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Early Morning Walk

Performance of Prolific Romanov, Finnsheep and Booroola Breeds and Their Crosses

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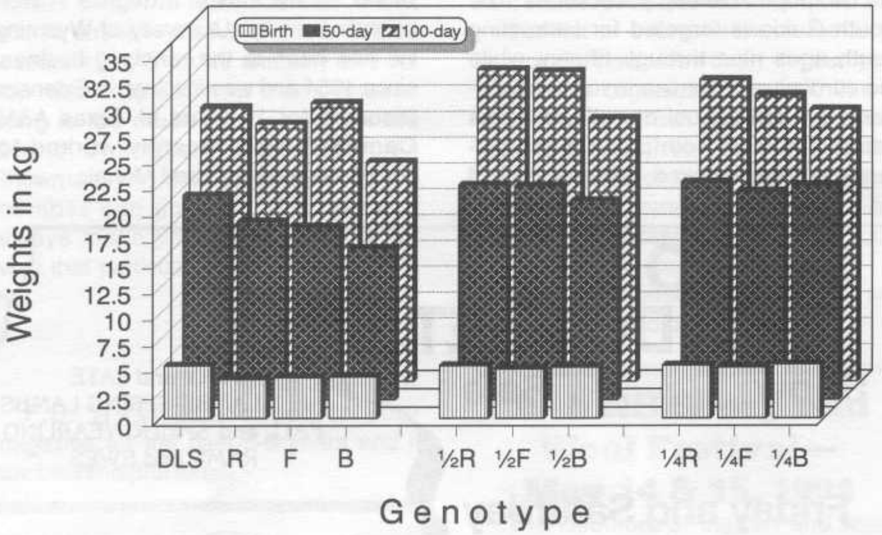
Improving local breeds has been the main reason for importing prolific breeds into North America. Crossbreeding with Finnsheep was not very popular in Canada because the crosses, though superior in prolificacy to the local breeds, were inferior in many other aspects of productivity, particularly lamb survival and growth rate. Importation of and crossbreeding with Romanov was tried as an alternative to Finnsheep. The recent discovery of a prolificacy gene in Booroola Merino sheep provided another means for improving prolificacy in local sheep using a different approach.

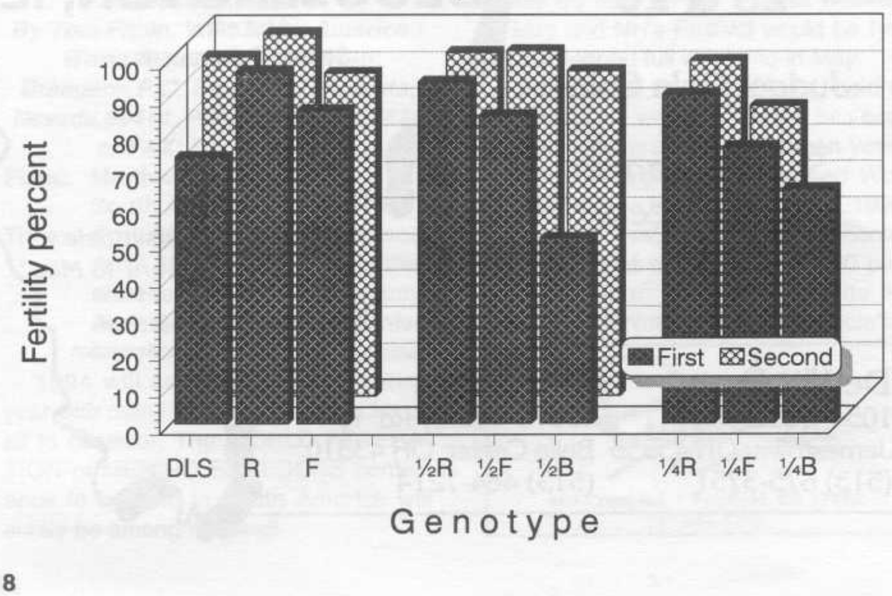
The increased popularity of prolific breeds and the huge expansion in using rams from prolific breeds on native breeds to produce prolific crosses required information on the relative performance of these breeds and crosses. The preliminary results on the performance available from a Canadian study were published in the September 1991 issue of *The Shepherd*. Recently, we reanalyzed the data, and included the information we gathered on the prolific pure breeds, Romanov, Finnsheep and Booroola. The present article summarizes the results obtained, and should answer many questions being raised by prolific sheep breeders. For readers who do not remember the first article and the newcomers to *The Shepherd*, a brief background of why we had undertaken this project and what we did to arrive at our objectives is in order.

