

# INTROGRESSION OF THE FEC<sup>B</sup> ALLELE OF THE BOORoola MERINO INTO A RAMBOUILLET FLOCK - 1996 PROGRESS REPORT

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The Booroola Merino is a highly prolific strain of medium-wooled non-Peppin Australian Merino which has been extensively studied and evaluated worldwide. Their exceptional reproductive performance is due to a single major autosomal allele, presently denoted as Fec<sup>B</sup>.

The study started at the Dixon Springs Agricultural Center of the University of Illinois in 1985, and the project was moved to the Arlington Agricultural Research Station of the University of Wisconsin-Madison in 1991. This report presents results obtained at the Wisconsin site from the autumn of 1991 through lambing in the spring of 1996.

Rambouillet and homozygous (Fec<sup>BB</sup>) Booroola Merino rams initially were mated to the flock of Rambouillet ewes. Booroola Merino-cross female progeny from this mating and subsequent matings were backcrossed to Rambouillet rams, and only BM-cross ewe lambs from dams expected to be heterozygous (Fec<sup>B+</sup>) were retained as replacements. The same Rambouillet rams were mated with the Rambouillet and BM-cross ewes. Lambs were weaned at approximately 60 days of age. Rambouillet replacement ewes were selected on estimated genetic merit for litter size. Ewes were mated in order to lamb first at approximately 2 years of age and annually thereafter. Prior to breeding each year, ovulation rate of ewes was determined by counting number of corpora lutea with a laparoscope. Booroola Merino-cross ewes were classed as carriers (Fec<sup>B+</sup>) if they had 3 or more ovulations at their first examination at approximately 19 months of age.

To indicate the size of the experiment, the number of observations for ovulation rate (trait with the greatest number of observations) and litter size (trait with the fewest number of observations) are presented in Table 1.

Table 1. Number of Observations for Ovulation Rate and Litter Size by Proportion of Rambouillet (R) Breeding and Genotype at the Fec Locus.

Trait	1/2 R Fec <sup>B+</sup>	3/4 R Fec <sup>++</sup>	3/4 R Fec <sup>B+</sup>	7/8 R Fec <sup>++</sup>	7/8 R Fec <sup>B+</sup>	15/16 R Fec <sup>++</sup>	15/16 R Fec <sup>B+</sup>	Ramb. Fec <sup>++</sup>
Ovulation rate	53	63	103	21	38	2	2	322
Litter size	47	37	92	16	38	2	3	288

Carriers of the  $Fec^B$  allele had 1.66 more ( $P < .01$ ) ovulations than non-carriers, and this difference was relatively consistent within the three backcross groups (Table 2). Rambouillet ewes weighed 16.3 kg more ( $P < .01$ ) than  $F_1$  Booroola Merino x Rambouillet ewes. As the proportion of Rambouillet breeding increased in the backcrosses, the breeding weights tended to increase, but at a slower rate than may be expected. Within backcross groups,  $Fec^{B+}$  ewes have slightly lighter breeding weights than  $Fec^{++}$  ewes; probably the result of the negative effects of increased number of lambs raised by the  $Fec^{B+}$  ewes on their subsequent body weights. Fleece weights were slightly greater for  $Fec^{++}$  ewes.

Table 2. Prebreeding Traits and Fleece Weight.

Ramb. breeding Fec genotype	Ovulation rate, no.	Breeding wt., kg	Condition score	Fleece wt., kg
1/2 Rambouillet $Fec^{B+}$	3.76±.14	57.0±2.1	3.19±.11	4.78±.19
3/4 Rambouillet $Fec^{++}$	1.91±.11	63.0±1.4	3.17±.08	4.89±.16
$Fec^{B+}$	3.43±.09	59.7±1.2	3.21±.06	4.65±.12
7/8 Rambouillet $Fec^{++}$	1.89±.17	65.6±1.9	3.26±.11	5.20±.21
$Fec^{B+}$	3.63±.15	63.7±1.7	3.51±.09	4.62±.18
15/16 Rambouillet $Fec^{++}$	1.60±.44	66.7±4.4	3.18±.26	4.79±.49
$Fec^{B+}$	3.27±.44	63.8±4.3	3.25±.25	4.53±.47
Rambouillet $Fec^{++}$	2.06±.05	73.3±.7	3.48±.04	4.98±.07
Contrast $Fec^{B+} - Fec^{++}$	1.66**	-6.1**	.02	-.32 <sup>†</sup>

\*\* $P < .01$ , <sup>†</sup> $P < .10$ .

Even with the high ovulation rates of  $Fec^{B+}$  ewes presented in Table 2, the lamb production of these ewes continues to be disappointing (Table 3). Weight of lamb weaned at 60 days per ewe exposed (ewe productivity) was not significantly different between  $Fec^{B+}$  and  $Fec^{++}$  ewes. The  $Fec^{B+}$  ewes gave birth to .53 more ( $P < .01$ ) lambs per ewe than did  $Fec^{++}$  ewes, but the lambs from  $Fec^{B+}$  ewes had greater mortality and were lighter at 60 days of age than lambs from  $Fec^{++}$  ewes. The lamb production advantage of the  $Fec^{B+}$  ewes at birth was lost by weaning.

However,  $Fec^{B+}$  ewes weaned approximately .34 more lambs per ewe exposed than did  $Fec^{++}$  ewes (1.93 vs. 1.59 lambs per ewe exposed, respectively). If lambs are marketed at a constant live weight of 53 kg and assuming no lamb losses from weaning to marketing, weight of

lamb marketed per ewe exposed would be 102.3 kg for Fec<sup>B+</sup> ewes and 84.3 kg for Fec<sup>++</sup> ewes. With lambs valued at \$1.85 per kg live weight, gross lamb income per ewe would be \$33.30 higher for Fec<sup>B+</sup> ewes compared to Fec<sup>++</sup> ewes. An economic analysis needs to be conducted to determine if this potential increase in gross income from Fec<sup>B+</sup> ewes will offset their greater costs of production, e.g. increased ewe feed costs during late pregnancy and lactation, increased lamb feed costs for more and lighter lambs, increased labor in caring for ewes of higher prolificacy, increased costs from more artificially reared lambs, etc.

Table 3. Lamb Production.

Ramb. breeding Fec genotype	Fertility, %	Prolificacy, no.	Lamb survival, %	Lamb wean. wt., kg	Ewe produc- tivity, kg
1/2 Rambouillet Fec <sup>B+</sup>	95.4±3.0	2.61±.14	81.0±4.8	16.7±.6	33.0±2.3
3/4 Rambouillet Fec <sup>++</sup>	100±3.6	1.68±.13	95.1±6.1	23.0±.7	36.6±2.9
Fec <sup>B+</sup>	96.7±2.2	2.72±.09	75.2±4.0	17.8±.5	33.9±1.7
7/8 Rambouillet Fec <sup>++</sup>	94.0±5.7	1.83±.17	90.5±9.3	23.0±1.1	38.0±4.5
Fec <sup>B+</sup>	100±4.3	2.12±.14	84.8±6.9	19.5±.8	33.0±3.4
15/16 Rambouillet Fec <sup>++</sup>		2.44±.50			
Fec <sup>B+</sup>		2.51±.37			
Rambouillet Fec <sup>++</sup>	94.3±1.4	1.84±.05	92.4±3.7	21.7±.4	34.5±1.1
Contrast Fec <sup>B+</sup> - Fec <sup>++</sup>	2.2	.53**	-12.3**	-4.6**	-3.1

\*\*P < .01.