Adaptation problems with the Finn-Dorset line

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Story in Brief

During the period between 1975 and 1981, a group of 1/2 Dorset, 1/2 Finnish Landrace (Finn) rams and ewes were either produced or purchased to serve as a base for a special line of sheep to be selected to be fertile and highly prolific when mated in May and June for October-November lambing. These ewes were initially mated to rams of the same breeding during at least two spring breeding seasons after which they were mated during the fall season in order to produce a larger number of second generation (F_2) ewes. About 120 F_2 ewes over one year of age are currently in the flock. These ewes have been mated only during the spring and were mated first at 7 or 12 months of age. From them there are currently about 30 F_3 ewes most of which are less than two years of age. Observations during the spring breeding season indicate that 50 to 75 percent of Finn x Dorset ewes and rams are fertile in April; less are fertile in May, and the majority of them go into anestrous sometime in June. The birth weights of fall born single and twin lambs average between 5 and 6 pounds and the birth weights of spring born lambs, of which there are more litters of 3 to 5 average between 6 and 7 pounds. The mortality rate of these lambs due to both stillbirths and lack of vigor has varied from 15 to 40 percent with the mortality of F_2 lambs being higher than for F_1's and of the F_3's even higher than F_2's. It is obvious that these F_2 and F_3 lambs are not biologically well adapted to the production conditions at Ft. Reno and for this reason, this selection project is being phased out.

Introduction

Sheep are very efficient producers of meat under certain production conditions. Their productivity could be tremendously increased if they were fertile on a yearlong basis. It has been shown that the ewes are physiologically capable of lambing every 8 months, but their inherent lower fertility during the period between February or March and July or August makes such an accelerated lambing program unfeasible with the currently available breeds or breed crosses of sheep. Since some breeds of sheep such as the Dorset and Rambouillet are much less seasonally anestrous than other breeds, it seems likely that it would be possible over time to select a line of sheep that is less seasonal in their fertility than any breeds that now exist.

A small flock of 1/4 Dorset, 1/4 Finn, 1/2 Rambouillet ewes at the Southwest Livestock and Forage Research Station (obtained by crossing 1/2 Finn, 1/2 Dorset rams on Rambouillet ewes) contained some individual ewes

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that were among the most productive ewes ever maintained at the station. This suggested that if there were a line of 1/2 Finn, 1/2 Dorset sheep from which males could be selected to mate to Rambouillet ewes, commercial sheepmen could produce a highly productive cross that were 1/4 Finn, 1/4 Dorset, 1/2 Rambouillet to use as commercial ewes in Oklahoma. The purpose of this project was to determine if it were feasible to combine the out-of-season breeding characteristics of the Dorset with the early sexual maturity and high prolificacy of the Finnish Landrace to produce such a highly fertile prolific line of sheep to be used to produce such rams.

Materials and Methods

The foundation for this line of sheep was 1/2 Finnish Landrace (Finn) x 1/2 Dorset. It was deemed important to have a broad base for the line and therefore the flock was put together slowly over a period of time and from many sources. The first sheep were bought in 1975 and involved 10 crossbred ewes and 2 crossbred rams from two different sources. In 1976, 25 crossbred ewes were produced by mating purchased Finn rams to Dorset ewes from 4 different Oklahoma flocks. In 1977 twenty-nine aged crossbred ewes were purchased in Nebraska and added to the flock. In 1978 and 1979 twenty-three Finn x Dorset ewe lambs and several ram lambs were raised from Finn ewes purchased from Kansas and bred to Oklahoma State University Dorset rams. Additional 1/2 Finn x 1/2 Dorsets were raised in 1980 and subsequently so that in total there were over 100 ewes and 20 rams that had an opportunity to make a contribution to the line.

Very little was known about these 1/2 Finn x 1/2 Dorset sheep and therefore the early years were devoted to trying different mating plans in order to learn about them. The general plan involved mating all of the crossbred ewes during the spring at least twice in order to get an indication of how readily they mated and whether or not they would conceive during the spring and lamb the following fall. Since the spring matings did not produce a large number of lambs, it was decided to follow this testing program by mating the ewes during the fall in order to produce a greater number of replacement ewes from these crossbreds more quickly (For the purpose of this discussion, first cross Dorset x Finn or Finn x Dorset animals are designated F_1 animals and when these first cross or F_1 animals were mated to each other the resulting generation are F_2 animals. The third generation, resulting from mating F_2 rams to F_2 ewes, are called F_3 animals. This is normal genetic terminology.).

