# CHEMICAL COMPOSITION OF DIETS CONSUMED BY CATTLE GRAZING NATIVE RANGE OR PLAINS BLUESTEM PASTURE

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## Story in Brief

Esophageal masticate was collected from native range and plains bluestem pasture in mid-May, late-June, mid-August and mid-October. Severe winter kill of plains bluestem prevented collection in May. Standing crop and species composition of both pastures were estimated each month. Diet crude protein was highest on native range in May and October; June and August were lower. On plains bluestem, protein content was lower in June and October, while August was 18% higher. Protein content of plains bluestem was greater than native range. Pepsin insoluble protein tended to increase as total forage protein decreased. Fiber content of diets on native range increased from May to June and then remained constant through the rest of the summer. Fiber content of plains bluestems was lowest in August. In vitro organic matter disappearance of native range was greatest in May. In vitro organic matter disappearance of plains bluestem was similar across months and was always higher than native range. Plains bluestems provides a higher quality diet during June, August and October and therefore is a good complement to native range in forage management systems in the Southern Rolling Plains.

(Key Words: Grazing, Cattle, Standing Crop, Species Composition.)

## Introduction

Native range and old world bluestems are two primary forage resources for beef cattle production in southwestern Oklahoma. Because these forages have different production curves and yields, incorporating them into an integrated forage system can improve animal performance and carrying capacity. Understanding the nutritive qualities of these forages at various times of the grazing season will improve recommendations for management of beef herds and forage systems.

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In many areas of the country the chemical composition of forages grazed by ruminants has not been characterized. Some studies have evaluated the nutrient composition of clipped forage samples. However, because of selective grazing, diets usually contain 1 to 2% more crude protien (CP) and 2 to 5% more digestible organic matter (OM) than clipped samples.

These data are preliminary results of a 2-year study evaluating the nutritional value of plains bluestem (*Bothriochloa ischaemum*) pasture and native range in southwestern Oklahoma. This part of the study was conducted to examine the nutritive quality of diets consumed by cattle grazing the forages.

## Material and Methods

### Research Site

The study was conducted at the Marvin Klemme Range Research Station in Washita County, OK. Precipitation at Clinton, OK, approximately 10 miles north, was 27.2 inches (normal, 25.2 inches) from January through October in 1990. The station is located in the Rolling Red Plains resource area (SCS, 1982). Soils on the range area are in the Cordell Series and are mapped as Red Shale Range sites. The 125 acres of native range has never been cultivated. The 14 acres of plains bluestem pasture was established in 1989. Soils within this pasture are a St. Paul silty loam. Grazing and fertilization of the old world bluestem were the only range or pasture management practices implemented. The plains bluestem pasture was fertilized on July 26 with 65 lb of nitrogen and 47 lb of phosphorous/acre to produce 4000 lb/acre.

### Sampling Procedures

Four trials were conducted in 1990. Trial dates were mid-spring (14-15 of May), mid-growing season (25-26 of June), mid-summer (13-14 of August) and early dormancy (13-14 of October). Because of winter kill, the plains bluestem pasture was allowed to recover until mid-June before initiation of grazing. Therefore, the mid-spring trial does not include plains bluestem.

Standing crop in the experimental pastures was estimated during each trial period. The dry-weight-rank method (Gillen and Smith, 1986) was utilized to estimate species composition of both pastures. Herbage samples were individually weighed in the field then dried to a constant weight. Live:dead ratios in the quadrats were estimated using simultaneous equations relating total sample dry matter to dry matter of the live and dead fractions.

Russian thistle was included in measurements on the plains bluestem pasture in June and August. Cattle readily consumed the plant during these trials. In October, russian thistle had matured and was not grazed by the cattle. Therefore, it was not included in estimates of available forage.

Four steers fitted with esophageal cannulae were allowed to graze each experimental pasture for 1 week before diet sampling. Masticate samples were obtained from each pasture on two consecutive days. The steers were fitted with screen bottom collection bags and were allowed to graze for 30 to 45 minutes. Steers were herded as they grazed to obtain a more uniform sampling of the entire pasture. After collection, samples were mixed by hand and a 20% aliquot was stored frozen in a plastic bag. Prior to laboratory analysis, masticate was composited across days within steer then lyophilized and ground in a Wiley mill to pass a 2 mm screen.

