Effects of Confinement vs Cover Crop-Grazing on Lamb Performance, Carcass Quality and Parasite Loads

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IMPACT STATEMENT

Little information is available on the integration of lamb finishing systems with the termination of a cover crop. The synergistic impacts of using sheep to terminate cover crops in organic and no-till farming systems as a method of finishing lambs and a partial solution to the seasonal availability of quality lamb, is an area which needs further research. Using lambs to terminate a cover crop may prove to be beneficial to both the crop and animal producer by reducing termination costs while allowing lambs to gain weight on an inexpensive, high quality feed source.

SUMMARY

The objective of this two year study was to evaluate two confinement [high energy content, barley-based diet (BAR) and moderate energy content, alfalfa-based diet (ALF)] and two cover crop grazing [continuous (CNS) and high intensity/short duration (ROT)] finishing systems on growth performance, carcass characteristics, and parasite loads of wether lambs. In 2013, ADG was greater for lambs consuming ALF than for lambs consuming BAR and both ALF and BAR were greater than either CNS or ROT. ALF was higher than CNS and ROT for Quality Grade but also had a greater ending trichostrongyle egg count.

In 2014, ADG did not differ for ALF and BAR and was greater than either CNS or ROT. Back fat thickness was greater for BAR than all other treatments and fecal egg counts did not differ among treatments.

INTRODUCTION

Many studies have reported differences in performance and carcass quality of cattle and sheep finished on concentrates versus forage-based systems. However, there is a lack of information on parasite load differences in lambs finished on the different systems and no research on incorporating lamb finishing into the termination of a cover crop by either rotational or continuous grazing.

Traditionally, cover crops have been terminated using non-selective, post-emergence contact or systemic herbicides (Anderson, 1996). However, herbicide cost is a disadvantage and can comprise a large portion of a farmer's annual expenses (Kelly et al., 1996). Organic farmers typically rely on tillage for cover crop termination. Reducing tillage in organic grain production systems has the potential to reduce soil erosion, improve soil quality, increase soil carbon sequestration, decrease greenhouse gas emissions and reduce energy requirements relative to traditional organic-production methods (Mirsky et al., 2012).

PROCEDURES

All animal procedures were approved by the Montana State University Agricultural Animal Care and Use Committee (Protocol #2013-AA07). The study was conducted at Montana

State University's Fort Ellis Research Station in Bozeman, MT during summers 2013 and 2014.

Forty-eight Rambouillet wethers (47±3.6 kg, 1 yr of age) were selected from the Pilster Ranch near Alzada, MT to be used in 2013. In 2014, 36 Rambouillet wethers (48.6±4.3 kg, 1 yr of age) were selected from the Red Bluff Research Ranch near Norris, MT. Upon arrival, wethers in both years were fasted for 24 h to reduce effects of gut fill on initial body weight. Wethers were paint-branded or ear-tagged for identification purposes and fasted weights were recorded. Wethers were stratified by BW and then randomly assigned to treatments.

Treatments in 2013 were: 1) confinement fed 71% alfalfa, 26% barley pellet diet (ALF), 2) confinement fed 60% barley, 18% alfalfa pellet diet (BAR), 3) continuous graze of a pea (Pisium sativum) cover crop (CNS), and 4) rotational graze of a pea (Pisium sativum) cover crop (ROT). Treatments in 2014 were: 1) confinement fed 71% alfalfa, 26% barley pellet diet (ALF), 2) confinement fed 60% barley, 18% alfalfa pellet diet (BAR), 3) continuous graze of a sweet clover (Melilotus officinal) cover crop (CNS), and 4) rotational graze of a sweet clover (Melilotus officinal) cover crop (ROT).

For ALF and BAR, a GrowSafe feed intake system (GrowSafe Systems, LDt., Airdrie, AM, Canada) was used to measure individual intake by wethers. Both the CNS and ROT systems were conducted in fields measuring 15.2 m by 44.2 m each. ROT fields were subdivided into 4 equal sections of 15.2 m by 11.0 m. ROT wethers were allowed to graze for 4 d (2013) or 5 d (2014) in each section and each section was grazed twice.

