DEVELOPMENT OF THE POLYPAY BREED OF SHEEP

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Summary

Development of the Polypay breed was undertaken to combine into a composite breed the potential for greatly increased reproductive capacity along with desirable growth rate and carcass quality. Four breeds were selected for the foundation of the new breed—the Rambouillet and the Targhee for hardiness, large body size, long breeding season, herding instinct and fleece characteristics; the Dorset for carcass quality, milking ability and long breeding season and the Finnsheep for early puberty, early postpartum fertility and high lambing rate. Dorset × Targhee and Finnsheep × Rambouillet matings were first made in 1968, and reciprocal Dorset-Targhee × Finn-Rambouillet matings were initiated in 1969. Beginning in 1970, the respective two-breed crosses and the four-breed cross (Polypay) were each mated inter se and selected, along with straightbred Rambouillets and Targhees, for lamb production when given two opportunities to lamb/year. Initial comparisons among straightbreds and inter se mated groups showed few important differences in meat-type body conformation, body condition or growth rate, but superior annual reproductive performance by Polypays. Fertility of Polypays at 1 yr of age was high and comparable to that of the Finn-Rambouillets. Response of Polypays to twice-a-year lambing was superior to responses of Rambouillets, Targhees, Dorset-Targhees or Finn-Rambouillets. The 1974 to 1975 annual production of young Polypays was about 13% more lambs weaned than from Finn-Rambouillets and 18% more weight of lamb weaned than from Dorset-Targhees, the best of the other groups for these traits. The current (1979 to 1981) reproductive performance of Polypay ewes selected for high once-a-year lambing rate under typical range management conditions is very competitive with that of ½ Finn crossbreds. Annual production of mature Polypays on the twice-a-year lambing schedule was 1.78 lambs weaned and 58.6 kg of lamb weaned/ewe put into fall breeding.

(Key Words: Polypay, Composite Breed Development, Selection, Reproductive Performance.)

Introduction

Achievement of improved reproductive performance in most domestic sheep breeds of the United States has been regarded with considerable caution because of low heritabilities for reproductive traits. However, this view is changing with increasing availability of exotic breeds that have high reproductive capacity. The characterization of these exotic breeds in crosses with domestic breeds has shown that major improvement in reproductive rate is attainable. Crossbreeding has been demonstrated to be an effective method for exploiting the commercial value of highly prolific breeds (Turner, 1969; Carter, 1976; Dickerson, 1977; Jakubec, 1977; Meyer et al., 1977). The development of composite breeds that combine the potential for greatly increased reproductive rate along with the desired growth, carcass and fleece attributes is an important extension from crossbreeding for achieving important and permanent increases in production efficiency (Carter, 1976; Smith et al., 1979; Hulet et al., 1981).

Development of the Polypay breed (the name was coined to suggest more than two paying crops per year, i.e., one wool and two lamb crops) was begun with matings made at the U.S. Sheep Experiment Station in 1968. The objective was to develop a breed with a reproductive

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capacity markedly superior to that of domestic Western range breeds. The purpose of this paper is to report some of the reproductive and body trait records of the Polypay during the first few years of its development and those of some of the contemporary breeds and crosses from which the Polypay was derived.

Materials and Methods

Five primary goals were adopted for the proposed new breed: 1) high lifetime prolificacy, 2) a large lamb crop at 1 yr of age, 3) ability to lamb more frequently than once per year, 4) rapid growth rate of lambs and 5) desirable carcass quality.

A twice-a-year lambing schedule (conventional spring lambing plus a fall lambing) was adopted as the goal for increased lambing frequency because it is more adaptable to range operation management than three lambings at approximately equal intervals during a 2-yr period.

Four breeds were selected for the foundation of the new breed—the Rambouillet and the Targhee because of their hardiness, large body size, long breeding season, herding instinct and fleece characteristics; and Polled Dorset because of its carcass quality, milking ability, long breeding season and white fleece and the Finnsheep because of its early puberty, early postpartum fertility and high lambing rate.