### Laboratory Analyses

Masticate samples were analyzed for DM, ash and kjeldahl nitrogen (AOAC, 1990). Pepsin insoluble N was determined utilizing a modification of the procedure described by AOAC (1990). Crude protein was estimated as 6.25 x N. Insoluble CP is reported as a percentage of total sample CP. Neutral detergent fiber and ADF were determined by nonsequential methods (Goering and Van Soest, 1970). All values were adjusted to an OM basis.

In vitro organic matter disappearance (IVOMD) was determined as described by Tilley and Terry (1963). Incubation tubes were inoculated with a 50:50 rumen fluid:McDougall's buffer containing urea. Rumen fluid was collected from rumen cannulated heifers maintained on a 50% alfalfa:50% prairie hay diet.

### Statistical Analysis

Standing crop and species composition data were not statistically analyzed. Masticate composition data were analyzed as a factorial treatment design. Models contained pasture, month and month x pasture as sources of variation and were tested with residual error. A protected least significant difference procedure was utilized to separate means.

## Results and Discussion

### Standing Crop

Residual standing crop on native range increased from May until August, then decreased in October (Table 1). Residual standing crop

**Table 1. Standing crop and species composition of plains bluestem pasture and native range at the Marvin Klemme Range Research Station in southwestern Oklahoma (1990).**

| Species | Month | | | |
|---|---|---|---|---|
| | May | June | August | October |
| Native range | | | | |
| Total available DM, lb/acre | 1505 | 1718 | 2114 | 1538 |
| | | | % | |
| Sideoats grama | 21 | 28 | 26 | 28 |
| Blue/hairy grama | 17 | 11 | 21 | 17 |
| Buffalograss | 14 | 15 | 14 | 17 |
| Little bluestem | T[a] | T | 3 | 3 |
| Other grasses | 13 | 26 | 15 | 30 |
| Annual grasses | 6 | 0 | 0 | 0 |
| Forbs | 27 | 18 | 20 | 4 |
| Locoweed | 1 | 0 | 0 | 0 |
| Half shrubs | 2 | 2 | 1 | 1 |
| Live:dead ratio | 2.5 | 1.3 | .3 | .9 |
| Plains bluestem pasture | | | | |
| Total available DM, lb/acre | --- | 1643 | 2121 | 2124 |
| | | | % | |
| Plains bluestem | --- | 66 | 69 | 96 |
| Shortgrasses | --- | 1 | 4 | 0 |
| Other grasses | --- | 14 | 6 | 1 |
| Forbs[b] | --- | 19 | 21 | 3 |
| Live:dead ratio | --- | .6 | 2.0 | 24.0 |

[a] T denotes trace amounts, less than 1% of total DM/acre.
[b] Russian thistle was excluded from standing crop estimates during October because of lack of utilization by cattle.

estimates were similar to total production estimates (between 600 and 1400 lb/acre; SCS, 1982). Therefore, total production at this particular site in 1990 was in excess of SCS estimates. Forage availability should not have limited intake in any month.

Total standing crop on the plains bluestem pasture in June and August were similar to that available on native range (Table 1). However, October standing crop of plains bluestem pasture (excluding russian thistle) was greater than on native range.

## Species Composition

Species composition of the range site indicated the site was in excellent range condition (Table 1). Forbs composed a considerable portion of the total standing crop until October. This reduction in total forbs would be the result of forbs becoming senescent as the plant community entered early dormancy. Although wooly locoweed (*Astragalus mollissimus*) accounted for only 1% of the total available herbage in May, concentration of locoweed in esophageal masticate and ruminal contents appeared to be disproportionately high. Ralphs et al. (1986) reported that cattle preferentially grazed white locoweed (*Oxytropis sericea*) from high mountain pastures in Utah, especially the seedpods and flowers.

Live:dead ratios on native range decreased as the grazing season advanced from May until August (Table 1). In October, live:dead ratios increased due to fall regrowth.

The large increase noted for percent plains bluestem in October was probably due to recovery from the winter kill and exclusion of russian thistle from standing crop estimates. Live:dead ratios on plains bluestem increased as the grazing season advanced (Table 1).

## Chemical Composition

The CP content of native range diets decreased ($P<.05$) 33% from May to June (Table 2), but then increased ($P<.05$) from June to October. Protein requirements for a 600 lb steer gaining 1.8 - 2.0 lb/day are 10.2 and 10.5%, respectively (NRC, 1984). Percent protein in the range diets met NRC requirements every month except June. Stocker steers (450 lb initial wt) grazing adjacent native range gained 1.8 lb/day from May until July 15 and 2.0 lb/day from July 16 until September 15 (McCollum and Gillen, unpublished data).

