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DJ Cottle* BC Russell† J Eappleston‡

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Merino Sire Evaluation Central Test Results 1987-1991

D.J. Cottle, B.C. Russell and J. Eppleston
Department of Wool and Animal Science
University of New South Wales
P.O. Box 1, Kensington, NSW 2033

Introduction

Merino Sire Evaluation is a service provided co-operatively by the University of New South Wales and New South Wales Agriculture and is a means whereby rams from a range of studs can be progeny tested at a central location. Two Riverina test sites at Hay and Deniliquin are currently administered by the University with a third site at Dubbo being managed privately but linked to the University schemes via common reference rams. Fine wool schemes are also being run in the New England region of N.S.W and at Hamilton in Victoria.

The schemes are run on a fee for service basis with ram breeders currently paying $2000 per ram entered, which covers the cost of artificial insemination, wool testing, classing, data collection and analysis, report generation and management. The protocols and management of the schemes have been described previously by Roberts et al. (1991).

Due to costs, traits currently measured are restricted to the most economically important ones such as clean fleece weight and fibre diameter (Cottle et al. 1991). Research projects run by the University have resulted in fibre diameter variability, lamb birth coat score and colour also being measured. Progeny are assessed for visual characteristics, which describe the conformation, wool quality, fleece quantity and pigmented markings of the sheep as well as classing performance (see Casey 1991).

A major criticism of central test sire evaluation is the small number of sires that may be tested. Currently it is only practical to evaluate 12-16 sires per test station per year. For this reason it is important that data from different sites and years be combined to allow comparison of a larger number of sires. The development and availability of software such as SIREBLUP (Gilmour 1990) has allowed across site and year comparisons to be made using multi-trait Best Linear Unbiased Prediction (BLUP) methods. Despite a number of technical problems with its use in sire evaluation (Russell and Cottle 1992), multi-trait BLUP has become the standard method of analysis of objective data from sire evaluation programs.

This paper presents sire evaluation results combined across five years (1987-1991) and three sites (Hay, Deniliquin and Dubbo). These results greatly enhance the value of the programs, and provide an accurate assessment of 92 sires from over 3,000 progeny. Previously published comparisons have been limited to 12 or 14 sires. A related paper (Atkins et al. 1993) presents subjective results on culling performance, conformation, wool quality and fleece quantity pooled across years and sites. Both papers need to be considered to maximise the information from the programs.

Merino sheep evaluation central test results 1987-1991.

Materials and method

The results reported here come from nine programs conducted at Hay, Deniliquin and Dubbo in NSW, between 1987 and 1991. The rams entered were generally of local origin, broadly classified as medium to strong woolled Merinos, although a number of rams were tested from South and West Australia. Rams can be compared across programs due to the use of link or reference sires at each site. These are rams who are used across a number of programs, thus providing a genetic 'link' between sites and years. Effectively, the performance of the previously untested rams is determined through their performance relative to the link sires whose progeny were run in the same program.

Following weaning, progeny were run as a single mob until classing and shearing as hoggets. At shearing, greasy fleece weights were recorded and mid side samples obtained for testing. Progeny were further retained until their four tooth (adult) shearing when the measurements were repeated. In total, hogget and adult fleece and body weight data from 3,139 progeny representing 92 sire families were collected.

Data were analysed to estimate breeding values of the sires for six traits, hogget and adult clean fleece weight, fibre diameter and body weight (HCFW, ACFW, HFD, AFD, HBWT, ABWT) using multi-trait BLUP procedures, through the SIREBLUP program (Gilmour 1990). The data were pre-adjusted for the fixed effects of birth status and sex, with the fixed effect of group (location/year) being fitted by the program, together with BLUP solutions for the random effects (sires). The genetic and phenotypic parameters used to obtain the solutions are shown in Table 4 (K.D. Atkins, unpubl.).