(Figure 1) Birth, 50- and 100-day weights of DLS, Romanov, Finnsheep, and Booroola pure- and crossbred lambs

(Averages presented are adjusted to single male lamb born to 2-3 year old ewe equivalent)



(Figure 2) Fertility of pure- and crossbred ewes at first and second parities



There are two types of prolific sheep, prolificacy is either controlled by numerous genes and transmitted quantitatively as in Finnsheep and Romanov, or is controlled by what is believed to be one of a few closely associated genes with large effect on ovulation rate such as in the Booroola. Studies comparing breeds from both types of prolificacy simultaneously and/or their crosses with non-prolific breeds commonly used by the industry are still rare. To obtain the necessary information to pass on to breeders, an intensive crossbreeding program was initiated at La Pocatière Experimental Farm in Quebec. A secondary objective was to improve prolificacy in DLS sheep, a breed we developed in Quebec (*The Shepherd*, August 1990) by crossing with prolific breeds. To achieve these objectives, Romanov (R) and Finnsheep (F), representing the first type of prolificacy, and Booroola (B), representing the second type, were crossed with the DLS and backcrossed to the DLS.

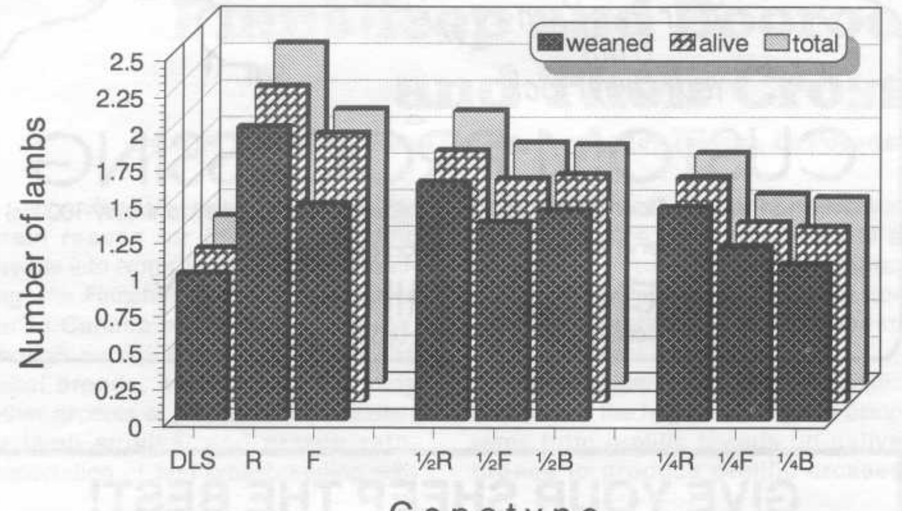
To have a valid comparison it was essential to have all the animals from the different groups born, raised, and produce at the same time. It took several years of planning to achieve that. First, during the fall of 1985, R and F rams mated DLS ewes to produce crossbred rams R x DLS and F x DLS. Then, in the following Fall, rams from each of R, F, and B breeds mated ewes of their own breeds and DLS ewes to produce purebred and first-cross lambs. First-cross R x DLS and F x DLS rams produced the previous year were mated to DLS ewes to produce backcrosses. Other DLS ewes were mated to DLS rams to produce purebred DLS offspring. The target was to produce 30 to 35 females from each of pure R, F, B, DLS; first cross $\frac{1}{2}$R, $\frac{1}{2}$F, $\frac{1}{2}$B; and backcross $\frac{1}{4}$R, $\frac{1}{4}$F, and $\frac{1}{4}$B, in the spring of 1987 and similar numbers in the spring of 1988. However, because the B x DLS rams were not available until 1987, more DLS ewes were allotted to the B rams in 1987 to achieve the target number of 70 ewes from these matings, whereas in 1988 more DLS ewes were allocated to the B x DLS rams, with fewer allocated to the pure B rams. Although a group of pure B was also produced, this group was used to study growth and was removed from the study of reproductive traits due to the limited number of ewes, resulting from a high ewe and lamb mortality and unfavorable sex ratio.

