A COMPARISON OF GRASS SAMPLING TECHNIQUES WITH SOME OBSERVATIONS ON GRAZING BEHAVIOR

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INTRODUCTION

One part of this study was concerned with a comparison of grass sampling techniques. Collecting samples of forage that are representative of the ingested material is a complex problem. Animals often select plants and plant parts from a mixture of species. The selectivity of the animal may vary with the species of animal, available plants, stage of maturity, intensity of grazing and weather conditions. Sampling from fistulated animals and plot clipping have been recognized as methods of obtaining forage samples of the ingested material under pasture and range conditions.

The objective of this phase of this experiment was to obtain forage samples of the grazing animals diet by the plot clipping method and from rumen fistulated animals and to compare the two methods by chemical analysis as to crude protein, ether extract, crude fiber, nitrogen-free extract, and ash.

Some observations on grazing behavior were also made. Cattle have well-defined habits and their movements on range land are far from random. Several workers have been concerned with the study of the activities of cattle as they graze naturally on the range. It appears that environmental factors such as the condition of the pasture, temperature, weather conditions, distance to water, wind direction, and the lightness of the night influence the activities of cattle.

The objective of this part of the study was to compare the grazing behavior of two different lots of cattle that were fed two different supplements. One lot of 10 heifers received two pounds of ground sorghum grain per head per day as a supplement to the native range forage. The other lot of 10 Hereford heifers received two pounds of soybean oil meal per day as a supplement.

The observations started February 19, 1965, and closed May 21, 1965, a period of fourteen weeks. The study period was marked with cold, moist weather. Snow with rain was rather frequent and it was difficult to move around the pasture the first ten weeks of the study.

REVIEW OF LITERATURE

Grass Sampling Techniques

The problem of obtaining a sample of forage which is representative of that selected by the grazing animal has long vexed researchers in their attempts to evaluate pasture and range feed. Hardison et al. (1954) reviewed the subject of selective grazing and obtained some quantitative measure of the difference between the forage available and that grazed. They ran concurrent digestion trials on steers grazing pasture and stall-confined steers fed herbage from a similar area. On the basis of these investigations they concluded that the chemical composition of the clipped herbage is an unreliable index of the chemical composition of the forage selected by the animal. Torell (1954) conducted a series of four trials to prepare an esophageal fistula which would operate efficiently in making collections of forage consumed by sheep. In the final trial, a fistula was developed on a two year old wether that was fairly successful. Lesperance et al. (1959) used steers with either rumen or esophageal fistulae to sample the forage at two-to-three-day intervals. The composition of the fistula samples failed to agree with the composition of samples hand-harvested under cages the same day. Cook et al. (1958) stated that hand plucking was totally inadequate on complex mixtures of plant species. Smith et al. (1959) studied methods of obtaining forage samples. Forage samples obtained from following steers were compared

with others obtained from clipping plots. Clippings were collected from three caged plots in each quarter of the pasture. Hand plucked forage samples were obtained by following each of four steers in the sample pasture. Three trials were conducted, one each during September 1953, June 1954, and August 1954. Smith stated that there was little evidence that these two methods produced similar results. Lesperance et al. (1960) developed techniques to sample grazed forage with steers using both rumen and esophageal fistulae. They conducted a comparison between feeds of known chemical composition and samples collected from the same feeds through fistulae. The amount of protein and ether extract was the same in the fistula samples as the feed, but significant changes were noted in the amount of crude fiber, N.F.E. and energy. The composition and the amount of saliva secreted while consuming a sample of forage was investigated, to explain some of the changes noted. Repeated feed sampling on the same day with the same animal had little effect on the fistula samples. Due to the high variation among feeds, and the generally high correlation between the feed and the fistula samples, it was felt that the fistula samples gave a good estimate of the foraging animal's diet. Torell et al. (1959) stated that correlation and regression studies indicated that it was feasible to estimate what an animal would eat from hand-clipped material. Cook et al. (1963) stated that three methods have been used successfully in obtaining forage samples representative of ingested material. These are: (1) hand plucking, (2) before and after grazing, and (3) sampling from fistulated animals. Two types of fistulae in animals are being used to collect samples of ingested forage, esophageal and rumen fistulae. The observations showed that fistulated and unfistulated animals selected diets that were comparable in the same pasture. It was stated that the rumen-fistula method was considerably more time consuming than the esophageal fistula

technique and had the distinct disadvantage of being more distasteful to the attendant.