Four unrelated Polled Dorset rams of large body size and with outstanding lamb production records (acquired from breeders in Oregon, California, Montana and North Carolina) and a Finnsheep ram (from among the initial group imported into the United States in 1968; Oltenacu and Boylan, 1981) were purchased to cross on U.S. Sheep Experiment Station Rambouillet and Targhee ewes. The Rambouillet and Targhee ewes (noninbred) had been selected for several years for high reproductive rate and represented a random selection of ewes from the U.S. Sheep Experiment Station physiology research program flock. Initial Dorset × Targhee and Finn × Rambouillet crosses were made in 1968. These were followed in 1969 by Dorset-Targhee × Finn-Rambouillet crosses. Crossbreds resulting from the two- and four-breed foundation crosses were then mated inter se and selected according to the five primary goals listed above. Between 1969 and 1972, four additional Finnsheep rams were purchased for use in foundation cross matings but no additional Dorset rams were added. During years subsequent to the initial crossings, additional two- and four-breed crosses were produced, top-crossed with inter se mated sires of the same respective foundation cross and their selected offspring included into the inter se mated groups.

Ewes were managed under fenced range conditions during most of the grazing season but were herded on open sagebrush-wheatgrass range during the late fall. When grazing was not available, ewes were kept in drylot and fed pelleted alfalfa hay. Hormone therapy was used for the spring breeding (Hulet and Stormshak, 1972) through 1978, and lambs were born in April and October of each year. Lambs were weaned at about 80 d of age and put on pasture with creep or in drylot (depending upon the availability of grass). Weanling data were obtained when lambs averaged about 120 d of age. Weanling average daily gain was determined for the interval between birth and 120 d of age.

The use of hormones as an aid to achieving twice-a-year lambing was discontinued in 1978 because of uncertain availability of exogenous hormones and possible future problems with regulatory agency approval. After 1978, a continuation of the selection program was combined with management procedures to lengthen the natural breeding season to enhance the achievement of twice-a-year lambing. Adjustments in lambing dates and weaning ages were a part of the change in management procedures. Beginning in 1979, lambing was changed from a 6-mo spring-fall schedule to a 6-mo winter-summer schedule. Ewes started lambing on January 16 in 1979. During each subsequent year, winter lambing was scheduled to start about 1 wk earlier than during the previous year. Winter-born lambs were generally early weaned at about 31 d of age in an effort to optimize early postpartum rebreeding. Early weaning lambs were kept in drylot and fed to achieve a rapid growth rate. Summer-born lambs were generally not early weaned. Collection of weanling data since 1979 continued to be at about 120 d of age for both winter- and summer-born lambs.

Weanling and yearling scored traits were estimated by three independent scorers using a five-point system with plus and minus scores for each point, thus providing 15 scoring units. Lower scores indicate superior merit. Thus, lambs considered as having the most satisfactory meat-type conformation were given a score

of 1. Condition score, or degree of fatness, was estimated by feeling along the back and ribs of each lamb. A condition score of 1 indicates a high degree of fatness. To facilitate analysis, scores were coded to a scale ranging from 2 through 16 with codes 3, 6, 9, 12 and 15 corresponding to score values of 1, 2, 3, 4 and 5, respectively. Wool grade is a code of the visually estimated spinning count grade and ranges from 1 (70's) through 9 (48's). Thigh score is a measure of uniformity between side and thigh wool grades. A thigh score of 1 indicates that side grade and thigh grade are the same. The score increases by 1 for each grade that thigh grade is coarser than side grade. Yearling data included in the study were obtained only from spring-born ewes and were collected at shearing time (late May) when the average age was near 400 d. Yearling staple length, wool grade and face score were determined just before shearing. Fleeces were weighed on the shearing floor, and body weights were determined immediately after shearing. Yearling average daily gain was determined for the period between weaning (120 d) and shearing (400 d).

