

Practical application of precision sheep management

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Abstract: Precision Sheep Management (PSM) is a practical approach to managing sheep (sub) flocks to achieve increased profits. By collecting individual measurements on animals, the top and bottom performers in the flock can be identified and grouped to maximise production and minimise costs. There is a large amount of variation between animals for most traits and by collecting and using this information for selection, nutrition and disease management, there can be large benefits. There are different entry levels for using PSM and the identification level depends on the cost and labour availability. Many benefits from PSM can be obtained with a visual tag provided labour is available. However, using RFID tags makes data capture easier, uses less labour and greatly reduces errors in data recording, thus allowing speedy retrieval of data for differential management of sub-groups. There have also been many advances in the technology using RFID tags that cannot be duplicated with visual tags. These automated systems allow information such as repeated liveweights and maternal pedigree data to be captured with minimal human intervention. The benefits of adopting any of these PSM systems depend entirely on how the information will be used. Collecting the information is one step, but utilising it is the most important.

Introduction

Precision Sheep Management involves managing (groups of) individual animals according to their level of production or risk, rather than the more traditional approach of managing all animals within a flock the same. This will enable increased on-farm productivity through improved selection, nutrition and disease management as well as delivering targeted products to meet market specifications. Basically, the goal of precision sheep management is to maximise the returns from the high value animals whilst also minimising the costs of the low value animals, resulting in a more profitable enterprise.

Managing groups of animals within a flock relies on a change of attitude from the more traditional management approach. Rather than relying on genetic change coming just from the ram source, PSM enables effective selection among the ewes (and wethers) as well. Instead of culling animals when they reach a certain age, with additional information, we can keep the high performers longer and remove the low performers earlier from the system. Feed costs can be reduced by only feeding animals that

require supplementation according to the animal condition and history, rather than feeding the whole flock. Joining is another example where PSM could improve the flock by assisting with mating selection. Often the oldest age group is mated to terminal sires, or the wool animals are selected and the excess are used for the meat flock. However, when additional information is collected, this could be used to identify those animals better suited for meat production and those best to be retained for wool production. This would result in two potentially valuable groups of animals, selected for their fitness for purpose, rather than one select group and the excess group with no benefit for the alternative product.

Variation – range and measurement

The biggest resource for these improvements is the variation within a flock. Table 1 shows the average trait information of a typical flock, which is often the information that most producers will have at hand. The additional and more important information is the variation within the flock. The table shows the average of the top 25% of the animals as well as the bottom

25% for each of these traits. The difference is quite large, remembering that this is the average of the top and bottom quarters, but also there is more variation between individual animals within these quartiles. Looking at reproduction, for example, the top quarter of the flock are producing on average 1.5 lambs each year (with the best consistently rearing multiples), but the bottom quarter are producing on average one lamb every three years (and some animals are producing none). This variation is similar for all traits, so there are many opportunities to improve the profitability of the flock in current generations, as well as in genetic gain achieved through selection of better performers to be retained in the breeding flock.

To take advantage of this variation, the performance of the animals must be measured individually. Most of these traits can be precisely and cost-effectively measured as long as the animals are individually identified. There are now widely-accepted and used techniques for capturing fibre diameter, fleece weight, body weight, fat scores and for scanning information on farm. It is one thing to measure animals to collect the data, but it is another matter entirely to store the data and turn it into information that can be applied. We can use fibre diameter and

fleece weight to reliably predict lifetime fleece value, scanning and lamb survival to predict current performance and lifetime reproduction, and multiple body weights to monitor growth rates and target markets by specification.

Pathways to benefits

There are multiple pathways to accumulate these benefits. Current generation improvements achieved by selecting animals to be retained for production in the current flock can be quite large, and the benefits can be achieved quite quickly. In addition to this though, is the genetic gain that can be made in future generations, through the progeny of these selected breeding ewes. Targeting markets is another opportunity where animals can be chosen for high value markets, and costs can be reduced for the low value markets, depending on factors such as different growth rates and target weights for various meat markets. Precision Sheep Management can be applied to selected sub-flocks to exploit this variation in value within flocks.

There are various levels of identification at which producers can enter precision sheep management, depending on costs and labour availability. RFID tags are not a necessity to gain benefits from this variation. They are, however,

Table 1. Variation within a flock in wool, meat and reproductive traits and in profitability (from Atkins, Richards and Semple (2006)).