All wethers were finished to a target live weight of 54.4 kg. In 2013, 6 wethers were randomly chosen from each treatment to be harvested. In 2014, all 36 wethers were harvested. Wethers were transported to Stillwater Packing Co. in Columbus, MT where they were harvested using standard methods. During processing to retail cuts, individual-level carcass outcomes were obtained including dressing percentage, hot carcass weight, back fat, rib eye area, leg score, conformation, flank streaking, and quality grades. Warner-Bratzler sheer force values were determined at a later date.

Fecal egg counts (FEC) were performed on rectal grab samples (collected from wethers at the beginning and end of the study period) to estimate parasite load. Total worm count analysis, to evaluate nematode species, was conducted using methods described by Wood et al. (1995).

Data were analyzed by year using the Proc GLM procedures of SAS (SAS Inst., Inc., Cary, NC). Beginning lamb BW was used as a covariate in the analysis of final BW and ADG. Fecal egg counts were log-transformed. Means were separated using the LSD procedure when a significant F value was found ($P \leq 0.10$).

RESULTS AND DISCUSSION

In 2013, ADG was greater for lambs consuming ALF than for lambs consuming BAR and both ALF and BAR were greater than either CNS or ROT lambs. ALF lambs consumed more feed than BAR lambs. Back fat thickness did not differ between ALF and BAR and BAR was greater than CNS and ROT; ALF did not differ from CNS but was greater than ROT. Back fat thickness did not differ between CNS and ROT. Quality Grade did not differ for ALF and BAR, but ALF was higher than CNS and ROT. Ending trichostrongyle egg counts did not differ for ALF and BAR but ALF was higher than CNS and ROT. Nematodirus spp. egg counts did not differ among treatments.

In 2014, ADG did not differ for ALF and BAR and was greater than either CNS or ROT. Both ALF and BAR had a greater ending BW than CNS or ROT. Lambs consuming ALF consumed more feed than BAR. Back fat thickness was greater for BAR than all other treatments. In 2014, egg counts did not differ among treatments.

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Table 1. 2013 Performance, carcass characteristics, and end counts of internal parasite eggs per gram (EPG) of Rambouillet wethers grazed continuously or rotationally on a pea or sweet clover cover crop and performance of wethers consuming either a forage- or grain-based diet in confinement[1]

	Treatment[2]					
Item	ALF[3,4]	BAR[3,4]	CNS[5]	ROT[5]	SEM	*P* Value
Ending BW[5], lb	128.7[a]	123.4[b]	114.8[c]	116.2[c]	1.08	<0.001
Gain, lb	25.3[a]	20.0[b]	11.4[c]	12.8[c]	1.03	<0.001
ADG, lb/d	0.81[a]	0.64[b]	0.42[c]	0.46[c]	0.04	<0.001
DMI, lb/d	5.5[a]	4.4[b]	-	-	0.15	0.029
Dressing percent, %	49.99	50.26	48.56	48.19	1.51	0.713
Carcass weight, lb	65.3[a]	61.6[a]	56.1[b]	53.2[b]	2.22	0.004
Back fat thickness, in	0.17[b,c]	0.26[a,b]	0.13[c,d]	0.05[d]	0.04	0.016
Ribeye area, in[2]	0.96	0.97	0.82	0.81	0.06	0.102
Leg score[6]	392	396	383	350	16.69	0.232
Conformation[6]	392	383	383	350	15.81	0.282
Flank streaking[7]	368	310	270	267	33.04	0.139
Quality grade[6]	467[a]	429[a,b]	417[b]	408[b]	15.95	0.080
WBSF[8], kg	3.4	4.2	3.8	3.5	0.26	0.137
Trichostrongyle type EPG	233.30[a]	99.16[a,b]	21.20[b]	57.59[b]	0.56	0.067
Nematodirus spp. EPG	4.63	3.89	0.00	6.03	0.62	0.153

[a-d] Least Square Means within a row with different superscripts differ (P < 0.10).

[1]Start date for treatments was June 13, 2013; end dates for grazing and confinement treatments were July 19 and 23, 2013, respectively.

[2]Pen is the experimental unit, 4 sheep per replicate and three replicates per treatment.

