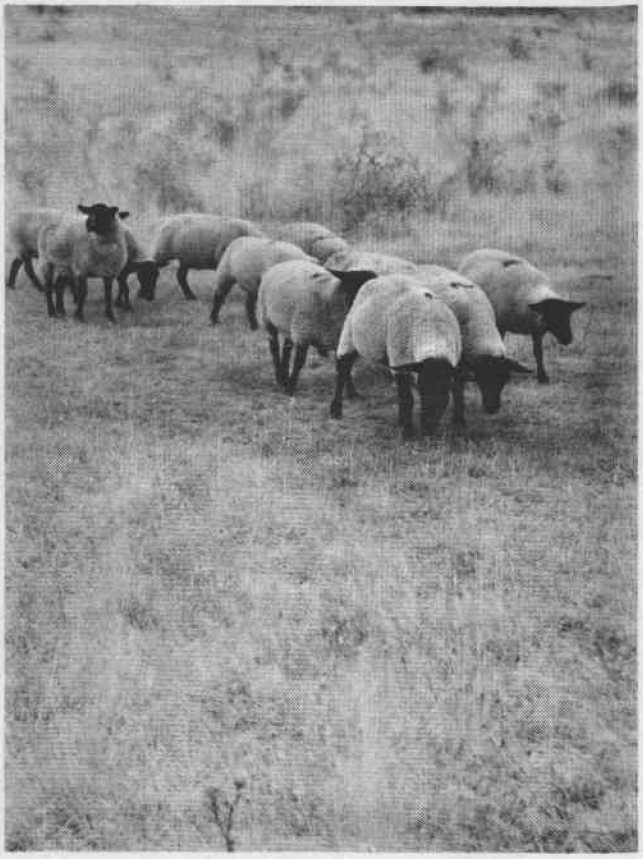
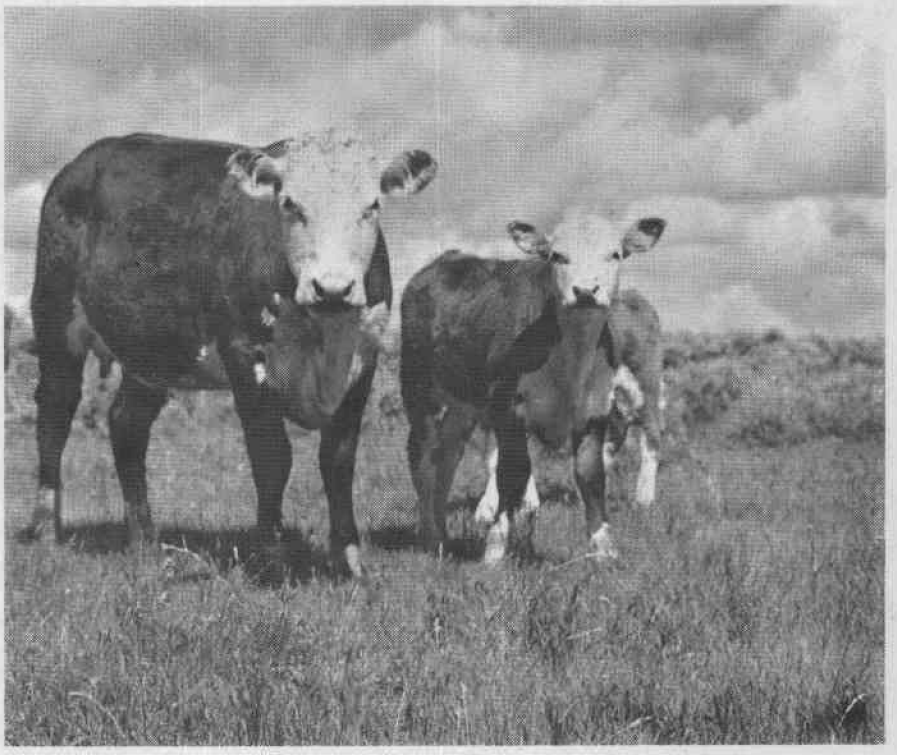


Range Studies No. 2

Clipping Treatments on Tall Fescue

D. W. Hedrick



Miscellaneous Paper 53

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Agricultural Experiment Station
Oregon State College
Corvaliis

Clipping Treatments on Tall Fescue

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One of the problems facing sheepmen on the nonirrigated pastures of western Oregon, particularly in the foothills surrounding the Willamette Valley, is the lack of succulent green pasture growth during the late summer breeding season. If early spring lambs are being produced, ewes must be bred in August and September while most pastures are in their poorest state for the year.

