
3.13 Newly Developed Prolific Breeds

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Introduction

This section describes newly developed breeds which are now established, may have a breed association and which are now used by the sheep industry in their countries of origin. Studies involving these breeds and breeds which are now under development and have not yet been released to the sheep industry are mentioned in parts of Chapter 6, 'The Use of Prolific Sheep in Various Countries', under the heading 'New Breed Development'. Breeds which were developed and used by the industry but which have become extinct are not included.

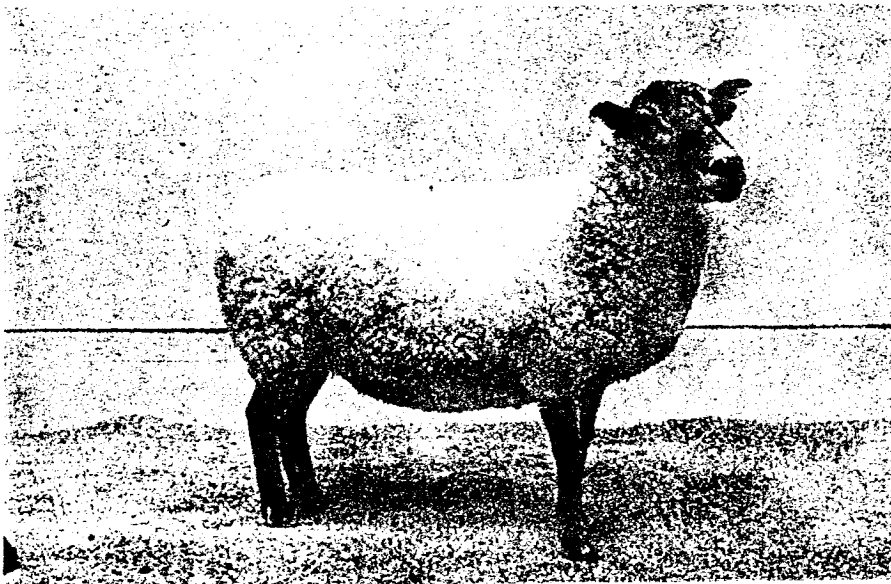
ABRO Damline

This breed was developed at the Animal Breeding Research Organization in Edinburgh, Scotland, in the early 1970s, to redress some of the deficiencies of the Finnsheep and Finnsheep crosses as sires of crossbred ewes. Four breeds were involved, Finnsheep, East Friesian, Dorset Horn and Border Leicester, contributing 47, 24, 17 and 12% of the Damline genetic composition, respectively (Smith *et al.*, 1979). The line was closed and selected for 8-week litter weight on a ewe lifetime index.

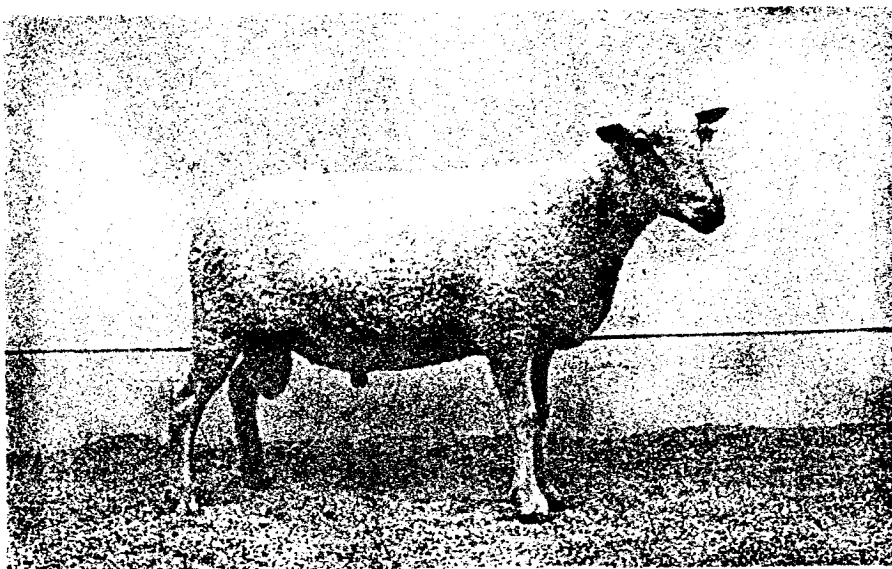
No reports are published on the performance of pure ABRO Damline. Barker (1977) reported that in 1975 the lambing percentage of the ABRO flock was 159 for ewe lambs, 193 for two-year-old and 235 for three-year-old ewes. Studies on crosses using ABRO Damline rams on ewes of other breeds, and especially Scottish Blackface, are available: Hoste and Smith (1986), Boaz *et al.* (1980), Cameron *et al.* (1983). All the studies showed a remarkable improvement in productivity of ABRO Damline crossed ewes (see Subchapter 6.1).