Table 1 Heritabilities (diagonal, bold), genetic correlations (below diagonal) and phenotypic correlations (above diagonal) used in the estimation of progeny values

	HCFW	HFD	HBWT	ACFW	AFD	ABWT
HCFW	**0.35**	0.24	0.33	0.65	0.22	0.29
HFD	0.25	**0.50**	0.12	0.20	0.75	0.10
HBWT	0.15	0.10	**0.45**	0.29	0.10	0.66
ACFW	0.80	0.25	0.10	**0.45**	0.24	0.31
AFD	0.25	0.95	0.10	0.30	**0.50**	0.14
ABWT	0.10	0.10	0.85	0.10	0.15	**0.35**

The EBV's that resulted from this procedure for hogget and adult traits were then halved to obtained EPVs (estimated progeny values). These were combined to obtain a 'lifetime' EPV for each trait. The EPV's were combined on the basis of 2.87 hogget expressions and 3.87 adult expressions, as outlined by Maxwell and Brien (1988). The annual EPV, averaged over the progeny lifetime was expressed as $EPV_L = 0.43\ EPV_H + 0.57\ EPV_A$. The resulting EPV's are listed in Table 2.

An attempt was also made to examine the stability of fibre diameter between the hogget and adult shearings, as suggested by Atkins (1990). The regression of fibre diameter on age was calculated for each progeny by subtracting the hogget fibre diameter from the adult fibre diameter. This value was then considered as a trait, and a single trait BLUP estimate of progeny value was determined for each sire using

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LSMLMW (Harvey 1990). A heritability of 0.23, as estimated by Atkins (1990) was assumed. Inclusion of fibre diameter stability in a multi-trait analysis was not feasible due to the lack of available parameters.

Table 2 Estimated Progeny Values for combined two and four tooth results from Hay, Deniliquin and Dubbo for years 1987-1991

		Estimated Progeny Value (EPV)				
Sire Code	Sire Name	PROG No.	CFW (kg)	FD (µm)	ΔFD (µm)	BWT (kg)
1904	**AMS 4268**	**38**	-0.23	+0.36	0.33	**4.2**
1905	**AMS 5414**	**42**	-0.42	**-1.04**	-0.20	0.4
1906	**AMS GT 118**	**33**	-0.46	**-0.95**	**-0.57**	0.9
1806	Avenel 5.27	**24**	0.10	-0.61	0.15	-1.4
1103	Avenel Oscar	27	-0.04	0.26	N/A	-0.5
1001	Boonoke B2.807	21	-0.06	0.10	0.12	-0.2
2905	Boonoke B7.1256	12	-0.19	-0.15	0.15	-0.1
2906	Boonoke B7.1273	24	0.03	0.54	0.00	-1.1
1802	Boonoke Pep 11.81	30	0.03	0.83	0.28	-0.8
2002	**Bungulla 4.178**	**29**	-0.06	-0.49	**-0.36**	-1.4
1701	**Collinsville 257.22.163**	**18**	**0.23**	-0.11	0.08	-0.9
1808	**Coonong 3.4**	**29**	-0.14	-0.58	**-0.42**	-0.3
1909	Coonong 6.28	33	0.19	-0.08	0.04	0.4
3008	Coonong 8.33	46	-0.15	0.14	N/A	-0.3
1106	Coonong 8.82	16	0.17	0.18	N/A	1.2
1702	**Cranmore Park 3.1**	**21**	-0.42	-0.54	**-0.51**	1.7
2001	Cranmore Park 6.5	15	-0.15	-0.59	0.00	1.0
1814	**Cranmore Park P Horn**	**13**	-0.16	0.58	-0.17	**2.5**
1913	Darajohn Red *	69	0.09	1.08	-0.17	-1.5
1108	**Dunedin Park Ben 129**	**9**	**0.25**	-0.08	N/A	0.1
1809	Dunedin Park Big Joe	26	0.08	0.76	0.13	2.0
1908	Dunedin Park Regent	24	0.17	0.46	0.42	-0.7
2003	East Roseville Ross	25	-0.10	-0.49	0.27	0.6
1105	Goolgumbla 7.1	20	0.08	-0.10	N/A	-0.7
2910	**Goolgumbla True Blue**	**30**	0.10	0.29	0.16	**2.2**
1002	Goolgumbla TB Son	42	-0.07	-0.05	0.13	-0.5
2106	Grange G2		semen	not	available	
2107	Grange GR 80068	22	0.06	-0.28	N/A	-1.1
2105	Grange GR 80100		semen	not	available	
2907	Grass 4.1	7	-0.05	-0.27	-0.02	0.2
1710	Grass Mogila 27	32	-0.01	0.46	0.18	-1.4
2004	Grass Sirius 6.1	68	-0.06	0.62	-0.19	0.2
3003	Haddon Rig 7-10	37	-0.14	-0.33	N/A	0.0
1704	**Haseley 3915**	**25**	-0.17	1.06	0.00	**2.3**
2909	Hazeldean 5.1312	21	0.00	-0.11	0.22	-0.9
1709	**Hazeldean 4.139 ***	**198**	**0.44**	0.06	-0.01	0.3
2005	Hazeldean 6.40 *	29	0.02	-0.69	-0.17	-0.4
2006	Hazeldean 7.64	24	0.13	-0.24	-0.30	1.4
1801	Hazeldean X3	37	0.04	0.16	-0.03	0.4
1807	Hinesville 6.20 mag		semen	not	available	
1003	**Illawarra Y3**	**26**	**0.25**	0.13	-0.05	-1.2
1107	Karmala Bradman	13	-0.09	-0.31	N/A	0.7
1703	Koordoux 339	22	0.01	-0.52	-0.20	1.2
1004	Lone Pine 7.4	36	0.01	0.26	-0.06	-0.3

