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PRONGHORN FOOD HABITS STUDIES, 1970-1972

Charles C. Schwartz and Julius G. Nagy

Department of Wildlife Biology

Colorado State University

Fort Collins, Colorado

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ABSTRACT

Food habits of tame pronghorn antelope [*Antilocapra americana* (Ord)] were investigated from December 1970 to January 1972 in diet pastures on the Pawnee National Grassland, Colorado. Both botanical and chemical compositions of the diet are listed. Antelope seemed to prefer plants in early phenological stages and ate a large variety of forbs, grasses, and browse when these were available. Supplemental feeding of animals with concentrate had a negligible effect on food habits in the pastures. When dietary habits of tame pronghorn and wild pronghorn were compared using the fecal microtechnique it seemed that, besides individual variation, availability of plant species was the major factor determining diet composition. Data did not indicate major differences in dietary habits of pronghorn due to background differences (tame vs. wild).

INTRODUCTION

This report covers activities of the antelope project from December 1970 to January 1972. The main area of investigation was the dietary habits of pronghorn on the Pawnee National Grassland.

Objectives

Main objectives of the study were: (i) to ascertain the botanical composition of the pronghorn diet both seasonally and under different cattle-grazing intensities, (ii) to measure the chemical constituents of plant species eaten and of composited diets, (iii) to estimate the digestibilities of plant species eaten and of composited diets, (iv) to compare dietary intakes of tame vs. wild pronghorn, and (v) to investigate effects of supplemental feeding and restricted grazing times on dietary intake of tame pronghorn.

MATERIALS AND METHODS

Botanical Composition of the Diet

Seven grazing trials were conducted to ascertain the botanical compositions of pronghorn diets. Dates of each trial were chosen to include all seasons. Sampling was intensified during the season of most plant growth so that changes in preference related to changes in plant phenology could be detected. Sampling dates were: 5-8 December 1970; 20-28 March 1971; 28 April-5 May 1971; 25 June-5 July 1971; 14-21 August 1971; 23-28 October 1971; and 15, 16, 22, and 23 January 1972.

The 5-8 December trial was conducted in half section 23 W. Eight tame pronghorn kids, four females, two males, and two castrated males were paired according to their compatibilities. Two different pairs of animals were transported to the study area each morning and each evening in a horse trailer. The first pair of animals were observed by two men for one hour and the second pair were observed the second hour. A similar pattern was followed by the two observers in the afternoon. The observation sequence of the animals and observers is listed in Table 1.

The remainder of the trials were conducted in diet pastures in section 21. Animals were kept at the Pawnee Site where they grazed freely throughout the day. In all cases animals were given at least 4 days to acclimate to the pasture and establish plant preferences. The 20-28 March trial was conducted in diet pastures 1, 2, and 3. Following this trial diet pastures 1 and 2 were combined to form one large light-use diet pasture. Three tame pronghorn kids, a male and two females, and one yearling female were used in all subsequent trials. Since only the March trial included a moderate-use diet pasture, its discussion is omitted. In each treatment (heavy- and light-use pastures), animals were observed for 3 days in a March trial and for 4 days in April-May, June-July, and August trials and for 2 days in an October and January 1972 trial. Since preliminary observations indicated that pronghorn grazed intensively for about 1.5 hr in any one grazing period, each observer watched two animals each morning and each evening for 45 min per animal. Following the afternoon grazing period, animals were led back to the corrals and held until the following morning's observation. Animals were permitted to graze freely during the day. The observation sequences for the March-January trials are listed in Tables 2 and 3.

Table 1. Animal observer sequence for dietary studies with pronghorn, 5-8 December 1970.

Time	Day			
	1	2	3	4
First A.M.	1-Cindy[a/] 2-Fredrica	1-Streak 2-Smoke	1-Kay 2-Liz	1-Curley[b/] 2-Jake[b/]
Second A.M.	1-Smoke 2-Streak	1-Liz 2-Kay	1-Jake 2-Curley	1-Fredrica 2-Cindy
First P.M.	3-Liz 4-Kay	3-Curley 4-Jake	3-Fredrica 4-Cindy	3-Streak 4-Smoke
Second P.M.	3-Jake 4-Curley	3-Cindy 4-Fredrica	3-Smoke 4-Streak	3-Kay 4-Liz

[a/] Number represents observer, followed by the animal's name.

[b/] Castrated males.

Table 2. Animal observation sequence for dietary studies with pronghorn, 20-28 March 1971.

Time	Day		
	1	2	3
First A.M.	1-Fredrica[a/] 2-Smoke	1-Kim 2-Kay	1-Kim 2-Smoke
Second A.M.	1-Kay 2-Kim	1-Smoke 2-Fredrica	1-Kay 2-Fredrica
First P.M.	1-Smoke 2-Fredrica	1-Kay 2-Kim	1-Smoke 2-Kim
Second P.M.	1-Kim 2-Kay	1-Fredrica 2-Smoke	1-Fredrica 2-Kay

a/ Number represents observer, followed by the animal's name.

Table 3. Animal observation sequence for dietary studies with pronghorn, April 1971 to January 1972.

Time	Day			
	1	2	3	4
First A.M.	1-Smoke[a/] 2-Kim	1-Fredrica 2-Kay	1-Kim 2-Smoke	1-Kay 2-Fredrica
Second A.M.	1-Fredrica 2-Kay	1-Kim 2-Smoke	1-Kay 2-Fredrica	1-Smoke 2-Kim
First P.M.	1-Kim 2-Smoke	1-Kay 2-Fredrica	1-Smoke 2-Kim	1-Fredrica 2-Kay
Second P.M.	1-Kay 2-Fredrica	1-Smoke 2-Kim	1-Fredrica 2-Kay	1-Kim 2-Smoke

[a/] Number represents observer, followed by the animal's name.

The method used to ascertain plant species and parts consumed has been described by Hoover (1971). The procedure used to estimate the dietary intake of pronghorn involved estimating the weight consumed by each species. Each diet sample contained the same proportion of each species by weight as eaten by the tame pronghorn. The weight per bite of each species was determined using the average plucked weight per 100 bites of each species. Species comprising more than 2.5% of the total bites taken were used in compositing pronghorn diets.

