Evaluating the effect of South African Meat Merino breeding on pre and postweaning growth, feedlot performance, carcass traits, and wool characteristics in an extensive production setting

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INTRODUCTION

Between 2010 and 2015, wool sales represented 6.5% to 13% and lamb sales 76% to 83% of the annual returns to a typical Western rangeland sheep operation (LMIC, 2016). An economically sound breeding program should focus on improving lamb production traits while maintaining wool quality. Mating Western white-faced ewes (e.g., Rambouillet, Targhee) to terminal sire breeds (e.g., Suffolk, Hampshire) has improved lamb pre and postweaning growth (Leeds et al., 2012; Notter et al., 2012) and carcass characteristics (Mousel et al., 2012, 2013). However, fleece quality is significantly reduced in these crossbred lambs (Scales et al., 2000) and resulting ewe lambs are not typically kept as replacements. A white-faced, dual-purpose sire breed that can improve lamb traits without large sacrifices in wool quality would be beneficial to the Western sheep industry.

Selection in the South African Meat Merino (**SAMM**) has emphasized lamb and wool production (Neser et al., 2000; Cloete et al., 2004b). Cloete and Durand (2000) reported that SAMM × Merino lambs were heavier at birth and weaning but had lighter clean fleece weight, shorter staple length, and higher mean fiber diameter as yearlings than purebred Merinos. The SAMM is a relatively new addition to the United States with few purebred flocks and research reports (Meyerhoff et al., 2017). Therefore, the objectives of this study were to compare pre and postweaning growth, feedlot performance, carcass traits, and fleece characteristics of sheep reared by Rambouillet dams and sired by either Rambouillet, Suffolk, or SAMM rams.

MATERIALS AND METHODS

The Montana State University (**MSU**) Agricultural Animal Care and Use Committee approved all husbandry practices and experimental procedures (2016-AA17) used in this study. Commercial Rambouillet ewes were exposed to either Rambouillet (n = 5), SAMM (n = 5), or Suffolk rams (n = 2) in November 2015 and 2016 and lambs were born in April of the following years. In both production years, ewes and lambs were managed on native rangeland until weaning.

Approximately 3 mo after weaning in 2016, Rambouillet (n = 10), Suffolk (n = 10), and SAMM (n = 10) sired wethers with a similar BW across genotype were placed in a single drylot pen (129 m × 21 m) equipped with four GrowSafe bunks (GrowSafe Systems Ltd., Airdrie, AB, Canada).

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Lambs were adapted to the GrowSafe bunks and trial diet (15.1% crude protein, 61.6% total digestible nutrients) for 10 d and fed ad libitum thereafter. Fasted BW was collected on consecutive days at the start and end of the 89 d feeding trial. Wethers were harvested following the feeding trial.

Rambouillet and SAMM sired replacement ewe lambs were selected at weaning in 2016 and 2017 and managed with the adult ewe flock thereafter. BW was collected on 2016 born Rambouillet and SAMM sired ewes at approximately 12 mo of age. Greasy fleece weight (**GFW**) and mid-side wool samples were collected at shearing (February 2018) on 2016 and 2017 born Rambouillet (n = 45) and SAMM sired (n = 37) replacement ewes. Fiber metrology traits of side samples were analyzed at the MSU Wool Laboratory on an Optical-based Fiber Diameter Analyser 2000 (BSC Electronics Pty. Ltd., Attadale, Western Australia) according to the International Wool Textile Organization (2013).

Statistical Analyses

Lamb BW at birth (n = 405) and 120 d (n = 305) was analyzed within year in the MIXED procedure of SAS (v. 9.4; SAS Inst. Inc., Cary, NC) with fixed effects of sire breed, sex, dam age (2, 3, or 4+ yr), and birth or rear type (single or multiple) and the random effects of dam and sire. In the 2015 breeding season, Rambouillet ewes were exposed to Suffolk rams in multiple sire groups, therefore, sire identification was not available in 2016 born Suffolk cross lambs and they were not included in the 2016 analysis.

Feedlot lamb BW at the start and end of the trial, average daily gain (**ADG**), feed conversion ratio (**FCR**), and carcass characteristics were separately analyzed in the GLM procedure with the class effect of sire breed. Carcass characteristics included: dressing percentage (**DP**), loin, leg, and rack weights, back fat depth (**BF**), and loin eye area (**LEA**). Yearling BW and lamb and yearling GFW, mean fiber diameter (**MFD**), and CV of fiber diameter (**CV-FD**) were analyzed separately in the MIXED procedure with the fixed effect of sire breed and the random effect of sire.