Recognizing the need for better nutrition at this critical period, an experiment was undertaken in 1953 and continued through 1955 investigating tall fescue's August regrowth response to spring cutting at several growth stages and stubble heights.

Previous Work

Spring clipping or grazing practices profoundly affect the aftermath production of pastures and meadows during summer and fall. Numerous studies have been undertaken to measure effects of clipping on growth behavior and composition of pasture stands; particularly when mixtures of grasses are involved. Few experiments, however, have been expressly designed to evaluate this regrowth during critical pasture periods, e.g., mid and late summer in areas of deficient summer rainfall.

Leukel, Camp, and Coleman (1934) studied effects of frequent cutting and nitrate fertilization on the growth behavior and relative composition of pasture grasses in Florida. They found a more vegetative composition in subsequent cuttings if frequently cut plants were harvested before seeds or fruits formed. When seeds or fruits were permitted to form, these workers reported a nitrogen decrease and corresponding increase

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in simpler carbohydrates and the more fibrous woody materials in the plants. They concluded that grazing is necessary to get maximum effect of nitrate fertilization.

Grunder (1952) conducted an experiment in western Washington on orchardgrass similar to the one being reported. His objective was to determine whether it would be practical to hold the late spring growth of orchardgrass pasture for use during summer and early fall months, when growth is normally limited. He used two strains; common and western Washington strain 88; making initial cuts at three stages of maturity; late vegetative, boot, and bloom.

Regrowth cuts on each initial treatment were made in July and October, August and October, September and October, and October alone. Grunder reported total regrowth to be greatest when the initial cut was made at the vegetative stage. Many heads appeared with regrowth when the initial cutting was made in the vegetative stage; relatively few with cutting at the boot stage; and rarely with cutting at the bloom stage. He concluded that in order to obtain maximum regrowth of orchardgrass with minimum head development, an initial cutting should be made at the late boot or early emergence stage. According to Grunder, if orchardgrass is allowed to stand uncut for a prolonged period it will gradually decrease in percentage of protein, even though remaining in a vegetative condition.

Green's work (1954) should help explain the results obtained by Grunder. Green reports that the date at which the last "preparatory" mowing or grazing is taken is more important than frequency of defoliation in spring — within reasonable limits. Based on his general observations, the most successful treatments for summer production were

those ending with a mowing or grazing at the time Dactylis flowers were emerging. Green further states that Dactylis will begin to grow quickly after a late hay cut (England conditions), but will not then give maximum weight of herbage in July and leafy strains in particular tend to smother white clover under this treatment.

Because of the limited work applicable to this problem more information is evidently needed regarding effects of spring herbage removal on summer regrowth of nonirrigated pastures.

Experimental Area and Design

The experiment was conducted on an area of Amity silty-clay loam. The principal improved forage species consisted of the Alta variety of tall fescue. The second most important species was orchardgrass (Dactylis glomerata) with smaller amounts of burnet (Sanguisorba minor), meadow foxtail (Alopecurus pratensis) and birdsfoot trefoil (Lotus corniculatus). Weedy species present were: velvetgrass (Holcus lanatus) and plantain (Plantago lanceolata).

One area selected for study was somewhat lower and more poorly drained, with a higher percentage of meadow foxtail than the other. This area was clipped in the fall of 1952 before the experiment was laid out. The other area had not been harvested the previous year. The better drained, unclipped area had less meadow foxtail but more orchardgrass and velvetgrass than the clipped area.

The experimental design consisted of a 4 x 4 factorial with four replications on each of the two areas. Plots were 12 feet square. Treatments consisted of cutting at four stages of growth: boot, emergent, heads fully out, and early flower — and four stubble heights: 2, $3\frac{1}{2}$, 5, and $6\frac{1}{2}$ inches. In order to evaluate cutting and fertilizer interaction,

ammonium nitrate was applied at the rate of 33 pounds of N per acre on two replications at random in each area.