Observations on Grazing Behavior

Grazing habits have been studied in various parts of this country. Cory (1927) in Texas made one of the earliest studies and presented considerable detail as to the time spent in various activities. Hein (1935) in Maryland found that grazing time was directly proportional to the abundance and palatability of the forage. Atkeson et al. (1942) in eastern Kansas found likewise that the time spent grazing was correlated with the condition of the pasture. More time was spent in grazing on the poor pasture. Stanley (1938) working in Arizona, concluded that grazing habits were dependent upon factors that influenced the condition of various plant species. Johnstone-Wallace et al. (1938) in New York reported that cattle may graze as much at night as in the daytime. Culley (1938) stated that in order to get the facts with respect to the grazing habits of cattle we have to live with them on the range and follow their movements in the daylight and night hours. They observed that two conditions on the range seem to affect the closeness of grazing: (1) the abundance of forage, and (2) how rocky the area was. At Hays, Kansas, Moorefield et al. (1951) found also that the activities of cattle on the range had certain relationships with proper range management. Dwyer (1961) working in Oklahoma found that the kind of vegetation on each range site was important in determining the amount of time the cattle spent grazing there. Results also showed that the cattle preferred the loamy prairie range site over shallow and rocky break sites for standing, lying or walking. Results also showed that the temperature of the day exerted considerable influence on the animals activities.

A COMPARISON OF GRASS SAMPLING TECHNIQUES

Methods and Procedure

The study was conducted on a native bluestem pasture located six miles northwest of the Kansas State University campus. Big bluestem (Andropogon gerardi), little bluestem (Andropogon scoparius), and indian grass (Sorghastrum nutans) make up 50 and 60 percent of the ordinary upland and limestone breaks sites as described by Anderson and Fly (1955).

The study was conducted during August and September 1964, beginning August 6. Plot clipped forage samples and rumen samples collected from three rumen-fistulated steers, were collected twice each week, Tuesday and Friday. All samples were collected during the morning hours.

The three steers were retained in a dry lot, without water, the night before the collection of the ingested material the next day. Rope halters were placed on the steers so that they could be retained easily in the lot and the pasture.

Ingested material was removed from the rumen with a disposable plastic, full arm length, glove. The rumen was emptied and flushed with distilled water several times and dried with a large sponge. The fistulated steers were then released in the pasture, without water, for a 45 minute period. The steers did not begin to graze for 15 to 20 minutes after being released in the pasture. At the end of the 45 minute period the steers were retained by halter ropes in the pasture and a quart jar of ingested material was collected from each steer. The ingested material was placed in a 250 mm seive, and washed with distilled water, using a sponge to press the water from the sample, and placed in a quart jar to take to the laboratory for chemical analysis.

Forage samples were obtained by clipping one-foot square plots from the area that the steers grazed during the forty-five minute grazing period. A one-foot square frame was tossed randomly into the sites. Ten tosses were made to obtain a representative forage sample. The one-foot square of each toss was clipped to a height of one-inch above the ground level. The ten samples collected from the ten tosses were kept separate by major grass species while being dried and ground preparatory to compositing them into a single sample to represent the diet of the animals. A box containing coded-named quart jars for each species of the predominant grasses and forbes was used in the collection of the clipped samples. An eight-inch shearer was used to clip the plots.

All materials, rumen ingested material and forage samples, collected in the field were placed in clean quart jars each day of the study and taken to the laboratory.

The forage samples and the fistula samples were compared as to content of crude protein, ether extract, crude fiber, nitrogen-free extract, and ash. The samples were analyzed according to Official Methods of Analysis (9th ed.), Association of Official Agricultural Chemists (1960).

All samples were placed in a forced-draft oven immediately after collection and dried with the fan at 60-70° C. for about two hours, then at 50-60° C. for about twenty hours. The samples were then ground, placed in clean quart jars and placed on the shelf for storage and later chemical analysis.

Four replications of each sample were made in the laboratory to determine the percentage of crude protein, ether extract, crude fiber, nitrogen-free extract and ash in the sample.