ARCOTT Outaouais and Rideau

The Outaouais and Rideau breeds were developed at the Animal Research Centre in Ottawa, Canada, as new breeds capable of performing under intensive management. The development started in 1966 with a foundation stock consisting of ewes and rams of the Shropshire and Suffolk breeds and a composite population (developed from Leicester, North Country Cheviot, Romnelet and Suffolk breeds, each contributing



Outaovais female.



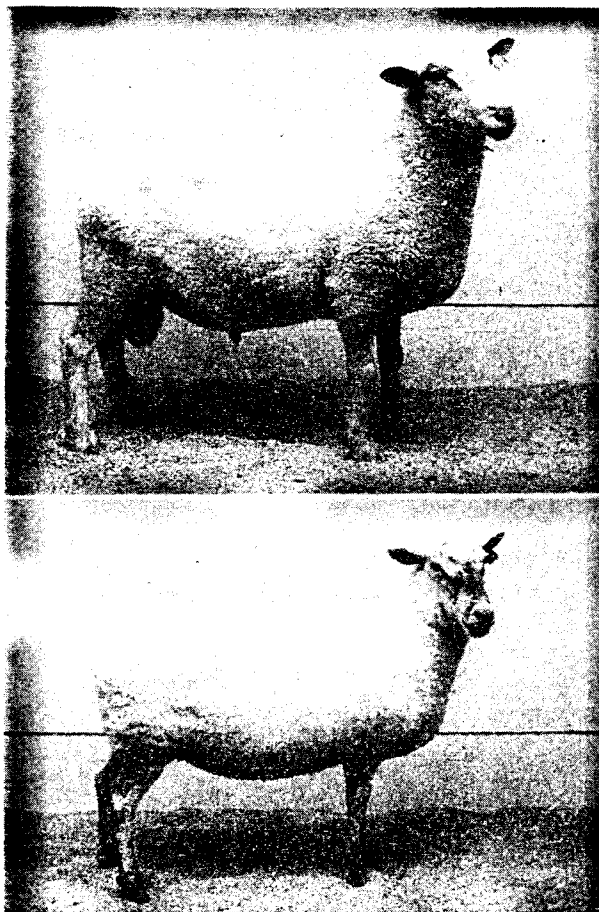
Outaovais male.

approximately 25%). Further additions to the gene pool included purebred and crossbred ewes and rams of Leicester, North Country Cheviot, Canadian and New Zealand Southdown, Corriedale, Ile-de-France and Dorset breeds. The Finnsheep breed contributed prolificacy to both breeds, and the East Friesian contributed high milk production and prolificacy to the Rideau breed. The Outaouais breed consists of 49% Finnish Landrace, 26% Shropshire and 21% Suffolk ancestry with minor contributions (4%) from Ile-de-France, East Friesian, Dorset, North Country Cheviot, Leicester and Romnelet breeds. The Rideau breed consists of 40% Finnish Landrace, 20% Suffolk, 14% East Friesian, 9% Shropshire and 8% Dorset Horn, with minor contributions (9%) from Leicester, North Country Cheviot, Romnelet and Corriedale breeds.

Both breeds are generally white, although colour may appear on head and legs. The head of both breeds is moderately fine, and rather short in the Outaouais and of medium length in the Rideau. The face is white, tanned or mottled and free of wrinkles and wool. The ears are horizontal, thin-textured, short in the Outaouais and of medium length in the Rideau. Ewes and rams are hornless; some rams may have scurs. The neck is medium in length, free of wrinkles and smoothly blends into trim, well-rounded shoulders which blend smoothly into the body. The chest is moderately wide and deep, and the back is strong, straight and level, carried well out to the dock. The loin is medium with adequate muscling and the rump long and level. Legs of Outaouais sheep are fine-boned, and those of Rideau sheep are medium-boned. In both breeds, legs are set squarely, adequately muscled and free from wool but covered with white or mottled hair. Pasterns are short. In both breeds, tails are long and narrow, covered with wool (Litterick, 1989). The body is completely covered with wool of medium grade. Ewes produce 2.0 kg of wool in 8 months growth. Mature body weight of Outaouais rams ranges between 75 and 100 kg, and of Rideau rams between 80 and 100 kg. Weight for ewes of both breeds varies between 70 and 90 kg (Fahmy and Shrestha, 1993).

