Wheat Pasture Bloat of Stockers

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Story in Brief

Ruminal motility and foam stability, and expansion and strength measurements of foamed rumen fluid samples (as estimates of the potential of bloat occurring in stockers) were made during the 1975-1976 wheat pasture season. Also, the chemical composition of wheat forage samples taken during the spring of 1973 from pastures (1) where bloat was not observed, and (2) where stockers were bloating or had died of bloat was characterized. The ruminal motility data indicate that wheat pasture bloat of stockers does not occur secondarily to a reduced ruminal motility. Significant differences were observed in the measurements of ruminal fluid foam stability, expansion, and strength at various times during the grazing season.

No significant relationships were found between the ruminal fluid foam stability measurements and dry matter, crude protein, foam-stabilizing protein (ribulose 1,5-diphosphate carboxylase), and soluble carbohydrate concentrations of wheat forage samples taken on the same days that foam stability measurements were made. Wheat forage samples from bloat-provocative pastures contained less dry matter and significantly less ($P<.05$) total fiber (neutral-detergent fiber). The concentrations of crude protein and soluble nitrogen fractions (total soluble N, and soluble protein N, and soluble non-protein N) of forage samples from bloat provocative pastures were all significantly increased. The data indicate that wheat forage maturity or age of accumulated forage growth may be a major factor which affects the incidence of bloat.

Introduction

Frothy bloat is a major cause of deaths in wheat pasture stockers that die of the stocker syndrome. Death losses due to the stocker syndrome are believed to be in the range of two to three percent, and have been as high as 20 percent on some wheat pastures. Some basic points relative to the etiology and prevention of frothy bloat in wheat pasture stockers are: (1) Bloat occurs when the rate of eructation or removal of rumen fermentation gases is less than the rate of production. This may result from an increased rate of production of gases or from impaired function of the rumen, cardia, or esophagus. (2) Rumen fermentation gases may become entrapped in ruminal fluid froth or foam, and cannot be eructated regardless of the functionality of the rumen and other digestive organs, and (3) The chemical composition of wheat forage changes, depending upon environmental growing conditions, stage of wheat plant growth or maturity and fertility level, and, therefore, would be expected to affect the degree or likelihood that a stable ruminal foam would be formed when wheat forage is grazed by stockers.

The objectives of the studies reported herein were: (1) to measure ruminal motility of stockers grazed on wheat pasture since secondary ruminal contractions are required for eructation of ruminal fermentation gases, (2) to determine the potential of bloat occurring in stockers, and (3) to assess the possible relationships between the bloat potential and chemical components of wheat forage samples taken during the 1975-1976 wheat pasture grazing season. In addition, the chemical composition of wheat forage samples taken during the spring of 1973 from pastures where stocker bloat was not observed, and where stockers were bloating or had died of bloat were characterized.

Materials and Methods

Wheat pasture and steers

Eight acres at the O.S.U. Dairy Cattle Center were seeded on September 8, 1975, with 104 pounds of Triumph 64 seed per acre. Urea (143 lb/acre) was applied immediately before drilling, and 48 lb./acre of 18-46-0 fertilizer was applied with the seed. Total nitrogen applied per acre at planting was, therefore, approximately 73 lb./acre. No additional nitrogen was applied during the remainder of the grazing season.

Four ruminal cannulated Hereford steers that weighed 475 $\pm$ 15 pounds were placed on the pasture on November 10, 1975; and four additional Hereford steers that weighed 548 $\pm$ 31 pounds were placed on the pasture on December 31, 1975. The average daily weight gains of these cattle from the time that they were put on the wheat pasture until April 26, 1976, was 2.05 $\pm$ .10 lb./head/day, and reflect the large amount of wheat forage that was available to them.

Ruminal motility

Ruminal motility of three of the four steers which had been placed on pasture on December 31, 1975 was measured at approximately weekly intervals from January to April 2, 1976 by means of pressure transducers surgically implanted in the rumen.

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 stockers at approximately weekly intervals from December 23, 1975 to April 1, 1976. Rumen fluid samples were foamed in glass columns by passing compressed air through a fritted glass disc for 10 minutes at constant pressure. Foam stabilities were estimated from the slopes (regression coefficients) of the resulting plots of foam height versus foaming time. Foam stability 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/cm. fluid) at the end of the 10 minute foaming time, and as the rate of fall (cm./sec.) of a perforated brass weight through the produced foams, respectively.