Heavy rain on August 9 prevented the collection of the forage samples. The fistulated animals did not graze after being released in the pasture.

Results and Discussion

Table 1 shows the average crude protein, ether extract, crude fiber, nitrogen-free extract, and ash content of the forage samples from the clipped plots and the rumen-fistulated animals. The protein content of the diet of the steers remained relatively constant for the period, August 6 to September 17, as measured by the fistula samples. The protein of the plot clipped samples varied during the period. The ash of the samples, both fistula samples and plot clipped samples, increased from three to four percent during the period. The fistula samples were generally higher than the forage samples in crude protein, ether extract, and crude fiber. The plot-clipped samples were higher in nitrogen-free extract than the fistula samples. Table 2 is a summary of the analysis of variance.

A cattle producer interested in the protein needs of grazing cattle can use the method of collecting a forage sample used in this study to determine the percentage of crude protein in the animal's diet. This is the step by step procedure that a cattle producer could follow in making the determination of the crude protein in the diet of the animals. (1) collect forage sample, (2) submit sample to a laboratory for analysis, (3) receive laboratory report showing the percentage of crude protein in the sample, (4) multiply the percentage of crude protein by .26, (5) add the answer to the percentage of crude protein, (6) the answer is the percent of crude protein in the animal's diet. For an example, the percentage of crude protein in the forage sample is 7.50 percent. 7.50 x .26 = 1.95 plus 7.50 = 9.45 percent, equals the percentage of crude protein in the animals diet. By comparing the estimated protein content of his grass with the requirement for protein the producer would be able to determine the protein needs of his cattle.

Table 1. A comparison of the chemical analysis of forage samples collected by rumen fistula with samples obtained by the plot clipping method (dry basis).

	Crude protein %		Ether extract %		Crude fiber %		Nitrogen-free extract %		Ash %	
	Fistula samples	Plot clipped samples	Fistula samples	Plot clipped samples	Fistula samples	Plot clipped samples	Fistula samples	Plot clipped samples	Fistula samples	Plot clipped samples
Aug. 6	8.56	6.25	1.67	1.27	32.35	30.10	49.27	55.46	8.15	6.92
13	8.41	5.81	1.71	1.37	30.10	28.00	51.81	57.81	8.31	7.01
16	8.34	6.34	1.26	1.02	29.31	27.51	52.49	56.52	8.60	8.61
20	9.64	7.63	1.52	1.32	24.50	23.31	55.20	57.81	9.14	8.96
24	9.50	8.44	1.56	1.26	25.03	23.33	54.86	58.06	9.05	8.91
27	9.85	7.44	1.65	1.12	25.43	23.70	54.94	58.43	9.13	9.31
Sept. 1	9.40	7.82	1.71	1.53	28.63	25.35	49.51	56.47	10.75	8.87
4	9.00	7.19	2.80	1.12	26.30	22.50	51.31	57.35	10.59	11.84
8	9.11	8.19	1.77	1.22	27.10	23.10	51.54	56.71	10.55	10.78
11	8.94	6.75	2.23	1.54	24.20	23.20	53.19	56.65	11.52	11.86
14	9.23	6.56	2.77	1.19	24.13	23.50	53.32	58.49	10.55	10.26
17	9.86	7.44	2.61	1.63	25.65	24.31	50.67	55.07	11.21	11.55
Average	9.15**	7.12	1.94**	1.29	26.89	24.84	52.34**	57.07	9.78	9.56

**Significant at P < .01

PLATE I

Three figures of the rumen-fistulated steers used in the trial to collect the ingested material from the rumen. The figures show some leakage from the fistula.

PLATE I

Figure 1

Figure 2

Figure 3

Table 2. Mean squares from the Analysis of Variance for the forage samples collected by rumen fistula and samples obtained by plot clipping.

Sources of variation	Degrees of freedom	Crude protein	Ether extract	Crude fiber	N.F.E.	Ash
Methods	1	23.96	2.45	76.36	128.21	.28
Samples	22	.47	.17	45.80	2.76	2.14
Total	23					

As the tall grasses in the pasture became mature the latter part of August the fistulated steers grazed the short grass areas of the pasture. Buffalo grass (Buchloe dactyloides), blue grama (Bouteloua gracilis), and side oats grama (Bouteloua curtipendula) were the predominant species of short grasses in the pasture. The ingested material collected from the rumen-fistulated steers changed from eighty-two percent tall grasses, August 7 to eighty-six percent short grasses, September 17. A complete identification of the forage species present in the ingested material from the fistulated steers was not determined because of the masticated condition of the samples and visual identification was not possible.