Chemical Analysis

Chemical analysis included the Van Soest (1963) method of fiber analysis, microKjeldahl measurement of nitrogen, bomb calorimetry, and phosphorus measurements. All species comprising 2.5% or more of the total bites taken in any sampling period were analyzed.

In Vitro Digestion

Dry matter digestion, in vitro, was measured for plant species making up at least 2.5% of the total bites taken and for composited diets for observation periods through 14-21 August. Digestion coefficients were not determined for the October and January trials. Rumen inoculum was obtained from two wild male pronghorn collected 25 September 1971. Animals were shot and immediately transported to the laboratory. Time from collection to initiation of in vitro fermentation technique used has been described by Tilley and Terry (1963) and Pearson (1970). Substrates for all digestion trials were triplicate 250-mg samples ground in a Wiley mill to pass a 0.5-mm screen. Rumen inoculum was prepared by adding one part strained rumen fluid (composited from the two animals) to four parts prewarmed (38.5°C) standard buffer

solution (McDougall 1948) saturated with CO_2. Some 30 ml of this mixture were used as inoculum in each tube.

Comparison of Diets of Tame and Wild Pronghorn

Fecal samples were collected from tame animals during dietary studies. Within 1 week after dietary studies, fecal groups were collected from wild animals. In all cases except 25 June-5 July, feces were collected from a wild herd less than 1 mile north of the study area. Since these animals could not be located during the June-July sampling period, fecal groups were collected on the Meadow Springs Grazing Association Ranch, 1 mile north and ¼ mile west of the Carr exit on Interstate 25.

To measure variability among wild herds, fecal groups were collected after the August sampling period from three herds. One sample was collected from a herd 1 mile north of the study area (Herd B); a second sample was collected in section 19, 4 miles east of the study area (Herd C); a third sample was collected on private land in section 32, 10 miles east and 1 3/4 miles south of the study area (Herd A). Fecal groups collected during the January 1972 trial were analyzed individually to determine the variation between animals within a wild herd.

Remains of plant species in fecal contents were identified using the microtechnique method of identification (Baumgartner and Martin 1939, Sparks and Malachek 1968). The technique is summarized by Hansen et al. (1971). For each sample, 20 slides with 20 fields per slide were read.

Effects of Supplemental Feeding and Restricted Grazing Times on Dietary Intake of Tame Pronghorn

Hoover (1971) stated that supplemental feeding of pronghorn may have affected the proportions of each plant species in the diets of tame pronghorn. Investigating this possibility, three animals in treatment 1 were

given *ad libitum* concentrate from 5:00 P.M. until 8:00 A.M., or the time the animals spent in the holding pens at night. Three animals in the second treatment were also in holding pens at night, but received no concentrate. These animals were observed for 30 min each morning in a random fashion by two observers. After observations were completed, animals were allowed to graze freely the remainder of the day. This trial was conducted for 4 days.

Since these tame pronghorn were kept in holding pens at night, it was necessary to determine if this affected intake and dietary selection the following day. Three free-grazing animals in treatment 1 were left in the diet pastures all night, while three animals in treatment 2 were locked in the holding pens from 5:00 P.M. to 8:00 A.M. Each morning penned animals were released. Animals in both treatments were observed for 30-min periods until all animals had been observed. Animal observation sequence was randomly chosen. This trial was conducted for 2 consecutive days.

RESULTS AND DISCUSSION

Botanical Composition of the Diet

Plant species comprising at least 2.5% of the total bites in any one season are listed in Table 4. Fringed sagewort (*Artemisia frigida*) and blue grama (*Bouteloua gracilis*) comprised over 70% of the diet during winter. Minor forbs eaten included scarlet globemallow (*Sphaeralcea coccinea*), thelesperma (*Thelesperma trifidum*), and primrose (*Oenothera* spp.) (since *O. albicaulis* and *O. coronopifolia* are difficult to identify without the flower the two were lumped as *Oenothera* spp.).

Table 4. Percent of the total bites taken by tame pronghorn by season.[a/]

Plant Code[b/]	1970	1971										1972	
	December 5-8	March 20-28		April 28-May 5		June 25-July 15		August 14-21		October 23-28		January 15-16	
	23W	Light	Heavy	Light	Heavy	Light	Heavy	Light	Heavy	Light	Heavy	Light	Heavy
AGSM	0.1	5.6	28.9	6.3	18.4	0.4	1.4	2.2	2.1	2.3	14.9	1.1	5.1
ARFR4	11.6	0.9	9.8	0.0	0.3	0.0	0.2	0.0	0.0	0.2	3.1	2.0	4.0
ASPE5	0.0	0.1	3.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0
BAOP	1.6	0.3	3.1	0.0	0.0	0.0	0.4	0.0	1.0	0.0	1.4	0.1	0.9
BOGR2	60.8	9.6	13.3	0.2	0.2	10.0	17.0	10.8	13.8	14.2	30.7	38.4	56.7
BRTE	0.0	50.6	0.0	15.7	0.0	0.1	0.0	0.0	0.0	51.6	0.0	17.7	0.0
BUDA	3.7	0.6	1.4	0.0	0.0	0.7	0.8	0.2	0.3	0.0	0.0	0.0	0.0
CAHE5	1.7	0.0	21.5	3.7	28.4	0.2	0.3	0.3	2.6	0.1	33.8	2.6	7.1
CHNA2	--	--	--	--	--	--	--	--	--	--	--	1.7	5.1
CHVI6	2.1	3.0	0.3	2.0	0.8	0.2	0.4	0.3	0.7	0.1	0.0	0.4	0.0
CYAC	0.0	1.1	0.2	10.6	3.3	1.9	0.0	0.0	0.0	0.0	0.0	--	0.0
DEPI	0.0	0.0	0.6	0.6	2.7	0.5	0.4	0.0	0.0	0.0	0.0	0.0	0.0
EREF	0.6	1.2	2.7	0.6	0.9	0.4	5.4	1.8	8.2	1.2	9.8	3.4	13.7
FEOC2	0.0	1.2	0.3	4.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0
GUSA2	0.3	1.3	3.0	0.0	0.0	0.1	0.5	0.1	0.2	0.0	2.5	0.0	0.7
IVAX	0.1	0.0	0.0	0.0	0.2	0.0	1.9	0.0	3.1	0.0	0.0	0.0	0.0
LEDE	0.1	0.3	0.0	1.7	7.7	1.4	5.3	0.2	0.1	0.0	0.0	0.1	0.0
LEMO4	0.0	0.0	0.0	10.4	4.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LOOR	0.0	0.0	0.1	1.9	3.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OEAL (OECO2)	4.3	0.1	0.0	0.2	0.3	0.7	0.3	0.0	0.0	0.0	0.0	0.0	0.0
PLPAG	0.0	2.8	0.0	0.2	0.0	11.6	2.0	0.1	0.0	0.0	0.0	0.0	0.0
SAKAT	0.2	3.1	0.5	0.0	0.0	2.6	1.1	6.8	2.0	0.0	0.0	0.3	0.4
SOSE4	0.0	0.0	0.0	0.0	0.8	0.8	2.3	12.9	0.0	0.0	0.0	0.0	0.0
SPCO	4.1	6.2	0.9	17.4	17.4	19.2	38.6	55.4	43.6	29.2	1.1	18.9	0.2
THFI	2.7	1.0	0.0	10.0	0.4	29.7	1.3	5.1	0.2	0.0	0.0	0.0	0.0