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Sire Code	Sire Name	PROG No.	Estimated Progeny Value (EPV) CFW (kg)	FD (µm)	ΔFD (µm)	BWT (kg)
1804	Lone Pine Lukin	38	0.05	0.78	0.06	0.0
1706	Lowanna 454	33	0.09	0.70	-0.09	-2.6
1910	Lowanna 7.1	38	0.13	0.27	0.05	-0.8
1005	Lowanna Y454	35	0.09	0.64	-0.07	-0.5
1006	Meadow View 8.2	37	0.12	-0.36	-0.04	0.1
3004	Mogila Poll	36	0.21	0.18	N/A	0.4
3009	Mullengudgery 1308	29	-0.20	0.56	N/A	-0.5
1815	Mumblebone 416	5	-0.04	-0.04	0.00	0.5
1813	N.R.F 6.066 •	176	-0.11	0.05	-0.25	1.0
1907	Old Ashrose 61	29	0.04	0.26	0.25	2.1
2008	Old Ashrose Angus	23	0.00	1.06	0.17	0.8
1705	Old Ashrose Egan	18	-0.04	-0.57	0.21	1.7
2102	Old Ashrose M111	36	0.06	-0.18	N/A	1.1
2101	**Old Ashrose PCC146**	**20**	0.10	0.48	N/A	**2.4**
1008	**Old Cobran Big Mac**	**24**	**0.12**	-0.31	0.40	0.5
1803	Old Cobran Gadaffi	27	0.24	0.09	0.35	1.1
1903	Old Cobran Snowball	37	0.10	0.90	0.27	-1.6
1911	One Oak 00.400	36	0.06	0.29	0.04	0.0
2007	One Oak 009	26	0.13	-0.47	0.10	0.2
1708	One Oak 221	22	0.08	0.42	-0.11	-0.4
1104	One Oak Atlas 438	17	0.14	-0.03	N/A	0.3
1007	One Oak G2	41	0.02	-0.16	0.07	-0.8
1810	One Oak Purple 179	24	-0.03	-0.22	0.06	-0.7
3006	Pemcaw 6.123	32	0.12	-0.41	N/A	-0.4
1102	Peppinella 5.1121	33	0.08	0.18	N/A	-1.6
1812	**Pooginok 5.2 Long John**	**26**	0.18	**-0.71**	-0.20	0.7
1902	Pooginook 4.2	35	-0.04	0.30	-0.02	0.3
1707	Pooginook 46	10	0.02	-0.17	0.23	-1.8
1009	Pooginook 8.11	44	-0.05	0.30	0.22	-0.7
2104	Roseville Park 0133	26	-0.03	-0.53	N/A	-1.0
2108	Roseville Park 1232	48	0.03	-0.48	N/A	-0.1
2009	Roseville Park 88		semen	not	available	
3002	Roseville Park 912	44	-0.22	-0.43	N/A	-1.2
1101	Somerset M302	18	-0.21	0.14	N/A	0.0
2912	**Strathcluan W305 ***	**145**	-0.13	-0.17	**-0.40**	0.9
3007	Syndicate Haddon Rig 6.17	35	0.17	-0.37	N/A	-0.2
2911	Uardry Windermere	28	0.12	-0.60	-0.12	-1.6
2904	Wanganella pp6.377 *	53	0.00	-0.32	0.13	0.1
2901	Wanganella pp6.596 *	79	0.10	-0.21	0.27	-1.0
2902	Wanganella pp7.1272	20	0.09	0.32	-0.30	0.0
2903	**Wanganella pp7.1356**	**50**	-0.13	**-0.88**	-0.26	0.4
1811	Willandra Little John	25	-0.01	-0.33	-0.28	-0.5
1912	Willandra Wes	52	-0.07	0.19	0.53	0.0
1010	Willurah 6.1	41	0.04	0.60	0.03	2.2
1805	Wonga 3.40	33	-0.04	1.38	0.36	-1.9
2103	Woolaroo 052	27	-0.06	-0.69	N/A	0.2
2010	**Woolaroo Blue 203**	**32**	-0.29	**-0.77**	-0.15	-1.0
2011	Woolaroo Blue 237	40	-0.21	-0.64	0.08	1.1
	Means	31	3.37	21.48	3.06	39.6