Table 3 shows the botanical identification of the forage samples from the clipped plots. The miscellaneous item in the table includes unidentifiable materials and small pieces of weeds. The percentage of the grasses was determined by weight in grams in the laboratory before the samples were placed in the ovens for drying. The tall grasses, big bluestem, little bluestem, and Indian grass made up the greater percentage of the grasses in the forage samples from the clipped plots on the first dates of the study. The percentage of short grasses in the forage samples continued to increase throughout the study period.

Table 3. Percent grasses and forbes in forage samples collected by the plot-clipping method of obtaining forage samples.

Species	August						September					
	6	13	16	20	24	27	1	4	8	11	14	17
	%	%	%	%	%	%	%	%	%	%	%	%
Big bluestem	31	8										
Little bluestem	34	31	28	15		8	26	21	4			
Indian grass	26											
Side oats grama		26	15	13	8			7		26	21	13
Buffalo grass		14	41	61	80	78	58	61	56	49	50	50
Hairy grama		15	8	8	9	7	13	7	36	21	22	28
Carex					1							
Misc.*	9	6	8	3	2	7	3	4	4	4	7	9

*Miscellaneous includes those broad-leafed weed parts and material that was not identifiable.

Summary

Rumen fistulated steers were used to sample the forage on native grass pasture. The samples were compared to clipped plots obtained by using a one foot square frame and tossing it at random in the area being grazed by the steers. Fistula samples and plot-clipped samples were collected twice each week of the study period, Tuesday and Friday mornings, starting August 6, 1964 and ending September 17, 1964.

The rumen samples and the forage samples were compared on the basis of crude protein, ether extract, crude fiber, nitrogen-free extract, and ash. The rumen samples were higher on an average in crude protein, ether extract, crude fiber and ash. The clipped samples were higher in nitrogen-free extract.

OBSERVATIONS ON GRAZING BEHAVIOR

Methods and Procedure

This study was also conducted at Kansas State University on native bluestem pasture located six miles northwest of the campus. The cattle used in the study were two year old Hereford heifers due to calve during April, May and June.

All the heifers in the pasture were penned three times weekly and fed an average of two pounds per head daily of a supplemental feed. The following three supplements were being compared: ground sorghum grain, 50% ground sorghum grain and 50% soybean oil meal, soybean oil meal. Only those heifers on the all sorghum grain and all soybean oil meal supplements were observed for grazing behavior. There were eleven heifers in each group and seven in each group were observed. Tatoo numbers of the eleven heifers in a group were placed in a box, the first number drawn would be first heifer observed from that group and so on down the line until the numbers of seven heifers were randomly selected. Each heifer's tatoo number was painted on her sides with large numerals using a pressure can of white paint. Seven different heifers from each group were observed during the study making a total of fourteen heifers being observed during the period. Observations were made each week for a twenty-four hour period, starting Friday evening, February 19, 1965 at 6:00 o'clock and terminating May 21, 1965, a total of fourteen weeks. Each study period was spent observing a different heifer. Three observers took part in the study.

A four-wheel-drive pick-up truck was used to watch the heifers. The truck did not cause any disturbance among the heifers, in fact, the heifers paid little attention to it. The heifers would become aware of an observer and get

excited if the observer got out of the pick-up truck. It was very easy to stay within 15 yards of the heifer being observed, although it was not necessary to remain this close during the daylight hours. It was impossible to get this close to the heifer in some cases because of the hilly terrain of the pasture. A three-celled flashlight was used to keep the heifer under observation at night. The daytime distance traveled by each heifer was estimated with the speedometer readings of the vehicle.

The time of day at which any change in activity of the heifer occurred and the period spent in each activity was recorded. The timed activities included grazing, resting, walking, watering and salting. All times were taken to the nearest minute. Other observations included number of urinations, number of defecations, sunset, sunrise, moon condition, estimated daylight travel, and weather conditions.

