louisiana, 18 miles north of Alexandria, near the center of the state. Study exclosures were on land representative of the heavily cut-over areas. Vegetation density in this open grassland (there was only a scattered stand of trees) averaged between 50 and 80 percent.

The vegetation on check plots at peak production in late summer averaged 83 percent grasses and 17 percent forbs. About 3 to 5 percent of the grass herbage was composed of grasslike plants (*Cyperaceae*), which were not measured separately. Pinehill bluestem (*Andropogon divergens*) was dominant, as it is in much of this type.

The frost-free period at Alexandria averages nearly 8.5 months—from March 11 to November 22 (Weather Bureau, 1949). Some herbage gets green in February, but growth is very slow until

late March. The growing season usually ends in October. On the experimental range, the last killing frosts during the winters of 1947, 1948, and 1949 fell between March 14 and 19.

Rainfall in the area averages 57 inches per year. There is almost always adequate soil moisture for good plant growth during the cool spring period of March, April, and May, even in dry years like 1948. The most variable part of the growing season, and the part that chiefly determines whether herbage production will be high or low, is the summer—the hot months from June through September. Total and seasonal rainfall in 1947 and 1949 were slightly above normal, but 1948 had a record drought (Table 1). However, the distribution of rainfall during the growing season made 1949 a wet, high-producing season, while 1947 balanced out about normal.

STUDY METHODS

Herbage production was measured on randomly located sample plots 3.1 feet square. The treatments tested were:

1. *Undisturbed production*—one harvest only. Every 2 weeks during the growing season 6 undisturbed plots were selected randomly, and harvested. A new set of plots was used each time. This procedure gave the cumulative seasonal production at biweekly intervals from areas not disturbed until the selected harvest date. It also provided the standard for evaluating the rest of the treatments. All other treatments in-

volved repeated clipping during the growing season.

2. *Two harvests*—Accumulated herbage removed May 1 and September 4.
3. *Four harvests*—herbage removed every 8 weeks.
4. *Seven harvests*—herbage removed every 4 weeks.
5. *Fifteen harvests*—herbage removed every 2 weeks.

TABLE 1

Rainfall on the experimental range, 1947-1949, and average at Alexandria, Louisiana

YEAR	TOTAL	GROWING SEASON		
		March-May	June-September	Total
<i>Study area</i>	<i>Inches</i>	<i>Inches</i>	<i>Inches</i>	<i>Inches</i>
1947	61.6	22.2	12.4	34.6
1948	41.6	13.3	4.3	17.6
1949	63.3	18.2	17.1	35.3
57-year av. (Alexandria).....	56.9	15.9	16.2	32.1

All plots were protected from grazing and fire. The herbage was harvested by clipping it just above the ground (Campbell and Cassady, 1949). It was kept separate in two sacks—one for all grasses and grasslike plants and the other for forbs. Green weights, air-dry weights, and nutritive composition were obtained in that order. Nutritive analyses were made by E. A. Epps, Jr., Chief Chemist, and his associates, C. C. Moreland, J. L. Farr, and Miss Frances Bonner of the Feed and Fertilizer Laboratory, Louisiana Agricultural Experiment Station, Baton Rouge.

Since close grazing during the growing season for several years will kill bluestems and associated bunch grasses, new plots were established and treated each year.

UNDISTURBED PRODUCTION

Grasses and grasslike plants contributed an average of 83 percent of total herbage production, ranging from 80 to 86 percent. On undisturbed plots, the maximum accumulation of herbage was reached in September or October, depending on early fall growing conditions. From then until spring, the herbage gradually decreased because of weathering, even if not grazed. To reduce seasonal variation in peak production of grasses and forbs, the yields for September 29 and October 13 were averaged. The data are summarized in Table 2.