[a/] Species listed do not represent all species eaten, only those representing at least 2.5% of the total bites taken in any season.

[b/] Code name; for scientific and common name see Appendix I.

Plant growth had begun when the 20-28 March trial started. Pronghorn selected predominately new growing species. Brome grass (*Bromus tectorum*) was the major species consumed in diet pasture 1. Western wheatgrass (*Agropyron smithii*) and blue grama were eaten to a lesser extent. Woolly Indianwheat (*Plantago purshii*) was eaten on 2 days when the ground was covered with snow. On these days the pronghorn ate plants protruding above the snow. Only one pawed snow to uncover plants observed.

Since brome grass did not occur in the heavy-use pasture, western wheatgrass and sun sedge (*Carex heliophila*) were the predominant species in the March diet. Also, since many forbs eaten in the light-use pasture were scarce in the heavy-use pasture, use of browse in the heavy-use pasture was more concentrated on fringed sagewort, snakeweed (*Gutierrezia sarothrae*) and false buckwheat (*Eriogonum effusum*).

By the 28 April-5 May trial many plant species were rapidly growing. Brome grass had already begun to mature and its consumption dropped. The quickly growing scarlet globemallow and thelesperma were highly preferred forbs. Common starlily (*Leucocrinum montanum*), a small fleshy plant, was also selected by the pronghorn.

Since brome grass and thelesperma did not occur in the heavy-use pasture, sun sedge and western wheatgrass predominated in the diet in this pasture. Common starlily was less abundant in the heavy-use pasture than in the light-use pasture, but was actively eaten. Cymopterus (*Cymopterus acaulis*) was taken in both pastures.

By the end of June many plant species preferred during earlier trials were dead and drying. Brome grass, cympoterus, and sun sedge were no longer consumed in large quantities. Scarlet globemallow was still growing and predominated in the diet in both pastures. Thelesperma, in flower by this time, was rapidly growing and its importance increased in the light-use pasture. Blue grama increased in significance in both pastures while woolly Indianwheat was flowering and readily consumed during this trial.

Most plant species were dead by the August sampling period. Scarlet globemallow still grew and was consumed in large quantities. Blue grama remained an important element in the diet. Although tumbling Russianthistle (*Salsola kali*), an actively growing forb, was not abundant in either diet pasture, it was actively sought and consumed.

By the October sampling period most preferred plant species had been grazed out of the heavy-use diet pasture. Consumption of scarlet globemallow dropped considerably from the August period. Pronghorn ate large amounts of blue grama, western wheatgrass, and sun sedge; and browse in the diet increased. Brome grass was the predominant species consumed in the light-use diet pasture. Quantities of scarlet globemallow remaining in the light-use pasture were consumed in considerable amounts. Essentially the October trial was comparable to the early March trial.

Little difference in plant preferences was detected between the January trial and the October and March trials. The major difference involved a shift from brome grass in the light-use pasture to blue grama. Animals also shifted from sun sedge and western wheatgrass to blue grama in the heavy-use pasture while also increasing their false buckwheat consumption.

Chemical Analysis and In Vitro Digestion

Chemical analysis of individual plant species comprising 2.5% or more of the total bites by pasture and by season are listed in Table 5. Moisture determinations indicate that plants varied widely in relative moisture over the year, with highest levels during the spring and early summer growing season. Gross energy levels varied from 4.7 to 2.8 kcal/g between species but did not follow any specific trends between seasons. The protein concentration in plants consumed by pronghorn varied by season, highest levels occurred during the plant growing season and lowest levels were observed during the winter. Fiber levels varied considerably between species and between seasons. Lowest levels of fiber generally occurred during the spring and early summer when plants were rapidly growing. Digestibility coefficients were determined for all seasons except October and January. Digestion coefficients like protein content were highest during spring and early summer.

Comparison of Tame and Wild Pronghorn

Fecal microscope analyses indicate considerable variation between individual tame pronghorn and between tame and wild pronghorn (Table 6). Fringed sagewort was the predominant species in fecal groups for wild antelope during the March trial while tame pronghorn consumed a variety of species. Fringed sagewort and blue grama were the dominant species in the April trial in wild pronghorn fecal samples, yet tame pronghorn consumed mostly scarlet globemallow, sun sedge, and brome grass. Similar differences in diets coexisted in the June-July, August, October, and January trials.

Table 5. Chemical constituents of plant species comprising at least 2.5% of the diet of tame pronghorn by season.

