
VOLUME 62 2002

ISSN 0370-2731/99 Proceedings of the New Zealand Society of Animal Production **59**: 17-18

Hogget wool traits of sheep breeds being used for crossbreeding with strong wool breeds - preliminary estimates from research studies

A.R. BRAY

AgResearch, PO Box 60, Lincoln, New Zealand

ABSTRACT

Average fleece weight and wool quality characteristics for pure breeds were calculated from comparisons of pure breeds and crossbreeds with strong wool sheep in fifteen studies. The results for each breed reflect the sample of the breed selected for the studies, after removal of environment effects.

Compared to the average Romney, fibre diameter was markedly lower in Merino (59 % of Romney, P<0.001) and Finn (72 %, P<0.001) but was not significantly different in Texel, Poll Dorset and East Friesian sheep. Staple lengths of other breeds were 53 to 77 % (P<0.05) of Romney values. Wool bulk was greater in Texel and Poll Dorset (both 49 %, P<0.001), and Merino (32 %, P<0.01).

To provide a better basis for predicting effects of crossbreeding in breeding ewe flocks, more information is needed from the East Friesian breed. Also the observations need to be extended to adult ewes and need to be obtained from wider samples of the breeds and sheep farming environments, and account needs to be taken of heterosis and other effects.

Keywords: wool; Romney; crossbreeding.

INTRODUCTION

The New Zealand sheep flock is dominated by breeds chosen for their ability to produce both prime lambs and strong wool. Such dual purpose flocks have made up around 80 % of the national flock for many years with the Romney breed maintaining a long term dominance (Carter and Cox, 1982; Statistics New Zealand 1997, personal communication).

A rise in interest in the introduction of new genes into strong wool ewe flocks by crossbreeding has been stimulated by shifts in the relative prices of lamb and wool. The shifts have encouraged crossbreeding to improve fecundity, lamb growth rates and carcass traits Also, better prospects for finer and bulkier wool are leading to crossbreeding to reduce fibre diameter and increase wool bulk. Breeds being used for these purposes include Texel, Finn, East Friesian, Poll Dorset and Merino. While the general nature of the impact on wool traits of introducing their genes into strong wool flocks is understood for some breeds and traits, there are significant gaps in the knowledge. Better knowledge is needed to assist breeders achieve the needs of particular wool markets, and to identify the wool implications of crossbreeding for lamb production reasons.

This report uses data from published and unpublished studies on hogget wool traits of the breeds being used for crossbreeding. The data has been analysed to calculate values for the most important wool traits that are more robust than those from single studies. The findings are expressed relative to Romney sheep since the Romney was the most common breed in the studies and because of its predominance within the New Zealand sheep population.

MATERIALS AND METHODS

Mean values for hogget wool traits of pure breeds and F1 and F2 crossbreds were taken from the reports of Allison (1996), Andrews *et al*., (1990), Baker *et al*., (1987), Everett-Hincks *et al*., (1998), Hawker *et al*., (1980), Meyer *et al*., (1994), Newman and Paterson (1991), Sherlock (1997), Wuliji *et al*., (1990) and Wuliji *et al*., (1995). In addition unpublished data from five flocks studied by Bray and colleagues were used. The first of those flocks contained pure Finns (n = 14) and F1 crosses with Merino (n = 13), Border Leicester-Romney (n = 14), and Lincoln (n = 6) ram hoggets from one flock. The second contained Finn (n = 9) and F1 Finn x Romney (n = 21) ram hoggets, and the third Finn (n = 16), F1 Finn x Romney (n = 22) and Finn x Corriedale (n = 20) ram hoggets. The fourth contained East Friesian ram (n = 17) and ewe (n = 12) hoggets. The fifth contained ewe and wether hoggets with Merino dams and Poll Dorset, Texel, Oxford Down, Border Leicester, or Suffolk sires (number of progeny per sire breed = 20-40).

Wool traits and measurement methods differed between studies.

The data was subjected to a least squares analysis which removed environment effects and assumed that breed effects were additive when calculating values for pure breeds. No account was taken of potential genotype by environment interactions, heterosis, sex, nor shearing date effects. Deviations from a Romney benchmark were estimated for pure breeds, and wool traits of selected crossbreds were calculated using those deviations.

RESULTS AND DISCUSSION

The values for fleece weight, fibre diameter and staple length for the average Romney hoggets (Table 1) indicate levels good of feeding in the average environment among the studies analysed. Deviations from the Romney values are in expected directions. Romney hoggets had higher fleece weights than other breeds for which data was available, particularly the Finn (35 % of Romney value, P<0.01). While other deviations were large in biological and economic terms, the variation in performance between studies meant that the differences in the overall means were not statistically significant.