Field trial data

Wheat forage samples were collected during the spring of 1973 from wheat pastures where bloat was not observed in stockers, and where stockers were bloating or had died of bloat. The samples were kept frozen in a freezer until they were analyzed.

Results and Discussion

Ruminal motility

The mean amplitude and frequency of ruminal contractions during the pre-wheat pasture control period in which the steers were fed a high cottonseed hull diet, and the wheat pasture grazing period are listed in Table 1. There were no significant differences among the mean amplitudes and frequencies of ruminal contractions measured at the various times during the wheat pasture grazing period. Therefore, the data shown in Table 1 represent the mean amplitude and frequency of ruminal contractions for the entire wheat pasture grazing period. The mean amplitude of ruminal contractions measured during the wheat pasture grazing period were significantly increased ($P<.05$) by a magnitude of two-fold. Extremely large amplitudes, in the range of 40 to 50 mm. Hg, of ruminal contractions were frequently observed during the wheat pasture grazing period. The frequency of ruminal contractions was only slightly increased (1.1-fold) during the wheat pasture grazing period. Reduced ruminal motility patterns, as compared with pre-wheat pasture motility patterns, were not observed at any time during the wheat pasture grazing period.

The increased amplitudes of the ruminal contractions that were observed are probably indicative of the large forage intakes of wheat pasture stockers. In

Table 1. Ruminal motility[1] of wheat pasture stockers

	Pre-wheat pasture control period	Wheat pasture grazing period	Fold increase[2]
Amplitude, mm. Hg	10.4 ± 1.8	21.1* ± 1.1	2.0
Frequency, sec.	32.7 ± 2.1	35.8 ± 1.7	1.1

[1]Mean ± standard error of mean for amplitude and frequency of ruminal contractions.
[2]Fold increase during wheat pasture grazing period over pre-wheat pasture, control period.
*Significantly greater ($P<.05$) than mean of pre-wheat pasture amplitudes.

general the ruminal motility data indicate that wheat pasture bloat of stockers does not occur secondarily to a reduced ruminal motility or ruminal stasis.

Ruminal fluid foam stability, expansion and strength

Table 2 shows the foam stability, expansion, and strength measurements of ruminal fluid samples taken from stockers at various times during the 1975-76 wheat pasture grazing period. The initial foam stability measurement (12-23-75) has been assigned a relative value of 100 percent, and the magnitudes of the remainder of the measurements of foam stability are expressed as a percentage of the initial value. Ruminal fluid foam stabilities were significantly ($P<.05$) increased (420 percent of initial value) on 3-11-76. Foam stabilities on 2-12-76 and 3-5-76 were significantly lower ($P<.05$) than those measured on 1-22-76 and 2-26-76. An explanation as to why the least and most stable ruminal foams occurred only six days apart (3-5-76 vs. 3-11-76) is not apparent. It is not likely that the composition of the grazed wheat forage would have changed enough during this six-day period to effect these extreme differences in the foam stability measurements. Measurements of ruminal fluid foam expansion and strength were the highest on 3-11-76, and the lowest foam expansions occurred on 2-12-76, and 3-5-76 which coincided with the foam stability measurements.

No significant relationships were found between the ruminal fluid foam stability mesurements and dry matter, crude protein, foam-stabilizing protein (ribulose 1,5-diphosphate carboxylase), and soluble carbohydrate concentrations of wheat forage samples taken on the same days that foam stability measurements were made. Coefficients of determination (R^2 values) indicated

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

	Stability			
Date	Linear regression coefficients	Percent of initial value	Expansion (Cm. foam/cm. fluid)	Strength (cm./sec.)
12-23-75	.396[ab]	100	7.48[ab]	- - - -
12-30-75	.268[ab]	68	4.26[ab]	- - - -
1-15-76	.303[ab]	77	6.25[ab]	1.92[a]
1-22-76	.564[b]	142	9.20[ab]	2.18[a]
1-29-76	.193[ab]	49	3.88[ab]	2.45[a]
2-12-76	.061[a]	15	2.49[a]	2.58[a]
2-19-76	.419[ab]	106	7.68[ab]	1.92[a]
2-26-76	.618[b]	156	9.79[b]	3.80[a]
3-5-76	.010[a]	3	2.58[a]	2.95[a]
3-11-76	1.665[c]	420	26.16[c]	10.78[b]
3-17-76	.366[ab]	92	7.27[ab]	2.65[a]
3-25-76	.387[ab]	98	8.28[ab]	4.50[a]
4-1-76	.393[ab]	99	8.57[ab]	2.35[a]

[a,b,c]Means in the same column that have common lettered superscripts are not statistically different ($P>.05$).

that only 0.57, 3.81, 3.88, and 1.80 percent of the total variation in foam stabilities was accounted for by the dry matter, crude protein, foam-stabilizing protein and soluble carbohydrate concentrations, respectively.