Results and Discussion

There were three consistent grazing periods during the 24 hours. These periods were between 6:00 and 9:00 in the morning, from 4:00 to 7:30 in the evening, and at midnight. During these periods the cattle were extremely busy grazing.

The heifers grazed with their supplemental group most of the time. One reason for this may have been that after feeding they were released as a group. The cattle grazed the tops of the hills, the plateaus, during the month of February and the first part of March. As the grass started to green-up in the valleys and low ground areas of the pasture the latter part of March the cattle started to graze in the low land pasture sites.

When warmer temperatures arrived in April the heifers never passed up the opportunity to rub themselves whenever they came near an object that

provided a rubbing surface. The trees in the pasture provided these rubbing places.

At about midnight each night the heifers would get up to graze. Heifers would stand for 10 minutes and then graze for an average of 1.45 hours. Grazing usually took place in the same general area of the bedding grounds. Temperatures during the night appeared to have no influence on the grazing behavior of the animals.

At about thirty minutes before sun-up when the eastern sky became bright, the heifers scratched their necks on the ground, arose from lying, stretched, curling their tails over their backs and extended a hind leg. They usually stood for ten minutes before they started to graze.

The heifers then grazed rather intensively in the general direction of the water tank. The heifers arrived at the watering place sometime between 8:00 and 9:00 a.m. After their first drink of the day, they rested for about an hour. Most of the period was spent lying down and ruminating. The heifers then resumed grazing in the direction of the salt box. By 12:30 p.m. most of the animals were resting, standing or lying down. The heifers gradually drifted away from their resting place from 3:00 to 4:00 p.m. in small groups, and began their evening period of grazing. Grazing usually stopped at thirty minutes after sundown. They rested, standing or lying down, until about midnight when the animals would get up, one by one, and begin to graze. They usually did not graze too far from the resting place. In cold weather the animals were less active, when they grazed they grazed longer and when they rested they rested longer, compared to the warmer weather when the cattle were up and down more.

Table 4 shows a comparison of the grazing time and the resting time according to the supplement fed to the two groups of cattle. Cattle which

Table 4. A comparison of the grazing behavior over a 24 hour period of cattle being fed two different supplements, ground sorghum grain and soybean oil meal on native grass pasture. Times are reported in hours unless otherwise specified.

Date	Heifer No. Supplementation 2# SBOM	Heifer No. Supplementation 2# ground sorghum grain	Estimated distance traveled miles	Grazing	Resting	No. of times Defecations	No. of times Urinations
Feb. 19		18	2.1	11.1	12.9	6	7
26	13		2.3	9.4	14.6	6	4
March 5		354	2.9	8.5	15.5	3	3
12	332		1.5	8.0	16.0	6	4
19		70	2.7	9.4	14.6	4	3
26	134		1.5	7.7	16.3	4	3
April 2		18	1.6	10.3	13.7	5	3
9	371		2.7	12.3	11.7	11	4
16		112	2.3	13.3	10.7	12	5
23	133		2.3	13.2	10.8	11	4
30		388	3.2	13.3	10.7	13	6
May 7	116		3.3	10.5	13.5	13	6
14		81	3.2	11.6	12.4	14	8
21	242		3.0	10.2	13.8	12	5
Average of all heifers			2.44	10.63	13.37	8.57	4.64

Average grazing time:
SBOM 10.19 hours
Ground sorghum grain 11.07 hours

Average resting time:
SBOM 13.81 hours
Ground sorghum grain 12.93 hours

Average defecations, No. of times:
SBOM 9.00
Ground sorghum grain 8.14

Average urinations, No. of times:
SBOM 4.29
Ground sorghum grain 5.00

were supplemented with two pounds of soybean oil meal grazed on the average .88 of an hour less for each twenty-four hour period than the cattle which received two pounds of ground sorghum grain.

The average grazing time for the two groups is plotted in figure 1. In this study, the grazing time of both groups declined the first four weeks. The grazing time increased to a high point of over thirteen hours the middle of April. The grazing time of both groups declined during the month of May. There was an abundance of palatable grass during May due to warmer temperatures and excellent moisture conditions. It seems quite possible, in view of the work of Hein (1935), that grazing time is directly proportional to the abundance and palatability of the forage.