TABLE 1: Wool traits for Romney hoggets, and deviations from Romney values for pure breeds, after removal of effects of environment.

	Greasy fleece weight (kg)	Clean fleece weight (kg)	Fibre diameter (μm)	Staple length (mm)	Loose wool bulk (cm^3/g)
Romney	3.72	3.55	35.6	141	21.6
Deviations					
Finn	n.a	-2.3 ± .5	-9.8 ±1.3	-40 ± 16	+2 ± 2
Texel	-0.6 ± 1.6	-1.1 ± 0.5	+0.6 ± 1.4	-32 ± 13	+11 ± 1
Poll Dorset	-1.3 ± 0.9	-1.3 ± 0.8	-1.0 ± 2.0	-61 ± 19	+11 ± 2
East Friesian	n.a	n.a	-5.7 ± 3.2	n.a	+3 ± 3
Merino	0.0 ± 0.4	n.a	-14.7 ± 1.0	-60 ± 13	+7 ± 2

n.a = not available

Fibre diameter was markedly lower in Merino (59 % of Romney value, P<0.001) and Finn (72 %, P<0.001) but was not significantly different from Romney in Texel, Poll Dorset and East Friesian sheep. Staple lengths of other breeds were 53 to 77 % of Romney values (P<0.05). Wool bulk was greater in Texel (49 %, P<0.001), Poll Dorset (49 %, P<0.001), and Merino (32 %, P<0.01). Neither the percentage yield of clean wool nor the unscourable colour measurements of Y and Y-Z (data not presented) differed significantly between breeds. This is not surprising since they are substantially influenced by environmental factors.

The values obtained for each breed reflect the representatives of the breed present in the studies and will be influenced by the environment in which the study took place. They will also by influenced by the lack of adjustment for heterosis, sex, shearing date and other fixed effects that influence wool traits, and by genotype by environment interactions. Thus geneticists and others will be rightly concerned over the accuracy of the findings. No doubt enthusiasts for particular breeds will dispute the results where their breed has not performed as well as they expected. The findings are presented to identify where further effort is needed and to stimulate collection of more information that covers a wider selection of the gene pool of each breed and a wider selection of environments. It is not until more information is available that it will be possible to present information more relevant to individual farmer breeding decisions.

The amount of data available on the East Friesian breed in particular was not adequate to produce robust estimates. Information is needed on East Friesian fleece weight and staple length. Its fibre diameter deviation is greater and the wool bulk value lower than expected from comments by industry sources. The deviation of bulk for the Merino breed was also less than expected. Whatever the limitations of the findings, they were derived from a comprehensive collation of available information, and so provide the most robust indications on breed effects to date.

One way of using the results is to identify a type of wool to produce, and then to examine the crossbreeding options to achieve it. For instance, a market for hand knitting yarn may require wool with a fibre diameter of 31-33 μm, a staple length of 100-120 mm and bulk of 24 – 26 cm^3/g. This combination could be achieved by, say, ¼ Merino ¾ Romney or ¼ Finn ¼ Poll Dorset ½ Romney sheep. A market for machine-made carpet yarn might require wool of 36 μm diameter, 100 – 150 mm length and 25 – 28 cm^3/g bulk. That could be achieved by ½ Romney with either ½ Texel or ½ Poll Dorset. Another way to use the information is to check the wool implications of crossbreeding decisions made for lamb production reasons. What are the wool implications of producing ¼ Finn ¾ Romney ewes to increase lambing percentages? In addition to the influence on product traits, crossbreeding may influence animal health and so affect costs. It may also influence ewe size and efficiency, and so have additional effects on the amount of wool produced through impact on the size of flocks (Brookes, 1997).

ACKNOWLEDGEMENTS

This study was funded by WoolPro.

REFERENCES

Allison, A.J. 1996. More opportunities with sheep: The East Friesian breed and it's relevance to the New Zealand sheep industry. *Proceedings of the Sheep Sessions of the Second Pan Pacific Veterinary Conference 1996*. pp 19-28.

Andrews, R.N.; Dodds, K.G.; McEwan, J.C. and Wuliji, T. 1990. Wool production and other characteristics of progeny from high performance Coopworths x Romney rams. *Proceedings of the New Zealand Society of Animal Production.* **50:** 305-309.

Baker, R.L.; Clarke, J.N.; Meyer, H.H.; Harvey, T.G. and Bigham, M.L. 1987. Genetic variation among six strains of Romneys and Border Leicester and Coopworth crosses. *Proceedings of the New Zealand Society of Animal Production.* **47:** 101-105.

