

EFFECT OF LASALOCID AND STAGE OF MATURITY OF WHEAT FORAGE ON RUMINAL FERMENTATION OF STEERS

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Story in Brief

The effect of lasalocid and stage of wheat forage maturity on ruminal fermentation of steers grazing wheat pasture was studied during the 1983-84 and 1984-85 wheat pasture grazing seasons. Eight rumen cannulated steers (1000 lb) grazed a common wheat pasture and received 0 or 300 mg lasalocid/head/day. Two periods of wheat pasture maturity were studied. Immature wheat forage representing the lush spring growth period, and mature forage representing forage shortly after flowering. Ruminal ammonia concentrations, the molar proportion of acetate and the acetate to propionate ratio were greater in steers grazing immature forage. Ruminal pH, total volatile fatty acid concentration and the molar proportion of butyrate, valerate, isobutyrate and iso-valerate were lower for steers grazing immature wheat forage. Lasalocid supplementation increased ruminal ammonia concentrations, decreased the molar proportion of acetate and increased the molar proportion of propionate. The acetate to propionate ratio was decreased only 6%. Other mechanisms such as shifts in site and extent of nutrient digestion may also be involved in the effect of lasalocid in increasing weight gains of wheat pasture stocker cattle.

(Key Words: Wheat Pasture, Lasalocid, Rumen Fermentation.)

Introduction

Lasalocid is an ionophore that has been shown to increase daily weight gains of stocker cattle grazing winter wheat pasture (Andersen and Horn, 1985). Lasalocid increased ruminal ammonia concentration, however did not affect total volatile fatty acid (VFA) concentration or the molar proportions of acetate, propionate or butyrate. However, rumen fluid samples were collected by aspiration through stomach tube, and detection of differences in molar proportions of VFA may have been masked by unrepresentative samples. Andersen et al. (1985) reported lasalocid increased ruminal ammonia concentration, decreased ruminal acetate concentration, and the acetate to propionate ratio in steers (approximately 1000 lb body wt) receiving 0 or 300 mg lasalocid/day. Rumen fluid samples were taken through rumen cannulas to provide more representative samples. Data on site and extent of nutrient digestion indicated that advancing forage maturity and lasalocid shifted site of digestion to the post-ruminal tract (Zorrilla-Rios et al., 1985). The objective of this study was to obtain additional information relative to effects of lasalocid and stage of forage maturity on rumen fermentation, forage intake, site and extent of nutrient digestion of steers grazing wheat pasture. Effects of lasalocid and wheat forage maturity on rumen fermentation measurements are reported herein.

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Materials and Methods

During the wheat forage grazing periods of March through May of 1984 and 1985, eight rumen fistulated mature Hereford steers grazed a single paddock of wheat pasture (Var. TAM-105) with free access to water and salt. Steers were randomly allotted to one of two treatments, and received ruminal dosages of 0 or 300 mg lasalocid daily in gelatin capsules. During the 1985 grazing season, one steer died prior to completion of the study. Measurements of rumen fermentation were made each year while steers grazed immature and mature wheat forage. Immature wheat forage was grazed during periods of March 7 to 27, 1984 and March 8 to April 1, 1985. Mature wheat forage was grazed during April 22 to May 14, 1984 and April 23 to May 13, 1985.

Rumen fluid was collected once during each period of each year. Fluid was obtained via the rumen fistula and strained through 3 layers of cheesecloth. Ruminal pH was measured immediately with a glass electrode and pH meter, and 100 ml aliquots were acidified with 2 ml of 20% H_2SO_4 and placed in an ice slurry until analyses were conducted for ruminal ammonia concentrations by MgO distillation. Five milliliter aliquots of the rumen fluid were acidified with 1 ml 25% metaphosphoric acid and frozen for later analysis of volatile fatty acid concentrations by gas-liquid chromatography.

Forage samples were obtained by hand clipping during each period of the study and were freeze dried. Nitrogen content of forage was determined by Kjeldahl analysis, NPN content was determined by difference between total nitrogen and protein nitrogen, which was precipitated in a 10% H_2SO_4 and Na-tungstate solution. Soluble nitrogen was determined by Kjeldahl analysis of filtrate following a 1 h incubation in a 2% buffer solution (Ohio Buffer, pH=6.5). In vitro dry matter digestibility (IVDMD) of forage samples was determined following a 48-h incubation with buffered rumen fluid and subsequent 24-h digestion in pepsin and HCl.

