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BUSINESS METRICS FOR SHEEP IMPROVEMENT LIMITED (SIL) RAM BREEDERS

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SUMMARY

While there is not a clear distinction between the information used in potential ram breeding business metrics and flock genetic improvement, the objective of this research was to look for opportunities to report statistics back to breeders each year that would help guide their ram breeding business. A consultation process showed that breeders are interested in generating more progeny of higher genetic merit and reducing the number of progeny culled because they do not meet criteria for sale to ram buyers. Breeders put less value on metrics related to how much clients pay for rams, or how many years clients had been buying rams.

This paper describes the data requirements for, and calculation of, business metrics that utilise information held in the SIL database together with sale data ram breeders can collect. These metrics include measures of the 'impact' a given sire has on the ewe flock (through selection and persistence of his daughters), the proportion of a ram's sons sold, average price of a ram's sons, and average price per unit of estimated breeding value, sub-index or overall index. Examples are provided for those metrics where information is already available on the SIL database. Calculation of the reported metrics is straightforward. However, more complete data are required in existing SIL record fields in addition to the need to include new data fields in SIL, in order to produce robust and informative metrics for ram breeding businesses.

INTRODUCTION

Sheep Improvement Limited (SIL) has a wealth of data and information on individual animal and flock performance (Newman *et al.,* 2000). Many ram breeders also collect data about client expectations, sale prices, general signals coming from the commercial market, and financial performance of their business. Leading ram breeders strive to increase the profitability of their business. In order to do so, information beyond that associated with flock genetic improvement is required.

There is an opportunity for wider use of the SIL database, such that some data held by ram breeders could be analysed along with data in the SIL database to generate metrics that better characterize the ram breeding business. The Irish Cattle Breeding Federation (ICBF) and Sheep Ireland database is used extensively in the provision of information beyond that associated with genetic improvement (Wickham, 2012). This paper describes the data requirements for, and calculation of, business metrics that utilise information held in the SIL database together with information ram breeders can collect.

CONSULTATION

This work was initiated by surveying a small number of large-scale breeders since they are more likely to yield robust metrics and to see the benefits of these to their ram breeding business. Dual Purpose (DP or ewe breed) flocks were chosen because of the importance of maternal traits in defining genetic merit and because it was considered that Terminal Sire (TS or meat breed) flock metrics would be a subset of those studied for DP flocks. Three flocks belonging to different breeders provided the information on which this report is based. The consultation process involved individual meetings with the breeders. From these meetings a list of potentially useful ram breeder business metrics was compiled based on suggestions from breeders and from discussions related to

metrics offered to the breeders at that time. Later, the breeders completed a survey which offered them paired alternatives from this list of different ram breeder business metrics to determine their preferences (Byrne *et al.*, 2012).

This consultation process showed that breeders are interested in generating more progeny of higher genetic merit and producing progeny that make it through commercial culling criteria. This essentially reflects a desire to reduce 'wastage', i.e. rams bred that cannot be sold to commercial farmers. Breeders generally maintain strong relationships with their clients, have a good knowledge of client requirements and value clients that buy lower priced rams as much as those buying higher priced rams. Hence there appears to be little business value in knowing how much different clients pay for rams.

METRIC CALCULATION

The priority metrics for breeders were; 1) measures of the 'impact' a given sire has on the ewe flock (through selection and persistence of his daughters), 2) the proportion of a ram's sons sold, 3) average price of a ram's sons, and 4) average price per unit of estimated breeding value (eBV), sub-index or overall index. Each of these is considered in more detail below.

The 'impact' a given sire has on the ewe flock. Impact can be calculated such that a) the number of daughters born to each sire (this represents the total opportunity the sire has to contribute to the flock through his daughters), b) the subsequent proportion of each sire's daughters that enter the flock, and c) the subsequent survival of daughters of each sire in the flock are all taken into account.

Data requirements for this metric include a count of the number of daughters born to a sire, the number of daughters born to a sire lambing in each cohort in the flock, and the total number of ewes lambing in each cohort in the flock. Progeny born to a sire (attribute = number of progeny) and daughters with a lambing record (attribute = number of daughters lambing) are already held in the SIL database. Number of daughters lambing in each cohort in the flock is also in the database through NLB records (NLB1, NLB2 etc.).

Cohort impact (*CDI*) can be reported as a deviation from that which would be expected, in terms of percentage contribution to a lambing cohort, based on the number of daughters born, calculated as:

$$CDI_{sc} = \left(\left(\frac{DS_{sc}}{TS_c} - \frac{DB_s}{TB}\right) \times 100\right)$$

where for sire s in lambing cohort NLB1 to NLBc, where c is the total number of lambing cohorts, *DS* is the number of daughters selected (i.e. lambing in the cohort), *DB* is the number of daughters born, *TS* is the total number of daughters selected and *TB* is the total number of daughters born.