All second generation (F_2) ewes were mated as soon as possible, but were mated only in the spring. This meant that fall born ewes were mated the following spring when they were about 7 months old and spring born ewes were mated the following year when they were about 12 months old. Because the F_2 ewes were mated only in the spring, all F_3 lambs were born in the fall.

Initially half of the ewes were exposed for mating the first of April and the other half exposed the first of May. This was to determine at which time the ewes tended to be more fertile. It was determined rather quickly that the ewes were more fertile in April than in May and since it was the intent of the project to develop a line of sheep that were fertile in May, the subsequent matings were made in May and June.

An additional problem that arose involved determining which of the available rams were more fertile. By rotating several rams through several small groups of ewes and recording the time that each ewe was exposed to each ram, it was determined rather quickly that some of the rams were apparently incapable of impregnating ewes in April or May and others had a much greater capability. In order to ascertain that each ewe that was capable of conceiving had an opportunity to become pregnant, a plan of group matings was followed such that groups of ewes were exposed to groups of rams, and it was impossible to determine which sire produced each lamb born.

During the past two years, 1981 and 1982, a study has been under way in which an effort was made to predict which rams were most fertile by measuring the ram's scrotal circumference during the fall, winter and spring months and then classifying rams on the basis of how much their testicular size changed. The idea was that those rams whose testicles shrunk most during the winter period would likely be least fertile and those whose testicles tended to maintain a more constant size might also maintain a more constant level of fertility. During the 1981 and 1982 seasons, selected rams, based on testicular size changes, were mated to random samples of ewes in order to determine how well testicular size changes were related to apparent ram reproductive proficiency. These results are reported elsewhere in the 1982 Animal Science Research Reports, but did indicate that a certain amount of predictability was involved in the testicular size changes.

The mating plan followed resulted in lambs being born during the fall and spring. In both seasons, the usual records were obtained at lambing time and the lambs were moved to a feeding area where there was a creep available, and the lambs were given an opportunity to grow in a normal fashion. It was apparent that the 1/2 Finn x 1/2 Dorset lambs were smaller at birth than the normal commercial 1/2 Blackface type lambs that have been routinely raised at the Southwest Livestock and Forage Research Station and that there were some problems associated with getting the lambs to compete in the creep feeder and to grow in a satisfactory manner between birth and weaning. The lambs were not vigorous and were quite timid by nature so that they did not compete well with the larger lambs in the lot. Because of this, some of them were isolated to improve their opportunities to maintain a reasonable growth pattern.

Because they were relatively small and lacking in vigor and often came in relatively large litters, they actually received more care and attention from the shepherd than was normally given to the other lambs in the experimental flock. In spite of that, as results will show, there was a relatively high mortality rate at birth and during the first two weeks following birth. Excess lambs were often placed on an artificial milk diet in order to try to raise those that were in excess of what the ewes could normally be expected to raise.

The management of the ewe flock during the initial years of the project was similar to that normally given to the rest of the experimental flock. It became apparent that these ewes were not good foragers and that the growing ewe lambs needed special diets and the young ewes needed to be supplemented more than was true of the normal ewes in the flock. Extra supplementation was provided in order to try to maintain the breeding flocks in satisfactory condition for reproduction.

Results and Discussion

The principle concern in this project was to develop a line of sheep based on a 1/2 Finn, 1/2 Dorset foundation that would breed readily in May and June and lamb during the fall. The results that have accrued during the course of the project involved the lambing performance of spring bred first cross (F_1) ewes plus the spring lambing performance of these ewes after they had had two opportunities to lamb during the fall. These results have been reported in the 1980 and '81 Animal Science Research Reports.

It was not until a fairly large group of second cross (F_2) ewes had been produced and observed that it was possible to get a fairly decent estimate of the potentiality of this project. These F_2 ewes have been mated only in the spring and the only progeny produced were from ewes and rams that were fertile in the spring. These progeny of the F_2 matings constitute the F_3 generation, and it is their characteristics that largely determine the feasibility of the proposed Finn x Dorset line.