Selection of replacement ewe lambs was made after wealing data were obtained. Culling occurred in late summer of each year before ewes were put into breeding. Ewes put into breeding generally completed the annual production cycle and no additional culling took place until the next summer. Primary emphasis in selection was on lambing performance of dams when given two opportunities to lamb/year and also on each ewe's own lambing performance at about 12 to 14 mo of age. Sires were selected on the basis of dam lifetime lamb production record plus own growth rate from birth to weaning.

The same selection criteria were applied to each of the breeds and crosses. Comparisons among breeds and crosses (which estimate breed differences as well as heterosis effects) during the early years of Polypay development were made to aid in assessing each represented genotype for likely success in meeting the established criteria: (1) ability to produce a lamb at 1 yr of age and (2) ability to lamb more frequently than once a year.

Because of the nature of the breeding program, the age profiles of the various breeding groups were similar but not characteristic of a typical flock. During the first 5 yr of the breeding program (1969 through 1973), the respective age group data were analyzed by chi square on a within year basis. Data for 1974 and 1975 were obtained from a reasonably stable population of different aged ewes (2- through 5-yr-olds) within each breed group and were analyzed by least-squares procedures (Harvey, 1975). The 1979 to 1981 reproductive performance data have been included as current information about the Polypay and some contemporary breeds and crosses at the U.S. Sheep Experiment Station; however, statistical comparisons are not appropriate because of differences in management practices among the breeds and crosses.

Results and Discussion

Lambing Performance of Breeds and Crosses at 1 Yr of Age. The first lambing performance comparisons among 1-yr-old ewes were made in April 1969. Preliminary observations made among Rambouillet, Targhee, and Columbia straightbreds and the Dorset × Targhee and Finn × Rambouillet crosses showed that lambing performance of the Finn × Rambouillets was outstanding. Performance of the Columbias was so inferior to the other breed groups that the decision was made to not include them in future trials.

Reciprocal Dorset-Targhee × Finn-Rambouillet matings were first made in the fall of 1969. Beginning in 1970, the respective two-breed crosses and the Dorset-Targhee × Finn-Rambouillet cross were each mated inter se and selected, along with straightbred Rambouillets and Targhees, for lamb production when given two opportunities to lamb each year. Spring lambing fertility of ewe lambs bred to lamb at 1 yr of age is shown in table 1 for the 3-yr period 1971 through 1973. A study then in progress to evaluate effects of feed level and breed on pregnancy in ewe lambs (Hulet and Price, 1974) indicated that feed treatment differences among years contributed importantly to among year differences in later maturing breeds, but were not important in crosses with ¼ or ½ Finsheep breeding. Performance of Finn-Rambouillets and Dorset-Targhee × Finn-Rambouillets (Polypays) was consistently at a high level. Targhees and Dorset-Targhees were generally poorer than Finn-Rambouillets and Polypays but were superior to the slower maturing Rambouillets.

Early indications of response to twice-a-year lambing are shown in table 2. Of all yearlings

exposed to breeding during the spring of 1972, 52% of the Polypays lambed that fall, a much higher percentage than of Rambouillets (27%), Targhees (29%), Dorset-Targhees (26%) or Finn-Rambouillets (22%). Ewes that lambed during the fall of 1972 were exposed (while lactating) to rams for about 6 wk, beginning within 2 wk of lambing. During the next spring lambing (as 2-yr-olds), fertility of Polypays (100%) was much superior to that of

TABLE 1. FERTILITY OF PUREBRED AND INTER SE MATED EWE LAMBS BRED IN NOVEMBER AND DECEMBER AT 7 TO 8 MO OF AGE

Breed or cross	No. ewes exposed			Percentage of ewes lambing		
	1971	1972	1973	1971[a]	1972[b]	1973[c]
Rambouillet	27	38	30	4[e]	16[e]	37[e]
Targhee	31	35	37	10[ef]	57[f]	73[f]
Dorset-Targhee	20	39	42	35[f]	64[f]	86[fg]
Finn-Rambouillet	39	32	31	92[g]	94[g]	87[fg]
Polypay[d]	35	65	33	77[g]	94[g]	97[g]

[a]All ewes received .80 kg alfalfa pellets/d as a supplement to dry fall range grazing. Ewe lambs were bed on the range with mature ewes. Heavy snow and blizzard conditions existed near the end of the breeding period.