Outaouais ewe lambs weighing 46 kg conceive at 239 days of age, whereas Rideau ewe lambs weighing 47 kg conceive at 228 days of age. Ewe lambs of both breeds can be bred at 7 months to lamb at 1 year of age. Under intensive systems, ewes of both breeds can lamb at 8-month intervals in February, October and June, with conception rate of 55–57% for ewe lambs and 80–82% for adult ewes. Conception rate for ewes lambing once a year is 83–86%. Average gestation length is 146 and 145 days for Outaouais and Rideau ewes, respectively (Shrestha and Heaney, 1990).

Ovulation rate of Rideau ewes of different ages is between 2 and 6 ovulations (average 3.25). Ewes superovulated with 800 IU of PMSG had between 3 and 11 ovulations (average 5.67) (Fahmy *et al.*, 1994). On commercial or accelerated systems, Outaouais ewe lambs produce 1.8 lambs while adult ewes produce 2.6 lambs. The percentage of litters with multiple births is 83%. Average litter size of 92 ewes is 2.9 lambs, in which 15.2% are singles, 59.8% twins or triplets, 31.5% quadruplets or quintuplets,



and 4.3% sextuplets. Rideau ewe lambs produce 1.7 lambs and adult ewes 2.5 lambs. In a recent study, adult ewes averaged 2.9 lambs. Multiple births accounted for 82% of all litters. In intensive systems, lamb mortality from birth to 91 days of age of both breeds averages 23%, while it is about 27% under conventional systems.

Outaouais lambs weigh 3.3 kg at birth and grow at 271 g day^{-1} from birth to weaning from milk replacer at 21 days and 274 g day^{-1} from 21 to 91 days of age. At 118 days of age lambs weigh 35 kg. Rideau lambs weigh 3.4 kg at birth and grow 271 g day^{-1} from birth to weaning from milk replacer at 21 days and 281 g day^{-1} from 21 to 91 days of age. At 118 days of age, lambs weigh about 36 kg. Lambs slaughtered at 117–120 days produce carcasses with estimated lean content of 43%. Loin-eye muscle and fat thickness over the 12th rib average 11.6 cm^2 and 5.8 mm (Outaouais) and 11.7 cm^2 and 5.3 mm (Rideau), respectively.

Outaouais ewes machine milked twice daily for about 120 days, following weaning at 30 days, produced 54 L of milk, containing 7.3% fat,

6.1% protein and 4.6% lactose, whereas Rideau ewes produced 77 L of milk, containing 6.6% fat, 5.8% protein and 4.8% lactose (Fahmy and Shrestha, 1993).

Belclare

The development of the Belclare breed was initiated in 1978 at the Belclare Research Institute in Ireland. Three genotypes were involved, Fingalway (interbred population from crossing Finnsheep and Galway) contributed 18%, High Fertility (high prolificacy sheep selected for litter size) contributed 32%, and Lley (a Welsh breed selected in Ireland for high lifetime litter size) contributed 45%. Animals from reciprocal crosses of Fingalway and High Fertility were crossed with Lley to produce the foundation population of Belclare. Occasionally, genetic material from selected Galway and Finnsheep was introduced into the composite, contributing the remaining 5% (Hanrahan, 1989).

Belclare sheep are polled, white in colour, with a good fleece and sound feet. The animals are of medium body weight, with ewes 2, 3 and > 4 years weighing 59, 65 and 70 kg, respectively. Ewes are docile, have excellent mothering ability, with minimum of lambing difficulty and are capable of rearing three lambs if adequately fed. Ewes reach puberty at 229 days of age when they weigh 34.4 kg (Ronayne *et al.*, 1990). The onset of the breeding season is around 15 September and it lasts for 168 days (Hanrahan, 1988). Belclare ewe are highly fertile, with conception rate ranging between 91 and 95% for ewes of different ages. Ovulation rate of ewes varies between 1 and 6 but some exceptional ewes ovulate up to 18. Ovulation rate at first oestrus is 1.5 and for 2, 3 and > 4-year-old ewes ovulation rate is 2.2, 2.5 and 3.2 and litter size is 1.9, 2.0 and 2.4 lambs, respectively (Hanrahan, 1989). Lamb survival is high, ranging from 97% for single to 79% for triplet lambs. Average daily gain of lambs from birth to 10 weeks and from 10 to 14 weeks is 256 and 172 g, respectively. Lambs slaughtered at 37 kg dress around 46% (Flanagan and Hanrahan, 1985).