Field trial data

The results of the chemical analyses of wheat forage samples taken during the spring of 1973 from pastures where stocker bloat was not observed and where stockers were bloating or had died of bloat are shown in Table 3. Wheat forage samples from bloat-provocative pastures contained less dry matter, and significantly less ($P<.05$) total fiber (neutral-detergent fiber). The concentrations of crude protein and soluble nitrogen fractions (total soluble N, soluble protein N, and soluble non-protein N) of forage samples from bloat provocative pastures were all significantly increased ($P<.05$). The extent to which the analyses in Table 3 reflect stage of wheat forage growth or age of accumulated forage growth is not known. The data in Table 3 do suggest, however, that a subtle relationship (Figure 1) may exist between (1) climatic (growing) conditions, (2) soil fertility management, and (3) stocking rates as they affect the age of accumulated forage growth, forage maturity and the incidence of bloat.

Wheat forage of several or many days accumulated growth would be more fibrous and less succulent than wheat forage of only a few days growth. Stockers grazing the more fibrous, less succulent wheat forage may secrete greater quantities of saliva during the chewing associated with eating and during the re-chewing of regurgitated boluses. The increased amounts of saliva may have an anti-foaming effect, and thus reduce the incidence of frothy bloat. The significantly decreased total fiber content (neutral-detergent fiber) of wheat forage samples from pastures where stockers were bloating supports this rationale. From a practical standpoint, wheat pasture stockers that are

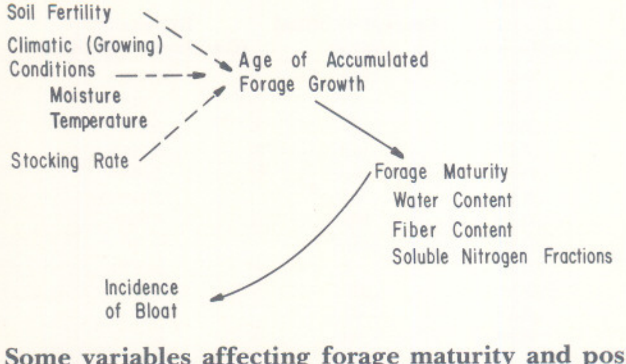

Figure 1. Some variables affecting forage maturity and possibly the incidence of bloat in wheat pasture stockers.

Table 3. Chemical composition of wheat forage where bloat was not observed and bloat-provocative pastures

Wheat pasture	Bloat not observed	Bloat-provocative pastures
Number of samples	9	7
Dry matter (DM), %	28.48	22.31
Total fiber		
(Neutral-detergent fiber)	44.59	35.02*
Crude protein, %	25.40	31.75*
Soluble nitrogen		
% of DM	1.85	3.24**
% of total N	44.94	61.79*
Soluble Protein Nitrogen		
% of DM	0.79	1.30*
% of total N	19.07	24.53
Soluble non-protein nitrogen		
% of DM	1.06	1.94**
% of total N	25.84	37.18**
Soluble carbohydrate, %	13.09	9.27

Significantly different from wheat forage samples taken from pastures where bloat was not observed: *(P<.05); **(P<.01).

frequently seen "chewing their cuds" may be less likely to bloat than those that are not. Also freeze-burned, dormant wheat forage is not likely to cause bloat.

Plant Chemical Composition and Digestibility of Rangeland Forage

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Story in Brief

Forage samples were collected on a monthly basis from various points on a watershed. Both live and standing dead plants were collected. At the various sampling points both caged (C) and grazed (G) vegetation was sampled. Fiber (ADFP), lignin (ADLP) and cellulose (CELLP) data were very similar in both the caged (live and dead) and grazed (live and dead) samples for the months of June, July and August. Fiber data showed CLADFP, CDADFP, GLADFP,