[b]Ewe lambs of each breed-group were divided into two groups of approximately equal size. One group received .80 kg alfalfa pellets·head^{-1}·d^{-1} as a supplement to dry fall range grazing and were bred on the range with mature ewes. The other group received a supplement of 1.5 kg alfalfa pellets/d and were bred with ewe lambs only.

[c]All ewe lambs received .80 kg alfalfa pellets/d as a supplement to dry fall range grazing and all were bred with ewe lambs only.

[d]Polypays are (Dorset-Targhee) X (Finn-Rambouillet).

[e,f,g]Means in the same column with different superscripts differ ($P<.05$).

TABLE 2. EARLY POSTPARTUM FERTILITY OF FALL-LAMBING PUREBRED AND INTER SE MATED EWES AS INDICATED BY NUMBER OF EWES LAMBING THE FOLLOWING SPRING

Breed or cross	Ewes lambing					
	Fall 1972		Spring 1973		Spring 1973 by April 24[a]	
	No.	%[b]	No.	%[c]	No.	%[d]
Rambouillet	33	27[f]	25	76[f]	8	32[f]
Targhee	21	29[f]	17	81[f]	11	65[g]
Dorset-Targhee	19	26[f]	18	94[fg]	14	78[g]
Finn-Rambouillet	17	22[f]	14	82[f]	11	79[g]
Polypay[e]	14	52[g]	14	100[g]	11	79[g]

[a]Cut-off date for hormone treatment of spring lambing ewes.

[b]Percentage of 122 Rambouillet, 72 Targhee, 73 Dorset-Targhee, 77 Finn-Rambouillet and 27 Polypay ewes treated and exposed to breeding during the spring of 1972.

[c]Percentage of 1972 fall-lambing ewes that lambed during the spring of 1973.

[d]Percentage of 1972 fall-lambing ewes that lambed before April 24, 1973.

[e]Polypays are (Dorset-Targhee) X (Finn-Rambouillet).

[f,g]Means in the same column with different superscripts differ ($P<.05$).

Rambouillets (76%), Targhees (81%) and Finn-Rambouillets (82%), but not to Dorset-Targhees (94%). Although 76% of the Rambouillets lambed in the spring, only 32% of those that lambed did so sufficiently early to be hormone-treated and rebred for the next fall lambing, a percentage somewhat lower than the other breed groups (65, 78, 79 and 79% for Targhees, Dorset-Targhees, Finn-Rambouillets and Polypays, respectively). Estrous observations indicated that the poor performance of the Rambouillets was due in part to delayed estrus after parturition. The comparatively long Rambouillet gestation period (Terrill and Hazel, 1947) probably also contributed to their poor performance. Because of continued poor performance of Rambouillets as 1-yr-olds, and their poor response to a twice-a-year lambing schedule, they were dropped from the trials in 1975 to provide additional space and facilities for increasing numbers in the other groups.

Reproductive Performance of Young Ewes During Spring and Fall Lambings. By 1974, some of the early two-breed and four-breed cross ewes were 4- and 5-yr-olds. Advanced generation inter se cross ewes, as well as some additional F_1 generation crosses that had been added to the breed groups each year, were 2- and 3-yr-olds. Reproductive traits of these young ewes are shown in table 3.

