FORAGE QUALITY, INTAKE, AND WASTAGE BY EWES IN SWATH GRAZING AND BALE FEEDING SYSTEMS

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Impact Statement

Harvested feed costs, particularly throughout the winter, are traditionally the highest input associated with maintaining a ruminant livestock operation. Swath grazing reduces labor, time, and costs associated with feeding baled forages because the burden of harvest is transferred to the livestock. Our research expands on previous research for cattle and suggests that swath grazing forage may have utility in sheep production. Although our results show that nutrient composition tended to be lower in the swathed forage, wastage and animal performance were similar between swathed and grazed treatments, and suggests that a swathed feeding system could function as a viable alternative to a traditional baled feeding system in arid climates. Our study furthers our understanding of alternative feeding systems for sheep, and provides a biological foundation for a future economic evaluation of a swath verses bale feeding system in commercial sheep operations.

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SUMMARY

Sixty mature, white-faced ewes were used in a completely randomized design repeated 2 years to evaluate whether feeding method (swath grazed or fed as hay in confinement) of intercropped field pea (*Pisum sativum* L.) and spring barley (*Hordeum vulgare* L.) forage affected forage DMI, wastage, or nutrient composition. Each year, 30 ewes were allocated to 3 confinement pens (10 ewes/pen) and 30 ewes were allocated to 3 grazing plots (10 ewes/plot). In 2010, DMI was lower for swathed versus baled forage, but DMI did not differ between treatments in 2011. Forage wastage was similar between treatments for both years. Wastage and animal performance were similar between the two treatments despite lower nutrient values in swathed forage, suggesting that a swathed feeding system can function as a viable alternative to a traditional baled feeding system in commercial sheep operations.

INTRODUCTION

Swath grazing, practiced for over 100 years, is the process of cutting hay at peak nutritional value and leaving it in windrows or raking it into swaths for livestock to graze at a later date. As the burden of harvest is transferred to livestock, swath grazing reduces labor, time, and costs associated with baled forages. The quality of forage tends to be lower in swaths compared to bales because exposure to precipitation and other environmental conditions degrade its nutritive value (Nayigihugu et al. 2007). However, swathed forage may still be a viable feeding alternative for livestock operations if lower feed costs offset nutritive limitations (Karn et al., 2005).

PROCEDURES

Research was conducted at the Fort Ellis Experiment Station of Montana State University. The study used 12 distinct forage plots (intercropped field pea and spring barley forage) with each plot measuring 15.2 m × 91.4 m.

Activities involving live animals were approved by the Agricultural Animal Care and Use Committee at Montana State University (2009-AA04). This study used 120 non-pregnant, non-lactating, mature western white-faced ewes over a two year period. Ewes were randomly assigned to either a swath grazing treatment (GRAZE, *n*=30), or a bale-fed treatment (BALE, *n*=30). For the GRAZE treatment, forage was defined as 1) the swath and 2) standing forage including post-harvest stubble and regrowth. For the BALE treatment, forage was defined as baled forage fed in an outdoor drylot enclosure. Ten ewes were assigned to each

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plot based on NRC (2007) projected DMI levels for mature non-lactating ewes (75.0 – 81.5 kg) adjusted for *ad libitum* access to forage which allowed for 3 replications for GRAZE treatment and 3 replications for BALE treatment. Our stocking protocol assumed 75-80% consumption of initial available forage over the span of 7 d (with no less than 15-20% forage refusal) for GRAZE treatments. Ewes in BALE treatments were fed an amount of hay sufficient to ensure no less than 10% forage refusal.

All ewes were permitted *ad libitum* access to water as well as salt mixed with Sheep Range Mineral (CHS, Inc., Sioux Falls, SD) for all classes of sheep. We measured DMI via daily Cr_2O_3 dosing and fecal grab sampling and wastage during October 9 15, 2010 and September 1319, 2011.

In both GRAZE and BALE treatments, initial and final forage availability was determined to calculate DM wastage as $W = F_i - F_f - I$, where W is wastage, F_i is initial available forage, F_f is final available forage, and I represents intake over the 7-d collection period. Final edible forage available for BALE and GRAZE treatments was estimated by weighing refused forage (unsoiled and untrampled in GRAZE and remaining in the feeder in BALE) at the end of the 7-d data collection period.

This study was a completely randomized design with each GRAZE or BALE enclosure as the experimental unit. PROC GLM of SAS (SAS Institutional Inc. Cary, NC) was used to evaluate within-year treatment differences in DMI, BW, wastage, and nutrient composition. Means were separated using the LSD procedure when a significant F value was found ($P \leq 0.10$).

RESULTS AND DISCUSSION

Ewe Performance. Proper nutrients and intake are critical in winter feeding systems for animal performance. DMI, measured as kilograms per ewe per day, and percentage of BW, differed between feeding treatments ($P \leq 0.08$) in 2010 (Table 1). In 2010, both measures of DMI were lower ($P < 0.08$) for GRAZE ewes compared with BALE ewes. Substantial regrowth was available to GRAZE ewes in 2010 but not in 2011 due to application of glyphosate in 2011 to prepare the area for future research. In 2011, DMI did not differ ($P > 0.24$) between GRAZE and BALE treatments (Table 1). Despite GRAZE ewes demonstrating decreased intake in 2010, their BW did not differ ($P > 0.26$) between GRAZE and BALE treatments for either 2010 or 2011 (Table 1). Nevertheless, our finding of no change in BW over such a short period may not be indicative of results on a long term application.