Brookes, I. 1997. Factors affecting feed requirements of sheep. *Proceedings of the Southern North Island Sheep and Beef Cattle Farmers Conference.* pp.35 –38.

Carter, A.H. and Cox, E.H. 1982 Sheep breeds in New Zealand. In Sheep Production, Volume 1. Breeding and Reproduction, ed. G.A.Wickham and M.F. McDonald. New Zealand Institute of Agricultural Science, Wellington, New Zealand.

Everett-Hincks, J.M.; Wickham, G.A. and Blair, H.T. 1998. Performance of Romney and ¼ Merino x ¾ Romney sheep on Wanganui hill country. *Proceedings of the New Zealand Society of Animal Production.* **58:** 266-269.

Hawker, H.; Davis, G.H. and Allison, A.J. 1980. Wool production and characteristics of Merino and longwool ewes and their respective Booroola crosses. *Proceedings of the New Zealand Society of Animal Production.* **40:** 205-208.

Meyer, H.H.; Bigham, M.L.; Baker, R.L.; Harvey, T.G. and Hickey, S.M. 1994. Effects of Booroola Merino breeding and the Fec^B gene on performance of crosses with longwool breeds. 1. Effects on growth, onset of puberty, wool production and wool traits. *Livestock Production Science.* **39**: 183-190.

Newman, S-A.N. and Paterson, D.J. 1991. Lamb and hogget wool production from crosses of new and traditional sheep breeds. *Proceedings of the New Zealand Society of Animal Production.* **51:** 271-276.

Sherlock, R. 1997. Breed differences in fleece quality, quantity and value. *Proceedings of the Southern North Island Sheep and Beef Cattle Farmers Conference.* pp 18-26.

Wuliji, T.; Andrews, R.N.; Davis, G.H. and Farquhar, P.A. 1990. Hogget fleece weight and fleece characteristics of Texel x Romney, Texel x Coopworth, Romney and Coopworth sheep. *Proceedings of the New Zealand Society of Animal Production.* **50:** 495-497.

Wuliji, T.; Dodds, K.G.; Andrews, R.N.; Turner, P.R.;Smith, B.R. and Wheeler, R. 1995. Breeding for a sheep with bulky wool by crossbreeding Texel sires with fleeceweight-selected Romney ewes. *New Zealand Journal of Agricultural Research.* **38:** 399-406.

ISSN 0370-2731/99 Proceedings of the New Zealand Society of Animal Production **59**: 17-18

Hogget wool traits of sheep breeds being used for crossbreeding with strong wool breeds - preliminary estimates from research studies

A.R. BRAY

AgResearch, PO Box 60, Lincoln, New Zealand

ABSTRACT

Average fleece weight and wool quality characteristics for pure breeds were calculated from comparisons of pure breeds and crossbreeds with strong wool sheep in fifteen studies. The results for each breed reflect the sample of the breed selected for the studies, after removal of environment effects.

Compared to the average Romney, fibre diameter was markedly lower in Merino (59 % of Romney, $P<0.001$) and Finn (72 %, $P<0.001$) but was not significantly different in Texel, Poll Dorset and East Friesian sheep. Staple lengths of other breeds were 53 to 77 % ($P<0.05$) of Romney values. Wool bulk was greater in Texel and Poll Dorset (both 49 %, $P<0.001$), and Merino (32 %, $P<0.01$).

To provide a better basis for predicting effects of crossbreeding in breeding ewe flocks, more information is needed from the East Friesian breed. Also the observations need to be extended to adult ewes and need to be obtained from wider samples of the breeds and sheep farming environments, and account needs to be taken of heterosis and other effects.

Keywords: wool; Romney; crossbreeding.

INTRODUCTION

The New Zealand sheep flock is dominated by breeds chosen for their ability to produce both prime lambs and strong wool. Such dual purpose flocks have made up around 80 % of the national flock for many years with the Romney breed maintaining a long term dominance (Carter and Cox, 1982; Statistics New Zealand 1997, personal communication).

A rise in interest in the introduction of new genes into strong wool ewe flocks by crossbreeding has been stimulated by shifts in the relative prices of lamb and wool. The shifts have encouraged crossbreeding to improve fecundity, lamb growth rates and carcass traits Also, better prospects for finer and bulkier wool are leading to crossbreeding to reduce fibre diameter and increase wool bulk. Breeds being used for these purposes include Texel, Finn, East Friesian, Poll Dorset and Merino. While the general nature of the impact on wool traits of introducing their genes into strong wool flocks is understood for some breeds and traits, there are significant gaps in the knowledge. Better knowledge is needed to assist breeders achieve the needs of particular wool markets, and to identify the wool implications of crossbreeding for lamb production reasons.