TABLE 2

Peak yields of grass and forbs (air-dry) during 1947, 1948, and 1949

YEAR	GRASSES		FORBS		TOTAL Lbs. per acre
	Lbs. per acre	Pct.	Lbs. per acre	Pct.	
1947	2,121	85	371	15	2,492
1948	1,308	86	211	14	1,519
1949	3,083	80	755	20	3,838
Average..	2,170	83	446	17	2,616

The three study years gave what may be regarded, in the light of present knowledge, as normal, near-minimum, and near-maximum grass herbage yields—the product of average, extremely dry, and relatively wet growing seasons. It is significant for range management that grass production fell only 40 percent below normal in 1948. Even in that year, sufficient grass was produced to meet grazing requirements on conservatively stocked range. In 1949, grass production was 42 percent above normal.

The most important segment of forage was produced by mid-summer. Favorable growing conditions continued into June of each year, and by that time a reasonably good forage crop was already made. The chief differences in production began

to show up in late June and July (Fig. 1). The 1948 growth stopped in June, while the 1949 growth was accelerated in July, August, and September. Flowerstalks made up about half the late summer growth. They are fairly nutritious during formation, but after maturity they become woody and are seldom grazed.

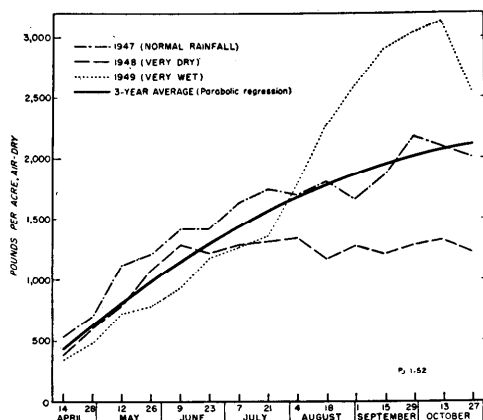


FIGURE 1. Grass production on very open forest range dominated by bluestem grasses. Central Louisiana, 1947-1949.

Figure 1 shows the extremes that may be expected in undisturbed production on very open longleaf pine ranges dominated by pinehill bluestem. The heavily inked curve is the smoothed three-year average or "normal" production curve for these conditions. It is the parabolic regression line fitted by least squares analysis from the biweekly averages of 1947, 1948, and 1949 grass production. On ranges where slender bluestem (*Andropogon tener*) is dominant, the curve for normal production would very likely flatten out more rapidly in summer because slender bluestem matures earlier than pinehill bluestem does.

This growth curve provides an estimate of grass produced up to any time during the growing season. It will be a useful base for utilization surveys in mid-season, when utilization is extremely hard to

estimate because grazing evidence is obscured by rapid regrowth.

REPEATED HARVESTING

The data taken in 1947 show how herbage production in a nearly normal year is reduced by close, repeated harvesting (Fig. 2). Harvesting four times (every 8 weeks) and harvesting twice during the growing season did not reduce grass production. The curves for these two treatments closely follow the "normal" curve in Figure 1, as well as the undisturbed production curve in Figure 2.

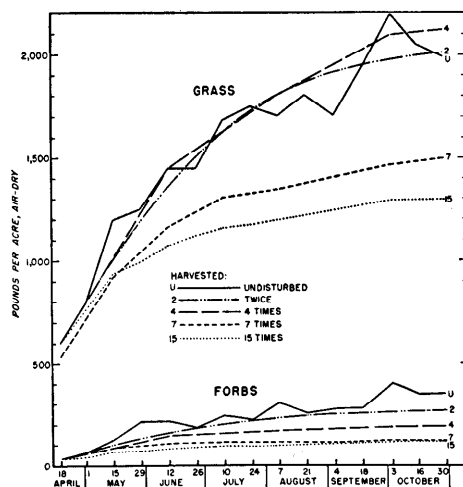


FIGURE 2. Cumulative production of grass and forb herbage in 1947 on very open forest range in central Louisiana.

