Using eID for fleece weighing

Producer case study: Fiona Conroy

Aim

To determine if weighing individual sheep before (full wool) and after shearing could be used as a surrogate measure of individual animal fleece weight and ranking of best and poorest performers.

The demonstration site / producer knowledge

Based out of the Bellarine Peninsula, Fiona Conroy manages a 390-hectare property running a total of 550 head of cattle and 2,200 head of sheep. Fiona is no stranger to electronic identification technology (eID) in cattle already owning a wand for data collection and utilising a program called KoolCollect for her data management for years.

Seeing the potential use of eID technology in sheep early, Fiona has been collecting tag numbers, birth year and genders of all lambs born since the tags became mandatory in 2017. Since 2019 data collection in her sheep enterprise has expanded to include health treatments in her flock, but she is driven to get greater use out of eID technology in her business.

At the beginning of this Producer Demonstration Site (PDS) in 2020, Fiona judged herself to have a moderate to low level of knowledge in set up, capture and interpretation of eID data. However, her knowledge of eID technology application potential was extensive:

- Individual animal Id
- Monitoring growth rates and weights
- Monitoring fleeces weights
- Monitoring pregnancy status and history against individual ewe id (empty, twin, single)
- Recording individual ewe as wet or dry at lamb weaning
- Recording animal health treatments – (Chem name, Batch No, ESI, WHP) against individual ID to provide traceability,
- Individual property ID to allow traceability in the food chain,
- Individual carcass feedback from processors
- She also highlighted several specific areas where she believed that eID technology could benefit her business:
- Identifying animals to make informed culling and selection decisions based on individual performance,
- Traceability of animal treatments
- Use eID in sheep handlers/ auto-drafters to reduce labour requirements, improve farm safety and make recording of data easier,
- Potential access to individual carcass feedback from processors
- Better record keeping

Figure 1 Fiona Conroy

Method

Reducing labour requirements is a key area that can be improved using eID technology in farm management practices, and for this PDS, Fiona aimed to determine if weighing individual sheep before and after shearing could be used as a surrogate measure of individual animal fleece weights. If successful, it's hoped that these assessments could move outside the shed and reduce labour requirements in the shed at an already busy time.

A flock of 193 ewe hoggets, 16 months old with 10 months wool (i.e. previously shorn as lambs at 6 months) were weighed before entry into the shed (off feed but access to water). Ewes were scanned on the board and fleeces (less bellies) were weighed to 0.1 kg. Animals were weighed in full wool before entering the shed and then directly after shearing (max 7 hours for first animals shorn to last animals weighed).

Results

The weighing of sheep before and after shearing was a poor estimate of individual fleece weight, with a correlation of only 0.2. This was surprising given the range in fleece weights measured (2.7 kg to 6.3 kg gsy). However, a detailed examination of additional liveweight measurements indicated the accuracy of weighing was likely to be insufficient to achieve the sensitivity required to predict fleece weight.

Fleece weight

The average fleece weight (excluding bellies) was 4.35 kg/hd gsy. There was a large range in the fleece weights with decile 1 at 3.7 kg/hd and decile 9 at 5.1 kg/hd (Table 1). The middle 50% of fleece weights ranged between 3.9 kg/hd and 4.8 kg/hd (Figure 1).

Table 1 Decile range of fleece weights (kg/hd).

Range	Fleece wt. (kg/hd)
Lowest	2.70
Decile 1	3.70
Decile 2	3.88
Decile 3	4.00
Decile 4	4.20
Decile 5	4.30
Decile 6	4.50
Decile 7	4.70
Decile 8	4.90
Decile 9	5.10
Highest	6.30

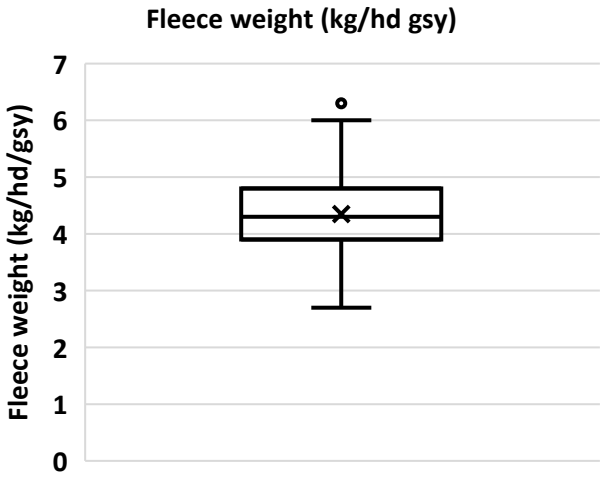

Figure 2. Box and whisker graph of fleece weight distribution.