Forage Wastage. Wastage can represent a costly aspect of feeding systems in both expense of feed lost as well as labor for removal of soiled feed (Karn et al., 2005). In 2010, a difference ($P = 0.02$) was observed between feeding treatments for wastage expressed in kilograms; GRAZE wastage (121.6 kg) exceeded BALE wastage (52.5 kg; Table 1). However, there was no difference found for wastage expressed as a percent of initial available forage in 2010 (P=0.28). Similarly, wastage did not differ between feeding treatments in 2011 ($P > 0.36$; Table 1).

Forage Quality. Our results for initial CP were inconsistent between years of the study. In 2010, changes in CP during the feeding trial differed between the treatments ($P < 0.01$) despite no difference ($P = 0.24$) in initial CP among the swathed, standing forage in GRAZE, and BALE forages (Table 2). In GRAZE, the CP in the swathed forage increased but decreased in the standing forage. Crude protein remained relatively constant in BALE forage. In 2011, a difference ($P = 0.07$) was found for initial CP with BALE forage being greater than the swathed forage in the GRAZE plots in 2011.

However, change in CP between swathed and baled forages did not differ (*P* = 0.52) in 2011.

Initial and change in ISDMD did not differ between feeding treatments in 2010 (*P* > 0.32; Table 2). Similarly, initial ISDMD did not differ between the swathed forage in GRAZE and BALE forage (P = 0.28). However, change in ISDMD differed between treatments in (*P* = 0.04) ISDMD decreased in the swathed forage and increased in the BALE forage.

In 2010, we observed differences (*P* < 0.01) in initial ADF and change in ADF over time among swath and standing forage in the GRAZE, and baled forage in BALE feeding systems (Table 2). Initial ADF of standing forage was greater compared to both swathed and baled forages. The ADF content increased in the swathed forage, decreased the greatest amount in standing forage, and decreased slightly in the baled forage. In 2011, we observed a difference (*P* = 0.02) in initial ADF between the swathed and baled forage, and no difference in changes in ADF (*P* = 0.55) was found between the forage treatments. Swathed forage had greater initial ADF content than baled forage, but the ADF content increased in both forages overtime.

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Table 1. Dry matter intake, initial BW, BW change, initial forage availability, and forage wastage for ewes in swath grazing and confinement feeding systems for two years

		Feeding system			
Year	Parameter	GRAZE[1]	BALE[2]	SEM[3]	*P*-value
2010	DMI, kg ewe^{-1} d^{-1}	1.68	2.38	0.22	0.06
	DMI, % BW	2.45	3.54	0.36	0.07
	BW change, kg	5.58	6.57	0.59	0.27
	Wastage, kg[4]	121.64	52.50	17.41	0.02
	Wastage, %[5]	31.96	19.71	7.51	0.28
2011	DMI, kg ewe^{-1} d^{-1}	1.93	1.54	0.22	0.25
	DMI, % BW	3.05	2.52	0.36	0.33
	BW change, kg	1.47	1.73	0.59	0.77
	Wastage, kg[4]	35.91	12.43	17.41	0.37
	Wastage, %[5]	17.44	10.22	7.51	0.52

[1]Ewes grazed pea-barley swaths and standing forage.
[2]Ewes fed pea-barley hay in confinement.
[3]Standard error of means.
[4]Wastage = initial forage availability – ending forage availability – total DMI.
[5]Percent wastage = (wastage / beginning forage availability) * 100.

Table 2. Forage quality over time[1] with CP, ISDMD[2], NDF, and ADF of standing and swathed forage, or baled pea-barley forage feeding systems

		Forage Type				
Year	Parameter	Swath	Standing[3]	Baled	SEM[4]	*P*-value
2010	Initial CP, %	10.80	10.00	11.83	0.68	0.24
	CP change, %	1.65[c]	-1.71[a]	-0.15[b]	0.28	< 0.01
	Initial ISDMD, %	72.70	62.97	62.00	5.15	0.33
	ISDMD change, %	-3.70	2.17	5.40	5.24	0.50
	Initial ADF, %	26.53[a]	34.33[b]	25.20[a]	0.77	< 0.01
	ADF change, %	5.47[c]	-6.57[a]	-1.97[b]	1.14	< 0.01
2011	Initial CP, %	5.30	—	6.93	0.47	0.07
	CP change, %	0.01	—	-0.35	0.36	0.52
	Initial ISDMD, %	36.80	—	40.10	1.85	0.28
	ISDMD change, %	-7.03	—	3.63	2.48	0.04
	Initial ADF, %	34.47	—	26.53	1.48	0.02
	ADF change, %	4.83	—	3.00	1.97	0.55

[1]Forage types were sampled on Aug. 11 and Oct. 7 in 2010 and on Aug. 22 and Oct. 27 in 2011.
[2]In situ dry matter disappearance.
[3]Regrowth with post-harvest stubble not present in 2011.
[4]Standard error of means.
[a-c]Within 2010, means without a common superscript differ ($P < 0.10$).