

GENETIC PROGRESS IN AUSTRALIAN YOUNG SIRE PROGRAMS: A MODEL FOR INCREASING THE RATE OF GENETIC IMPROVEMENT

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SUMMARY

Young sire programs (YSP) are an essential tool for developing and maintaining high rates of genetic gain in sheep breeds of Australia. The five YSP have a significant participation rate (between 18-51% of recorded data), higher rates of genetic gain and greater accuracy of key traits used in commercial lamb production. In addition due to the structure of the YSP, average linkage between the flocks is higher which contributes to greater genetic progress through across flock and across breed comparisons. Clearly YSP offer significant advantages to the breeders that participate and these benefits will continue to increase as new technologies that rely on high data quality such as genomic selection start to be implemented.

INTRODUCTION

One of the key mechanisms that Sheep Genetics utilises through LAMBPLAN to promote genetic gain for the future is through assisting groups of breeders involved in Young Sire Programs (YSP). These programs exist through individual breeders working together to share genes from the best and most genetically diverse young sires from each drop. The key features of YSP are that they have been developed to accelerate the rate of genetic gain, use high merit young sires, test genes at the earliest point, minimise the chance of inbreeding, increase the accuracy of ASBVs through better flock linkage and are the most efficient way of testing “NEW” genes. At present there are five breed specific YSP that differ in terms of their development and structure, but all have the common goal of trying to ensure that genetic gain for their breed is optimised whilst also ensuring that there is sufficient genetic diversity for future genetic change.

A further advantages of the YSP is that it provides a network of information for the breed that enables breeders to examine the genes of as many new sires per year as possible. By using a diverse range of young sires this lowers inbreeding levels within the group therefore providing, more chances of increasing genetic gain and finally through good links across the group, the group can be confident that it is able to select the next generation of parents with as higher accuracy as possible. The YSP are a network of like minded breeders and this also provides an excellent forum for the exchange of information and resources between breeders to improve their understanding and thus genetic improvement. These features lead to considerable competitive advantages for group members. This paper will use results from LAMBPLAN genetic analyses to demonstrate what advantages have been achieved over the last 10 years of operation. It will use results from the Meat Elite (Poll Dorset; Banks *et al* 2002), White Suffolk Flock Improvement Program (WSFIP) (White Suffolk) and SuperBorder\$ Genetic Improvement Program (\$BGIP) (Border Leicester) programs as examples of the YSP progress.

MATERIALS AND METHODS

A young sire program using rams less than 12 months without progeny involves sharing of genes via artificial insemination. Each member receives semen from a team of young sires (between 2 and 3 rams) selected by the group on merit, genetic diversity, structural soundness and breed type. The average merit of the team that each breeder receives is approximately the same so each member receives benefits of being well linked and so achieving more reliable ASBVs and

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Indexes, and getting excellent new genetics at a discounted price. Each member contributes to the group by helping to source elite young sires. The ability to accurately predict the breeding merit of the young sires used depends on each group members data quality on the progeny from the team member and on data quality of the progeny of non-team sires in the portion of the flock mated to the member's own sires. For this reason all YSP have imposed standards on data collection and recording.

As previously mentioned there are five formally structured young sire programs (YSP) that Sheep Genetics contributes to. Meat Elite (Poll Dorset) and the White Suffolk Flock Improvement Program are both have been allocating semen from sire teams to members since 1996. The three maternal sire programs (Coopworth, Border Leicester and Corriedale) have all been in operation for a variable number of years with the SuperBorder Genetic improvement program (GIP) being the longest at 8 years. All these groups have committees to select rams based on breeder nominations, hold annual meetings to review progress and sample genes from within and outside the group. Importantly all five groups have provided a significant share of the young sires that have entered the Information Nucleus of the Sheep CRC. The key elements of the three reported YSP are shown in Table 1.