Plant Code	Dry Matter (%)	Gross Energy (kcal/g)	Protein N × 6.25 (%)	Ash (%)	Phosphorus (%)	CWC[a/] (%)	ADF[b/] (%)	Lignin (%)	In Vitro Dry Matter Digested (%)
				December 5-8 1970, 23 W					
ARFR4	25.0	4.7	10.4	7.8	--	44.8	38.4	11.1	50.4
BOGR2	36.4	4.2	6.2	10.0	--	69.9	43.2	5.7	37.2
BUDA	30.8	--	--	--	--	--	--	--	48.8
OEAL/ OECO2	35.3	4.1	5.1	7.3	--	40.6	38.7	9.3	48.4
SPCO	49.5	4.0	7.3	12.6	--	47.6	37.6	9.5	--
THFI	35.0	4.3	5.8	5.7	--	60.4	51.4	15.6	36.2
				March 20-28, Light Pasture					
AGSM	78.4	4.2	6.7	8.2	0.123	68.0	45.7	3.2	42.0
BOGR2	87.5	4.2	5.3	9.6	0.097	71.5	44.2	4.0	34.4
BRTE	39.2	3.7	13.5	22.1	0.300	41.4	36.4	3.8	52.8
CHVI6	90.4	4.1	5.6	8.2	0.087	48.6	45.9	9.6	48.4
PLPAG	39.5	4.4	5.8	5.5	0.126	68.0	50.9	6.8	52.6
SAKAT	92.3	3.7	5.1	7.7	0.079	63.7	43.4	6.1	40.8
SPCO	89.0	3.7	6.3	15.3	0.156	51.5	83.4	6.5	43.7

Table 5. (Continued).

Plant Code	Dry Matter (%)	Gross Energy (kcal/g)	Protein N × 6.25 (%)	Ash (%)	Phosphorus (%)	CWC[a/] (%)	ADF[b/] (%)	Lignin (%)	In Vitro Dry Matter Digested (%)
				Heavy Pasture					
AGSM	79.0	4.2	9.3	9.1	0.135	65.3	43.8	4.2	39.6
ARFR4	50.0	4.4	10.7	8.3	0.176	43.9	37.4	10.9	49.2
ASPE5	92.8	4.4	8.5	4.1	0.041	57.0	45.2	7.9	51.6
BAOP	92.0	4.7	8.0	7.2	0.105	33.6	29.2	7.7	68.4
BOGR2	83.4	4.1	8.4	9.8	0.111	72.0	43.6	5.1	32.8
CAHE5	60.1	4.0	14.9	11.8	0.095	59.6	37.6	4.4	42.4
EREF	86.2	4.4	8.9	3.0	0.077	43.3	54.5	19.9	14.0
GUSA2	76.1	4.6	10.2	6.1	0.152	49.8	40.7	12.5	38.4
				28 April-5 May, Light Pasture					
AGSM	30.2	4.2	16.4	9.1	0.368	48.4	29.8	2.5	68.8
BRTE	24.2	4.0	16.5	11.9	0.424	41.6	26.6	2.2	63.2
CAHE5	41.1	4.3	17.1	7.0	0.286	58.1	28.3	3.4	60.0
CYAC	25.9	4.2	20.1	10.9	0.368	18.2	15.9	3.7	80.4
FEOC2	43.6	4.2	18.8	13.9	0.352	30.7	28.3	4.4	68.4
LEMO4	19.4	4.0	23.6	12.9	0.422	21.8	18.2	2.0	77.2
SPCO	34.7	3.6	20.1	14.2	0.422	42.0	34.4	2.8	60.8
THFI	21.0	4.2	20.4	13.2	0.520	21.5	21.5	5.7	76.0

Table 5. (Continued).

Plant Code	Dry Matter (%)	Gross Energy (kcal/g)	Protein N × 6.25 (%)	Ash (%)	Phosphorus (%)	CWC[a/] (%)	ADF[b/] (%)	Lignin (%)	In Vitro Dry Matter Digested (%)
				Heavy Pasture					
AGSM	33.1	4.3	23.5	9.7	0.362	49.2	29.1	1.9	68.8
CAHE5	45.3	4.3	20.1	6.5	0.332	57.1	27.4	1.0	60.8
CYAC	21.2	4.2	22.1	11.9	0.489	35.5	20.4	3.5	78.0
DEPI	22.9	4.0	29.7	6.7	0.620	18.8	19.6	3.0	76.4
LEDE	24.5	2.8	24.5	35.1	0.560	34.0	16.7	2.8	68.4
LEMO4	22.6	4.0	25.0	14.9	0.442	21.8	19.6	1.8	79.2
LOOR	21.7	4.2	15.2	21.4	0.357	26.9	23.4	5.1	73.6
SPCO	34.0	3.7	21.0	16.9	0.354	47.7	34.6	3.3	63.2
				25 June-5 July, Light Pasture					
BOGR2	60.8	4.1	7.3	7.4	0.167	73.0	36.1	--	48.8
PLPAG	39.8	4.0	6.0	6.6	0.226	--	39.8	--	61.2
SAKAT	29.6	3.0	12.4	23.7	0.253	30.8	15.4	--	47.6
SPCO	43.8	4.0	11.2	8.2	0.251	44.8	35.1	--	47.6
THFI	22.3	4.2	13.3	9.4	0.277	30.8	16.8	--	75.2

Table 5. (Continued).