From the beginning, it has been apparent that the Finn x Dorset lambs are smaller in size at birth than most commercial lambs and that they grow more slowly. Once a reasonable number of F_2 lambs had been studied, it became apparent that they were even smaller than the F_1 lambs and less viable. The F_3 lambs were even smaller and less viable than the F_2 lambs. This report presents some information relative to the birth weights of the fall vs spring born lambs as well as the birth weights of lambs born in different size litters and also a comparison of the size and mortality rate of the F_2 and F_3 generation lambs.

Previous research and observations by many sheepmen indicated that lambs born during the fall are not as large as those born during the spring. Table 1 presents a comparison of the birth weights of the Finn x Dorset F_2 generation lambs that were born during the spring and during the fall. The presentation gives the average weight of single lambs, twins, triplets, quadruplets and quintuplets. It is apparent from these data that the spring born lambs are about 1 3/4 pounds heavier than the fall born lambs in each of the litter size classifications. This compares to a difference of about 2 1/2 pounds that has been found when comparing the birthweights of lambs out of Blackface sires and Whiteface ewes that are born during the fall as compared to the winter. Since there is usually a relationship between birth weights and liveability, it would be expected that liveability of fall born lambs would be slightly less than that of winter or spring born lambs.

Table 1. Birth weights of Finn x Dorset F_2 generation spring- and fall-born lambs by litter size.

	Spring born		Fall born	
Litter size	No.	Wt (lb)	No.	Wt (lb)
Singles	22	8.37	35	6.55
Twins	125	7.25	152	5.59
Triplets	126	6.52	33	4.93
Quadruplets	19	6.56	4	4.25
Quintuplets	10	5.06		

In these discussions of birth weights, it is well to keep in mind that the values that are presented are averages and within any group, there is a lot of variation. As an example: If we take the 7.25 average birth weight of the twin lambs born in the spring and study the variation, we find that about 2/3 of those twin, spring-born lambs weighed within 1 1/2 pounds of the average—that is, about 2/3 of the lambs weighed between 5.75 and 8.75 pounds. About 1/6 of the lambs were smaller than 5.75 pounds and about 1/6 were larger than 8.75. If we remember that this same kind of variation existed for the 33 fall born triplet lambs, we will realize that about 1/6 of those lambs weighed less than 3.4 pounds at birth and only about 1/6 weighed 6.4 or more pounds at birth.

If one studies the average weights of the average singles, twins, triplets, etc., and thinks through the previous discussion about variation, it is easy to see that in these large litters where there are triplets, quadruplets and quintuplets, there were many lambs born that were quite small. This accounts for some of the lack of viability and poor growth rates observed in these lambs.

The project is concerned primarily with fall born lambs and, therefore, the summary was made that is presented in Table 2 where the weights of F_2 Finn x Dorset, F_3 Finn x Dorset and some FinnDorset x Rambouillet lambs were compared. It can be seen that the F_2 lambs were between .5 and 1.4 lbs heavier at birth than the F_3 lambs. The tendency for smaller birth weights for lambs in larger litters also existed. It should be especially noted that the F_3 Finn x Dorset lambs that were multiple born lambs were quite small and this accounted for a lack of viability in these lambs also. Also presented in Table 2 are the birth weights of fairly large numbers of single and twin born lambs that were out of Rambouillet ewes that were mated to the same rams that produced the F_3 lambs. The size of the mature Rambouillet ewes was similar to the size of the Finn x Dorset ewes, yet the lambs born out of these Rambouillet ewes when bred to the same rams as the Finn x Dorset ewes that produced the F_3 lambs were on the order of 3 pounds heavier for singles and about 1.7 pounds heavier for twins. The results for the F_2 and F_3 Finn x Dorset lambs in Table 2 strongly suggests that these fall born lambs are not very large and helps to explain the difficulty that the shepherds had in trying to raise them.

The genetic explanation for a part of what happened as illustrated in the Finn x Dorset lambs in Table 2 is that the F_2 Finn x Dorset lambs were produced by F_1 ewes that exhibited some heterosis as far as the ewes ability to conceive and produce a lamb was concerned. The lambs themselves as far as individual heterosis was concerned have only one-half as much as would be found in F_1 lambs. This probably accounts in some small measure for the small

Table 2. Birth weights (by litter size) of fall-born F_2 and F_3 Finn x Dorset and Finn Dorset x Rambouillet lambs.