Table 1. Key characteristics of three representative YSP in Australia

Young Sire Program	No of active breeders	Number of 2009 drop animals in group	Total Number of 2009 drop animals in breed*	% of the breed*
SuperBorder\$ GIP	19	7,189	14,182	51
White Suffolk FIP	18	7,683	36,758	26
Meat Elite	19	7,802	43,571	18

* breed numbers are for those studs that supply information to Sheep Genetics not the entire breed

As a way of demonstrating the relative success of these YSP, results from the January 15th run of LAMBPLAN 2011 were used to examine characteristics such as average merit and accuracy of key commercial traits and average merit and accuracy of industry indexes. Linkage statistics (as described by Brown *et al.* 2007) were also summarised for each YSP and compared to their respective breed as a whole.

RESULTS AND DISCUSSION

All three YSP have achieved considerable rates of genetic progress relative to their contemporary breeds over the last 10 years and this rate of progress has had a significant effect on the genetic gain of their respective breeds. As shown in table 1 Meat Elite had 7,802 animals tested from the 2009 drop that represented 18% of the breed within LAMBPLAN. This group has been able to increase the genetic merit of the teams selected so that the 2009 drop was approximately 10 index points (Carcase Plus) better than the breed average from that drop (Table 2). This differential is worth approximately 2 years of genetic gain and gives the group a clear genetic advantage. In terms of key terminal sire traits (Table 2), Meat Elite has established a significant difference in weaning weight (WWT), post weaning weight (PWWT), post weaning eye muscle depth (PEMD) and post-weaning worm egg count (PWEC) whilst maintaining birth weight (BWT) and post weaning fat (PFAT) at breed average.

The WSFIP program had 7,683 animals tested (26% of White Suffolk breed within LAMBPLAN). The relative difference in index is similar to that of Meat Elite with 11 index points or 2 years of genetic selection. As with Meat Elite the WSFIP has generated considerable difference in WWT, PWWT and PEMD whilst PFAT and BWT are the same. Furthermore the

breeders involved in these two Young Sire Programs almost inevitably achieve 5 or more Index point's genetic improvement per year (Figure 1), due to the fact that they use good young sires in the team and because typically they ensure that the rest of the sires they use are competitive in index value.

Table 2. Average ASBV values and accuracies (in parentheses) for the key commercial traits and indexes of the YSP group relative to the breed

Trait	Poll Dorset		White Suffolk		Border Leicester	
	Meat Elite	Breed	WSFIP	Breed	SuperBorder\$ GIP	Breed
BWT (kg)	0.39 (61)	0.36 (54)	0.28 (62)	0.28 (56)	0.22 (59)	0.16 (50)
WWT	7.49 (65)	6.67 (62)	7.33 (65)	6.32 (62)	3.44 (66)	2.34 (62)
PWWT	11.51 (65)	10.00 (63)	11.85 (66)	10.03 (64)	5.18 (65)	3.47 (62)
PFAT	-0.81 (64)	-0.77 (62)	-0.60 (65)	-0.54 (62)	-0.21 (62)	-0.18 (55)
PEMD	1.12 (66)	0.79 (64)	0.68 (67)	0.49 (63)	0.05 (60)	-0.09 (54)
PWEC	-8.26 (20)	-0.77 (3)	5.29 (33)	-1.19 (25)	1.04 (18)	-0.11 (3.1)
MWWT			0.59 (44)	0.18 (40)		
NLW			6.07 (38)	3.20 (27)		
Index	177 (61)	167 (58)	173 (62)	162 (58)	115.19 (50)	108.87 (43)