Trait	Production level of flock:		
	Average	Top 25%	Bottom 25%
Wool traits:			
Fleece weight (kg)	4.6	5.3	3.9
Fibre diameter (μm)	20.4	18.9	21.9
Staple strength (N/ktex)	35	42	28
Meat traits (crossbred lambs)			
Growth rate (g/day)	284	357	200
Fat depth (mm)	10.6	8.9	12.5
Reproduction			
Lambs weaned per ewe joined	0.86	1.43	0.28
Profitability traits			
Fleece value per ewe (\$)	\$54	\$82	\$37
Carcase value per ewe (\$)	\$33	\$56	\$12

a means of reducing the errors and labour component attached to using visual tags. With no permanent identification, selection decisions can be made according to measurement taken at the time, and keeping the sub-flocks separated thereafter. Group IDs might be used to identify like groups, which can then be separated into those specific groups throughout their lifetime, but individual IDs are needed to combine information on various traits that are measured at different times. Individual IDs also enable decisions to be made in the future about information collected previously. For example, the information would be available for regrouping if the breeding objective changed or the proportion of animals within the sub-groups needed to be adjusted. Previous information can also be used for determining feed requirements leading into joining. RFID tags enable flocks to be run together at different times of the year, and they can be easily drafted according to different criteria for certain events throughout the year. This type of management can be achieved with just visual tags, but the labour component is much higher when drafting according to manual draft lists relying on previous information.

Technology

This paper is not going to cover all of the technologies that are available now to ease data collection, but will cover two examples of some of the more recent achievements in PSM. Walk-Over-Weighing and Pedigree MatchMaker are two systems that were developed through the CRC for Sheep Industry Innovation (Sheep CRC) as alternative ways of collecting information with low labour and low cost.

Walk-Over-Weighing

Walk-Over-Weighing (WOW) was developed to enable the collection of regular body weights without the need to muster the animals or bring them to yards. The animal ID is recorded when the animal walks over a weigh platform into a yard containing an attractant (such as feed or water). A weight corresponding to an ID is recorded by an indicator. These weights over a period of time can be used to calculate the average weight of the animal during that period, and multiple weights can be used to calculate growth rates. Growth

rates can be used to predict whether each animal will reach a target weight and in what time frame. It is also useful to monitor the condition of the animals, because the system can pick up relatively small changes in weight well before a visible change in condition score is evident. This can be used to make feed adjustments or manage parasites before they have a large effect on the performance of the animals. The actual and predicted growth rates can also be used to target the product to the correct market, and close monitoring and prediction assist the meeting of market specifications. This automated data capture reduces stress on animals (with no handling necessary) and does not take labour away from other farm activities.

Pedigree MatchMaker

Pedigree MatchMaker was developed as an alternative approach to collecting pedigree. The most common method requires manually capturing the dam information each morning during lambing and physically catching each lamb and recording that information. This is a highly labour intensive process. The less common alternative is DNA matching at a later date. This approach requires less labour but can be quite costly, resulting in many flocks not recording maternal pedigree. Pedigree MatchMaker is a low-cost, low-labour alternative. This system relies on ewes and lambs having RFID tags, and uses a similar setup to the WOW system, but without the weigh scales under the platform. The order of the tags is recorded as the animals walk through the race, past the reader on the way in to the fenced off attractant. After providing a list of ewe tags and lamb tags, the collected information can then be used to match lambs to their dams according to the level of association between all of the ewes and lambs. Trials have shown the maternal association has similar accuracy to that of the manual mothering up process, provided the data is collected for at least 4–6 weeks. This electronic process is much less labour intensive and lower cost. Collecting maternal pedigree can improve the accuracy of estimated breeding values, which leads to faster genetic progress and productivity improvement, eventually achieving higher profits. It is also

useful for genetic comparisons between animals over time and across flocks.

Conclusions

There are many opportunities within precision sheep management but there are no set guidelines for adoption. There are many places where we can make better use of existing technologies to achieve higher profits. There are also opportunities for the development of new technologies to improve productivity and profit. The most important benefits will be the ability to better handle risk. Some examples of risk minimisation include:

- Culling less productive individuals (instead of an age group) to reduce stock numbers, which will have less impact on the overall productivity of the flock
- Only treating the ones at risk or requiring treatment instead of all animals
- Additional resources can be provided to those that will maximise marginal returns

- Optimising the time for intervention, selection or sale of less productive animals

Precision Sheep Management provides an opportunity. It is ready and can easily be implemented in all flocks at various levels of adoption. There just needs to be a change in the way people think; Don't look out and see a flock of sheep, look out and see a paddock full of individuals with lots of opportunities.

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Reference

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