Cattle supplemented with ground sorghum grain had .7 more urinations than the cattle supplemented with soybean oil meal. The table also shows that the number of excretions made during the study period was steadily increasing as the dates got closer to the warmer months of the year. This could be explained by the facts that the grass was green and more palatable, the days were longer, and a greater intake of grass and water, at this time of the year.

Table 5 is a summary of the Analysis of Variance for the two groups of cattle being fed the two different supplements. There was not a significant difference between the two groups in grazing time, resting time or urinations.

Figure 1

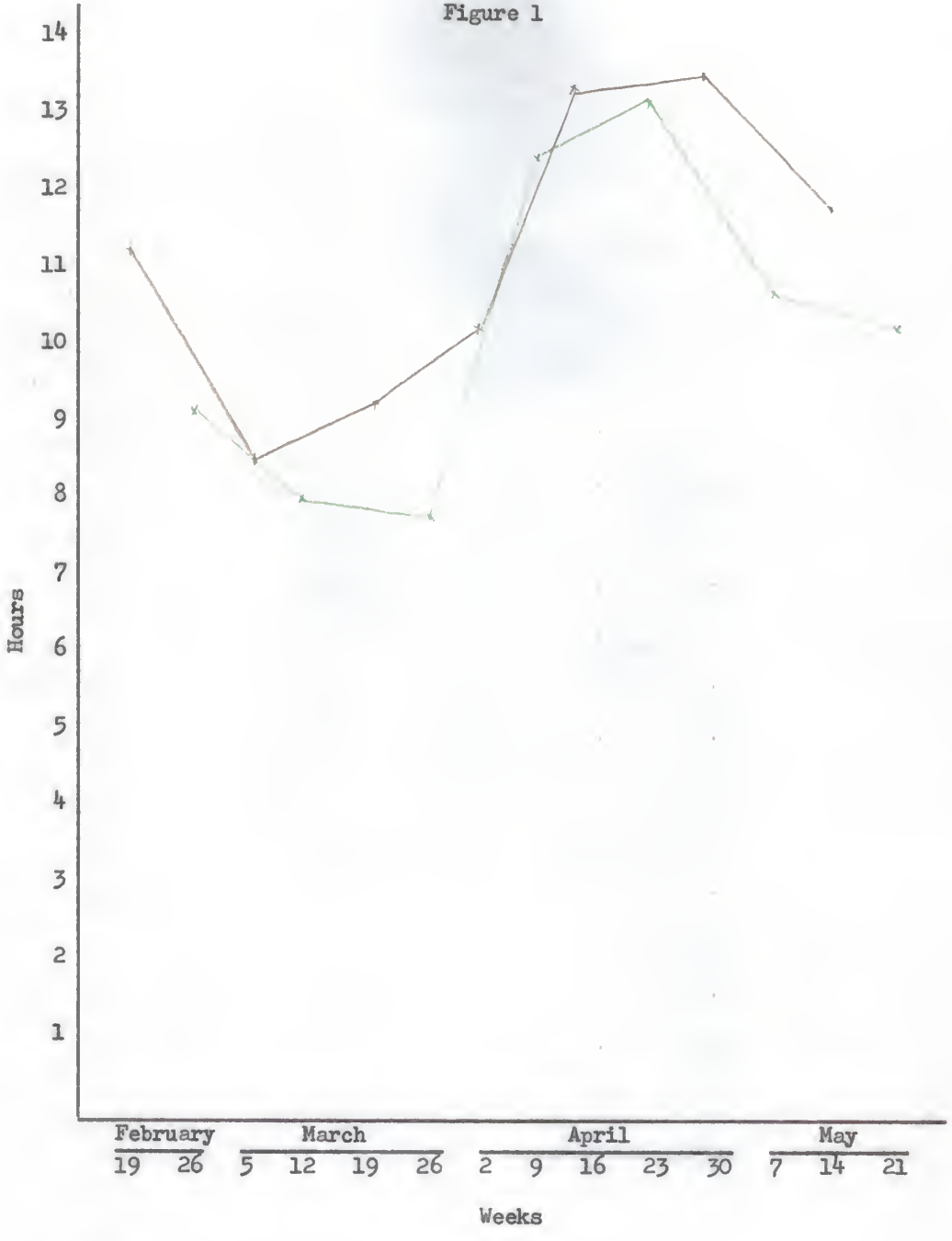
14
13
12
11
10
9
8
7
6
5
4
3
2
1
Hours
February
19 26
March
5 12 19 26
April
2 9 16 23 30
May
7 14 21
Weeks
SBOM cattle
Grain sorghum cattle

Table 5. Mean squares from the Analysis of Variance for grazing time, resting time, defecations and urinations between two groups of cattle being fed two different supplements.

