Some Ontario sheep producers have been asking the question: What frame size of ewe should we be targeting for the best overall efficiency. The question is such that, while larger ewes (within a breed) should give more lambs born and larger kilograms of weaned lamb, would that extra kilograms of lamb cover the extra feed associated with a larger ewe? As completing such a trial would include a number of unknowns (would proposed feed set-up work, what numbers would be required to get statistical significance) it was decided to do a preliminary trial with eight ewes first. While this number of ewes would not likely give a statistically clear answer to the original question, it would indicate to whether the question could be answered reasonably.

A string of feeders from Amerian Calan that have special entry doors that only open when a ewe wearing the correct RFID pendant tries to open it, were purchased. With this system the amount of feed each ewe consumes each day could be weighed. It was very seldom that the system failed. There were less than 10 incidences of individual mix ups over the eight month trial. The research team believes the data collected was sound. Training the ewes to find their own feeder was surprisingly easy as corn is a wonderful motivator. At first the doors were tied open so the ewes could get used to sticking their heads in the feeder. Then they were untied but the locks were blocked so they could learn to push the doors open. And then finally the doors were made completely functional and the ewes had to learn which door was their own to open. Training took approximately 7 days. Ewes were not observed stealing feed from another feeder throughout the trial, though attempts were observed.

Three large framed ewes, two medium framed ewes and three small framed ewes were selected. All ewes were from the University of Guelph's Ponsonby Sheep Facility and were of Rideau Arcott base. Ewes available for selection were limited but the weights ranged from 50 kg to 88 kg at the beginning of the trial. Ages ranged from 4 to 7 years with the average age being just under 6 years old at the beginning of the trial. Ewes were weighed at various stages of production (breeding/early gestation, mid gestation, late gestation, lambing and weaning).

A vasectomized ram was placed in the pens for 14 days from October 21 to November 4. As he had a ram harness/marker on, there was confirmation that he mated with six of the eight ewes. On November 4 an intact Dorset ram was placed in the pens with the ewes with a different coloured marker. By November 18 he had bred all eight ewes and the marker was changed to another colour. In the next 14 days there were no other breedings recorded and the ram was removed from the ewes. Because the rams had no access to a feeder when with the ewes, they were removed each day for about 30 minutes and offered feed in an adjacent pen. On January 8 the ewes were all confirmed pregnant by ultrasound.

Ewes began to lamb on April 1 and continued to April 14. At birth lambs were tagged, tails were docked, given a shot of selenium and weighed. In order to ensure lambs were not confused between ewes at lambing, all ewes were placed in a claiming pen two or three days before their predicted lambing date. Supplemental heat was made available in a hover by way of a heat lamp in each claiming pen. Approximately three days after lambing the ewes and lambs were returned to the general pen in which a creep area was provided for the lambs. Lambs were weaned and weighed at 60 days. Depending on stage, ewes received grass hay, alfalfa hay, whole corn and/or supplement (the corn/oats/barley feed from previous lamb trial) for feed. A total consumption for the entire project was calculated for each

feed and a feed cost was determined for each ewe. Table 1 shows some ewe, weaned lamb and feed data across the three ewe weight categories.

Table 1.

	Light ewes			Medium ewes			Heavy ewes			p
	Mean	StdErr		Mean	StdErr		Mean	StdErr		
ewe weight	52.2 kg	4.6	a	71.2 kg	5.7	ab	81.3 kg	4.6	b	0.02
lambs weaned	2.33	0.35	a	2.50	0.43	a	2.67	0.35	a	0.80
total weaned lamb weight	47.13 kg	6.93	a	59.20 kg	8.49	a	69.53 kg	6.93	a	0.17
average lamb weight	20.00 kg	2.51	a	23.70 kg	3.08	a	27.03 kg	2.51	a	0.24
total feed fed	432.23 kg	30.21	a	459.55 kg	37.00	a	589.07 kg	30.21	b	0.03
total feed cost	$68.24	4.18	a	$75.60	5.12	a	$96.16	4.18	b	0.01
ewe feed cost per lamb weaned	$30.65	5.34	a	$31.91	6.54	a	$37.14	5.34	a	0.69
ewe feed cost per kg of lamb weaned	$1.55	0.23	a	$1.35	0.28	a	$1.38	0.23	a	0.82

Rows with different letters (a,b) differ (P< 0.10).

