# Stocker Bloat on Wheat Pasture

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## Story in Brief

Ruminal motility and ruminal fluid foam stability, expansion and strength measurements were made on steers during the 1976-77 wheat pasture grazing season. Both the amplitude and frequency of ruminal contractions of steers on wheat pasture were generally increased, and did not indicate that reduced ruminal motility is a predisposing etiological factor in the bloating of wheat pasture stockers. Measurements of ruminal fluid foam stability, expansion and strength, taken as indices of the likelihood that stockers would bloat, did change significantly over the wheat pasture grazing period. However, multiple chemical components of wheat forage accounted for only 50.1 percent of the variation observed in the ruminal fluid stability measurements, and therefore would have low predictive value.

## Introduction

Among the health problems of stocker cattle grazed on wheat pasture is one known as the stocker syndrome. Frothy bloat is a major cause of deaths in wheat pasture stockers that die of the stocker syndrome. Our studies relative to this problem during the 1976-77 wheat pasture grazing season have been conducted along the following lines of question: (1) Is wheat pasture bloat in stockers a secondary bloat to a reduced ruminal motility? (2) Does ruminal fluid foam stability, expansion and strength (as indices of bloat potential or the likelihood that stockers would bloat) change during the wheat pasture grazing season? (3) What changes in concentration do certain wheat forage chemical components, which are believed to be related to the incidence of bloat, undergo during the wheat pasture grazing season, and can they be used to predict bloat potential?

## Experimental Procedure

### Wheat pasture and steers

The studies were conducted on eight acres of wheat pasture at the O.S.U. Dairy Cattle Center. One-hundred and four pounds (104 lb) of triumph 64 seed were sown per acre on September 9, 1976. Prior to drilling, urea (143

lb/acre) was applied and 48 lb/acre of 18-46-0 fertilizer was included with the seed. There were no additional applications of nitrogen during the test period. The animal observations were taken from four ruminally cannulated Hereford X Angus steers (average initial wt of 535 ± 13 lb). The steers were placed on wheat pasture on November 13, 1976 and remained on pasture until March 24, 1977 (152 total days). The average daily gain of the steers while on wheat pasture was 2.1 ± .11 lb.

## Ruminal motility

In order to establish baseline data, amplitude and frequency of ruminal contractions were measured for three consecutive weeks prior to putting the steers on wheat pasture, and for two consecutive weeks after the steers were taken off wheat pasture. The mean pre- and post-wheat pasture amplitudes and frequencies were not statistically different ($P>.05$). While off wheat pasture the steers were fed a ration that consisted of about 54 percent ground alfalfa hay, 32 percent corn, 7 percent cottonseed hulls and 5 percent soybean meal. Measurements of ruminal motility were taken from November 23, 1976 to March 15, 1977 during the wheat pasture grazing period. Ruminal motility of the steers was measured by placing implantable pressure transducers in the dorsal ruminal sac through small ruminal cannulas.

## Ruminal fluid foam stability, expansion and strength

Measurements of foam stability, expansion and strength were made on ruminal fluid samples taken from the four rumen cannulated steers at approximately weekly intervals from December 21, 1976 to March 22, 1977. Rumen fluid samples were foamed in glass columns by passing compressed air through a fritted glass disc for 10 min at a constant pressure. Foam stabilities were estimated from the slopes (regression coefficients) of the resulting plots of foam height versus foaming time. Foam stability was defined as the rate of foam formation compared to the rate of foam breakdown, and increased as the magnitude of the regression coefficients increased. Foam expansion and strength were measured as the number of volumes of foam obtained from one volume of fluid (cm foam/ml fluid) at the end of the 10-min foaming period, and as the rate of fall (cm/sec) of a perforated brass weight through the produced foams, respectively.

## Ruminal fluid viscosity

Ruminal fluid viscosity was measured as a possible alternative to measurements of ruminal fluid stability, expansion and strength. Studies have shown that ruminal fluid viscosity is increased in bloated animals possibly as a result of the rupturing of microbial cells and the subsequent spillage of cell contents into the rumen due to elevated intra-ruminal pressures. The measurements were obtained by using a No. C-155, size 100 viscometer . The data were expressed in units of centistrokes.

The experimental design used to analyze the ruminal motility and all

measurements made on the rumen fluid samples was a randomized complete-block design with steers as blocks and time period as the treatment application. The date x steer mean square was used as the error mean square.

### Wheat forage composition

Six random clippings were taken from the wheat pasture at weekly intervals from November 4, 1976 to March 24, 1977. Analysis of specific wheat forage components included: 1) dry matter, 2) neutral-detergent fiber (NDF) or total forage fiber, 3) total nitrogen (crude protein), 4) total soluble nitrogen, 5) soluble non-protein nitrogen and 6) soluble protein nitrogen. The neutral-detergent fiber analysis was by the procedure of Goering and Van Soest (U.S.D.A. Agr. Handbook No. 379, 1970). Analysis of the soluble nitrogen fractions was conducted using a mineral mixture from the "Ohio" *in vitro* fermentation media (Johnson, R. R., 1969, Techniques and Procedures in Animal Science Research).