British Milksheep

This breed was developed in England by Lawrence Alderson in Wiltshire and Northumberland. The main objective was a ram with high performance crossbred progeny when mated to ewes of different types in different environments. Its make-up is 70% East Friesian, 10% Bluefaced Leicester, 10% Polled Dorset, 5% Lley and 5% a composite of Bluefaced Leicester, Polled Dorset and Lley, previously developed by the same breeder. The breed was established and released in 1980. The animals are robust and active and, because they were developed in the northern Pennines, the animals have developed toughness and hardiness. The animals are docile and adaptable. Animals of this breed are medium to

large in size, polled, with white face and legs.

Milksheep is the most prolific breed in United Kingdom with litter size averaging 2.21 in yearlings, 2.63 in 2-year-olds, and 3.07 in mature ewes. Lambing is easy in Milksheep ewes as a result of their exceptionally roomy pelvic area. Milk yield of 650–900 L in a 300-day lactation, is exceptionally high. As a result of high milk yield, triplets reared on the ewe average a weight gain of 0.33 kg day⁻¹. The yield of milk solids is particularly high. The protein content rises from about 5% in early lactation to 7.5% in late lactation, and the fat content rises from about 5.5 to 9%.

British Milksheep produce heavy, lean carcasses. Fleece weight is about 4.5 kg in ewes and up to 6.5 kg in rams. The demi-lustre wool has a spinning count of 50–54's with a staple length of 15–17 cm.

(Source: *British Sheep*, 8th edition, 1992, National Sheep Association, Malvern, England, pp. 38–39).

Dutch Prolific Breeds

Three breeds were developed in the Netherlands recently, Noord-Hollander (North Holland), from a cross between Finnsheep and Texel Flevoland from a cross between Finnsheep and Ile-de-France, and Swifter from a cross between Flemish Landrace and Texel sheep. The number of lambs weaned per ewe per year in an 8-month-interval



Flavolander.

lambling system was reported at 2.78 and 2.13 for the first two breeds, respectively (Wensvoort, 1984).

The development of the Flevoland started in 1975 by producing reciprocal crosses of Finnsheep with Ile-de-France. Between 1981 and 1986, the two reciprocal crosses were intermated and cross-mated with each other to form the base population which consisted of 224 ewes from 22 sires from the two breeds of origin. Preliminary reports on prolificacy in an 8-month-lambing system estimated litter size at birth and weaning at 2.5–2.6 and 2.1–2.2 lambs, respectively (Visscher, 1987). More details on the Flevoland are presented in Subchapter 6.1.

The Swifter was developed between 1967 and 1971. The nucleus flock consisted of 8 rams and 16 ewes selected for their production and reproduction characteristics. Litter size at birth of ewes 1, 2 and 3 years old was reported at 1.65, 2.28 and 2.57 (Bekedam, 1982) and more recently at 1.72, 2.57 and 3.79, respectively (Van Snick, 1986). Litter size at weaning was reported at 2.03–2.18 lambs (Wensvoort, 1984). Lambing is easy and very few ewes experience dystocia.

Frisarta

This breed was developed in Greece by crossing East Friesian rams with a population of local sheep improved by introducing genes from the Chios, Karagouniko and Zakynthos breeds. The main objective of the crossing was to improve the milking potential of the local sheep; however, as a result of introducing genes from prolific breeds, the Frisarta is also reported to be prolific. The number of pure Frisarta is reported as 30,000 sheep and increasing, with the greatest concentration in the plains of Arta in western Greece. In appearance the Frisarta sheep resemble their East Friesian ancestors. The animals are white, and hornless in both sexes; females weigh 70–80 kg, and the breed is characterized by a long thin tail.

Ewe lambs can be bred for the first time at 8 months of age. Prolificacy is around 1.8 lambs. Following a 42-day suckling period, Frisarta ewes produce 230–250 kg of milk in a 220-day lactation period. Wool production varies between 2 and 5.5 kg (Espejo Diaz *et al.*, 1989).