Sources of variation	Degrees of freedom	Grazing time	Resting time	Defecations	Urinations
Treatment	1	2.74	2.74	1.14	1.79
Animals	12	3.79	3.79	17.95	2.62
Treatment + Animals	13				

Summary

For a twenty-four hour period, once weekly over a period of fourteen weeks, observations were made on heifers grazing native range. The heifers received different supplemental feeds, one group received two pounds per head daily of ground sorghum grain, the other the same amount of soybean oil meal. A heifer from one group was observed one week, the next week a heifer from the other group was watched.

The heifers spent an average of eleven hours grazing. Those fed ground grain sorghum tended to graze longer than those fed soybean oil meal, .88 of an hour, but this difference was not statistically significant. The heifers urinated on an average of 4.6 times and defecated 8.9. They traveled an estimated 2.44 miles per 24 hour period.

SUMMARY AND CONCLUSIONS

The objective of the first part of this study was to compare forage samples collected by the plot-clipping method and collected from rumen-fistulated animals, and to measure the differences between the two methods by

chemical analysis, as to crude protein, ether extract, crude fiber, nitrogen-free extract and ash.

Samples were collected twice each week, Tuesday and Friday, for twelve weeks, August 6 to September 17. Three rumen-fistulated steers were used to obtain the fistula samples. Ten random tosses of a one-foot square frame were used to obtain the plot-clipped samples.

Fistula samples had a higher percentage of crude protein, ether extract and crude fiber, than the plot-clipped samples. There was an increase in the percentage of ash in both the fistula samples and plot-clipped samples as the study continued to September 17.

Botanical identification of the plot-clipped forage samples showed the preference of the animals for the short grasses after the tall grasses matured and produced seed stalks.

The results indicated plot clipping did not give the same measure of the composition of the forage being grazed by animals as rumen fistula samples.

A second phase of this study was concerned with the grazing behavior of two groups of cattle that were fed different supplements. One group received two pounds of ground sorghum grain per head daily as a supplement to the native range forage. The other group received two pounds of soybean oil meal per day.

An individual heifer was observed from 6:00 in the evening to 6:00 the next evening, a period of 24 hours, each week of a fourteen week period.

Seven heifers out of eleven in each group were randomly selected and observed on alternate weeks. Since there were 14 weeks in the study, a different individual heifer was observed from each group seven times.

The average grazing time of the heifers being supplemented with two pounds of SBOM per head daily was 10.1 hour and the resting time was 13.9 hours. The heifers being supplemented with two pounds of ground grain sorghum grazed an average of 11.0 hours and rested 13 hours.

The average daily distance traveled by the animals was estimated at 2.44 miles. An average of 8.5 defecations and 4.6 urinations occurred per heifer each twenty-four hours. The cattle that were supplemented with ground sorghum grain had .7 more urinations than the SBOM supplemented animals. As the season progressed from February to May and the grass began to grow and the days became longer, the number of defecations per heifer increased.

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LITERATURE CITED

Anderson, K. L. and C. L. Fly. 1955. Vegetation-soil relationships in Flint Hills bluestem pastures in Kansas. Thesis. Univ. of Neb. 88 pp.

A.O.A.C. 1960. Official Methods of Analysis (9th ed.). Association of Agricultural Chemists. Washington, D. C.

Cook, C. W., J. L. Thorne, J. T. Blake, and J. Edlefsen. 1958. Use of esophageal-fistula cannulae for collecting forage samples by grazing sheep. J. Animal Sci. 17:189-193.

Cook, C. W., J. T. Blake and J. W. Call. 1963. Use of esophageal-fistula cannulae for collecting forage samples from both sheep and cattle in common. J. Animal Sci. 22:579-581.