The experimental design for analyzing the forage data was a completely randomized design with time periods (weeks) as the treatment. The sample x date mean square was used as the error mean square.

## Results and Discussion

### Ruminal motility

The mean amplitude and frequency of ruminal contractions during the pre- and post-wheat pasture, and the wheat pasture grazing period are shown in Table 1. The amplitude of ruminal contractions was significantly increased

**Table 1. Ruminal motility of wheat pasture stockers (1976-77)**

| | Amplitude of contractions (mmHg) | Frequency of contractions (seconds) |
|---|---|---|
| Mean, pre- and post-wheat pasture periods: | 17.1 | 23.8 |
| Wheat pasture: | | |
| 11-23-76 | 17.3 | 31.7* |
| 11-29-76 | 16.5 | 29.4 |
| 12- 7-76 | 18.0 | 32.7* |
| 12-14-76 | 15.9 | 33.8* |
| 12-28-76 | 15.9 | 30.6* |
| 1- 4-77 | 23.5* | 38.0* |
| 1-18-77 | 33.5* | 33.5* |
| 2- 1-77 | 25.4* | 28.7 |
| 2- 8-77 | 15.2 | 29.6 |
| 2-15-77 | 12.4 | 34.4* |
| 2-22-77 | 26.6* | 22.0 |
| 3- 1-77 | 11.0* | 35.4* |
| 3- 8-77 | 15.9 | 21.9 |
| 3-15-77 | 15.1 | 15.8* |

*Significantly different from mean of pre- and post-wheat pasture periods ($P<.05$).

($P<.05$) on four dates during the wheat pasture grazing period, whereas the mean amplitude on March 1, 1977 was significantly decreased ($P<.05$). Frequency of ruminal contractions were generally increased. In agreement with the ruminal motility measurements of the 1975-76 wheat pasture grazing season, these data do not indicate that reduced ruminal motility is a predisposing factor in the bloating of wheat pasture stockers.

## Ruminal fluid foam stability, expansion, strength

The initial foam stability value (12-21-76) was assigned a value of 100 percent and the remaining values were expressed as a percentage of the initial value (Table 2). The most stable foam occurred on this date. Both foam stability and foam expansion showed similar patterns of remaining fairly constant until 2-15-77. The next week foam stability decreased to a level similar to that observed on 2-8-77 before decreasing even lower for the remainder of the wheat pasture grazing period. Foam expansion decreased on 2-22-77 and continued to decrease until 3-22-77.

No significant change over time was observed in the rumen fluid viscosity measurements, and they accounted for only 1.36 percent of the total variation in the foam stability measurements.

## Wheat forage composition

All wheat forage components showed significant differences over time ($P<.0001$). The changes in forage dry matter, crude protein and neutral-detergent fiber (forage components which may reflect forage maturity and may be related to the incidence of bloat) are shown in Figure 1. The large, early increases in dry matter and neutral-detergent fiber, and the concomitant

**Table 2. Rumen fluid foam stability, expansion, strength and viscosity measurements**

| Date | Stability: Linear regression coefficients | Stability: Percent of initial value | Expansion (cm foam/ml fluid) | Strength (cm/sec) | Viscosity (centistrokes) |
|---|---|---|---|---|---|
| 12-21-76 | .715$^{bc}$ | 100 | 1.22$^{c}$ | 1.27$^{ab}$ | |
| 12-28-76 | .68$^{bc}$ | 95 | 1.155$^{bc}$ | .55$^{a}$ | |
| 1- 4-77 | .63$^{bc}$ | 88 | 1.18$^{bc}$ | 2.96$^{c}$ | |
| 1-18-77 | .60$^{abc}$ | 84 | 1.14$^{bc}$ | .60$^{ab}$ | 2.00$^{a}$ |
| 2- 1-77 | .577$^{abc}$ | 81 | 1.19$^{bc}$ | 1.94$^{abc}$ | 2.01$^{a}$ |
| 2- 8-77 | .597$^{abc}$ | 83 | 1.22$^{c}$ | 1.74$^{abc}$ | 1.68$^{a}$ |
| 2-15-77 | .892$^{c}$ | 125 | 1.31$^{c}$ | .91$^{ab}$ | 1.57$^{a}$ |
| 2-22-77 | .575$^{abc}$ | 80 | .755$^{abc}$ | 1.78$^{abc}$ | 1.44$^{a}$ |
| 3- 1-77 | .21$^{ab}$ | 29 | .425$^{ab}$ | 1.08$^{ab}$ | 1.63$^{a}$ |
| 3- 8-77 | .19$^{ab}$ | 27 | .422$^{ab}$ | 1.30$^{ab}$ | 2.19$^{a}$ |
| 3-15-77 | .06$^{a}$ | 8 | .325$^{a}$ | 2.04$^{bc}$ | 1.66$^{a}$ |
| 3-22-77 | .28$^{ab}$ | 39 | .572$^{abc}$ | 2.87$^{c}$ | |

$^{abc}$Means in the same column that have common lettered superscripts are not statistically different ($P>.05$).