A randomly located strip 11.3 feet long x 1.7 feet wide was harvested from each plot with a Scythette at the appropriate growth stage and stubble height in the spring. Regrowth was obtained in mid-August by cutting all plots at two inches above ground level. After a sample strip was obtained in both spring and August clippings, the remainder of the plot was cut to a uniform stubble height.

Protein analyses of August regrowth were made in the Animal Nutrition Laboratory of the Department of Animal Husbandry at Oregon State College under the direction of Dr. J. E. Oldfield.

As a result of two years' data from the initial experiment it was decided to reduce the spring cutting treatments to two — emergent and heads out — and the stubble heights to three — 3, 4, and 5 inches. In order to better evaluate possible interactions between growth stage and fertilizer treatment, a simple 2 x 2 factorial with 4 replications was used. The main effects were: the emergent growth stage with and without nitrogen, and the heads out growth stage with and without nitrogen. Nitrogen was applied as ammonium nitrate in early March. The different stubble heights were cut on three subplots within these four main treatment combinations.

In an effort to obtain an animal evaluation of these treatments, the study was designed so New Zealand weaner rabbits could be used to graze the summer regrowth. Results of the rabbit grazing and possible uses of this technique have been published (Hedrick, 1957).

A uniform stand of tall fescue, orchardgrass, and burnet located near the original experiment was obtained for the new study. Composition

of the forage cover, based on estimates from 240 square-foot plots taken in the spring of 1955, revealed it to be 44% tall fescue, 13% orchardgrass, 20% burnet, and 23% other species — principally velvetgrass with mixed annual grasses and forbs.

The area was selected and the old growth removed during the fall of 1954. Fertilizer was applied in March, 1955. Clipping treatments were applied in May by the same methods used earlier on plots 3/100-acre for the main effects and 1/100-acre in area for stubble heights.

Results were similar to those obtained in 1954. The main effects of fertilizer and stage of growth were significant, along with the subplot treatments of different stubble heights. There were no significant interactions for August regrowth yields.

Results and Discussion

The boot stage was reached April 24 on the fertilized plot and April 30 on the unfertilized plot in 1953. In 1954 the same stage was reached about one week later, or April 30 and May 7, respectively. However, because of drier weather (figure 1) in May 1954, the early flower stage was reached about one week earlier (June 3, 1954) as compared to the same stage in 1953 (June 10). In both years, however, fertilized plots matured about one week earlier than unfertilized ones.

Analyses of variance for regrowth yields in 1953 and 1954 indicated the only important differences in results between 1953 and 1954 were: (1) Nitrogen fertilizer was not as effective in raising yields in 1954 as in 1953, and (2) there was no significant interaction between stage of growth and fertilizer in 1954.

Table 1 includes a summary of the effects of previous treatment, stage of growth, nitrogen fertilizer, and stubble height, on August

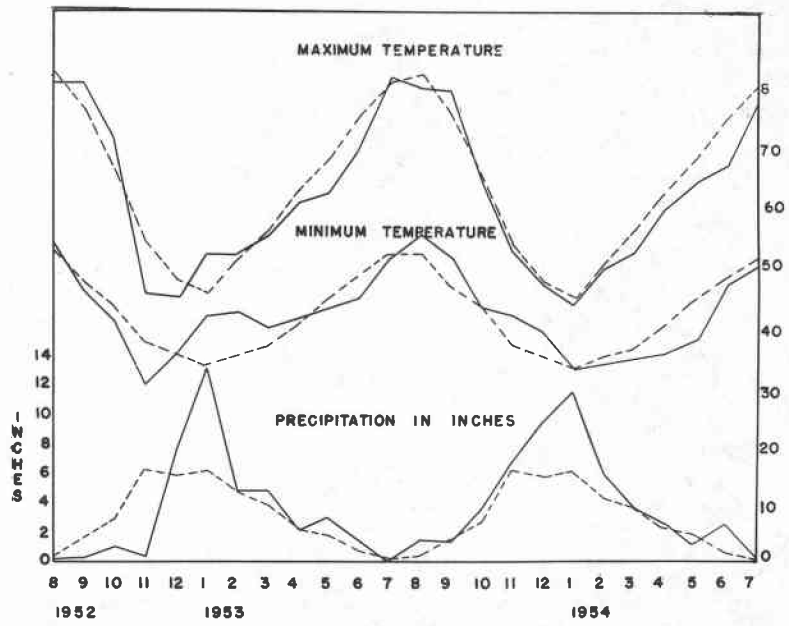

Figure 1. Precipitation and mean temperatures by months shown as solid lines for 1952-53 and 1953-54. Broken lines indicate 60-year averages. Records taken at station near experimental area.