The SuperBorder\$ GIP is now in its 8th round of matings and represents a major proportion of the Border Leicester breed in Sheep Genetics (51%). One of the key features of this program is that it offers group members the most opportunity for capturing the value of genetic improvement by being well linked to a marketing initiative that rewards genetic improvement. In this program rams that are greater than the mean \$ index for the drop are ear tagged as SuperBorder\$ and can be sold with a certificate that allows 1st cross ewe breeders to ear tag progeny of these rams. Both rams and their ewe progeny enjoy a significant price premium in the market place. As with the Terminal Sire YSP, there is considerable genetic benefit from being in the GIP. The difference of \$6 in index value is of high significance given the fact that only rams in the top 50% of the breed can be given a SuperBorder\$ tag for that year. This YSP has been highly focussed on maternal traits which are reflected in the difference in number of lambs weaned (NLW) and maternal weaning weight (MWWT). Growth in the form of WWT and PWWT is also much higher in the YSP relative to the breed. In contrast there is little actual difference in the carcass traits between YSP members and the breed for Border Leicester.

Table 3. Average linkage statistics for the Meat Elite, WSFIP and SuperBorder GIP programs compared to their respective breeds

	Weight		Carcass		Wool		Reproduction		Worm egg count	
	No Links*	Max Link#	No Links	Max Link	No Links	Max Link	No Links	Max Link	No Links	Max Link
Meat Elite	326.2	97.4	317.8	97.5	0.0	0.0	16.6	31.0	17.4	41.5
Breed	108.0	39.0	105.4	39.0	0.0	0.0	2.3	4.4	0.8	2.1
WSFIP	61.9	92.7	59.5	90.2	31.2	85.3	47.5	88.2	4.4	30.8
Breed	23.8	44.9	21.6	42.5	5.1	16.0	12.2	29.2	1.0	6.3
SuperBorder\$	352.1	92.1	346.7	92.3	0.0	0.0	23.7	37.4	13.9	29.8
Breed	175.6	62.7	166.9	61.1	0.0	0.3	2.6	5.5	1.3	3.9

* Average number of links with other flocks

Average maximum link with other flocks

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Table 2 shows the average accuracies of the ASBVs for all traits and indexes for the YSP program relative to the breed. In all cases, the YSP members have higher accuracies for all traits and in particular that are difficult or expensive to measure such as BWT, NLW and PWEC. As these traits are starting to emerge as real points of difference in commercial ram sales this increased accuracy will enable those members to make more accurate selection in these traits and therefore improve the value proposition for the group.

The extra genetic linkage created through the YSP helps greatly to improve the accuracy of across flock comparisons. Across all 3 breeds the YSPs have a significantly larger average number of links with other flocks in the analysis (Table 3). The YSPs also had on average higher levels of accuracy of those links with other flocks.

What is the Future of Young Sire Programs? The genetic sector of the Australian Sheep industry is on the verge of significant change with the introduction of genomic predictions for difficult and expensive to measure traits such as eating quality. This will see increased need for seedstock breeders to invest in technologies that improve the characterisation of genes for carcase yield and merit, eating quality, disease resistance and fertility and use this information in a much more professional manner. All of this change should also promote a renewed interest in technologies such as MOET, JIVET and TGRM (Kinghorn, 2011). By working as a group, YSP members will be able to develop and use changes in genetic information at a much faster rate and a significantly lower cost when compared to the individual breeder. Combined with increased rates of genetic gain, this will further strengthen the competitive position of YSPs within and between breeds. In order to capture this competitive position and promote it to industry, YSPs will need to develop marketing profiles similar to that already in place for SuperBorder\$. It is likely that successful young sire programs will be associated with recognised trademarks for gene packages within the Australian Sheep Industry.

CONCLUSIONS

Young Sire Programs offer five major benefits to participating breeders and their commercial clients;

- Wider use of elite genes ~ spreading and utilising the best genetics
- Much earlier use of young sire resulting in reduced generation interval
- Improved utilisation of the genetic variation thereby reducing inbreeding and also the opportunity to purchase new genes (rams) as a group which reduces individual cost and risks
 - Improvements in data quality and accuracies, thus a better chance of finding more elite sires at an earlier age
 - Increased competitive advantage in the commercial market place, through access to and use of new emerging technologies.

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