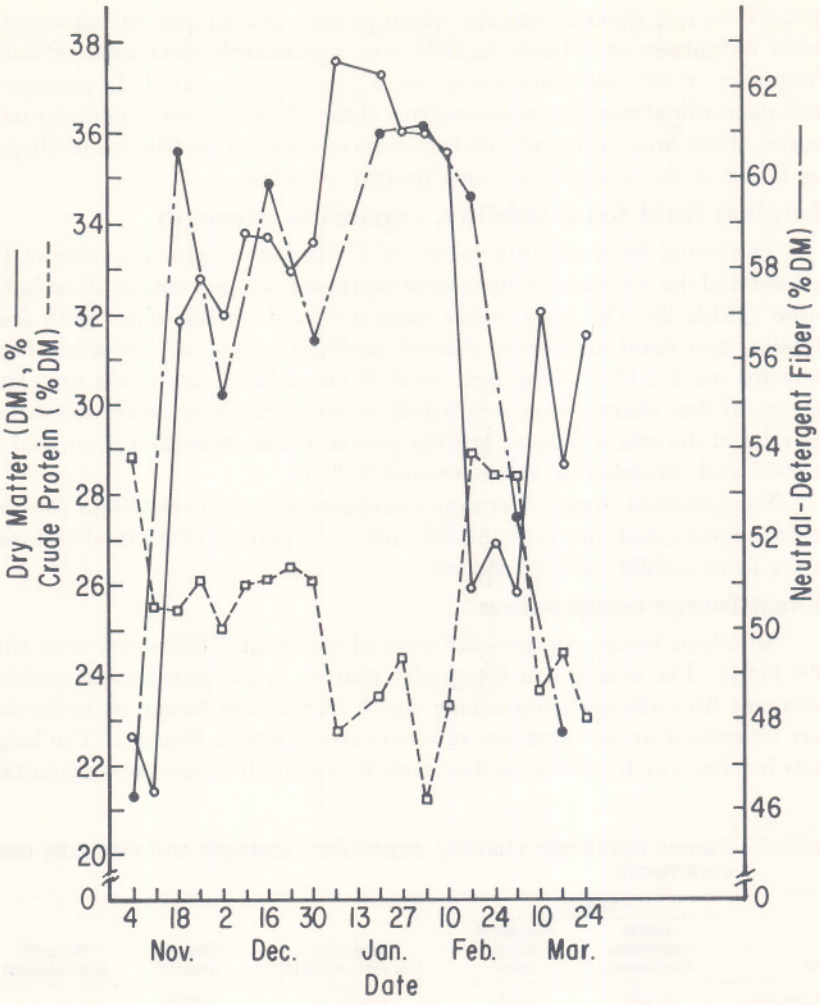


**Figure 1. Dry matter, crude protein and neutral-detergent fiber content of wheat forage**

decrease in forage crude protein content are probably reflective of the effect of the extremely dry and cold fall of 1976 on wheat forage growth.

Coefficients of determination ($R^2$values) for the regression of ruminal fluid foam stability, expansion or strength on single or multiple chemical components of wheat forage are shown in Table 3. The $R^2$ values represent what portion (percent) of the variation of a dependent variable can be accounted for by an independent or multiple independent variables. The inde-

**Table 3. Coefficients of determination ($R^2$ values) for regression of ruminal fluid foam stability, expansion or strength on chemical components of wheat forage**

| Dependent variable | Number of independent variables | Dry matter | Crude protein | NDF[a] | Total soluble N | Soluble protein N | Soluble NPN[b] | $R^2$ value |
|---|---|---|---|---|---|---|---|---|
| Foam stability | 1 | | | X | | | | .360 |
| | 2 | | X | X | | | | .418 |
| | 3 | | X | X | | X | | .459 |
| | 4 | | X | X | X | | X | .487 |
| | 5 | X | X | X | X | X | | .501 |
| Foam expansion | 1 | | | X | | | | .332 |
| | 2 | | | X | | | X | .343 |
| | 3 | | X | X | | X | | .367 |
| | 4 | | X | X | X | | X | .382 |
| | 5 | X | X | X | X | X | | .393 |
| Foam strength | 1 | | | | | X | | .232 |
| | 2 | X | X | | | | | .485 |
| | 3 | | | | X | X | X | .488 |
| | 4 | X | X | X | | X | | .492 |
| | 5 | X | X | X | X | | X | .493 |

[a]Neutral-detergent fiber (total forage fiber).
[b]Non-protein nitrogen.

pendent variables (forage chemical components) listed in Table 3 are believed to be related to the incidence of bloat based on chemical analyses of wheat forage samples taken from pastures within the state (1) where bloat was not observed or (2) where stockers were frequently seen bloated or had died of bloat. Forage crude protein and neutral-detergent fiber components accounted for 41.8 percent of the variation in ruminal fluid foam stability, and only 50.1 percent of the variation was accounted for by wheat forage dry matter, crude protein, NDF, total soluble nitrogen and soluble protein nitrogen concentrations.