The lambs produced from these matings were born in February and March 1987 and 1988. Records were available on weights at birth, day 50, and day 100 of 776 male and 602 female lambs. In late November and December 1987 and 1988, the females available (8 to 9 months old) were divided into 10 mating groups in which each genetic group was represented by at least three ewes. Two rams from each of DLS, R, F, B, and Coopworth (C) were used for a 6-week mating period. The rams that served in 1987 were replaced for the matings of 1988. The plan was to keep the ewes in the same mating groups and alternate the breed of ram at each mating, so after five matings, each ewe genotype would have been mated to rams from all the breeds involved in the crossing, and to C as a different breed to all of them.

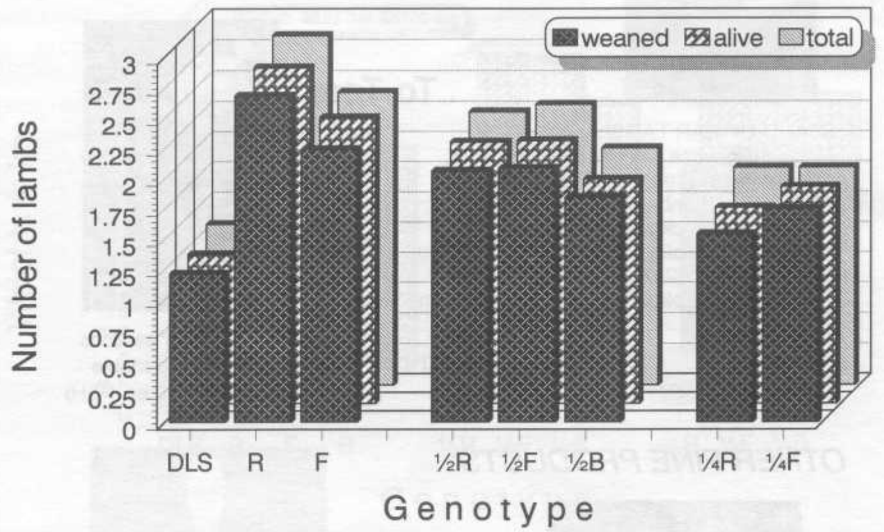
Animals born in 1987 were mated in December 1987, August 1988 and May 1989; those born in 1988 were mated in December 1988, and August 1989. The study was planned to last until 1993, so each group would have completed at least five lambings; however, a fire in October 1989, destroyed the facilities and killed all the animals.

Records of the first two lambings of ewes born in 1987 and first lambing of those born in 1988 were collected. These included weights at birth, day 50 and day 100, and preweaning and postweaning ADG, (also collected on 776 male sibs) fertility, total number of lambs born, number born alive, and number of