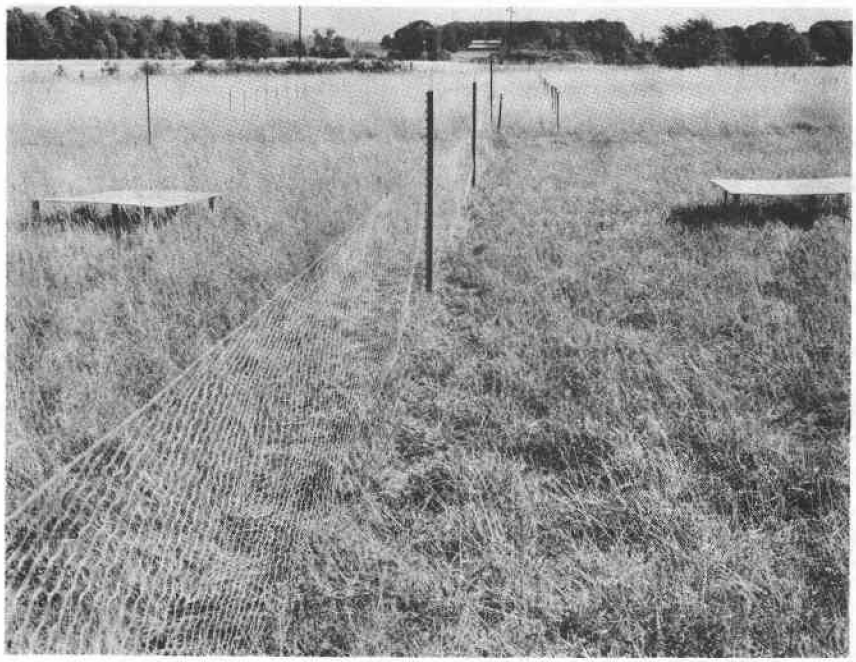

Figure 2. Two clipping treatments made in May 1955 and photographed August 11, 1955. Emergent clipping on left and heads-out on right, with unclipped in background. Sheep were grazed on area clipped in heads-out stage, similar to right foreground.

regrowth yields and protein content. These data enable one to select combinations of stages and stubble heights that produce a maximum of high quality regrowth. When percent of crude protein and herbage weights are considered, the maximum amount of good regrowth appears to be produced by spring cuttings made in the boot, emergent, and heads out stages at stubble heights between 3½ and 5 inches. Boot-stage cutting produces about an equal amount of regrowth but is less desirable to animals since nearly all Alta fescue plants produce normal seed heads when cut at this stage in the spring.

Data in table 2 indicate that the stage at which the first clipping is made does not materially affect total production for the season. From the standpoint of regrowth there is a nearly linear decline with increase in stage of growth, except for 1953. In that year, with nitrogen fertilizer, about as much regrowth was produced when first cuttings were taken either in the emergent or in the boot stage.

Nitrogen fertilizer was much more effective when applied to an area clipped the year before treatments were begun. This effect was much less pronounced in 1954 (table 2). Yields were only about one-half as large in 1954 as they were in 1953 but weather data for the two years, as given in figure 1, do not logically account for such a large difference. In fact, late spring and summer moisture was more plentiful in 1954. This pronounced decline is probably a result of lowered vigor from clipping the plants the same way for two successive years. Such treatment probably prevents adequate storage of reserves in stem bases and roots. This conclusion is substantiated in part by the 1955 yields from the second experiment.

Table 1. Air-dry herbage, and protein yield in grams, per plot of August regrowth in response to spring cutting treatments at various growth stages and stubble heights. Grams per plot x 5 equals pounds per acre.