Plant Code	Dry Matter (%)	Gross Energy (kcal/g)	Protein N × 6.25 (%)	Ash (%)	Phosphorus (%)	CWC[a/] (%)	ADF[b/] (%)	Lignin (%)	In Vitro Dry Matter Digested (%)
				Heavy Pasture					
BOGR2	61.0	4.1	7.3	7.5	0.167	73.2	36.1	--	54.0
EREF	39.5	--	10.9	4.4	0.195	42.2	--	--	33.6
LEDE	47.0	4.8	8.8	5.7	0.241	62.5	41.1	11.7	61.6
SPCO	41.1	9.0	15.0	8.9	0.212	--	32.4	--	65.2
				14-21 August, Light Pasture					
BOGR2	70.8	4.2	7.7	7.5	0.122	--	37.3	3.8	85.2
SAKAT	29.5	3.1	13.9	23.5	0.179	32.2	15.2	2.4	55.2
SPCO	50.8	4.1	8.4	10.1	0.091	39.7	31.4	3.7	61.2
THFI	34.9	4.3	9.8	8.2	0.171	20.6	17.3	5.6	60.8
				Heavy Pasture					
BOGR2	75.6	4.3	6.3	8.7	0.113	73.6	40.0	3.9	44.8
CAHE5	84.6	4.4	9.4	6.7	0.068	65.9	35.9	3.6	50.4
EREF	43.7	4.2	11.1	5.1	0.133	25.0	24.4	7.4	2.8
IVAX	38.7	3.8	8.1	15.0	0.163	31.8	26.3	5.4	68.4
SOE4	49.5	4.4	9.3	7.0	0.102	32.1	25.2	5.4	63.2
SPCO	49.1	3.9	8.2	12.7	0.120	42.7	33.2	6.0	50.0

Table 5. (Continued).

Plant Code	Dry Matter (%)	Gross Energy (kcal/g)	Protein N × 6.25 (%)	Ash (%)	Phosphorus (%)	CWC[a/] (%)	ADF[b/] (%)	Lignin (%)	In Vitro Dry Matter Digested (%)
				23-28 October, Light Pasture					
BOGR2	85.1	4.3	8.3	10.1	0.154	71.7	42.6	5.5	--
BRTE	90.1	3.9	8.7	18.9	0.286	48.9	41.1	4.3	--
SPCO	86.7	4.4	8.9	12.9	0.226	42.7	32.1	6.0	--
				Heavy Pasture					
ARFR4	66.8	4.8	11.4	7.1	0.231	38.0	35.3	11.4	--
BOGR	79.8	4.3	7.0	11.1	0.234	72.6	44.4	6.0	--
CAHE	83.6	4.3	11.8	7.1	0.156	66.1	36.4	3.8	--
EREF	87.1	4.6	7.7	4.9	0.100	46.7	36.8	20.4	--
GUSA2	78.4	5.0	8.1	5.6	0.200	38.8	31.9	9.1	--

Table 5. (Continued).

Plant Code	Dry Matter (%)	Gross Energy (kcal/g)	Protein N × 6.25 (%)	Ash (%)	Phosphorus (%)	CWC[a/] (%)	ADF[b/] (%)	Lignin (%)	In Vitro Dry Matter Digested (%)
				15-16 and 22-23 January, Light Pasture					
BOGR2	--	--	0.995	9.1	0.085	76.9	44.6	6.6	--
BRTE	--	--	1.950	35.4	0.253	33.4	44.0	4.3	--
CAHE5	--	--	1.395	10.0	0.108	69.9	43.6	4.9	--
EREF	--	--	1.230	3.2	0.091	47.7	43.6	22.9	--
SPCO	--	--	0.970	14.0	0.123	50.8	42.5	6.5	--
				Heavy Pasture					
AGSM	--	--	0.995	10.2	0.076	68.9	48.1	4.8	--
ARFR4	--	--	1.290	5.4	0.119	51.2	44.3	12.6	--
BOGR2	--	--	1.115	8.2	0.087	75.0	42.7	5.5	--
CAHE5	--	--	1.600	17.7	0.113	59.1	43.1	5.0	--
CHNA2	--	--	1.250	5.0	0.130	36.9	30.8	9.8	--
EREF	--	--	1.215	3.3	0.072	51.4	51.3	22.7	--

[a/] CWC = Cell wall constituents.

[b/] ADF = Acid-detergent fiber.

Table 6. Percent relative densities of plant species found in fecal samples by microtechnique.[a/]

Plant Code[b/]	20-28 March					28 April-5 May					25 June-5 July				
	Fredrica	Smoke	Kim	Kay	Wild Herd	Fredrica	Smoke	Kim	Kay	Wild Herd	Fredrica	Smoke	Kim	Kay	Wild Herd
AGSM	19.5	26.3	5.4	14.9	0.3	1.9	12.0	2.0	6.6	0	0.3	1.5	0.1	0.7	0
ARFR4	0.5	7.0	2.9	7.0	95.1	0	0	0	0	64.2	0	0.1	0.1	0	35.5
ASTRA	0	0.3	0	0	0	0	0	0	0	0	0	0.1	0	0	1.1
BOGR2	12.8	33.3	13.1	44.7	1.3	2.4	17.8	0	5.0	22.1	4.0	6.5	7.6	30.8	0.9
BRTE	13.6	7.0	16.7	8.6	0	13.6	8.8	16.8	14.9	2.0	8.6	9.8	9.4	14.0	3.8
BUDA	0.2	4.6	0.2	2.0	0	0	0	0	0	0	0	0.1	0	0.2	0
CAHE5	0.8	3.5	3.3	5.8	0	16.3	16.3	18.9	9.9	8.4	2.5	0.6	0.9	0.4	1.4
ERBE2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ERDI4	0	0	0	0	0	0	0	0	0.3	0	0	0	0	0	19.5
FEOC2	0	0	1.2	0.4	0	0.2	6.4	0	0.3	0	0.6	1.3	1.1	1.8	0
KOSC	0.2	0	2.9	0	0	0	0	0	0	0	0	0	0.2	0	1.3
MESA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PLPAG	0	0	0.6	0	0	0.1	0.2	0	0	0	1.3	6.8	7.3	8.8	0.1
Seed	27.8	7.2	19.3	5.4	0	4.9	5.6	3.7	4.6	0	0.1	2.1	0.2	0.1	0
SPCO	17.8	6.8	25.6	8.0	0.2	59.2	28.6	65.8	58.3	2.0	83.2	66.3	72.3	35.3	31.8
SPCR	4.3	1.1	3.9	2.0	0.1	1.2	0.5	1.2	0.8	0.6	0.8	3.2	1.2	3.0	2.8

Table 6. (Continued).