Sire impact (*SDI*) can be reported as the mean of the cohort impact deviations across lambing cohorts weighted by the total number of daughters in each cohort, calculated as:

$$SDI_s = \frac{\sum_{i=1}^{c}(CDI_{si} \times TS_i)}{\sum_{i=1}^{c} TS_i}$$

The following example describes the impact of 3 sires. Each of the sires has had daughters lambing in 3 different lambing cohorts, NLB1, NLB2, and NLB3. Table 1 presents the number of daughters have born (*DB*) and the number of daughters selected (*DS*) for sires A, B, and C respectively. The total number of daughters selected (*TS*) for each lambing cohort and the total number of daughters born (*TB*) is also presented.

Table 1. The number of daughters born (*TB*) and selected (*TS*) for sires A, B, and C respectively, the total number of daughters selected (*TS*) for each lambing cohort, and the total number of daughters born (*TB*)

	Number of daughters born (*DB*)	Number of daughters selected (*DS*)		
Sire		NLB1	NLB2	NLB3
A	288	102	85	61
B	140	62	51	39
C	113	35	30	15
	Total daughters born (*TB*)	Total daughters selected (*TS*)		
	541	199	166	115

Applying the formula, impact (*SDI*) for sires A, B, and C can be calculated as -1.57%, +5.79%, and -4.22%, respectively, as weighted average deviations from what would be expected, in terms of percentage contribution to a lambing cohort, based on the number of daughters born.

The proportion of a ram's sons sold. The idea of this metric is to capture how efficient sires are at producing sons that sell. Data requirements for this metric include a count of the number of sons born to a sire, and the number of sons sold. Data for sons born to a sire are already in the SIL database through the pedigree. Sale information would be obtained through existing SIL status codes. This sale percentage metric (*SP*) would be calculated for each sire as a proportion and reported as a percentage of sons sold as:

$$SP_s = \left(\frac{SS_s}{SB_s}\right) \times 100 ,$$

where for sire s , *SS* is the number of sons sold and *SB* is the number of sons born over the sire's lifetime.

The following example calculates the proportion of a ram's (sire A) sons sold. Assuming sire A has produced 150 sons over his lifetime and 60 have been sold; the proportion of his sons sold is 0.4. This can be compared, for example, to sire B who has produced fewer sons (65) over his lifetime but 45 have been sold; a proportion of 0.69.

The average price of a ram's sons. The idea of this metric is to capture how efficient sires are at producing sons that sell at high prices. Data requirements for this metric include a count of the number of sons sold from a sire, and the individual ram sale price. Sale information would be obtained through existing SIL status codes but additional information on sale price would need to be added to the database.

The average price metric (*AP*) would be calculated for each sire, and reported as the average price of sons sold as:

$$AP_s = \frac{\sum P_s}{N_s} ,$$

where for sire s , *P* is the sale price of sons sold, and *N* is the number of sons sold. An addition to this calculation would be the total earnings per sire or the earnings per sire adjusted for the number of progeny (earnings per progeny born). The total earning per sire (*TE*) metric would be calculated as:

$$TE_s = \sum P_s$$

where for sire s , *P* is the sale price of sons sold. The earnings per progeny born (*TEP*) metric would be calculated as:

$$TEP_s = \frac{\sum P_s}{NP_s},$$

where for sire s , *P* is the sale price of sons sold, and *NP* is the number of progeny born.

The average price per unit of estimated breeding value, sub-index or overall index. The idea of this metric is to capture the gross income received by the breeder per unit of eBV, sub-index or index. Data requirements for this metric include individual eBVs, sub-index or overall index for each ram sold and individual ram sale price. Estimated breeding values, sub-indexes or overall indexes for each ram sold would be obtained from SIL genetic evaluations, and sale information would be obtained through status codes. Price information would be required.
The index price (IP) metric would be calculated for each year cohort of sold rams, and averaged over cohorts, as:

$$IP_y = \overline{\left(\frac{I_y}{P_y}\right)},$$

where for sale year y , *I* is the eBV, sub-index, or index of rams sold and *P* is the sale price of sons sold.

DATA AVAILABILITY

Key pieces of data required for the calculation of each metric have been detailed. Counts of animals born and daughters lambing, statuses and ewe exit fate codes can be obtained from the SIL database. Sale prices are not currently recorded on SIL. However, if the metrics described here were available, it is expected this would be the incentive to record such data on SIL.

CONCLUSION

Breeders are interested in generating more rams that are of higher genetic merit and most importantly are of sale quality. There is value in producing metrics that assess the relative merit of sires in producing progeny (male and female) that deliver more value genetically and financially. Implicitly this includes commercial culling criteria such as physical soundness, not just genetic information from SIL. These metrics offer a practical way to include those criteria with an appropriate emphasis in the ram selling business. Breeders appeared to put much less business value on metrics related to how much clients pay for rams, or how many years clients had been buying rams.

Calculation of these metrics is simple. However, in order to calculate metrics described in this report, and for the results to offer value to ram breeders, the following requirements must be met:

- Accurate and complete recording of status and exit fate for all rams and ewes
- Recording of sale price individually for all rams sold

The findings of this study need to be extended by collecting price data and surveying of more breeders.

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