Spring lambing prolificacy of Finn-Rambouillets was superior (P<.05) to other breed groups, but net reproductive rate (lambs weaned/ewe exposed to breeding) and weight of lamb weaned were comparable among all breed groups. During the fall lambing season, performance of Polypays was superior (P<.05) to each of the other breed groups for fertility, net reproductive rate and weight of lamb weaned. When total spring and fall production was expressed on the basis of number of ewes put into breeding for the annual spring lambing, Polypay ewes weaned 1.60 lambs and 51.2 kg of lamb/yr (number of lambs alive at 120 d of age and weight of lamb adjusted to 120 d of age). Corresponding numbers of lambs and kilograms of lamb, respectively, at 120 d of age were 1.31 and 43.2 for Targhees, 1.30 and 43.5 for Dorset-Targhees and 1.42 and 43.0 for Finn-Rambouillets.

Age had an important effect upon reproductive performance (table 3). Spring-lambing ewes that were 3-yr of age and older were superior (P<.05) to 2-yr-old ewes for prolificacy, number of lambs weaned/ewe bred and weight of

TABLE 3. LEAST-SQUARES MEANS AND STANDARD ERRORS FOR 1974 TO 1975 REPRODUCTIVE PERFORMANCE OF TARGHEE, DORSET-TARGHEE, FINN-RAMBOUILLET AND POLYPAY EWES

	Winter lambing				Summer lambing			
Breed group	No. ewes exposed	Lambs born/ewe exposed	Lambs weaned/ewe exposed	Weight weaned (kg)/ewe exposed	No. ewes exposed	Lambs born/ewe exposed	Lambs weaned/ewe exposed	Weight weaned (kg)/ewe exposed
Targhee	155	1.37 ± .05	1.07 ± .06	35.96 ± 2.02	116	.48 ± .07	.32 ± .07	9.97 ± 2.06
Dorset-Targhee	168	1.28 ± .05	.98 ± .06	33.39 ± 1.99	131	.60 ± .07	.41 ± .07	12.90 ± 2.04
Finn-Rambouillet	202	1.72 ± .04	1.11 ± .06	34.30 ± 1.87	146	.55 ± .06	.42 ± .06	12.08 ± 1.93
Polypay	175	1.43 ± .05	1.10 ± .07	36.22 ± 2.27	141	.79 ± .08	.62 ± .08	18.52 ± 2.31
Age, yr								
2	228	1.22 ± .04	.82 ± .05	26.46 ± 1.72	180	.77 ± .06	.52 ± .05	15.31 ± 1.70
3	205	1.55 ± .04	1.16 ± .06	38.09 ± 1.77	152	.58 ± .05	.43 ± .06	13.07 ± 1.85
4+[a]	267	1.58 ± .05	1.22 ± .06	40.35 ± 1.83	202	.46 ± .05	.37 ± .06	11.73 ± 1.87

[a]Age group includes all ewes 4 yr of age and older.

lamb weaned/ewe bred. Interestingly, however, reproductive performance of fall-lambing 2-yr-olds tended to be superior to that of older ewes. Hulet and Stormshak (1972) attributed similar differences in reproductive performance of spring- and fall-lambing ewes to a more favorable response by younger ewes than by older ewes to hormone treatment.

Weanling and Yearling Growth, Body and Fleece Traits. Least-squares means for 1974 to 1975 weanling traits are presented in table 4. Breed was a significant source of variation for all traits except staple length. Finn-Rambouillets and Polypays were not as heavy at birth as Targhees and Dorset-Targhees, but weaning weight and average daily gain of Targhees, Dorset-Targhees and Polypays were superior ($P<.05$) to that of the Finn-Rambouillets. Dorset-Targhees were superior ($P<.05$) to the other breed groups for meat-type conformation score and condition score. Targhees and Polypays were superior ($P<.05$) to Finn-Rambouillets for both meat-type conformation and condition scores, but Polypays were also superior ($P<.05$) to Targhees for meat-type conformation score. Targhee wool was finer than the wool of the other three breed groups ($P<.05$). Wool of Finn-Rambouillets was slightly finer ($P<.05$) than that of Dorset-Targhees and Polypays but the three breed groups did not differ in thigh score.