[3]Confinement treatments were: ALF = pellet containing 71% alfalfa, 18% barley, 5% molasses, and 6% vitamin/mineral package; BAR = pellet containing 60% barley, 26% alfalfa, 4% molasses, 2.5% soybean-hi pro, and 7.5% vitamin/mineral package.

[4]Diets were provided for ad libitum intake.

[5]Grazing treatments were: CNS = continuously grazed pea (*Pisium sativum*) cover crop at a stocking rate of 4 sheep per [0.07 ha] for 35 d; ROT = rotationally grazed pea cover crop at a stocking rate of 4 sheep per [0.0175 ha]; rotations were every 4-d.

[6]325 = Good minus; 350 = Good; 375 = Good plus; 425 = Choice minus; 450 = Choice; 475 = Choice plus; 525 = Prime minus; 550 = Prime; 575 = Prime plus.

[7]100 to 199 = Practically Devoid; 200 to 299 = Traces; 300 to 399 = Slight; 400 to 499 = Small.

[8]Warner-Bratzler shear force (WBSF).

Table 2. 2014 Performance, carcass characteristics, and end counts of internal parasite eggs per gram (EPG) of Rambouillet wethers grazed continuously or rotationally on a pea or sweet clover cover crop and performance of wethers consuming either a forage- or grain-based diet in confinement[1]

	Treatment[2]					
Item	ALF[3,4]	BAR[3,4]	CNS[5]	ROT[5]	SEM	*P* Value
Ending BW[5], lb	137.3[a]	139.5[a]	121.7[b]	123.2[b]	1.54	0.001
Gain, lb	30.1[a]	32.6[a]	14.5[b]	16.3[b]	1.54	0.001
ADG, lb/d	0.75[a]	0.81[a]	0.37[b]	0.40[b]	0.04	0.001
DMI, lb/d	5.9[a]	5.3[b]	-	-	0.09	0.040
Dressing percent, %	49.32	51.29	48.32	48.79	1.46	0.500
Carcass weight, lb	68.0[a]	71.7[a]	59.0[b]	59.4[b]	2.24	0.001
Back fat thickness, in	0.11[b]	0.15[a]	0.08[b]	0.11[b]	0.02	0.020
Ribeye area, in^2	1.04[a]	1.05[a]	0.92[b]	0.96[b]	0.03	0.015
Leg score[6]	467[a]	464[a]	444[b]	436[b]	7.22	0.012
Conformation[6]	467[a]	464[a]	444[b]	436[b]	7.22	0.012
Flank streaking[7]	270	280	200	218	31.11	0.214
Quality grade[6]	456	447	417	417	19.68	0.377
WBSF[8], kg	4	3.7	3.9	4	0.26	0.800
Trichostrongyle type EPG	99.47	20.40	43.51	31.59	0.79	0.390
Nematodirus spp. EPG	1.58	0.55	0.00	0.00	0.38	0.265

[a-d] Least Square Means within a row with different superscripts differ (P < 0.10).
[1]Start date for treatments was June 12, 2014; end date for treatments was July 23, 2014.
[2]Pen is the experimental unit, 3 sheep per replicate and three replicates per treatment.
[3]Confinement treatments were: ALF = pellet containing 71% alfalfa, 18% barley, 5% molasses, and 6% vitamin/mineral package; BAR = pellet containing 60% barley, 26% alfalfa, 4% molasses, 2.5% soybean-hi pro, and 7.5% vitamin/mineral package.
[4]Diets were provided for ad libitum intake.
[5]Grazing treatments were: CNS = continuously grazed sweet clover (*Melilotus officinal*) cover crop at a stocking rate of 3 sheep per [0.07 ha] for 40 d; ROT = rotationally grazed sweet clover cover crop at a stocking rate of 3 sheep per [0.0175 ha]; rotations were every 5-d.
[6]325 = Good minus; 350 = Good; 375 = Good plus; 425 = Choice minus; 450 = Choice; 475 = Choice plus; 525 = Prime minus; 550 = Prime; 575 = Prime plus.
[7]100 to 199 = Practically Devoid; 200 to 299 = Traces; 300 to 399 = Slight; 400 to 499 = Small.
[8]Warner-Bratzler shear force (WBSF).