This report uses data from published and unpublished studies on hogget wool traits of the breeds being used for crossbreeding. The data has been analysed to calculate values for the most important wool traits that are more robust than those from single studies. The findings are expressed relative to Romney sheep since the Romney was the most common breed in the studies and because of its predominance within the New Zealand sheep population.

MATERIALS AND METHODS

Mean values for hogget wool traits of pure breeds and F1 and F2 crossbreds were taken from the reports of Allison (1996), Andrews *et al*., (1990), Baker *et al*., (1987), Everett-Hincks *et al*., (1998), Hawker *et al*., (1980), Meyer *et al*., (1994), Newman and Paterson (1991), Sherlock (1997), Wuliji *et al*., (1990) and Wuliji *et al*., (1995). In addition unpublished data from five flocks studied by Bray and colleagues were used. The first of those flocks contained pure Finns (n = 14) and F1 crosses with Merino (n = 13), Border Leicester-Romney (n = 14), and Lincoln (n = 6) ram hoggets from one flock. The second contained Finn (n = 9) and F1 Finn x Romney (n = 21) ram hoggets, and the third Finn (n = 16), F1 Finn x Romney (n = 22) and Finn x Corriedale (n = 20) ram hoggets. The fourth contained East Friesian ram (n = 17) and ewe (n = 12) hoggets. The fifth contained ewe and wether hoggets with Merino dams and Poll Dorset, Texel, Oxford Down, Border Leicester, or Suffolk sires (number of progeny per sire breed = 20-40).

Wool traits and measurement methods differed between studies.

The data was subjected to a least squares analysis which removed environment effects and assumed that breed effects were additive when calculating values for pure breeds. No account was taken of potential genotype by environment interactions, heterosis, sex, nor shearing date effects. Deviations from a Romney benchmark were estimated for pure breeds, and wool traits of selected crossbreds were calculated using those deviations.

RESULTS AND DISCUSSION

The values for fleece weight, fibre diameter and staple length for the average Romney hoggets (Table 1) indicate levels good of feeding in the average environment among the studies analysed. Deviations from the Romney values are in expected directions. Romney hoggets had higher fleece weights than other breeds for which data was available, particularly the Finn (35 % of Romney value, P<0.01). While other deviations were large in biological and economic terms, the variation in performance between studies meant that the differences in the overall means were not statistically significant.

TABLE 1: Wool traits for Romney hoggets, and deviations from Romney values for pure breeds, after removal of effects of environment.

	Greasy fleece weight (kg)	Clean fleece weight (kg)	Fibre diameter (µm)	Staple length (mm)	Loose wool bulk (cm^3/g)
Romney	3.72	3.55	35.6	141	21.6
Deviations					
Finn	n.a	-2.3 ± .5	-9.8 ±1.3	-40 ± 16	+2 ± 2
Texel	-0.6 ± 1.6	-1.1 ± 0.5	+0.6 ± 1.4	-32 ± 13	+11 ± 1
Poll Dorset	-1.3 ± 0.9	-1.3 ± 0.8	-1.0 ± 2.0	-61 ± 19	+11 ± 2
East Friesian	n.a	n.a	-5.7 ± 3.2	n.a	+3 ± 3
Merino	0.0 ± 0.4	n.a	-14.7 ± 1.0	-60 ± 13	+7 ± 2

n.a = not available

Fibre diameter was markedly lower in Merino (59 % of Romney value, P<0.001) and Finn (72 %, P<0.001) but was not significantly different from Romney in Texel, Poll Dorset and East Friesian sheep. Staple lengths of other breeds were 53 to 77 % of Romney values (P<0.05). Wool bulk was greater in Texel (49 %, P<0.001), Poll Dorset (49 %, P<0.001), and Merino (32 %, P<0.01). Neither the percentage yield of clean wool nor the unscourable colour measurements of Y and Y-Z (data not presented) differed significantly between breeds. This is not surprising since they are substantially influenced by environmental factors.

The values obtained for each breed reflect the representatives of the breed present in the studies and will be influenced by the environment in which the study took place. They will also by influenced by the lack of adjustment for heterosis, sex, shearing date and other fixed effects that influence wool traits, and by genotype by environment interactions. Thus geneticists and others will be rightly concerned over the accuracy of the findings. No doubt enthusiasts for particular breeds will dispute the results where their breed has not performed as well as they expected. The findings are presented to identify where further effort is needed and to stimulate collection of more information that covers a wider selection of the gene pool of each breed and a wider selection of environments. It is not until more information is available that it will be possible to present information more relevant to individual farmer breeding decisions.