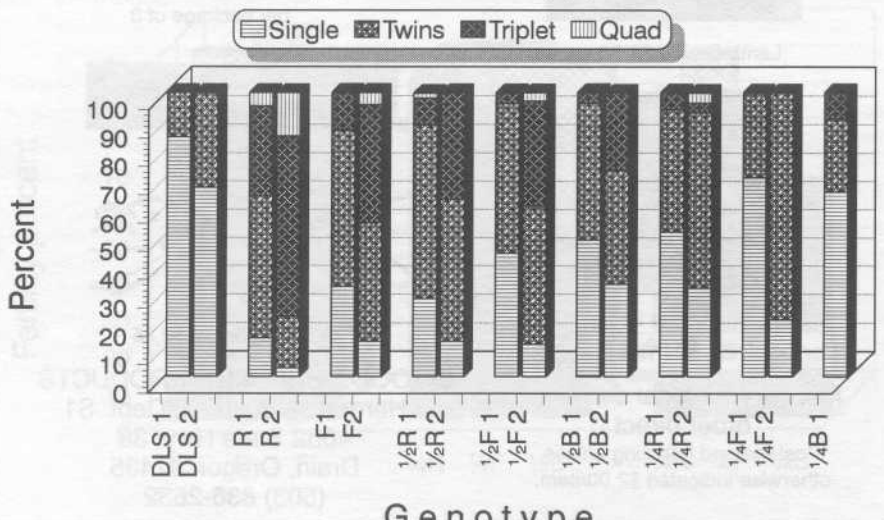
(Figure 3) Number of lambs born and weaned of purebred and crossbred ewes at first parity



(Figure 4) Number of lambs born and weaned of purebred and crossbred ewes at second parity



(Figure 5) Distribution of ewes producing litters of 1 to 4 lambs at first (1) and second (2) parities



lambs weaned per ewe (whether raised by her or artificially). Lambs born as triplets or quadruplets were left with their dams for 24 hours. Then only two lambs, usually the strongest, were left with the dam. The extra lambs were raised artificially for 30 days on milk replacer using an automatic dispensing machine. Also available, were litter birth and weaning weights and greasy fleece weights of ewes at their first (1987- and 1988-born ewes) and second (1987-born ewes) shearing. Ewes born in 1987 were shorn for the first time in May 1988 and again in February 1989, which represented 14-15 month and 9-10 month growth, respectively. Ewes born in 1988 were shorn in February 1989, which represented 12 month growth.

To obtain unbiased means for the different growth traits, it was important to adjust for differences in sex, birth rank, and age of dam. The data were adjusted to male, single, born to 2 to 3-year-old ewes equivalent, which means that the averages presented in the following figures are those for single males born to mature ewes. Figure 1 presents weights of lambs using the adjusted data. Booroola backcross lambs weighed 5.1 kg and were the heaviest at birth, whereas pure R lambs weighed 3.7 kg and were the lightest. The fastest preweaning ADG was made by ¼R (322 g) and ½F and ½R crosses. Preweaning growth of R and F lambs was similar, and between day 50 and day 100, growth of ½F and ½B and ¼R crosses was not significantly different from the average of their respective parental breeds, i.e., they did not show heterosis. Pre- and post-weaning growth rate of B and its crosses were generally lower than those of R and F and their crosses, with the exception of preweaning ADG of B and F backcrosses. At day 50 and day 100 the crosses and DLS weighed more than the three prolific breeds with three exceptions (F heavier than DLS, ¼B, and ½B at day 100 weight).

Only 50% of ½B and 64% of ¼B yearlings conceived at 8 to 9 months of age (Figure 2). Conception rate improved to 89% for ½B in second parity. Purebred R had the highest fertility rate at both parities, approximately 10% higher than F; these breeds were significantly more fertile than DLS at first parity, but non-significantly different at second parity.