RESULTS AND DISCUSSION

Preweaning Performance

Least-squares means for the main effects of birth or rear type, sex, age of dam, and sire breed on lamb BW at birth and 120 d in 2016 and 2017 are displayed in Table 1. Not surprisingly, single born/reared lambs were heavier at birth and 120 d ($P < 0.001$) than multiple born/reared lambs in both years. Males were heavier ($P < 0.001$) at birth than females in both years but sex had no effect ($P \geq 0.08$) on 120 d BW in either year. Age of dam did not affect ($P \geq 0.12$) lamb BW at birth or 120 d in either year.

In 2016, SAMM sired lambs were 0.2 kg heavier ($P = 0.04$) at birth than Rambouillet sired lambs. Suffolk sired lambs born in 2017 were 0.8 and 0.5 kg heavier at birth ($P \leq 0.01$) than Rambouillet and SAMM sired lambs, respectively, which were not different ($P = 0.12$). However, sire breed had no effect ($P \geq 0.38$) on 120 d BW in either year. Cloete and Durand (2000) reported that lambs sired by SAMM rams and reared by Merino ewes were 0.31 and 4.1 kg heavier at birth and 140 d, respectively, than purebred Merino lambs.

Table 1. Least-squares means (±SE) for the main effects of birth type (BT) or rear type (RT), sex, age of dam, and sire breed on lamb BW at birth and 120 d in the 2016 and 2017 production years

		2016		2017	
Effect	Level	Birth BW, kg	120 d BW, kg	Birth BW, kg	120 d BW, kg
BT, RT[a]	1	5.4 ± 0.10[c]	30.7 ± 0.70[c]	5.8 ± 0.13[c]	35.4 ± 0.73[c]
	2+	4.4 ± 0.08[d]	23.9 ± 0.81[d]	4.7 ± 0.11[d]	26.9 ± 0.76[d]
Sex	Ewe	4.7 ± 0.08[d]	26.5 ± 0.77	5.0 ± 0.10[d]	30.5 ± 0.69
	Wether	5.0 ± 0.08[c]	28.0 ± 0.74	5.5 ± 0.11[c]	31.8 ± 0.75
Age of dam, yr	2	5.0 ± 0.18	27.3 ± 1.72	5.0 ± 0.18	30.2 ± 1.07
	3	4.7 ± 0.08	26.9 ± 0.66	5.6 ± 0.20	32.8 ± 1.23
	4+	4.8 ± 0.07	27.7 ± 0.49	5.1 ± 0.09	30.5 ± 0.60
Sire breed[b]	Rambouillet	4.8 ± 0.07[d]	27.4 ± 0.70	4.9 ± 0.12[d]	31.0 ± 0.89
	SAMM	5.0 ± 0.07[c]	27.1 ± 0.81	5.2 ± 0.15[d]	30.4 ± 0.93
	Suffolk	—	—	5.7 ± 0.15[c]	32.1 ± 1.13

[a]BT, RT= observed birth type for birth BW or rear type at for 120 d BW.

[b]Lambs sired by either Rambouillet, South African Meat Merino (SAMM), or Suffolk rams and raised by Rambouillet ewes.

[c,d]Means within an effect and column are different ($P < 0.05$).

Feedlot Performance and Carcass Characteristics

Least-squares means for the main effect of sire breed on feedlot performance and carcass characteristics are presented in Table 2. Sire breed had no effect on BW at the start or end of the trial, ADG, or FCR ($P \geq 0.25$). Meyerhoff et al. (2017) reported similar results where no difference in BW gain or feed efficiency was observed between purebred and crossbred Rambouillet rams of varying (25–50%) SAMM breeding.

Suffolk sired lambs had the greatest DP (53.7%; $P \leq 0.001$), but DP of Rambouillet (50.0%) and SAMM sired (51.2%) lambs was not different ($P = 0.12$). Suffolk sired lambs also had the heaviest ($P \leq 0.01$) loin (3.11 kg) and leg weights (5.53 kg), but these were not different ($P \geq 0.52$) between Rambouillet (2.80 and 4.90 kg, respectively) and SAMM sired lambs (2.78 and 4.99 kg, respectively). No difference ($P = 0.28$) in rack weight was observed among sire breeds. Cloete et al. (2008) compared carcass characteristics of terminally sired lambs reared by either purebred SAMM or SAMM × Merino dams and found that while shoulder weight increased with proportion of SAMM breeding, hindquarter and loin weight did not.