Plains bluestem diets contained more ($P<.05$) CP than native range during all months. Diet CP content on plains bluestem peaked ($P<.05$) during August. Hand clipped plains bluestem plants contained 10.6, 10.6 and 8.8% CP in June, August and October, respectively. Russian thistle contained 26.6 and 27.5% CP during June and August, respectively. Based on the nutrient content of these clipped samples, it is estimated that russian thistle contributed 23 to 40% of diets in June and August.

Insoluble CP, as a percent of total CP, increased as total CP decreased (Table 2). Calculation of insoluble CP as a percent of OM shows that absolute amounts remained fairly constant across months within a forage (native range: 5.0, 5.0 5.0 and 4.7%; plains bluestem: 6.4, 6.4 and 6.3%). Insoluble CP is an index of indigestible CP.

**Table 2. Chemical composition of esophageal masticate collected from plains bluestem pasture (PB) and native range (NR) at the Marvin Klemme Range Research Station in southwestern Oklahoma (1990).**

| Item | Pasture | Month | | | | SE[a] |
|---|---|---|---|---|---|---|
| | | May | June | August | October | |
| CP, % of OM | NR | 13.1$^{c}$ | 8.8$^{eh}$ | 10.0$^{deh}$ | 10.6$^{dh}$ | .44 |
| | PB | ---- | 14.4$^{dg}$ | 17.5$^{cg}$ | 14.4$^{dg}$ | .69 |
| | SE[b] | | 1.13 | 1.69 | .81 | |
| Insoluble CP, % of total CP | NR | 37.6$^{f}$ | 56.9$^{cg}$ | 50.3$^{dg}$ | 44.3$^{eg}$ | 2.05 |
| | PB | ---- | 44.3$^{ch}$ | 36.4$^{dh}$ | 44.0$^{cg}$ | 1.45 |
| | SE | | 2.91 | 3.03 | 1.14 | |
| NDF, % of OM | NR | 68.2$^{d}$ | 80.6$^{cg}$ | 81.2$^{cg}$ | 77.7$^{cg}$ | 1.41 |
| | PB | ---- | 66.8$^{dh}$ | 61.9$^{eh}$ | 73.7$^{ch}$ | 2.10 |
| | SE | | 2.91 | 4.17 | .95 | |
| ADF, % of OM | NR | 36.0$^{d}$ | 38.9$^{cg}$ | 40.3$^{cg}$ | 38.8$^{cg}$ | .51 |
| | PB | ---- | 31.9$^{dh}$ | 29.8$^{dh}$ | 36.9$^{cg}$ | 1.12 |
| | SE | | 1.50 | 2.16 | .66 | |
| IVOMD, % of OM | NR | 58.64$^{c}$ | 54.16$^{dh}$ | 54.20$^{dh}$ | 53.68$^{dh}$ | .68 |
| | PB | ---- | 59.00$^{cg}$ | 60.75$^{cg}$ | 59.95$^{cg}$ | .46 |
| | SE | | 1.09 | 1.40 | 1.51 | |

[a] Standard error, NR n=16 and PB n=9.
[b] Standard error, n=7.
[c,d,e,f] Row means without common superscripts differ (P<.05).
[g,h] Column means without common superscripts differ (P<.05).

Neutral detergent fiber and ADF on native range followed similar patterns as the grazing season advanced. Both NDF and ADF increased ($P<.05$) from May through June then remained constant ($P>.05$) during the remainder of the grazing season (Table 2). The cell wall content (NDF) of a forage is involved in regulation of intake. Average intake by heifers grazing native range in June was 18% lower when compared to May (Gunter and McCollum, unpublished data). Plains bluestem diets contained less ($P<.05$) NDF and ADF than native range in all months except October when ADF was similar ($P>.05$).

In vitro organic matter disappearance from native range diets reflected ADF content. In vitro OM disappearance decreased ($P<.05$) 8% from May to June, then remained constant ($P>.05$) throughout the rest of the grazing season (Table 2). Acid detergent fiber content of native range diets was 7% higher in June than May. Plains bluestem diets were more ($P<.05$) digestible than native range during all months, but IVOMD of plains bluestem was similar ($P>.05$) among months. In vitro OM disappearance for forages is approximately equivalent to TDN. These diets did not meet the TDN requirements of a 600 lb steer gaining 2 lb/day (67% TDN; NRC, 1984). However, cattle grazing in adjacent range areas were gaining 1.8-2.0 lb/day.

Plains bluestems provides a higher quality diet during June, August and October and therefore is a good complement to native range in forage management systems in the Southern Rolling Plains.

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