Hungarian Prolific Merino

This new breed is a result of a cross between 22 Booroola Merino rams imported from Australia and New Zealand in 1980 and Hungarian Merino sheep. Animals of this breed are carriers of the fecundity gene and were recognized as a new breed in 1992. The sheep are selected for frequent lambing, heavier mature weight, longer and finer wool fibres and polledness. Selection is also directed to establishing a nucleus population homozygous for the fecundity gene.

The new breed has the same physical appearance of the Merino sheep.

Ewes weigh about 40 kg at their first lambing and gain between 35–40% of their body mass up to their 6th lambing. Sexual maturity is late and ewe lambs are not bred before they are 16–20 months old weighing 38–40 kg. Lambs weigh between 2.1 and 3.5 kg depending on age of their dams, litter size and sex. During the first 30 days, daily gain averages 150–220 g according to litter size and type of rearing. Lambs weaned at 56 days weigh 16.5 kg on average. During a 60-day fattening period, lambs gained about 227 g day⁻¹ on farms and 237 g day⁻¹ in central test stations. At 1 year of age, ram and ewe lambs weigh 50 and 36 kg, respectively (Veress, 1991). Killing out percentage is about 44%. Average fleece production is 4–5 kg for ewes and 7–8 kg for rams with 55–60 clean yield percentage. Staple length is about 9 cm and fibre diameter averages 20–22 μ m.

In sheep subjected to accelerated lambing, prolificacy averaged 1.98 and was found to vary according to lambing interval, from 1.77 for ewes with intervals less than 230 days to 2.12 for those with intervals of 261–290 days. The average number of lambs born and weaned per ewe per year is 2.45 and 1.91, respectively. Lamb mortality at birth is about 9% and from birth to weaning 14%.

At present, the population of registered Hungarian Prolific Merino is about 2000 ewes concentrated at three farms.

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Hyfer

The Hyfer breed was developed by New South Wales Agriculture as a composite dam breed suited to specialized and year-round lamb production in the more reliable lamb-producing environments of Australia. Hyfer sheep have a high lambing rate and extended breeding season which gives greater flexibility of lambing time and, with suitable management and environment, they are capable of successful accelerated lambings. The breed is also being used in the emerging Australian sheep dairying industry.

The breeding programme for Hyfer sheep was initiated in 1978 (Fogarty, 1978) and involved two generations of crossing with subsequent selection (Table 3.13.1). Rams from two high-fertility Merino strains (Booroola and Trangie Fertility) were joined to Poll Dorset ewes. These breeds and strains combine high lambing rate and out-of-season breeding ability with good lamb growth, carcass quality and wool traits. Rams and ewes of the F₁ crosses were reciprocally mated to produce a base population comprising 1/2 Poll Dorset, 1/4 Trangie Fertility Merino, 1/4 Booroola Merino. The base population was interbred and ewes joined in an accelerated lambing system. Following three joinings in their first 2 years (February, October and June), top performing ewes were selected into a nucleus flock to breed replacements. Selection was on the basis of total weight of lamb weaned (adjusted for age and sex) by ewes over the three joinings in 2 years. Rams were selected primarily on their dam's performance (total weight of lamb weaned) with consideration given to



Hyfer.

Table 3.13.1. Development of the Hyfer breed with years in which matings occurred in each generation.

1978–1981	Booroola Merino rams (B)	×	Poll Dorset ewes (D)	×	Trangie Fertility Merino rams (T)
	↓		↓		
1980–1983	BD ♂ and ♀	×	TD ♂ and ♀		Reciprocal matings
		↓			
1982–1985	Base population	$\frac{1}{2}D\frac{1}{2}B\frac{1}{2}T$			Interbreeding
		↓			Selection
1985–		HYFER			8-monthly joining Nucleus flock

growth, leanness and polledness (Fogarty, 1994). Hyfer sheep were released to Australian breeders in 1991.

The *FecB* major gene contributing to the high ovulation rate and litter size in the Booroola (Piper et al., 1985) became known after the Hyfer breeding programme commenced. The gene frequency of *FecB* was subsequently estimated to be about 50% in the original Booroola sires used and about 10% in the base population.

Hyfer animals are white, hornless and wool completely covers the body and extends to the legs. Average liveweight of mature ewes is 65 kg

(SD 10 kg) and mature weight of rams ranges from 80 to 100 kg. Average lamb birth weights are 4.7, 4.0 and 3.3 kg (SD 1.0 kg) for single, twin and triplet-born lambs, respectively. Under grazing management, 90-day weaning weights of lambs are 28, 25 and 22 kg (SD 5 kg) for singles, twins and triplets, respectively, with ram lambs being 2 kg heavier than ewe lambs. Average greasy fleece weight of ewes is 3.2 kg (SD 0.4 kg), with average fibre diameter ranging from 25 to 28 μm .