The most frequent fleece weight was 4.2 kg/hd (9.5 % of all fleeces) and there were 3 outlier fleeces at 2.7, 6.0 and 6.3 kg/hd (Figure 2). Despite the spread in fleece weights, a normal distribution best represented the fleece weight data (@Risk distribution statistical analysis).

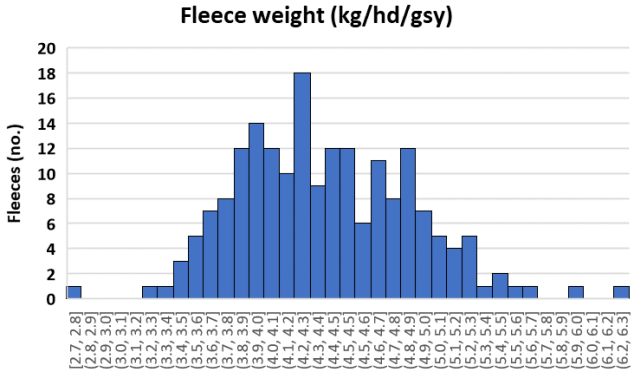

Figure 3. Frequency histogram graph of fleece weights.

Liveweight, full wool

The average liveweight in full wool was 43.0 kg (n=176, 18 missed weighing). There was a large

range in the body weights with decile 1 at 30.5 kg and decile 9 at 49.0 kg (Table 2). The middle 50% of liveweights ranged between 39.5 kg and 46.0 kg (Figure 3), although there was a widespread.

Table 2. Decile range of liveweights (full wool).

Range	Liveweight (kg)
Lowest	30.5
Decile 1	37.5
Decile 2	39.0
Decile 3	40.5
Decile 4	42.0
Decile 5	43.0
Decile 6	44.0
Decile 7	45.0
Decile 8	46.5
Decile 9	49.0
Highest	56.0

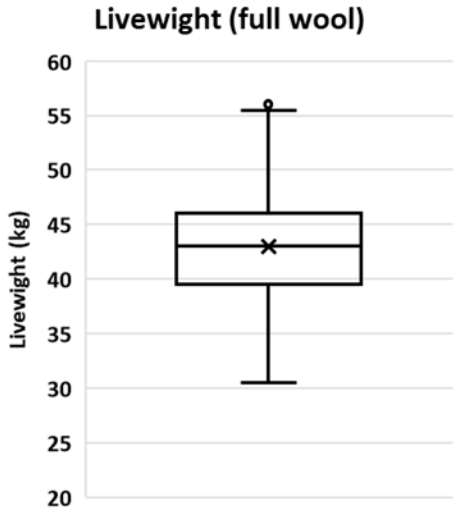

Figure 4. Box and whisker graph of liveweight distribution (full wool).

Liveweight, off shears

The average live weight off shears was 36.3 kg (n=189). There was a large range in the body weights with decile 1 at 25.0 kg and decile 9 at 47.9 kg (Table 3). The middle 50% of live weights ranged between 33.8 kg and 38.9 kg (Figure 4), although there remained a large upside and downside tail.

Table 3. Decile range of liveweights (off shears).

Range	Liveweight (kg)
Lowest	25.0
Decile 1	30.9
Decile 2	32.9
Decile 3	34.3
Decile 4	35.0
Decile 5	36.1
Decile 6	37.0
Decile 7	38.1
Decile 8	39.8
Decile 9	42.2
Highest	47.9

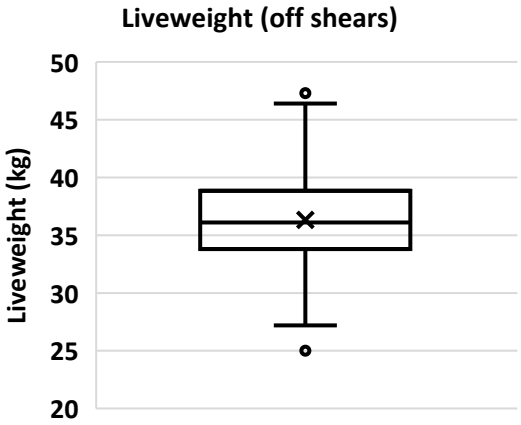

Figure 5. Box and whisker graph of liveweight distribution (off shears) (kg).

Discussion

The range in liveweights and fleece weights would give hope there should be an opportunity to identify differences in animal performance through weighing. However, this proved elusive.

Could live weight (full wool) into the shed be used as a surrogate estimate for fleece weight?

No. There was a poor correlation between the live weight of animals in full wool and the prediction of fleece weight (linear r2 = 0.22) (Figure 5).