The amount of data available on the East Friesian breed in particular was not adequate to produce robust estimates. Information is needed on East Friesian fleece weight and staple length. Its fibre diameter deviation is greater and the wool bulk value lower than expected from comments by industry sources. The deviation of bulk for the Merino breed was also less than expected. Whatever the limitations of the findings, they were derived from a comprehensive collation of available information, and so provide the most robust indications on breed effects to date.

One way of using the results is to identify a type of wool to produce, and then to examine the crossbreeding options to achieve it. For instance, a market for hand knitting yarn may require wool with a fibre diameter of 31-33 µm, a staple length of 100-120 mm and bulk of 24 – 26 cm^3/g. This combination could be achieved by, say, ¼ Merino ¾ Romney or ¼ Finn ¼ Poll Dorset ½ Romney sheep. A market for machine-made carpet yarn might require wool of 36 µm diameter, 100 – 150 mm length and 25 – 28 cm^3/g bulk. That could be achieved by ½ Romney with either ½ Texel or ½ Poll Dorset. Another way to use the information is to check the wool implications of crossbreeding decisions made for lamb production reasons. What are the wool implications of producing ¼ Finn ¾ Romney ewes to increase lambing percentages? In addition to the influence on product traits, crossbreeding may influence animal health and so affect costs. It may also influence ewe size and efficiency, and so have additional effects on the amount of wool produced through impact on the size of flocks (Brookes, 1997).

ACKNOWLEDGEMENTS

This study was funded by WoolPro.

REFERENCES

Allison, A.J. 1996. More opportunities with sheep: The East Friesian breed and it's relevance to the New Zealand sheep industry. *Proceedings of the Sheep Sessions of the Second Pan Pacific Veterinary Conference 1996.* pp 19-28.

Andrews, R.N.; Dodds, K.G.; McEwan, J.C. and Wuliji, T. 1990. Wool production and other characteristics of progeny from high performance Coopworths x Romney rams. *Proceedings of the New Zealand Society of Animal Production.* **50:** 305-309.

Baker, R.L.; Clarke, J.N.; Meyer, H.H.; Harvey, T.G. and Bigham, M.L. 1987. Genetic variation among six strains of Romneys and Border Leicester and Coopworth crosses. *Proceedings of the New Zealand Society of Animal Production.* **47:** 101-105.

Brookes, I. 1997. Factors affecting feed requirements of sheep. *Proceedings of the Southern North Island Sheep and Beef Cattle Farmers Conference.* pp.35 –38.

Carter, A.H. and Cox, E.H. 1982 Sheep breeds in New Zealand. In Sheep Production, Volume 1. Breeding and Reproduction, ed. G.A.Wickham and M.F. McDonald. New Zealand Institute of Agricultural Science, Wellington, New Zealand.

Everett-Hincks, J.M.; Wickham, G.A. and Blair, H.T. 1998. Performance of Romney and ¼ Merino x ¾ Romney sheep on Wanganui hill country. *Proceedings of the New Zealand Society of Animal Production.* **58:** 266-269.

Hawker, H.; Davis, G.H. and Allison, A.J. 1980. Wool production and characteristics of Merino and longwool ewes and their respective Booroola crosses. *Proceedings of the New Zealand Society of Animal Production.* **40:** 205-208.

Meyer, H.H.; Bigham, M.L.; Baker, R.L.; Harvey, T.G. and Hickey, S.M. 1994. Effects of Booroola Merino breeding and the Fec^B gene on performance of crosses with longwool breeds. 1. Effects on growth, onset of puberty, wool production and wool traits. *Livestock Production Science.* **39**: 183-190.

Newman, S-A.N. and Paterson, D.J. 1991. Lamb and hogget wool production from crosses of new and traditional sheep breeds. *Proceedings of the New Zealand Society of Animal Production.* **51:** 271-276.

Sherlock, R. 1997. Breed differences in fleece quality, quantity and value. *Proceedings of the Southern North Island Sheep and Beef Cattle Farmers Conference.* pp 18-26.

Wuliji, T.; Andrews, R.N.; Davis, G.H. and Farquhar, P.A. 1990. Hogget fleece weight and fleece characteristics of Texel x Romney, Texel x Coopworth, Romney and Coopworth sheep. *Proceedings of the New Zealand Society of Animal Production.* **50:** 495-497.

Wuliji, T.; Dodds, K.G.; Andrews, R.N.; Turner, P.R.;Smith, B.R. and Wheeler, R. 1995. Breeding for a sheep with bulky wool by crossbreeding Texel sires with fleeceweight-selected Romney ewes. *New Zealand Journal of Agricultural Research.* **38:** 399-406.