		Clipped Fall 1952						Unclipped Fall 1952					
Stage	Stubble	Herbage Wt.	1953 Protein	Protein* Wt.	Herbage Wt.	1954 Protein	Protein Wt.	Herbage Wt.	1953 Protein	Protein Wt.	Herbage Wt.	1954 Protein	Protein Wt.
	Inches	Grams	Percent	Grams	Grams	Percent	Grams	Grams	Percent	Grams	Grams	Percent	Grams
Boot	2	289	4.33	12.5	148	4.80	7.1	216	4.81	10.4	84	4.86	4.1
	3½	264	3.88	10.3	130	4.51	5.8	291	4.97	14.5	173	4.12	7.1
	5	357	3.99	14.2	161	4.73	7.6	350	4.59	16.1	225	3.74	8.4
	6½	398	3.81	15.2	178	4.21	7.5	312	4.66	14.5	218	3.73	8.1
Emergent	2	199	4.49	9.0	77	5.25	4.1	187	4.81	9.0	79	4.38	3.5
	3½	281	4.52	12.7	126	4.53	5.7	260	4.66	12.1	106	4.51	4.8
	5	377	4.26	16.1	182	4.80	8.7	261	4.62	12.0	126	4.12	5.2
	6½	322	4.08	13.1	220	4.49	9.9	340	4.38	14.9	178	3.99	7.1
Heads out	2	146	4.60	6.7	58	5.32	3.1	91	4.95	4.5	29	4.74	1.4
	3½	235	4.36	10.2	101	4.92	5.0	212	5.43	11.5	77	5.11	3.9
	5	273	4.45	12.2	125	4.98	6.2	249	4.90	12.2	142	4.33	6.1
	6½	319	4.32	13.8	201	6.59	13.2	264	4.43	11.7	143	4.21	6.0
Early Flower	2	72	5.70	4.1	44	5.54	2.4	55	6.64	3.7	30	4.85	1.5
	3½	147	5.56	8.2	76	4.83	3.7	125	6.20	7.7	62	5.16	3.2
	5	273	5.06	12.0	128	4.76	6.1	192	5.23	10.0	111	4.46	5.0
	6½	319	4.28	13.6	161	5.61	9.0	245	5.03	12.3	148	4.03	5.9

*Protein in grams obtained by multiplying forage weight in grams by percent protein.

Table 2. Spring clipping and August regrowth air-dry yields in lbs/acre as affected by stage of growth, previous treatment, and nitrogen fertilizer for 1953, 1954, and 1955.

Previous treatment ----------		Unclipped-Fall 1952				Clipped-Fall 1952				Clipped-Fall 1954	
Date of yields May and August ---		1953		1954		1953		1954		1955	
Fertilizer treatment --------		No N	33 Lbs. N	No N	33 Lbs. N	No N	33 Lbs. N	No N	33 Lbs. N	No N	33 Lbs. N
Stage of growth		Lbs/a	Lbs/a	Lbs/a	Lbs/a	Lbs/a	Lbs/a	Lbs/a	Lbs/a	Lbs/a	Lbs/a
Boot ----------	Init. clip.	280	340	90	160	80	80	70	130	----	----
	Regrowth	1140	1790	750	1000	1230	2040	550	990	----	----
	Total	1420	2130	840	1160	1310	2120	620	1120	----	----
Emergent ------	Init. clip.	400	440	220	330	110	230	110	330	160	430
	Regrowth	900	1720	460	770	940	2000	490	1020	1340	1720
	Total	1300	2160	680	1100	1050	2230	600	1350	1500	2150
Heads out -----	Init. clip.	460	520	220	450	220	550	160	410	310	900
	Regrowth	820	1220	430	540	820	1610	550	660	1240	1580
	Total	1280	1740	650	990	1040	2160	710	1070	1550	2480
Early ----------	Init. clip.	600	840	280	600	510	1390	240	590	----	----
	Regrowth	730	810	370	500	610	1150	390	640	----	----
flower	Total	1330	1650	650	1100	1120	2540	630	1230	----	----

Table 3. Influence of nitrogen fertilizer and stage of growth on August regrowth. Yields in pounds of air-dry herbage per acre.