The mean litter size of mature Hyfer ewes mated in late summer is 1.91 (SD 0.76). The distribution of litter size is approximately 30% single, 55% twin, 12% triplet and 3% higher order. Ewes mated under an accelerated 8-monthly lambing system achieve an average of 1.22 lambings per year, with fertility levels of 75 to 80% from 6-week spring matings. Average lambing rates under extensive grazing management are 1.98 lambs born and 1.45 lambs weaned per ewe joined per year. Growth of lambs from Hyfer ewes is similar to those from Border Leicester \times Merino ewes and carcasses have similar composition.

Estimated heritability for mean performance (three records) for litter size is 0.31 ± 0.08 and lambs born, lambs weaned and weight of lamb weaned (all per ewe joined) 0.19 ± 0.06 , 0.10 ± 0.06 and 0.13 ± 0.06 , respectively (Fogarty *et al.*, 1994). Selection, over approximately two generations, for total weight of lamb weaned from three joinings in 2 years has resulted in an 11% advantage over the unselected control flock, with all components contributing to the response (Fogarty, 1994).

INRA 401

The development of the INRA 401 was initiated in 1969 by the Institut National de la Recherche Agronomique at Bourges, in France. It started as a crossbreeding study between Romanov and Berrichon du Cher breeds, and was recognized as a new breed in 1980 (Razungles *et al.*, 1985). The Romanov and Berrichon du Cher, whose reproductive performance and carcass quality are complementary, were crossed and interbred for four generations. The population of INRA 401 in 1990 was about 21,000 sheep, and rams are distributed all over France to use in grading up.

Animals of this breed are rather large; average weights are 65 kg for ewes and 80 kg for rams. The head is triangular with a straight profile. The ears are horizontal and the animals are hornless. The tail is thin and medium in length. There is a wide variation in the colour and quality of the fleece (Perret, 1986).

Fertility at the first two parities is 86 (off-season) and 82%, which increases to 96% in adult ewes. Litter size is 1.7, 1.9 and 2.1, and milk production is 1.5, 1.7 and 2.0 kg day⁻¹ for the three ages, respectively (Ricordeau *et al.*, 1990). Lamb mortality ranges from 9 to 19% and average daily gain of twin-suckled lambs from 10 to 30 days of age ranges between 185 and 225 g day⁻¹, depending on age of ewe. Body weight of ewes at 15

months is around 60 kg and mature ewe weight is about 70 kg (Tchamitchian *et al.*, 1986)

Katahdin

This breed was developed in Maine, USA, by Michael Piel starting in 1957. Its ancestry includes hair sheep imported from the Virgin Islands crossed with a variety of standard woolled breeds, along with a later contribution from the Wiltshire Horn breed (Mason, 1988). Twenty years of intense selection for hair coat, growth rate, mutton performance and prolificacy, and against wool and horns, produced the Katahdin breed. The present population of registered pure Katahdin is between 3500 and 4000 sheep raised on approximately 200 farms in North America. There are also animals from this breed in various Latin American countries.

Animals of this breed have a hair coat with an undercoat of fine wool which is shed in the spring. The predominant colour is white but many animals show different types of coloration. Most of the animals are hornless, only 5% of the males may have horns. Mature body weight ranges from 50 to 75 kg for ewes and 90 to 110 kg for rams.

Sexual maturity is attained at a young age – ewe lambs begin oestrous cycling by 6 months of age. Ewes have an extended breeding season and



Katahdin.

some can be bred year round. Well-selected ewes average 2.0 lambs per litter. Lambing is easy and cases of dystocia are rare. Lambs are strong at birth and thrive without assistance. Milk production is sufficient to feed the lambs born, and performance is strong on good quality forages.

Average daily gain of lambs is 267 g and feed conversion ratio is 6.63. Lambs slaughtered at 46 kg dress at 65.1% with rib-eye muscle of 14.1 cm² and 5.2% internal fat. The longissimus dorsi muscle contains 72.4% moisture, 19% protein and 11.8% fat (Horton and Burgher, 1992).