Plant Code	14-21 August					23-28 October					14-21 August		
	Fredrica	Smoke	Kim	Kay	Wild Herd	Fredrica	Smoke	Kim	Kay	Wild Herd	Wild Herd	Wild Herd	Wild Herd
AGSM	8.3	11.8	7.3	3.4	1.0	49.8	26.2	34.5	16.0	0.7	0.8	0.0	2.0
ARFR4	0	0	0	0	38.4	0	0	4.4	1.0	32.1	0	38.4	0
ASTRA	0	0	0	0.2	8.2	0	0	0	0	0	0	8.2	4.6
BOGR2	3.9	6.8	8.3	7.1	0.6	7.5	9.6	30.6	55.2	1.9	1.3	0.6	1.3
BRTE	0	0	0	0	0	0	0	0.1	0	0	0	0	0.1
BUDA	0	0	0	0	0	0	0	0	0	0	0	0	0
CAHE5	0.4	0.1	0.1	0	0.3	4.4	2.9	14.5	4.6	1.0	0.3	0.3	1.7
ERBE2	0	0.2	0.1	0.1	8.7	0	0	0	0	0	0	8.7	45.2
ERDI4	0	0	0	0	0	0	0	0	0	0	0	0	0
FEOC2	0.1	0.1	0.3	0.3	0.2	0	0.2	0	0	0	0	0.2	0
HEAN3	0	0	0	0	0	0	0	0	0.1	3.7	0	0	0
KOSC	0.1	0	0.2	0.1	2.1	0	0	0	0	0.1	3.3	2.1	0.3
MESA	0	0	0	0	0	0	0	0	0	0	61.1	0	0
PLPAG	0	0.1	0	0	0	0	0	0	0	0	0	0	0
Seed	0	0.1	0	0	0	0	0	0	0	0	0.2	0	0
SPCO	85.5	79.1	82.6	87.5	36.6	0	60.4	10.5	22.1	58.1	22.9	36.6	42.1
SPCR	0.3	0.4	0.3	0.5	0	36.6	0	0	0.3	0	0	0	0

Table 6. (Continued).

Plant Code	14, 15, 22, and 23 January				14, 15, 22, and 23 January									
					Wild Herd Fecal Groups									
	Fredrica	Smoke	Cindy	Kay	1	2	3	4	5	6	7	8	9	10
AGSM	91.1	83.5	49.3	81.8	0.3	0	0.4	0.1	0.7	0.4	0	0	0.1	0.2
ARFR4	0.5	5.4	7.9	4.8	11.0	25.9	9.0	10.7	8.3	7.3	10.3	18.4	7.6	14.4
ATCA2	0.1	0.1	0.4	0	3.3	1.2	0.5	2.7	0.4	2.7	1.1	2.6	0.2	1.9
BOGR2	3.5	4.4	30.2	8.8	0.1	0.1	0.9	0.2	0.5	0.1	1.3	0.1	1.1	0.2
BRTE	0	0	0	0	0.3	0	0	0	0	0	0	0	0	0
BUDA	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0
CAHE5	1.9	0.4	1.6	1.6	0.2	0	0	0.1	0.4	0.1	0.4	0	0.4	0
CHNA2	0.8	0.9	3.2	0.5	79.4	69.4	68.8	83.4	69.3	83.7	68.7	79.1	50.6	76.2
COCA5	0	0	0	0	0	0	5.0	0	0.3	0	0.2	0	0.6	0
ERBE2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ERDI4	0	0.1	0	0	0	0	0	0	0	2.1	0	2.8	0	2.8
FEOC2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HEAN3	0	0	0	0	0	0.9	0	0.1	0	0	0	0.2	0	0.8
KOSC	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MATA	0	0	0	0	0	0	0	0.8	0	0	0	0	0	0
MESA	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0
OPPO	0.2	3.1	3.8	0.2	1.2	0.2	5.2	1.3	17.8	2.1	14.2	34.8	0	1.5
PLPAG	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Seed	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0
SPCO	1.2	0.5	1.3	0.8	1.6	2.2	9.2	0.6	2.0	1.1	0.8	1.6	1.1	1.8
SPCR	0.3	0	0.8	0.1	0	0	0	0	0	0	0	0	0	0

[a] Only those species comprising 2.5% or more of the diet in any one sample period are listed.

[b] Code name; for scientific and common names see Appendix I.

Comparisons of three different wild herds during the August sampling period revealed marked variation in plant remains in fecal samples between herds (Table 6). Of the three herds compared, scarlet globemallow was the only plant consumed in large quantities by all three herds. Scarlet globemallow was also preferred by the tame pronghorn.

Variation between individuals was determined during the January 1972 trial (Table 6). Individual wild pronghorn exhibit considerable variation in the percent of relative density of the same plant species in fecal groups. Rubber rabbit brush (*Chrysothamnus nauseosus*) was the predominant species in all animals, but varied from a relative frequency of 50.6% to 83.4%. Similar variations occurred with fringed sagewort (7.3 to 25.9%) and plains prickly pear (*Opuntia polyacantha*) (0.2 to 34.8%).

It therefore appears that there is *considerable* variation among individuals in a single herd and between herds in the Pawnee grasslands.

Effects of Supplemental Feeding and Restricted Grazing Times on Dietary Intake of Tame Pronghorn

Since tame pronghorn have been used for food habits studies on the Pawnee National Grassland, several questions have evolved concerning the influence of supplemental feeding and restricted grazing time on the intake of tame pronghorn. Analysis of variance data indicate that there are no significant ($P > 0.05$) differences between species preferences for tame pronghorn fed *ad libitum* concentrate when compared to those fed no concentrate (Table 7). There were also no significant differences ($P > 0.05$) between species preferences for pronghorn grazing freely for 24 hr and those restricted to only daytime grazing (Table 7).

Table 7. Food references expressed by tame pronghorn: Comparison of methods for feeding and handling animals between trials. Data are percent of each plant species in the diet, expressed as percent of total bites taken.[a/]

Plant Code[b/]	*Ad Libitum* Concentrate	No Concentrate	24-Hour Grazing	Daytime Grazing Only
AGSM	0.1	1.2	0	2.5
BOGR2	9.8	5.3	0.6	4.4
KOSC	1.1	0.7	4.9	2.5
PLPAG	5.2	6.5	1.8	1.2
SAKAT	7.3	4.6	20.9	14.9
SPCO	28.1	47.6	15.5	45.9
THFI	28.0	17.5	41.9	18.2
Total No. Bites/Day	986	1587	1151	1610

[a/] Species listed do not represent all species eaten, but only those representing 2.5% or more of the total bites taken in any one season.