Least-squares means for yearling traits are presented in table 5. Although results reflect the selection that occurred between weaning and yearling ages, it is evident that some loss in fleece weight was associated with the influence of Finnsheep and Dorset breeding. Targhee grease fleece weight was heavier ($P<.05$) than that of Finn-Rambouillets (by 38%), Polypays (by 24%) and Dorset-Targhees (by 11%). Targhees also had finer wool ($P<.01$) than the other three breed groups. Targhee wool averaged 60's to 62's, Polypays and Finn-Rambouillets 60's and Dorset-Targhees 60's to 58's.

Differences in face score (Finn-Rambouillets most open, followed by Polypays, Targhees and Dorset-Targhees) reflected a breed-type characteristic that was probably only minimally affected by selection but scores indicated that average face covering of yearling ewes was less than that of weanling age lambs. Dorset-Targhees continued at yearling age to have a slight advantage over the other breed groups for meat-type conformation score; but condition scores of Targhees, Dorset-Targhees and Polypays were very similar and all were superior ($P<.05$) to Finn-Rambouillets. Yearling weight, yearling average daily gain and staple length did not differ ($P<.05$) among groups.

TABLE 4. LEAST-SQUARES MEANS AND STANDARD ERRORS BY BREEDING GROUP FOR BIRTH WEIGHT AND WEANLING TRAITS

Trait	Breed or cross[a]			
	T (n=217)	DT (n=222)	FR (n=290)	P (n=277)
Birth weight, kg	4.40 ± .05	4.10 ± .06	3.51 ± .05	3.78 ± .05
Weaning weight, kg	34.29 ± .39	34.37 ± .41	32.21 ± .38	33.70 ± .36
Face score[b]	10.17 ± .16	10.55 ± .17	6.19 ± .15	8.91 ± .15
Meat-type conformation score[b]	8.63 ± .10	7.45 ± .11	9.24 ± .10	8.22 ± .10
Condition score[b]	7.58 ± .10	6.84 ± .10	8.27 ± .10	7.44 ± .09
Weaning avg daily gain, kg	.263 ± .003	.239 ± .003	.226 ± .003	.236 ± .003
Staple length, cm	4.55 ± .05	4.64 ± .05	4.57 ± .04	4.63 ± .04
Wool side grade[c]	3.11 ± .07	3.59 ± .08	3.36 ± .07	3.64 ± .07
Wool thigh grade[c]	4.12 ± .09	4.79 ± .09	4.49 ± .08	4.84 ± .08
Wool thigh score[d]	2.00 ± .05	2.20 ± .05	2.14 ± .05	2.19 ± .05

[a]T = Targhees, DT = inter se mated Dorset-Targhees, FR = inter se mated Finn-Rambouillet, P = Polypay.

[b]Scored traits are ranked according to merit on a 15-point scale ranging from 2 through 16; lower score values indicate superior merit.

[c]Wool grade (spinning count) is coded on a scale from 1 (= 70's) through 9 (= 48's).

[d]A thigh score of 1 indicates side and thigh grades are equal. The score increases by 1 for each grade that thigh score is coarser than side score.

TABLE 5. LEAST-SQUARES MEANS AND STANDARD ERRORS BY BREEDING GROUP FOR YEARLING EWE TRAITS

Trait	Breed or cross[a]			
	T (n=62)	DT (n=47)	FR (n=55)	P (n=53)
Yearling weight, kg	50.13 ± .88	48.84 ± 1.02	48.41 ± 1.12	47.78 ± 1.31
Yearling avg daily gain, kg	.048 ± .003	.042 ± .003	.045 ± .003	.042 ± .004
Face score[b]	8.56 ± .24	8.78 ± .28	4.28 ± .31	7.16 ± .36
Meat-type conformation score[b]	6.90 ± .16	6.59 ± .19	7.65 ± .20	7.26 ± .24
Condition score[b]	7.37 ± .11	7.34 ± .13	7.98 ± .15	7.45 ± .17
Staple length, cm	9.12 ± .15	8.73 ± .17	8.74 ± .19	8.68 ± .22
Grease fleece weight, kg	4.18 ± .08	3.74 ± .10	3.03 ± .11	3.37 ± .12
Fleece grade[c]	3.76 ± .19	4.28 ± .23	4.04 ± .25	4.02 ± .29