Katahdin sheep have a good flocking instinct and tend to be efficient grazers. They can tolerate high and low temperatures and show high tolerance to internal and external parasites (Mason, 1980).

Polypay

The development of the Polypay breed was initiated in 1968 at the United States Department of Agriculture Sheep Experimental Station in Dubois, Idaho. The objective was to create a breed with high lifetime prolificacy, a large lamb crop at 1 year of age, ability to cope with intensive systems, rapid growth rate of lambs and desirable carcass quality, by combining genes from four breeds each contributing 25% (Hulet *et al.*, 1984). First, the Finnsheep × Rambouillet and Dorset × Targhee crosses were obtained then the Polypay was made from mating the two crosses.

Shortly after 1968 a few breeders in California, Idaho and Montana, with varying degrees of independence, using primarily foundation stock from the Dubois Sheep Experimental Station but also some from other sources, and generally following similar goals, began selective breeding using the same formula as that outlined by the Dubois Station. The American Polypay Sheep Association was formed in 1980.

Polypay sheep are white. The head is free of horns and has an open, white face. Ears of medium length are evenly covered with white hair or very short wool. Eyes are clear and bright. The neck is smooth from head to shoulder, with no excessive wrinkles. The body is characterized by a strong, level back along with a thick fleshy chest and trim brisket. Forelegs are set squarely under the body. The rump is moderately level on top to dock. Body weight of rams and ewes at 1 year of age is 65 and 46 kg, respectively, and for ewes 3 years old and older is 65 kg (Hulet *et al.*, 1984). Legs are medium in proportion to size, with medium bone, straight feet, and strong pasterns. The tail is long and narrow and covered with wool. The body is completely covered by a dense fleece of average staple length, with uniform fibre quality. Wool covers most of the belly and legs.

Sexual maturity is early, many lambs can breed at 5 months of age and most conceive at 7 months and lamb for the first time at 1 year (Fahmy and Lavallée, 1990). Polypay ewes have an extended breeding season and can be bred successfully every 6, 7 or 8 months. In the United States, Polypay ewes were subjected to twice-a-year lambing, resulting in 1.78

lambs (58.6 kg) weaned (Hulet *et al.*, 1984). In Canada, Polypay ewes subjected to five matings in 3 years averaged 1.5 litters per year. Gestation length averages 146 days. Conception rate is high for ewes mated in the normal breeding season (97%, Nawaz and Meyer, 1992; 96%, Fahmy and Lavallée, 1990; 95%, Pope *et al.*, 1989) and out of the breeding season (88%, Fahmy and Lavallée, 1990; 50%, Pope *et al.*, 1989). Conception rate of ewe lambs mated at 7–8 months is 89%.

Ovulation rates of 2.68 resulting in 2.08 lambs born (West *et al.*, 1991) and 1.94 resulting in 1.88 lambs born have been reported (Nawaz and Meyer, 1992). Lambs born per mature Polypay ewe exposed was reported at 1.8 lambs for once-a-year lambing and 2.1 for twice-a-year lambing in the United States (46.5 and 57.1 kg weaned lambs at 120 days, respectively). Ewes exposed to intensive systems of three matings in 2 years (3/2) or five matings in 3 years (5/3) averaged 1.5 lambings per year. Yearly production under the 3/2 and 5/3 systems was 2.77 and 2.11 lambs born and 2.53 and 1.79 lambs weaned, respectively (Fahmy and Lavallée, 1990).

Embryonic mortality was 11% in twin- and 19% in triplet-ovulating ewes (West *et al.*, 1991). Lamb mortality was 7.3% at birth and a further 8% between birth and weaning (Fahmy and Lavallée, 1990).

Milk production is high, ewes lambing singles and twins produced 2.88 and 3.54 kg day⁻¹ at 28 days of lactation. Persistency is also high; at 56 days of lactation ewes produced 1.95 and 2.52 kg day⁻¹, and at 98 days, 0.41 and 0.87 kg day⁻¹, respectively (Snowder and Glimp, 1991).

Polypay lambs weighed 4 kg at birth, 20.5 kg at 50 days and 34.2 kg at 100 days (Fahmy and Lavallée, 1990). In another study, lambs averaged 3.8, 33.7 and 48 kg at birth, 120 days, and 1 year of age, respectively. Lambs slaughtered at 46, 49 or 56 kg liveweight dressed 49.4, 52.6 or 53.6%, respectively. They had 4.5, 4.7 or 5.2% kidney fat; 7.7, 8.3 or 10.9 mm back-fat thickness; and 12.7, 14.8 or 16.7 cm² rib-eye area, respectively, according to American studies. It is not recommended to feed Polypay wethers to weights over 52 kg.