[b/] Code name; for scientific and common names see Appendix I.

A marked difference did occur in the percent of bites taken for thelesperma, but extreme animal variability made it impossible to detect treatment differences if they existed.

An effect of *ad libitum* concentrate on animal behavior was noticeable. Animals receiving concentrate appeared more playful, grazed considerably less, and were harder to manage and observe. The total number of bites taken was also considerably less for animals on a concentrate diet (Table 7). Since food habits data were the main objective, it appeared that supplemental concentrate was not desirable.

Few behavioral differences were noted between pronghorn that grazed freely for 24 hr and those penned up at night. However, one difference was that, upon release, the penned treatment group grazed intensively while pronghorn that were free overnight grazed more slowly and with less intensity. Free-ranging pronghorn, in most cases, were actively grazing when the observation period began. This factor may bias preference results since pronghorn do change plant preferences during a feeding period, consuming predominately scarlet globemallow during the early period of feeding and later changing to thelesperma.

LITERATURE CITED

Baumgartner, L. L., and A. C. Martin. 1939. Plant histology as an aid in squirrel food-habit studies. J. Wildlife Manage. 3:266-268.

Dickinson, C. E., and C. V. Baker. 1972. Pawnee Site field plant list. U.S. IBP Grassland Biome Tech. Rep. No. 139. Colorado State Univ., Fort Collins. 44 p.

Hansen, R. M. 1971. Drawings of tissues of plants found in herbivore diets and in the litter of grasslands. U. S. IBP Grassland Biome Tech. Rep. No. 70. Colorado State Univ., Fort Collins. 69 p. (Artist: A. S. Moir).

Hoover, J. P. 1971. Food habits of pronghorn antelope on Pawnee National Grasslands, 1970. M.S. Thesis. Colorado State Univ., Fort Collins. 285 p.

McDougall, E. I. 1948. Studies on ruminant saliva. I. The composition and output of sheep's saliva. Biochem. J. 43(1):99-109.

Pearson, H. A. 1970. Digestibility trials: In vitro techniques, p. 85-92. *In* Range and wildlife habitat evaluation, a research symposium. U.S. Dep. Agr. Misc. Publ. No. 1147.

Sparks, D. R., and J. C. Malachek. 1968. Estimation percentage dry weight in diets using a microscopic technique. J. Range Manage. 21:264-265.

Tilley, J. M. A., and R. A. Terry. 1963. A two-stage technique for the in vitro digestion of forage crops. J. Brit. Grassland Soc. 18(2): 104-111.

Van Soest, P. J. 1963. Use of detergents in the analysis of fibrous feeds. II. A rapid method for the determination of fiber and lignin. J. Ass. Offic. Anal. Chem. 46:829.

APPENDIX I

SCIENTIFIC AND COMMON NAMES FOR PLANT SPECIES CODES[a/]

SCS Code	Scientific Name	Common Name
AGSM	*Agropyron smithii* Rydb.	Western wheatgrass
ARFR4	*Artemisia frigida* Willd.	Fringed sagewort
ASPE5	*Astragalus pectinatus* (Hook.) Dougl.	Narrowleaf poisonvetch
ASTRA	*Astragalus* L.	Milkvetch
ATCA2	*Atriplex canescens* (Pursh) Nutt.	Fourwing saltbush
BAOP	*Bahia oppositifolia* (Nutt.) Dc.	Plains bahia
BOGR2	*Bouteloua gracilis* (H.B.K.) Lag.	Blue grama
BRTE	*Bromus tectorum* L.	Cheatgrass brome
BUDA	*Buchloe dactyloides* (Nutt.) Engelm.	Buffalograss
CAHE5	*Carex heliophila* (=Pennsylvanica) Mackenz.	Sun sedge
CHNA2	*Chrysothamnus nauseosus* (Pall.) Gritt.	Rubber rabbitbrush
CHVI6	*Heterotheca* (=Chrysopsis) *villosa* (Pursh) Skinners	Hairy goldaster
COCA5	*Conyza* (=Erigeron) *canadensis* (L.) Cronquist	Canadian horseweed
CYAC	*Cymopterus acualis* (Pursh) Raf.	Stemless spring parsley
DEPI	*Descurainia pinnata* (Walt.) Britt.	Pinnate tansymustard
ERBE2	*Erigeron bellidiastrum* Nutt.	Fleabane

SCS Code	Scientific Name	Common Name
ERDI4	*Erigeron divergens* T. & G.	Spreading fleabane
EREF	*Eriogonum effusum* Nutt.	Spreading wildbuckwheat
FEOC2	*Vulpia octoflora* (Walt.) Rydb.	Sixweeks fescue
GUSA2	*Gutierrezia sarothrae* (Pursh) Britt. & Rusby	Broom snakeweed
HEAN3	*Helianthus annuus* L.	Common sunflower
IVAX	*Iva axillaris* Pursh	Poverty sumpweed
KOSC	*Kochia scoparia* (L.) Schrad.	Belvedere summercypress
LEDE	*Lepidium densiflorum* Schrad.	Prairie pepperweed
LEMO4	*Leucocrinum montanum* Nutt.	Common starlily
LOOR	*Lomatium orientale* Coult. & Rose	Bisquitroot
MATA	*Aster tanacetifolius* H.B.K.	Tansyleaf aster
MESA	*Medicago sativa* L.	Alfalfa
OEAL	*Oenothera albicaulis* Pursh	Prairie evening primrose
OECO2	*Oenothera coronopifolia* Torr. & Gray	Cutleaf evening primrose
OPPO	*Opuntia polyacantha* Haw.	Plains pricklypear
PLPAG	*Plantago purshii* Roem. & Schult.	Woolly Indianwheat
SAKAT	*Salsola kali tenuifolia* Tausch.	Tumbling Russianthistle

SCS Code	Scientific Name	Common Name
SOE4	*Sophora sericea* Nutt.	Silky sophora
SPCO	*Sphaeralcea coccinea* (Pursh) Rydb.	Scarlet globemallow
SPCR	*Sporobolus cryptandrus* (Torr.) A. Gray	Sand dropseed
THFI	*Thelesperma filifolium intermedium* (Rydb.) Shinners	Greenthread

[a/] See Dickinson and Baker (1972).