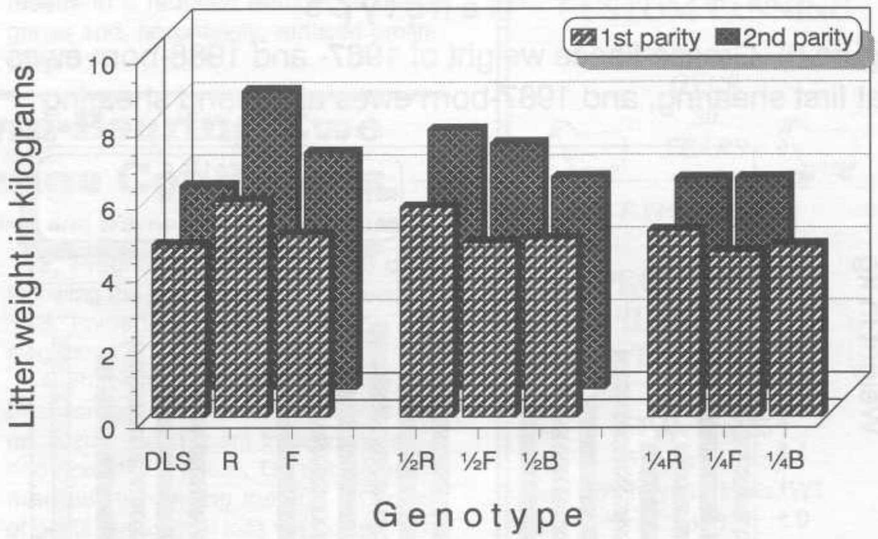
At first parity, R purebreds were more prolific than F and DLS purebreds and R crossbreds were more prolific than F and B crossbreds (Figure 3). At second parity (Figure 4), although R purebreds were still more prolific than F by 0.5 lamb, the crosses of the two breeds were equally prolific. Romanov and F first crosses showed more prolificacy than B first cross, however, the differences were not tested statistically (Figure 4). The higher prolificacy of the R than of the F ewes resulted from higher percentage of triplets and quadruplets and lower percentage of single births (Figure 5). The distribution of births for first and backcross ewes also indicated a better performance for R crosses. There was a marked improvement in prolificacy with advance in parity for ½B, reflecting the slower sexual maturity for ewes with Merino ancestry. The presence of the fecundity gene from B in a ½B cross was responsible for 0.4 and 0.6 more weaned lambs than DLS at first and second parities, respectively. These effects of the B genes resulted in less prolificacy than those caused by a sample half of R genes at first (0.63 lambs) and second (0.83 lambs) parities. When comparing the prolificacy from the B genes with that of F, the effect was equal to a sample half of F genes at first parity (0.36 lambs) but less than at second parity (0.87 lambs).

Lamb survival at birth in litters of ewes of all genotypes was generally high, ranging from 91% for DLS to 98% for F ewes at first parity, and between 90% for ¼R to 99% for ¼F at second parity. Survival rate between birth and day 50 of age was lowest in pure F ewes (80%), whereas in the other ewe genotypes, it ranged between 89 and 97% at first parity. At second parity, it was generally high in all ewe genotypes (95 to 100%).

At first parity, the number of lambs weaned averaged 2.0 for R, compared with 1.5 for F and 1.0 lamb for DLS. Romanov first and backcross ewes weaned more lambs than F and B crosses, the latter two being similar in performance (Figure 3). At second parity, R ewes weaned 2.7 lambs compared with 2.2 for F and 1.2 for DLS (Figure 4). At first and second parities, the averages for ½R and ½F ewes were 1.5 and 2.1 lambs at day 50, which were 0.1 and 0.3 lambs more than those for ½B, respectively. First parity average litter size at day 50 for ¼R and ¼F ewes was 0.25 lambs more than ¼B ewes.

Romanov, followed by ½R ewes, lambed the heaviest litters at both parities (5.9 and 5.7 kg first, and 8.2 and

(Figure 6) Litter birth weight at first and second parities of ewes from prolific breeds and crosses