1. Sire Code - Site/Year/No.
   Site: 1=Hay 2=Deniliquin 3=Dubbo, Year: 7=1987 8=1988 9=1989 0=1990 1=1991,
   No.: 01=Sire 1 for that site/year 02=Sire 2 etc.
2. Link Sires are marked with an asterisk
3. ΔFD is the difference between four tooth and two tooth fibre diameter expressed as a deviation from the average difference (3.06 µm). Sires marked N/A in this column have not had four tooth fibre diameter measured as yet.
4. Trait leaders are marked in bold (five for each trait)

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Discussion

Table 2 provides estimated progeny values for the lifetime performance of the sires' progeny for three traits (clean fleece weight, fibre diameter and body weight) as well as a measure of the relative change in fibre diameter between the two and four tooth shearings. For example the progeny of AMS 4268, the first ram in Table 2 will on average produce 0.23 kg less clean wool per year than the mean of the sires in the list. The EPV is the average figure taken over the lifetime of the progeny and takes into account performance at both hogget and adult ages. Sires whose results have been excluded through non-availability of semen were included in the initial analysis, and thus their performance contributes to the average for each trait.

The reliability of linked results such as these is dependent on link sires performing consistently across sites and years (i.e. no sire x environment interaction). If for example a reference sire was more suited to one environment than another, the test rams at the station where his progeny performed better would be unfairly disadvantaged. In addition, if sire x environment interaction was a significant factor, the performance in other environments of sires evaluated here could not be predicted with any certainty from these results. MacLeod et al. (1990) identified significant interactions between sire and environment for clean and greasy fleece weight and fibre diameter. Few other studies have been reported, although Lewer (unpubl. data) noted sire x environment interaction for fibre diameter in sire referencing schemes conducted in Western Australia. Preliminary work (B.C. Russell, unpubl.) indicates that sire x environment interaction is not an important factor in UNSW schemes, although work on a larger data set is continuing.