APPENDIX II

FIELD DATA

Data on antelope forage intake (bite counts) collected in 1970 at the Pawnee Site is Grassland Biome data set A2U60EB. Data were collected on form NREL-70. A copy of the data form and an example of the data follow.

IBP

GRASSLAND BIOME

U.S. INTERNATIONAL BIOLOGICAL PROGRAM

FIELD DATA SHEET--ANTELOPE FORAGE INTAKE

Site

11 Pawnee

Treatment

1 Ungrazed
2 Lightly grazed
3 Moderately grazed
4 Heavily grazed
5 Grazed 69, Ungrazed 70
A Diet light
B Diet moderate
C Diet heavy
D ESA - D
E ESA - W
F ESA - N
G ESA - WN
H Lynn Lake
J Winter grazed

Data Type	Site	Date			Initials	Treatment	Time	Antelope	Species	Bites	Species	Bites	Species	Bites	Species	Bites	Species	Bites	Species	Bites	Species	Bites	Species	Bites	Species	Bites
		Day	Month	Year																						
1-2	3-4	5-6	7-8	9-10	11-13	14	15-17	18-22	23-26	27-29	30-33	34-36	37-40	41-43	44-47	48-50	51-54	55-57	58-61	62-64	65-68	69-71	72-75	76-79
70																								

*** EXAMPLE OF DATA ***

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         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890

7011231071CS C1AMSMOKEBOGR500BOGR595EREF232CAHE009BAOP070SOSE001GUSA002CHNA005
7011231071CS C1AMSMOKESPC0005AGSM002
7011231071CS C2AMFRED BOGR077EREF001CAHE036
7011231071MT C1AMKIM  GUSA025AGSM033BOGR500BOGR442ARFR004CHNA033EREF047CAHE028
7011231071MT C1AMKIM  SPC0024UG  003
7011231071MT C2AMKAY  BOGR178HASP002SPC0003RAPE004GUSA040
7011231071CS C1PMKIM  BOGR160AGSM419EREF024HASP003CAHE068ARFR002RAPE012GUSA002
7011231071CS C1PMKIM  CHNA005SPC0011LIIN0010ESP001
7011231071CS C2PMKAY  BOGR253AGSM077CAHE007ARFR142SPC0003UF  006SIAL011PEAL003
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7011231071MT C1PMSMOKEBOGR233EREF120BASP172CAHE149AGSM056SPC0007GUSA012HASP005
7011231071MT C1PMSMOKEOPP0024
7011231071MT C2PMFRED BOGR122EREF061AGSM541CAHE153SPCR009CHNA029GUSA013ARFR024
7011231071MT C2PMFRED BAOP024HASP007SPC0004
7011241071CS A1AMSMOKESPC0732BOGR169LEDE002EREF029SENE004GUSA004SOSE001HASP003
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7011241071MT A1AMKIM  SPC0954ARLO020SENE004BRTE083
7011241071MT A2AMKAY  SPC0328BOGR245BRTE761THTR004HASP002
7011241071CS A1PMKIM  BRTE873SPC0112BOGR217RAPE003HEVI004UF  001SIAL002DEPI002
7011241071CS A2PMKAY  BRTE739SPC0241BOGR228FEOC001HEVI011GUSA005
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7011261071CS C1AMFRED GUSA016BOGR291CAHE181FREF278BAOP022AGSM130PACH002
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7011261071CS C2AMKIM  BAOP001AGSM143
7011261071MT C1AMKAY  CHNA011GUSA139BOGR727AGSM141ARFR081CAHE008EREF076SPC0013
7011261071MT C1AMKAY  BAOP061
7011261071MT C2AMSMOKEBOGR181CAHE500CAHE500CAHE500CAHE439EREF006GUSA017BAOP002
7011261071MT C2AMSMOKESPC0002CYSP008TASP003
7011261071CS C1PMKAY  BOGR273AGSM050BAOP010GUSA074ARFR222PACH001TOGR009CAFE004
7011261071CS C1PMKAY  SENE003HEVI001CYSP002ARIN002SPC0017SESP001CAHE096FREF076
7011261071CS C2PMFRED BOGR010CAHE278EREF544BAOP032AGSM412SPC0004
7011261071MT C1PMSMOKEBOGR192SPC0012CYSP002AGSM155GUSA003CAHE150CHNA007EREF020
7011261071MT C1PMSMOKEHEVI002
7011261071MT C2PMKIM  BOGR024CAHE076ARFR004AGSM075SPC0065CYSP043EREF020SIAL005
7011261071MT C2PMKIM  OESP001
7011281071CS A1AMFRED SPC0827BOGR074BRTE032HASP002EREF104SAKA001GUSA006RAPE004
7011281071CS A2AMKIM  BRTE548
7011281071MT A1AMKAY  SPC0151LEDF003BOGR075BRTE183HASP005UF  001ARFR008EREF008
7011281071MT A1AMKAY  CHNA003HEVI003
7011281071MT A2AMSMOKESPC0001BRTE453
7011281071CS A1PMKAY  BRTE150SPC0050PEAL008EVNU005THTR003BOGR200GUSA035CAHE010
7011281071CS A2PMSMOKEBRTE538SPC0014FEOC002ARFR002BOGR074
7011281071MT A1PMFRED SPC0279BOGR139AGSM017CHSP001CAHE003BRTE704EREF030UF  001
7011281071MT A1PMFRED SAKA002
7011281071MT A2PMKIM  BRTE584SPC0028BOGR026FREF001ARFR013CHNA004RAPE022
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