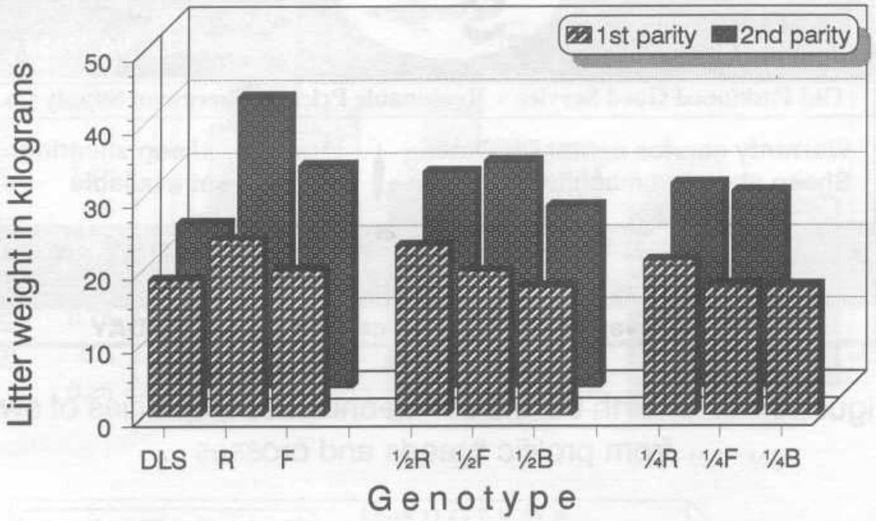


7.1 kg second parity, respectively [Figure 6]). Romanov ewes also weaned the heaviest litters at both parities (24.0 and 39.9 kg), followed by ½R at first parity (23.1 kg) and ½F at second parity (31.0 kg). At first parity, ¼B and ¼F crosses were similar in litter weights at birth and day 50, whereas the litters of ½B ewes were 0.1 kg heavier at birth but 2.1 lighter at day 50 than ½F ewes. At second parity, ½R litters were 0.38 kg heavier than F, and 1.31 kg heavier than ½B crosses at birth, whereas at day 50, ½F cross litters were the heaviest, 1.48 and 6.13 kg heavier than ½R and ½B crosses, respectively.

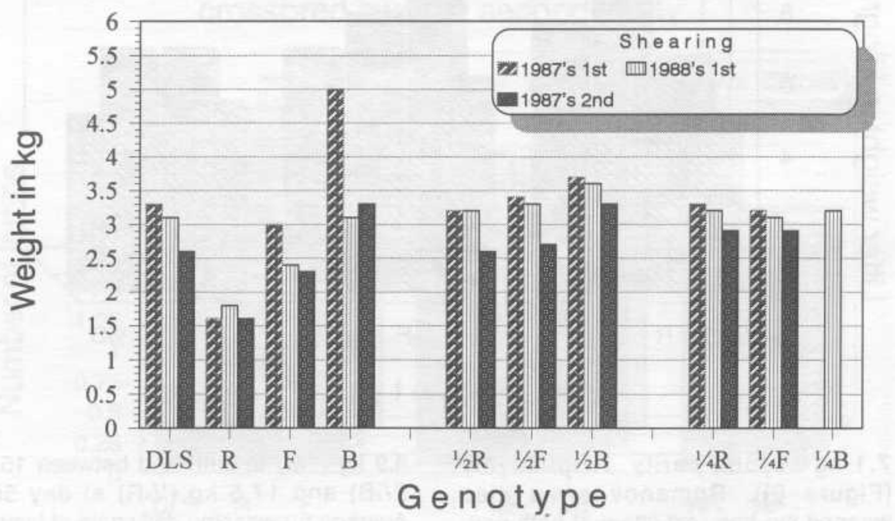
Birth and weaning weights, adjusted to single, male equivalent of lambs born to ewes from the nine ewe genotypes sired by rams from five breeds are presented in Figure 8. The lambs born to DLS ewes were the heaviest at birth (4.2 kg) and at weaning (17.5 kg). Lambs born to other ewe genotypes varied in weight between 3.4 (F) and 3.9 kg (¼B) at birth and between 15.5 (½B) and 17.5 kg (¼R) at day 50. Average preweaning daily gain of lambs ranged between 252 g/d for pure F ewes and 275 g/d for ¼R ewes; the difference was small and nonsignificant. Only lambs from ½B ewes and especially those sired by B rams showed the lowest growth rate (235 and 210 g/d, respectively).