Table 2. Least-squares means (±SE) for the main effect of sire breed on feedlot performance and carcass characteristics

	Sire breed[a]		
Trait[b]	Rambouillet	SAMM	Suffolk
Start BW, kg	39.0 ± 0.72	38.7 ± 0.72	39.7 ± 0.72
End BW, kg	60.8 ± 1.06	60.3 ± 1.06	62.7 ± 1.06
ADG, g d^{-1}	245.8 ± 8.6	241.3 ± 8.6	258.5 ± 8.6
FCR	10.6 ± 0.37	10.7 ± 0.37	10.3 ± 0.37
DP, %	50.0 ± 0.51[d]	51.2 ± 0.48[d]	53.7 ± 0.48[c]
Leg, kg	4.90 ± 0.11[d]	4.99 ± 0.10[d]	5.53 ± 0.10[c]
Loin, kg	2.80 ± 0.08[d]	2.78 ± 0.08[d]	3.11 ± 0.08[c]
Rack, kg	2.62 ± 0.06	2.54 ± 0.06	2.68 ± 0.06
LEA, cm[b]	15.2 ± 0.37	15.68 ± 0.37	16.39 ± 0.37

[a]Lambs sired by either Rambouillet, South African Meat Merino (SAMM), or Suffolk rams and raised by Rambouillet ewes.

[b]Start BW = BW at the start of the trial; End BW = BW at the end of the trial; ADG = average daily gain; FCR = feed conversion ratio; DP = dressing percentage; Leg, Loin, and Rack = weight of leg, loin, and rack, respectively; LEA = loin eye area.

[c,d]Sire breed means within a trait are different ($P < 0.05$).

Wool Characteristics and Yearling BW

Least-squares means for the main effects of age of ewe and sire breed on wool characteristics are displayed in Table 3. Two-yr-old ewes had heavier GFW, coarser MFD, and lower CV-FD ($P \leq 0.005$) than 1-yr-old ewes. Mid-side wool samples of SAMM sired ewes were 2.1 µm coarser ($P = 0.04$) than Rambouillet sired ewes, but sire breed did not influence GFW or CV-FD ($P \geq 0.40$). Cloete and Durand (2000) reported that SAMM × Merino ewes had 0.81 kg lighter yearling GFW and 1.5 µm coarser MFD than purebred Merino ewes but did not differ in CV-FD. In the present study, Rambouillet sired ewes were heavier (45.6 kg; $P < 0.001$) as yearlings than SAMM sired ewes (41.5 kg). In contrast, Cloete and Durand (2000) reported that SAMM × Merino yearling ewes were 11.0 kg heavier than purebred Merino yearling ewes.

IMPLICATIONS

The SAMM is a relatively new addition to the U.S. sheep industry and has not been extensively compared with breeds commonly used in Western sheep production. The majority of the reviewed literature compared the performance of purebred Merino and crossbred SAMM × Merino sheep. Although the Rambouillet and Merino are both fine-wool breeds, they have differences in growth rate and mature BW (Snowder et al., 1997a, b). Results from the present study indicate that 120 d BW and carcass characteristics were similar between purebred Rambouillet and SAMM × Rambouillet lambs. However, Rambouillet sired

Table 3. Least-squares means (±SE) for the main effects of sire breed and ewe age on yearling greasy fleece weight (GFW), mean fiber diameter (MFD), and CV of fiber diameter (CF-FD)

		Trait		
	Level	GFW, kg	MFD, µm	CV-FD, %
Sire breed[a]	Rambouillet	2.0 ± 0.06	19.9 ± 0.38[c]	17.6 ± 0.44
	SAMM	2.0 ± 0.06	22.0 ± 0.40[b]	17.0 ± 0.46
Age of ewe, yr	1	1.4 ± 0.06[c]	19.7 ± 0.32[c]	17.9 ± 0.38[b]
	2	2.7 ± 0.06[b]	22.2 ± 0.40[b]	16.6 ± 0.40[c]

[a]Ewes sired by either Rambouillet or South African Meat Merino (SAMM) and raised by Rambouillet ewes.

[b,c]Means within an effect and column are different ($P < 0.05$).

ewes were heavier as yearlings and had lower MFD than SAMM sired ewes. These results should be interpreted judiciously as a preliminary component of a multi-year study. Future research evaluating lifetime lamb and wool production of SAMM cross ewes is ongoing with this project.

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