Litter size	F_2 Finn x Dorset		F_3 Finn x Dorset		FD x Ramb.	
	No	Wt (lb)	No	Wt (lb)	No	Wt (lb)
Singles	35	6.55	33	5.73	210	8.67
Twins	152	5.59	86	5.01	152	6.71
Triplets	33	4.93	13	3.51		
Quadruplets	4	4.25	4	3.55		

birth weights and the lower viability of F_2 lambs. The F_3 lambs were produced by F_2 ewes that had lost half of their heterosis as females and the actual amount of heterosis in the lamb was down to 1/4 of what one would expect to find in F_1 lambs. Therefore, the direction indicated in these results relative to birth weights and liveability are not surprising, but the extent of those differences is surprising.

In order to study the relationships between birth weights and viability of the various kinds of lambs, the summaries presented in Table 3 were developed. This table presents, by single, twin, triplet and quadruplet classes the birth weights of lambs that were stillborn, died within 2 weeks of age or survived beyond 2 weeks of age. The data are presented for both F_2 and F_3 Finn x Dorset lambs. It is quite apparent that within each litter size those lambs that survived were, on the average, larger than those that were stillborn or died during the first 2 weeks. It is especially apparent among the F_3 lambs that the lambs that did not survive to 2 weeks were quite small in size.

The last line in Table 3 summarizes the mortality through 2 weeks of age and shows that 15 percent of the F_2 lambs were either stillborn or died before they were 2 weeks old; whereas, 33 percent of the F_3 lambs did not survive to 2 weeks. These figures compare to the flock of sheep involving Rambouillet ewes mated to the same rams that produced the F_3 lambs wherein 7 percent of the lambs did not survive to 2 weeks of age.

To date there have been 12 F_4 lambs born with an average birth weight of less than 5 pounds and a mortality rate before 2 weeks of 33 percent also.

The average growth rate of these F_2 and F_3 lambs has been impossible to measure accurately because some lambs were raised on the bottle and some other lambs did not compete well when they were in groups of commercial type lambs. Nevertheless, there are sufficient observations to cause us to con-

Table 3. The relationship of birth weight to lamb livability of F_2 and F_3 generation fall born lambs.

Litter size and livability class	F_2 Finn x Dorset		F_3 Finn x Dorset	
	No	Wt (lb)	No	Wt (lb)
Single				
stillborn	2	5.6	2	2.50
died w/in 14 da	2	3.9	6	3.52
survived	31	6.79	25	6.52
Twins				
stillborn	11	4.14	11	3.57
died w/in 14 da	10	4.36	13	3.79
survived	131	5.80	62	5.52
Triplets				
stillborn			8	2.99
died w/in 14 da	2	4.10	2	4.80
survived	27	5.13	5	4.24
Quadruplets				
stillborn	2	2.00	4	3.55
died w/in 14 da	0			
survived	2	6.50		
Mortality to two wks	15%		33%	

clude that under conditions where 1/2 Blackface lambs out of Whiteface Dorset x Rambouillet type ewes will average about 55 pounds at 10 weeks of age, these lambs will average between 40 and 45 pounds. Part of this difference is due to the fact that there are more twin, triplet and quadruplet lambs among the Finn x Dorsets than among the commercial lambs. This however does not account for nearly all of the difference in growth rate. Although it was never intended that the Finn x Dorsets be a commercial line as such, it is necessary that they have sufficient vigor at birth and growth rate to develop normally so that they can come into productivity at a year of age.

Conclusion

The various generations of lambs and ewes included in this project have been studied rather carefully, and it is apparent that this particular line is biologically ill-adapted to the production conditions found at Ft. Reno, Oklahoma. Even though it appears that the F_3 ewes are a bit more fertile than the F_2's on the average, the extreme difficulty in keep these sheep alive and in rearing their lambs has forced the conclusion that there are many other types of sheep research activities that would be more beneficial to the state of Oklahoma than a continuation of this project. This does not mean that the time and effort was wasted. Much as been learned about the problems of trying to develop new lines and the apparent severe loss of heterosis that occurs when one produces an F_2 generation from an F_1 generation or when one produces an F_3 generation from an F_2 generation when the genetic base of the line is fairly narrow as it was in the case of this experiment.

The results and observations from this experiment will be developed and published in order than other people thinking about trying to do something similar will have the benefits of the experiences that have evolved during the course of this study.