Cory, V. L. 1927. Activities of livestock on the range. Texas Agr. Expt. Sta. Bull. 367. 47 pp.

Culley, M. J. 1938. Grazing habits of range cattle. Amer. Cattle Prod. 19:3-4, 16-17.

Dwyer, D. D. 1961. Activities and grazing preferences of cows in northern Osage County, Oklahoma. Okla. Expt. Sta. Bull. B-588. 61 pp.

Hardison, W. A., J. T. Reid, C. M. Martin and P. C. Woolfolk. 1954. Degree of herbage selection by grazing cattle. J. Dairy Sci. 37:89-94.

Hein, H. M. 1935. Grazing time of beef steers on permanent pastures. J. Amer. Soc. Agron. 34:191-197.

Johnstone-Wallace, D. B., and K. Kennedy. 1938. Grazing management practices and their relationship to the behavior and grazing habits of cattle. J. Agric. Sci. 34:191-197.

Lesperance, A. L., V. R. Bohman, D. W. Marble, E. H. Jensen, and R. A. Madsen. 1959. The development of techniques for evaluating grazed forage. Proc. West. Sec. Amer. Soc. Animal Prod. 10(XXXI):1-6.

Lesperance, A. L., E. H. Jensen, V. R. Bohman and R. A. Madsen. 1960. Measuring selective grazing with fistulated steers. J. Dairy Sci. 43:1615-1622.

Moorefield, J. G. and H. H. Hopkins. 1951. Grazing habits of cattle in a mixed-prairie pasture. J. Range Mangt. 8:51-57.

Smith, E. F., V. A. Young, L. A. Holland and H. C. Fryer. 1959. A comparison of two grass sampling methods for digestion trials on pasture. J. Range Mangt. 12:306-308.

Torrell, D. T. 1954. An esophageal fistula for animal nutrition studies. J. Animal Sci. 13:878-884.

Torrell, D. T., and W. C. Weir. 1959. The effect of rotation grazing on animal nutrition. Proc. West. Sect. Amer. Soc. Animal Prod. 10(XL): 1-6.

A COMPARISON OF GRASS SAMPLING TECHNIQUES WITH SOME OBSERVATIONS ON GRAZING BEHAVIOR

by

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The objective of the first part of this study was to compare forage samples collected by the plot-clipping method and collected from rumen-fistulated animals, and to measure the differences between the two methods by chemical analysis, as to crude protein, ether extract, crude fiber, nitrogen-free extract and ash.

Samples were collected twice each week, Tuesday and Friday, for twelve weeks, August 6 to September 17. Three rumen-fistulated steers were used to obtain the fistula samples. Ten random tosses of a one-foot square frame were used to obtain the plot-clipped samples.

Fistula obtained samples had a higher percentage of crude protein, ether extract and crude fiber, than the plot-clipped samples. There was an increase in the percentage of ash in both the fistula samples and plot-clipped samples as the study continued to September 17.

Botanical identification of the plot-clipped forage samples showed the preference of the animals for the short grasses after the tall grasses matured and produced seed stalks.

The results indicated plot clipping did not give the same measure of the composition of the forage being grazed by animals as rumen fistula samples.

A second phase of this study was concerned with the grazing behavior of two groups of cattle that were fed different supplements. One group received two pounds of ground sorghum grain per head daily as a supplement to the native range forage. The other group received two pounds of soybean oil meal per day.

An individual heifer was observed from 6:00 in the evening to 6:00 the next evening, a period of 24 hours, each week of a fourteen week period.

Seven heifers out of eleven in each group were randomly selected and observed on alternate weeks. Since there were 14 weeks in the study, a different individual heifer was observed from each group seven times.

The average grazing time of the heifers being supplemented with two pounds of SBOM per head daily was 10.1 hour and the resting time was 13.9 hours. The heifers being supplemented with two pounds of ground grain sorghum grazed an average of 11.0 hours and rested 13 hours.

The average daily distance traveled by the animals was estimated at 2.44 miles. An average of 8.5 defecations and 4.6 urinations occurred per heifer each twenty-four hours. The cattle that were supplemented with ground sorghum grain had .7 more urinations than the SBOM supplemented animals. As the season progressed from February to May and the grass began to grow and the days became longer, the number of defecations per heifer increased.