Polypay yearling males and females produced 5.2 and 3.8 kg of wool, respectively, whereas 2-year-old and older ewes produced about 4.2 kg (Hulet *et al.*, 1984) and only 2.84 kg in another study (Nawaz and Meyer, 1992). The fibres range between half and quarter blood in fineness, which is equivalent to 58's spinning count.

Flocking tendency is judged to be good in Polypay sheep. They appear to herd well on desert and mountain ranges in Idaho. They maintain flock integrity on fenced ranges of the southwestern United States. Some ewes lambing as lambs at 1 year of age need attention. Mature Polypay ewes are exceptionally good mothers and take adequate care of their lambs.

Salz

The Salz breed was developed in the Ebro Valley in Spain starting in the late 1970s by crossing Romanov rams of two strains with Aragonese ewes



Salz.

in two flocks. Salz sheep are hardy, white and polled, with medium-quality wool and an average body weight of 50–55 kg for ewes and 70–75 kg for rams (Sierra, 1989).

Sexual maturity is early in Salz sheep; 84.6% of ewe lambs show sexual maturity and 82.3% conceive by 6 months of age. Normal age at first lambing is 12–13 months on average. For spring and autumn matings, conception rate is 66.3–77.17 and 86.07–92.0%, and litter size ranges between 1.69–1.78 and 2.07–2.23, respectively. Under accelerated lambing systems (1.4 lambings per year), Salz ewes averaged 2.67 lambs born and 2.25 weaned per ewe per year (Sierra, 1990). Lamb mortality within 48 hours of birth was estimated at 9.03%, between 3 and 100 days at 7.98%, and total mortality 0–100 days at 16.3% (Sierra, 1990). With complementary artificial rearing of lambs under accelerated lambing system, total lamb mortality was reported at only 12.6% (I. Sierra-Alfranca, 1994 unpublished data).

Milk production is rather high and ewes show good lactation persistency. Milk production in the second and fourth weeks of lactation averaged 1.36 and 1.24 kg per day in primiparous ewes nursing singles, 1.87 and 1.64 in those nursing twins, and 2.04 and 2.19 in multiparous ewes nursing twins, respectively (Forcada, 1989).

Body weight and daily gain of males and females averages 3.06 and 2.53 kg at birth, 194 and 183 g, from birth to 30 days, and 277 and 235 g,

from 30 to 90 days, respectively (Sierra, 1989). Body weights at birth, 30 and 90 days of ewe lambs under intensive management average 2.8, 8.4 and 23.8 kg, respectively (Sierra, 1990). Body weight at 100 days averages 26.7 kg, with a carcass yield of 46.5%, but when crossed with Suffolk rams, body weight at 100 days reached 32.3 kg, with a cold carcass weight of 15.2 kg (Sierra, 1989). Compared with the parental types, Salz sheep are intermediate in prolificacy and growth traits, and similar to Romanov in sexual maturity. The Salz breed has proved particularly suitable for intensive systems.

Tahirova

The development of this breed started in 1964 in Turkey from local Kivircik ewes and imported East Friesian rams (contributing 25 and 75% of the genetic make-up, respectively). The purpose has been to create a prolific crossbred with high milk and meat-producing potential. Tahirova sheep are white, polled, open faced, and thin tailed. Average weights are 4.0–5.4 kg at birth and 28–30 kg at 90 days. Adult weight is 55–65 kg for ewes and 80–90 kg for rams. Mean age at puberty is 290 days. Average litter size varies between 1.5 and 1.8, with multiple births accounting for about 60%. Lamb mortality up to weaning is about 5%. Ewes produce between 250 and 300 kg milk in 200–240 days of lactation. Grease fleece weight averages 3–4 kg with spinning count of 50's or better. The present population of the Tahirova stands at approximately 500,000 sheep. The breed was also involved in developing several dam-lines in Turkey.

Wealden Four-quarter Sheep

This breed was developed over a period of 22 years in the United Kingdom. The origin was a Romney Marsh ewe with four teats. This ewe was mated with a Clun Forest ram for 3 years and the three progeny had four teats. Friesian, Finnish Landrace, Booroola Merino and Suffolk inheritance was incorporated in developing this breed which is now a stable recognizable prolific type with four functional teats (Hope, 1993).

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