As expected, B and its crosses excelled in fleece weight, whereas R ewes had the lowest wool production. The difference between R and F was significant. Booroola first-cross ewes were higher in wool production to R and F first-crosses, whereas the three backcrosses showed similar performance (Figure 9). The differences between F and B first crosses and F backcross and the average of the two respective parental breeds were highly significant, indicating a superiority of the crosses in wool production, whereas those of the R two crosses and B backcross were nonsignificant.

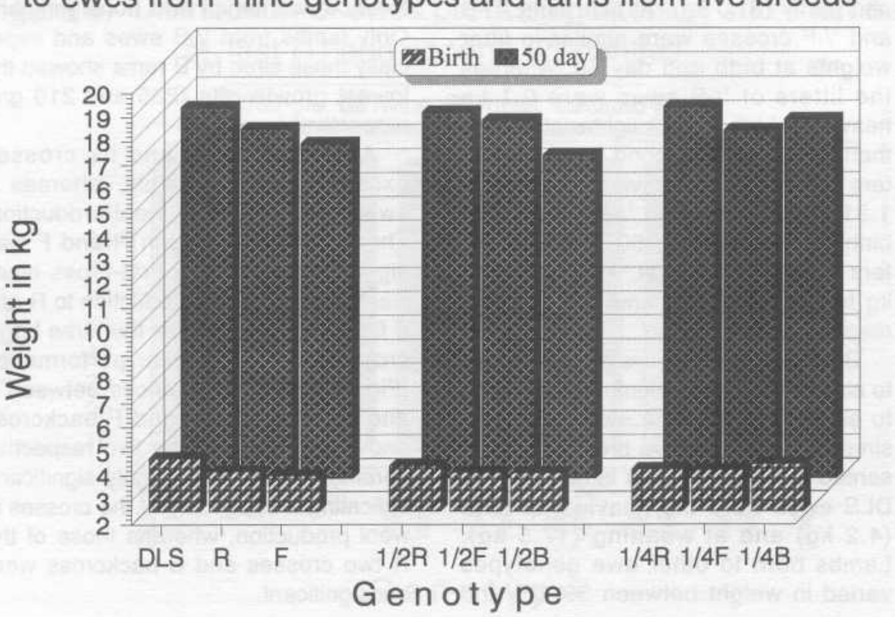
(Figure 7) Litter 50-day weight at first and second parities of ewes from prolific breeds and crosses



(Figure 9) Grease fleece weight of 1987- and 1988-born ewes at first shearing, and 1987-born ewes at second shearing



(Figure 8) Average weights at birth and 50 day of lambs born to ewes from nine genotypes and rams from five breeds



It is well recognized that in crossbreeding with prolific breeds, undesirable characteristics from the prolific breeds are also inherited, and a proper balance should be maintained on the proportion of each breed in the combination to achieve maximum benefits. In the case of the breeds involved in this project, the weak points of the R and F breeds are well recognized in terms of inferior wool production and light weights, slow growth rate, and poor carcass quality of their lambs. The weak points of the B Merino are slow growth rate, retarded puberty and also poor carcass quality (refer to *The Shepherd,* January 1993). By backcrossing to the nonprolific breed it was believed that improvement in these weak points could be achieved, but a reduced prolificacy was also to be expected.

Despite the widespread use of prolific breeds, very few comparative studies of their performance as purebreds or crossbreds are available. To my best knowledge, none involved simultaneous comparisons of the three breeds used in the present study or between R and B breeds. A few studies compared the progeny of B and F rams mated to crossbred ewes for birth, weaning and 5-month weights, survival, and carcass traits. Equal birth weights for B and F-sired lambs and heavier weights for F-sired lambs at weaning and 5 months of age were reported, which agrees with our findings, and indicated that Merino genes are responsible for slower growth in crossbred lambs. In other studies comparing F and B progeny, the general conclusions were that B crosses were generally lighter in weight and reach sexual maturity at an older age. On the other hand, they produce heavier fleeces than F crosses. In addition, prolificacy of the crosses was similar, especially in later parities. Similar performance between F and B first and backcrosses was also found in our study at first parity, however, at second parity the F crosses were slightly superior.