[a]T = Targhees, DT = inter se mated Dorset-Targhees, FR = inter se mated Finn-Rambouillet, P = Polypay.

[b]Scored traits are ranked according to merit on a 15-point scale ranging from 2 through 16; lower score values indicate superior merit.

[c]Wool grade (spinning count) is coded on a scale from 1 (= 70's) through 9 (= 48's).

By 1976, it was evident that the inter se mated Polypays offered good balance of body growth and type traits, acceptable fleece characteristics and an excellent opportunity for achieving the reproductive performance goals that had been established for the new composite breed. Dorset-Targhee and Finn-Rambouillet inter se matings were discontinued as a part of the accelerated lambing program. Polypay numbers were increased, but intensive selection was continued for twice-a-year lambing activity.

The 1978 decision to discontinue hormone therapy during the spring breeding season was accompanied by major management adjustments. A series of experiments was initiated to study such factors as lactation, nutritional status, breeding season of year, the sudden introduction of the ram (ram effect) and other management considerations for achieving early postpartum rebreeding (Stellflug and Hulet, 1982; Hulet et al., 1983). Under these new management programs, Polypays continued to perform very satisfactorily and exhibited a clear potential for superior reproductive performance on an accelerated lambing schedule. Additionally, two Polypay lines were initiated in 1978 to be selected for once-a-year lamb production when managed under typical range conditions. Current performance of the once-a-year lambing Polypays is very competitive with that of ½ Finncrosses (table 6, the ½ and ¼ Finncross ewe data included in table 6 are from Finnsheep crosses with Rambouillet, Targhee and Columbia ewes). Contemporary reproductive performance means of Polypays on the twice-a-year lambing schedule are also included in table 6. The current annual production of Polypays on the twice-a-year lambing schedule was about 22% more lambs weaned and more weight of lamb weaned than production when only the winter lambing was considered. Note that the annual production of the once-a-year lambing Polypays is very similar to that of the winter production of Polypays on the twice-a-year lambing schedule. However, caution must be exercised in comparing once-a-year and twice-a-year lambing performance because of management differences between these groups.

General Conclusions

The typical mature Polypay ewe is of moderate size (shorn body weight of about 65 kg) and produces annually about 4.2 kg of 58's spinning count wool (table 7). Weanling age (120 d) growth rate, meat-type conformation and body condition scores of Polypay lambs are comparable with or superior to those of other breeds and crosses at the U.S. Sheep Experiment Station.

The challenge in development of the new breed has been to achieve markedly improved reproductive performance in such a way that adaptability, growth rate, carcass quality and fleece characteristics are not unacceptably com-

promised. Fleece characteristics of Finnsheep are typically inferior to most whiteface breeds of sheep found in the United States and the influence of Finnsheep is usually apparent in crosses with these breeds (Alonso et al., 1978; Dahmen et al., 1978; Drummond et al., 1980). Although some of this undesirable influence from the Finnsheep is apparent in fleece characteristics of the Polypay, the compromise is economically relatively unimportant when con-

TABLE 6. AVERAGE REPRODUCTIVE PERFORMANCE OF ONCE- AND TWICE-A-YEAR LAMBING GROUPS (1979 TO 1981)