Combining performance in the same trait over different ages is not a common practice in animal breeding. For example beef cattle generally have 200 day, yearling and final weights recorded, yet these three measures of body weight are treated as separate characters and are presented as such. Atkins (1990) suggested that hogget and adult (2-6 years) clean fleece weight could be considered separate characters due to a genetic correlation across the age groups of less than 0.8, although the correlation across ages for fibre diameter was closer to unity.

However combining data across age groups aids the presentation and interpretation of results. Breeders are faced with large amounts of information on any particular sire, including the visually assessed traits. Combination of two and four tooth objective data into a single figure condenses the quantity of data to be interpreted, while still accounting for performance at both ages. Separate two and four tooth results are available for any breeder who wishes to see them, although they will not be published in this summary in the future. The calculated trait ΔFD is provided so the relative change in fibre diameter between two and four tooth shearings may be seen, so little information is lost through the combination of results across age groups. This trait has been included in response to breeder interest in 'micron blowout'.

There is some debate as to whether it is appropriate to provide a selection index for rams on test. Scientists generally believe such an index is the optimum method to combine traits into overall economic value within a flock. Some studbreeders, however, consider that its use is inappropriate as it does not take into account traits not included in the index and it does not take into account the selection of rams for corrective mating. Howe (1984) showed theoretically that corrective mating reduces between-sheep

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variance by only 4-8% but also reduces heritability of the trait by 10-20%. Recombination eventually returns variance to its initial level on cessation of corrective mating. One of the main objectives of corrective mating is to mate sheep with a below acceptable standard in some trait with above-average rams.

Debate regarding the appropriate index usually revolves around the choice of a set of relative economic values for fleece weight and fibre diameter (Cottle 1990). An analysis of historical prices suggests that a 5% index (i.e. reduction of one micron in diameter results in a 5% increase in price) is appropriate for medium/strong wools if the market value of wool is used to calculate the index (D.J. Cottle, unpubl.). If the 5% index is calculated based on clean fleece weight, fibre diameter and body weight only, the 10 rams which have had the highest economic value are listed in Table 3. The index score is calculated by multiplying the sire's breeding value for the trait by the relative economic value. The resulting score is added to 100 to ensure no negative values occur. The relative economic values assumed for clean fleece weight, fibre diameter and body weight were $49.67, $-9.12 and $0.72 respectively. The progeny from these rams would be expected to return at least ten dollars per head per progeny lifetime more than the average of all rams tested.

Table 3 Ten rams with the best combination of fleece weight, fibre diameter and body weight

Sire	Sire Code	Economic Value (5%)
Hazeldean 4.139	1709	143.5
Pooginook 5.2 Long John	1812	132.0
Dunedin Park Ben 129	1108	126.2
Collinsville 257.22.163	1701	123.8
Syndicate Haddon Rig 6.17	3007	123.4
Old Cobram Gadaffi	1803	123.5
One Oak 009	2007	121.3
Coonong 6.28	1909	121.2
Uardry Windermere	2911	120.8
Illawarra Y3	1003	120.5

The rams in Table 3 are considered to be those who will provide the greatest economic benefit to a breeder under an assumed price schedule for the end products (i.e. wool and meat). It should be noted that the performance of these rams in other traits that many breeders consider when making selection decisions is not allowed for in the index score. Traits such as fleece rot resistance, conformation and wool quality generally influence breeders to some extent. When both economic value and visual assessment have been considered, the sire evaluation committee at each site nominate rams that they recommend to be used as link sires for on-farm schemes. These rams are those that the committee judges to be the best in overall performance, both in terms of visual and objectively measured traits. Obviously, semen must also be available for a ram to be considered a link sire. The link sires for 1992/93 are listed in Table 4. Although below average on index score, Woolaroo 237 was chosen as a link sire for breeders of finer woolled sheep. Cull and Top percentages are included in table 4, expressed as deviations from the mean cull and top percentages for all groups. Progeny are classed as being of cull, flock or stud quality independently by two classers prior to shearing at both two and

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four tooth stages. More detailed results of this process are provided by Atkins et al. (1993).