Even though there are relatively large differences between the highest and lowest treatment averages for feed cost per lamb and feed cost per kg of lamb (21% and 15%, respectively), neither was significant. Given that every last detail affecting a trait cannot be explained, there will always be some variation around an average. If a measure of that variation can be determined, it would be possible to determine how many replicates are needed to determine whether some factor has an impact on that trait. In order to confirm whether ewe mature frame size has any impact on the amount of lamb produced per dollar spent on ewe feed, 43 replicates per treatment (for ewe feed cost per lamb) and 83 replicates per treatment (for ewe feed cost per kg of lamb) would be required. Table 2 lists the mean, standard deviation, coefficient of variation and replicates required to determine if the difference seen in our preliminary trial are significant or not for the factors listed in Table 1.

Table 2.

	mean	standard deviation	Coefficient of variation	Replicates required per treatment*	Difference observed
lambs weaned	2.50	0.64	25.6	73	14%
total weaned lamb weight	58.55	12.68	21.7	7	48%
average lamb weight	23.56	4.60	19.5	9	35%
total feed fed	497.88	55.27	11.1	4	36%
total feed cost	80.55	7.65	9.5	3	41%
feed cost per lamb	33.40	9.77	29.3	43	21%
feed cost per kg of lamb	1.44	0.42	29.3	83	15%

*replicates required to determine if the difference observed was significant.

So what are the results from this preliminary trial? First of all, the set up worked at it worked well. The data from this trial also indicates that in order to get enough data to make a conclusive decisions on the issue of what frame size is the most economical with respect to ewe feed intake relative to weaned lamb or kg of weaned lamb, approximately 80 replicates per treatment are required. This does not mean the difference is so small that it is not important – dropping feed costs by 15 to 20% relative to income is immense but it is a considerably larger project to complete. It is doable but it would not be inexpensive.

There are other factors that must come into a calculation about ideal frame size for a ewe as well. For example, what is the weight a producer ships market lambs at? There is an article on the OMAFRA website that indicates that the average mature weight of your rams and ewes should be twice the final market weight of your lambs. If you wish to ship larger lambs, the issue of efficiency may be decided by this factor. It should be a simple matter of fact that if commercial market lambs are being produced that there is crossbreeding – if not more money is being left on the table than the mature size of ewes can ever provide. For example, if a 120 kg terminal ram is used on the three ewes sizes above, then the target shipping weight would be around 43 kg (95 lb), 47.5 kg (105 lb) and 50 kg (110 lb) for the small, medium and large ewes, respectively. If 50 kg or higher lambs are to be shipped then the size of the ewes has probably been already determined to be the larger ewes. The efficiency lost by trying to get small frame lambs to higher weights is unknown but would be an interesting question that would be related.

A few comments about the project set up would be appropriate. The research team has significant confidence in the data collected. While there were a few problems with a feeder being frozen shut off and on for a few days, when the solution was figured out, it was a relatively easy fix. The project was rather labour intensive. Weighing out individual feed for eight ewes takes time and it would be a bit concerning to think about having to do so with a larger group – certainly a dedicated technician would be required. All the hay that was fed was chopped in order to reduce wastage and to increase the amount that could fit into each feeder. The drawer size was a significant setback as during various stages a ewe's daily intake could not fit into the feeder at once. Certainly a setup with 64 such feeders (maximum that could be fit in current facility) would yield very powerful data – but it would be costly.

In conclusion, the project set up works – and there is full confidence in the data it provided. There were not enough replicates to determine if the extra feed costs associated with larger framed ewes were outweighed by an increase in weaned lambs or kg of weaned lambs but it was determined that around 80 replicates of each treatment would be sufficient.

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