Fertilizer treatment	Year	Stage of growth: Boot	Emergent	Heads fully out	Early flower	Means
		Lbs/a	Lbs/a	Lbs/a	Lbs/a	
Unfertilized	1953	1180	920	820	670	900
	1954	650	470	490	380	500
	1955	----	1340	1240	---	1290
Fertilized	1953	1920	1860	1420	980	1550
	1954	990	900	600	570	770
	1955	----	1720	1580	---	1650

Regrowth yields in table 3 are summarized to show average effects of stage of growth, nitrogen fertilizer, and years. Selection of a new area in 1955 markedly raised the yields, particularly from the unfertilized treatments. These data, together with those in table 2, indicate that use of nitrogen fertilizer is relatively more important for increasing early spring yields where silage is being harvested than in improving quantity or quality (table 1) of summer regrowth. From a livestock producer's standpoint it is essential to have reasonable production by mid-May in order to justify cutting a silage crop. In order to clip not later than the heads out stage at least 30 pounds of nitrogen per acre would be needed to make this harvest profitable. Other studies (Hedrick, 1957a) have shown that increases in spring yields of this type of forage by nitrogen fertilization are nearly linear up to about 100 pounds of N per acre. This means that within these limits the amount of silage produced in May before the heads out stage on tall fescue could be controlled by varying the application of early spring (March) applied nitrogen.

In 1955 a 5-acre area of similar pasture was fertilized with 30 pounds of nitrogen per acre and clipped for silage in mid-May to provide

summer regrowth for breeding ewes in late July and August. Results of this sheep grazing trial indicated the value of such management practices in improving the nutritive value for ewes during late summer, prior to breeding. Careful observations indicated that this area stayed greener in July and August and was utilized first when grazed in conjunction with a comparable unclipped area (figure 2).

Data from this experiment indicate the value of spring management in maximizing August regrowth. More information is needed about the grazing value of aftermath forage produced under these conditions. If bulk quality values are not greatly different, as indicated by crude protein contents, it is important that a large amount of material be produced. A great abundance of forage would tend to assure that the animals' selection in grazing would provide adequate nutrition in the forepart of the breeding season.

Summary

An experiment was designed to test the effects of spring cutting treatments on the August regrowth of the Alta variety of tall fescue. A factorial design was used with four growth stages--boot, emergent, heads fully out, and early flower--and four stubble heights: 2, 3½, 5, and 6½ inches. These treatments were applied in four replications on two areas where Alta fescue predominated.

One area had been clipped the previous season whereas on the other the last year's forage was left standing. All plots were cut in the spring at the various growth stages and stubble heights indicated. Summer regrowth was measured by clipping all plots to a uniform 2-inch height in early August. Nitrogen was applied at the rate of 33 pounds of N per acre on two replications in each area in early March.

Results from two years of treatment indicated that the total herbage produced in a season was not materially different for the 16 combinations used. Summer regrowth, however, was much greater on plots cut before the early flower stage, particularly if cut at the 3½- to 5-inch stubble heights. Nitrogen greatly increased the yield of August regrowth in both years. Yields the second year were reduced about one-half in comparison to the first year, indicating that any spring cutting treatment, when followed by an August harvest, interferes with the normal physiology and food storage processes of tall fescue.

A second experiment conducted in 1955 was undertaken to further test these results. Only two stages of growth — emergent and heads out — were used in a simple factorial with and without nitrogen fertilizer. Stubble heights were narrowed to three — 3, 4, and 5 inches — and applied on subplots within the four main treatments.

Results from this latest experiment emphasized the value of nitrogen fertilizer in increasing early spring forage so that clipping for silage in May would be practical. Careful observations of a sheep-grazing trial indicated the superiority of summer regrowth from an area harvested in the emergent to heads out stage as compared to similar pasture allowed to develop and mature seed.

Literature Cited

Green, J. O. 1954. Correspondence on work in progress on the production of leaf herbage for the drier months of the year--July and August--at Grassland Research Stations, Hurley, Berkshire, England. Dated December 9, 1954.

Grunder, M. S. 1952. Deferred grazing. Typewritten summary of findings received by correspondence, February 10, 1952, from Western Washington Experiment Station, Puyallup, Washington.

Hedrick, D. W. 1957. Rabbits as a tool in pasture and range utilization research. Jour. Range Mgt. 10(4):180-182.

_____ 1957a. Response of tall fescue (Festuca arundinacea) nonirrigated pastures to fertilizer treatments. Ore. Agric. Expt. Misc. Paper No. 52:1-22.

Leukel, W. A., J. P. Camp, and J. M. Coleman. 1934. Effect of frequent cutting and nitrate fertilization on the growth behavior and relative composition of pasture grasses. Fla. Agr. Expt. Sta. Bul. 269:1-48.