This list is revised annually as new superior sires are identified, or as semen from any of the rams becomes unavailable.

Table 4 N.S.W. Stud Merino Breeders' Link Sires 1992/93 (Combined two and four tooth results)

Sire Code	Sire Name	EPV CFW (kg)	EPV FD (µm)	%Cull Dev'n	%Tops Dev'n	Index 5%
2005	Hazeldean 6.40	0.02	-0.69	-7	+4	113.5
1008	Old Cobran Big Mac	0.12	-0.31	+4	-1	118.7
2007	One Oak 009	0.13	-0.47	-8	+9	121.3
3006	Pemcaw 6.123	0.12	-0.41	N/A	N/A	119.0
2108	Roseville Park 1232	0.03	-0.48	-13	+6	112.1
2901	Wanganella pp6.596	0.10	-0.21	-11	+7	111.8
2011	Woolaroo 237	-0.21	-0.64	-5	+4	92.7
Means		3.37	21.48	36%	18%	100.0

Conclusion

The linked results from the UNSW Merino Sire Central test sites will be updated and published annually in Wool Technology and Sheep Breeding. When used with the data from visually assessed traits, (see Atkins et al. 1993) a substantial amount of accurate and reliable information is available to assist breeders in selection of potential sires and semen. Semen catalogues often provide little worthwhile objective data, making semen purchase a risk based on word of mouth of the ram's performance and the reputation of the stud. Results such as these will hopefully reduce the risk of buying an unsuitable ram, an important point considering the high cost of semen and artificial insemination.

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References

Atkins, K.D. (1990). Incorporating parameters for lifetime productivity into breeding objectives for sheep. *Proc. 4th World Cng. Genet. Appl. Livest. Prod.* **15,** 17-26.

Atkins, K.D., Casey, A.E., Semple, S.J., Schumann, W.G. and Evans, I.B. (1993). Combining information on visual traits across groups in sire evaluation schemes. *Wool Technology and Sheep Breeding* **41**, 37-46

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Casey, A.E. (1991). Merino sire evaluation visual assessment. Hay and Deniliquin 1991. *Wool Technology and Sheep Breeding* **39**, 14-17.

Cottle, D.J. (1990). The derivation of economic values in breeding programs for Australian Merino sheep with changing wool prices and flock production averages. *Aust. J. Agric. Res.* **41**, 769-780.

Cottle, D.J., Eppleston, J. and Roberts, E.M. (1991). Fleece traits to be considered in Merino sire evaluation schemes. *Proc. Aust. Assoc. Anim. Breed. Genet.* **9**, 339-342.

Gilmour, A. (1990). SIREBLUP instuctions for use.

Howe, R.R. (1984). The genetic effects of corrective mating. *Proc. Aust. Assoc. Anim. Breed Genet.* **4**, 14-15.

MacLeod, I.M., Howe, R.R., Lewer, R.P. and Woolaston, R.R. (1990). Genotype by environment interactions among Merino sheep in Western Australia. *Proc. Aust. Assoc. Anim. Breed. Genet.* **8**, 303-306.

Maxwell, W.M.C. and Brien F.D. (eds.) (1988) A Rambreeders Guide to WOOLPLAN. S.A. Dept. Agriculture.

Roberts, E.M., Atkins, K.D., Cottle, D.J., Eppleston, J., James, J.W., Lollback, M., Schumann, W.G. and Reed, P. (1991). A national sire evaluation program. *Wool Technology and Sheep Breeding* **39**, 2-7.

Russell, B.C. and Cottle, D.J., (1992). The effect of genetic parameters on breeding value estimation in Merino sire evaluation programs. *Proc. Aust. Assoc. Anim. Breed. Genet.* **10**, 460-463.