Comparisons between R and F or between their crosses with other breeds are more numerous. These studies showed an advantage of R crosses over F crosses in traits associated with body weight and reproduction (fertility, prolificacy, and lamb survival). Similar superiority of R over F was observed in crosses with the DLS in the Canadian study. In many of these studies, including the present, the superiority of the R was evident at early stages of life, and the two breeds were rather similar in performance at later stages.

The reproductive performance of backcrosses was generally inferior to that of first crosses. In B backcross, half the animals were theoretically carriers of one copy of the fecundity gene while the other half were non-carriers. Similarly, in R and F backcrosses, one fourth of the genes were contributed by the prolific breeds. Whether the reduction in performance of the backcrosses was due to gene segregation in case of B or loss of additive gene effect in case of R and F, the final results were similar in both types of inheritance. The present results indicated that, in both first and backcrosses, the performance of the B crosses was generally comparable to that of F and slightly inferior to that of R.

The present study indicates that the combination of genes, each with small effect on prolificacy, inherited from breeds such as R or F may have more effect on prolificacy at the beginning of the reproductive life than a single fecundity gene with major effects such as that coming from the Booroola. However, because this study covered only a short period of the reproductive life of the ewe, the situation may be different over a longer interval of that life. The advantage of using fecundity genes in improving prolificacy is in the ability to continue backcrossing while selecting for the presence of the gene, and thus breed away undesired characteristics for meat production inherited from a breed such as the Merino, and eventually create a new breed. This approach cannot be used with breeds such as R and F in which prolificacy results from the action of numerous genes, because backcrossing to the nonprolific breed results in a reduced number of these genes and, accordingly, reduced prolificacy.

Managing the Twin-Bearing Ewe Under Western Range Conditions

By Mary Gessert, Cleon Kimberling, and Wayne Cunningham

The forages of our Western ranges are composed of grass and browse. In many cases browse comprises a high percentage of the diet. Studies conducted by Cook in 1952 showed that 70% of the digestible energy (DE) from browse was lost in the urine, whereas only 30% of the DE was lost from grass. Therefore, it is impossible to meet the energy requirements of a twin-bearing ewe with a high percentage of browse in the diet. Energy requirements for a sheep on ranges is 60-70% more than one in the lot and up to 10 times more depending on weather and terrain. In late gestation the nutritional requirements of the twin-bearing ewe are 70-80% more than that of the single. A twin-bearing ewe on rough terrain in severe weather on a high percentage browse diet needs the rumen capacity of a 55 gallon barrel to meet her energy needs. If this is not met, she may absorb one fetus and uses up her fat reserves. Shearing time is extremely revealing. We have starved the potential production out of this ewe. The key to producing more pounds of lamb per ewe exposed is to produce more twins and market a high percent of those twins.

Strategies for producing and saving twins:

1. Flush prior to and during the breeding period. Maintain all ewes on good nutrition for the first 100 days of gestation. Poor nutrition will result in the loss of one of a set of twins.
2. Pregnancy check at 80-85 days following the introduction of the rams.
3. Immediately separate twins and singles.
4. Place twin-bearing ewes on the best forage available and provide the necessary supplement to maintain a #3 body condition score. Do not compromise nutrition during the first 100 days of gestation as fetal loss will occur.
5. Seventy percent of the fetal growth occurs from day 100-148. The single-bearing ewe requires 1.6X maintenance while the twin-bearing ewe requires 1.9X maintenance.
6. Properly nourished ewes (body condition scores of 3 or 4) have better mothering instinct, produce more protective colostrum, and produce stronger, more vigorous lambs, which are heavier at weaning.
7. Place your best help with the twin group during and after lambing.
8. Following lambing, group twins into smaller bands, utilizing your best labor and nutritional resources for these lambs.