Results and Discussion

Chemical composition of wheat forage for years 1 and 2 is reported in Tables 1 and 2, respectively. Wheat forage quality did not vary considerably between years 1 and 2. Wheat forage protein was much higher in immature forage than mature forage, soluble nitrogen:total nitrogen was approximately 35%, IVDMD of wheat forage was about 76% for immature forage, and 66% for mature forage.

Effects of stage of maturity and lasalocid on rumen fermentation are shown in Table 3. A year by period interaction ($P<.10$) occurred for most measurements. However, the rank of mean values for period within each year was not affected, therefore this interaction was ignored and data were pooled across years. Stage of maturity of wheat forage affected all rumen fermentation measurements ($P<.01$), with the exception of the molar proportion of propionic acid. Ruminal pH was greater and ruminal ammonia concentration was lower for steers grazing mature wheat forage. The decrease in ruminal ammonia concentration coincides with lower protein content of mature wheat forage. Total volatile fatty acid (VFA) concentration was lower ($P<.01$) in steers grazing mature wheat forage. However, the molar proportion of acetate was greater, and the proportions of isobutyrate, butyrate, isovalerate and valerate were decreased.

Table 1. Chemical Composition of Wheat Forage Year 1. (Var. TAM-105).

Nutrient	Stage of Forage Maturity ¹	
	Immature	Mature
Dry Matter, %	24.3	22.7
Organic Matter, % of DM	92.5	93.7
Nitrogen, %		
Total	4.39	2.03
Soluble	1.184	0.691
NPN	0.438	0.201
Ratios		
Soluble N/Total N	27.0	34.0
NPN/Total N	10.0	9.9
IVDMD	75.6	66.4
Forage Available (lb/acre)	1642	1566

¹Immature (March 7-27)
Mature (April 22- May 14)

Table 2. Chemical Composition of Wheat Forage Year 2. (Var. TAM-105).

Nutrient	Stage of Forage Maturity ¹	
	Immature	Mature
Dry Matter, %	23.3	27.1
Organic Matter, % of DM	93.7	95.7
Nitrogen, %		
Total	3.91	2.11
Soluble	1.42	1.00
NPN	0.45	0.32
Soluble N/Total N	36.3	47.4
NPN/Total N	11.5	15.2
IVDMD	76.2	65.7
Forage Available (lb/acre)		3479

¹Immature (March 8-April 1)
Mature (April 23- May 14)

The effect of lasalocid on rumen fermentation measurements did not interact with stage of maturity or year ($P>.20$), therefore data were pooled across periods and years. Lasalocid did not affect ruminal pH ($P>.15$). Lasalocid increased ruminal ammonia concentrations ($P<.04$) possibly indicating greater ruminal degradation of forage protein. Lasalocid did not affect total VFA concentrations, but decreased the acetate:propionate ratio ($P<.27$) by decreasing the molar proportion of

Table 3. Effect of stage of Maturity of wheat forage and Lasalocid on rumen fermentation of steers.

	Stage of maturity wheat forage		Lasalocid (mg/day)		SE	Level of Significance	
	Immature	Mature	0	300		M	L
Observations	15	15	15	15			
pH	5.8	6.5	6.2	6.2	.06	.01	NS
Ammonia (mg/dl)	54.5	15.0	31.9	37.5	1.77	NS	.04
Volatile Fatty Acids Total (mm/l)	161.1	108.4	134.0	131.5	4.5	.01	NS
Molar Proportions, (%)							
Acetate	59.8	68.6	64.9	63.6	.56	.01	.06
Propionate	19.4	18.9	18.8	19.6	.33	NS	.04
Isobutyrate	1.8	1.1	1.4	1.5	.07	.01	NS
Butyrate	14.7	8.8	11.7	11.8	.43	.01	NS
Isovalerate	2.6	1.5	1.9	2.2	.07	.01	.02
Valerate	1.7	1.1	1.3	1.5	.08	.01	NS
Acetate:Propionate	3.11	3.66	3.49	3.28	.08	.01	.07

NS = non significant ($P > .10$).

acetate ($P < .06$) and increasing the molar proportion of propionate ($P < .04$). Lasalocid did not affect any other rumen fermentation measurements, with the exception of an increase in the molar proportion of isovalerate.

While lasalocid did decrease the acetate:propionate ratio of ruminal fluid, the reduction was small (i.e., about 6%). Other mechanisms such as shifts in site and extent of nutrient digestion, as observed by Zorrilla-Rios et al. (1985), may be involved in the improvement of gains of wheat pasture stocker cattle by lasalocid.

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