The most severe treatments, harvesting every 4 weeks and every 2 weeks, reduced grass production 33 and 41 percent below production on check plots. The reduction resulting from treatments was less than this in the dry year 1948 and more in the wet year 1949. These severe treatments give an indication of the reduced grass yield on spots grazed closely throughout the season. However, under presently recommended rates of stocking that aim to average about 40 percent utilization of

palatable grasses, only a minor part of the range is grazed closely. Moreover, the spring season (the best grazing season) is over before the overgrazed spots cover much of the range.

From these data and related observations, it is concluded that normal, conservative grazing of bluestem range during the growing season does not materially reduce grass production.

Forb growth, by contrast, was lowered by every degree of repeated harvest and to a much greater extent than grass production—the perennial forbs either stopped growing or were killed. The peak yields of forbs in 1947 on plots harvested 2, 4, 7, and 15 times were 29, 46, 64, and 65 percent lower, respectively, than on the plots where production was undisturbed (Fig. 2). Forb production after July 1 was from new seedlings, mostly annuals.

GRASS PRODUCTION ONE YEAR AFTER TREATMENT

Close, repeated harvesting for only one season not only reduced current production but also killed part of the desirable bluestem stand. Consequently, production the following year was reduced, and low-value plants invaded the treated plots. The plots harvested more than one time in 1948 were completely protected during the 1949 growing season; then they were harvested on October 12, 1949, for total production. The data are summarized in Table 3.

There was no measurable reduction in 1949 yield on the plots harvested twice in 1948, and they are used as a check in Table 3. The reduction on other plots was in proportion to the severity of treatment. It may require several years for the bluestem grasses to recover from the most severe treatments. Also, the treated areas were invaded by several annual plants. One prominent invader,

TABLE 3
1949 production on plots harvested repeatedly in 1948, but protected during 1949

TREATMENT IN 1948	PRODUCTION IN 1949			REDUCTION IN YIELD OF GRASS
	Grass	Forbs	Total	
<i>Harvested:</i>	<i>Pounds per acre, air-dry</i>			<i>Percent</i>
15 times	1,590	497	2,087	49
7 times	1,975	692	2,667	37
4 times	2,418	717	3,135	23
Twice	3,133	617	3,750	0

fine-leaved razorsedge (*Scleria* sp.), was abundant in early spring, but matured and dried in May.

NUTRITIVE VALUE OF HARVESTED GRASS

The chemical analyses of the grass samples indicated that intensive short-season grazing may maintain nutritive values at an adequate level longer and extend the good grazing season a few weeks.

The average phosphorus content in grass samples for the three years was increased by repeated clipping. For example, the undisturbed grass had a 3-year average of 0.07 percent phosphorus during the growing season, while grass from plots harvested every 4 weeks averaged 0.11 percent phosphorus. Even 0.11 percent phosphorus is inadequate for good nutrition of growing beef cattle, so this particular forest range requires a supplemental phosphorus concentrate yearlong.

Repeated harvesting of every degree increased the crude protein content of the grass. The average amount in all samples taken during three growing seasons was 7.6 percent crude protein; the range was from 4.0 to 12.0 percent. The checks or undisturbed grass samples averaged 5.8 percent (Fig. 3). In contrast, grass samples from plots harvested every 8, 4, and 2 weeks contained 7.2, 9.4, and 10.2 percent, respectively.

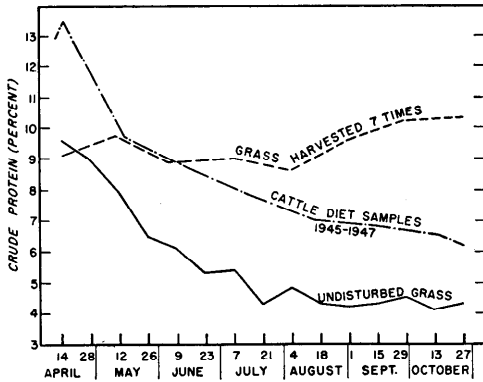


FIGURE 3. Crude protein (moisture-free basis) in grass herbage (1947-1949) and mixed herbage (cattle diet samples) from open forest range in central Louisiana.