Breed	Age[a]	No. ewes exposed	Lambs born/ ewe exposed	Lambs weaned/ ewe exposed	Weight weaned (kg)/ ewe exposed
		Once-a-year lambing groups			
Rambouillet	1	609	.69	.47	14.2
	2	400	1.27	.93	30.4
	3	390	1.47	1.18	36.7
	Mature[a]	1,007	1.59	1.32	40.6
Targhee	1	623	.54	.36	10.5
	2	407	1.18	.86	29.0
	3	435	1.29	1.00	32.8
	Mature	1,069	1.48	1.17	37.8
1/4 Finn[b]	1	458	.91	.53	15.8
	2	278	1.43	1.01	32.5
	3	163	1.68	1.30	42.0
	Mature	480	1.72	1.43	46.3
1/2 Finn[b]	1	532	1.23	.76	21.1
	2	331	1.81	1.27	38.6
	3	212	2.01	1.54	49.2
	Mature	485	2.09	1.59	50.7
Polypay	1	312	1.11	.73	21.5
	2	196	1.66	1.34	42.2
	3	171	1.89	1.61	49.3
	Mature	165	1.83	1.49	46.5
		Twice-a-year lambing Polypays			
Polypay (winter lambing)	1	362	1.12	.85	25.4
	2	268	1.45	1.24	40.6
	3	204	1.76	1.50	49.2
	Mature	242	1.74	1.41	47.9
Polypay (summer lambing)	1				
	2	233	.36	.33	10.7
	3	164	.56	.43	13.4
	Mature	190	.47	.37	11.7
Polypay (annual)[c]	1	362	1.12	.85	25.4
	2	268	1.76	1.52	49.9
	3	204	2.21	1.85	60.0
	Mature	242	2.11	1.70	57.1

[a]Age at lambing. Mature ewes were 4 yr of age or older. A higher proportion of mature Polypays were at older ages (up to 9 yr) than among other breed groups.

[b]Finnsheep crosses with Rambouillet, Targhee and Columbia ewes.

[c]Annual reproductive performance of Polypay ewes is based on the number of ewes exposed for the winter lambing.

TABLE 7. LEAST-SQUARES MEANS AND STANDARD ERRORS FOR BODY WEIGHT, FLEECE WEIGHT AND FLEECE GRADE OR POLYPAY EWES AND RAMS

Sex	Age group	No.[a]	Body weight, kg	Fleece weight, kg	Fleece grade score[b]
Ewes	1	338	45.8 ± .42	3.8 ± .05	4.7 ± .03
	2	269	57.7 ± .46	4.1 ± .06	5.1 ± .04
	3	188	64.0 ± .56	4.3 ± .07	5.2 ± .04
	4[c]	215	65.3 ± .52	4.2 ± .06	5.3 ± .04
Rams	1	159	65.0 ± .61	5.2 ± .10	5.0 ± .09

[a]Includes weights and fleece grade scores obtained during the 2-yr period, 1980 to 1981. Animals and fleeces were weighed immediately after shearing.

[b]The numerical score for fleece grade (spinning count) ranges from 1 (= 70's) through 9 (= 48's).

[c]Age group 4 includes 4-, 5- and 6-yr-olds.

sidered in conjunction with the Polypay's superior lambing ability.

It is of interest that, independent of Polypay breed development at the U.S. Sheep Experiment Station, private breeders had recognized the need for making major genetic improvements in reproductive efficiency of sheep and concurrently were initiating the development of breeds with higher reproductive performance. Mr. George Nicholas of Northern California coincidently selected the same foundation breeds and initiated a breeding program using essentially the same major objectives as those followed at the U.S. Sheep Experiment Station. He obtained foundation stock from independent sources and from the U.S. Sheep Experiment Station before he closed his flock. Sheep of the Polypay type which he developed were among the first registered by the American Polypay Sheep Association. Although the U.S. Sheep Experiment Station has been the primary original source of foundation Polypay breeding stock, the American Polypay Sheep Association permits the independent development of Polypay sheep from the four foundation breeds.

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