During 1947, the grass from check plots had about 9.5 percent crude protein in early spring, but this nutrient declined steadily through spring and early summer and leveled off at about 4.5 percent in late summer. Grass from plots harvested every 4 weeks started in spring at 9.0 percent crude protein and maintained this level most of the season, rising to 10.0 percent in September and October.

An earlier study (Campbell and Cassady, 1951) of yearlong grazing at a moderate rate on this same experimental range showed that composite samples of grass and forb herbage representative of the cattle diet contained crude protein somewhat intermediate between the undisturbed grass and that harvested every four weeks. Moderate grazing kept some of the grass cropped back and maintained fresher, more nutritious grass than on ungrazed range. Even on the grazed range, where cattle habitually crop the greenest forage, crude protein in the diet samples declined steadily and in July reached a point—at 8 percent and below—where cattle with calves started losing weight. Obviously, bluestem range is best if used in spring and early summer.

The harvesting treatments also produced some differences in the amount of fats, NFE carbohydrates, and calcium in the grass. However, the differences were too small to have practical significance in range management.

The few forb samples that were taken contained more water, crude protein, calcium, and total ash than the grass samples did. The fat, NFE carbohydrates, and phosphorus were about equal in grass and forb herbage. Although forbs do not contribute a high percent of the cattle diet, they add strength and variety.

SUMMARY

The production and the nutritive values of herbage on pinehill bluestem range, in a cut-over longleaf pine forest of central Louisiana, were measured during the growing seasons of 1947, 1948, and 1949 under two general conditions: (a) herbage undisturbed until measured and (b) herbage harvested repeatedly at 2-week, 4-week, 8-week, and 18-week intervals. The plots were protected from grazing and fire.

Seasonal rainfall in 1947 was near normal and grass production was about average—2,121 pounds per acre, air-dry. 1948 had a very dry growing season, and herbage production was 40 percent below normal. 1949, a very favorable season with well-distributed rainfall, produced 42 percent more grass than average.

About 70 percent of the grass was produced during the first half of the growing season; this portion constituted by far the most valuable part of the forage crop. Much of the late-season growth was in flowerstalks that are not grazed after they mature. A curve depicting average cumulative grass production for this range type was developed from data taken during the three seasons.

Repeated harvesting at 2-week and 4-

week intervals reduced grass production 41 percent and 33 percent, respectively. Part of the bluestem vegetation was weakened or killed by this close, repeated cropping, which simulates the spotty grazing common in this area.

Repeated harvesting at 8- and 18-week intervals did not measurably reduce grass production during the season of treatment. However, the production of forb herbage was reduced materially by all repeated harvest treatments.

The ill effects of close repeated harvesting may last for several seasons, even under complete protection. The plots harvested several times in 1948 were protected during 1949 and then harvested on October 12. The grass yield was 49, 37, and 23 percent less than normal on the plots that had been harvested every 2, 4, and 8 weeks in 1948.

Crude protein in undisturbed grass declined from about 9.5 percent in spring to 4.5 percent in late summer. The grass from plots clipped every 4 weeks contained between 9 and 10 percent crude protein throughout the growing season.

These and other studies in the same areas indicate that by far the best use of bluestem ranges in the longleaf pine belt will be short-season grazing which starts on or before April 1 and lasts until cows stop gaining weight in summer. Such relatively intensive seasonal grazing, aimed at 40- to 50-percent utilization of key grasses, may lengthen the gaining season normally obtained by the less intensive utilization under yearlong grazing.

LITERATURE CITED

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TILLAGE

A field becomes exhausted by constant tillage.—*Ovid*.



When tillage begins, other arts follow. The farmers, therefore, are the founders of human civilization.—*Daniel Webster*.