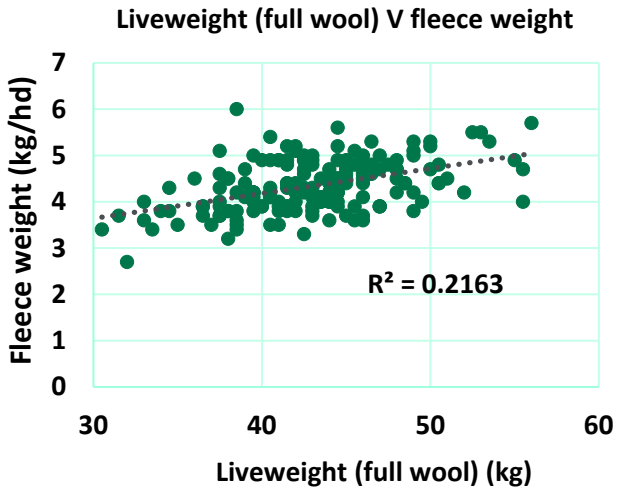

Figure 6. Liveweight (full wool) against fleece weight (excluding bellies) (kg).

While there was a slight upward trend, the variation in fleece weight at the same liveweight was too great. This may be explained by the rate at which animals 'emptied out' before being weighed although the difference is greater than expected.

Could liveweight off shears be used as a surrogate estimate for fleece weight?

No. There was a very poor correlation between liveweight of the animal after shearing and the prediction of fleece weight (linear r2 = 0.11), worse than the full wool prediction (Figure 6).

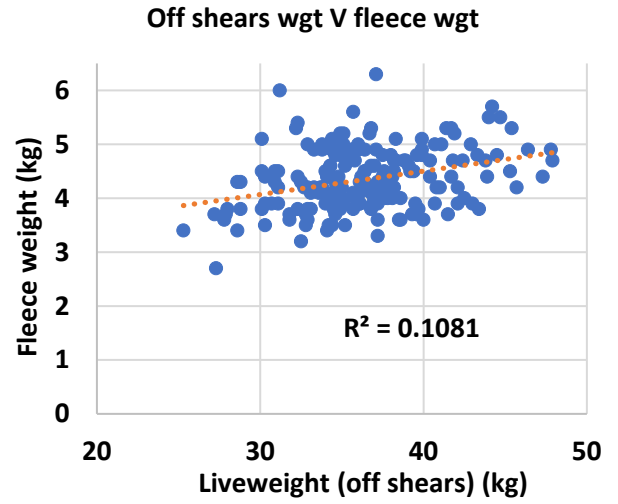

Figure 7. Liveweight after shearing against fleece weight (excluding bellies) (kg).

Could the change in liveweight (full wool) and liveweight off shears be used as a surrogate estimate for fleece weight?

No. The correlation between change in animal weight in full wool and off shears was poorly correlated with measured wool cut (Figure 7).

The calculated wool cut from the difference in live weight was an average of 6.6 kg/hd, whereas the average measured fleece weight was 4.3 kg/hd. The average weight of bellies was 0.81 kg/hd. This leaves an unaccounted weight difference of 1.5 kg/hd. Moreover, there was a poor correlation that an adjustment calibration could not be applied.

Although the results suggest liveweight changes cannot be used to determine individual fleece weights accurately, could the change in liveweight be used to rank the best and worst-performing animals?

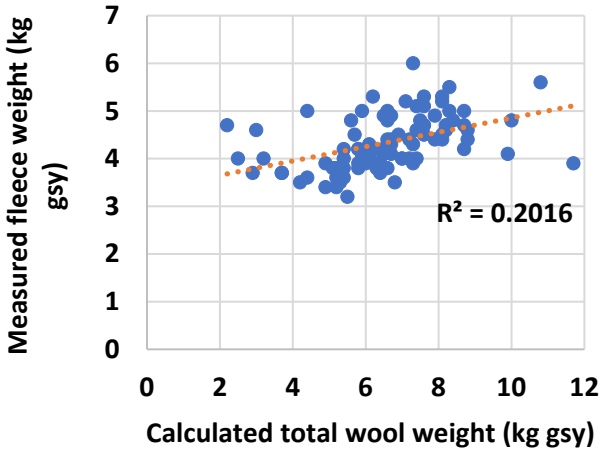

Figure 8. Calculated total wool weight against measured fleece weight (kg gsy).

Could the change in liveweight (full wool) and liveweight off shears be used to rank fleece weight differences?

No. The variability in ranking was too great (Figure 8). There was also no correlation between measured fleece weight and wool characteristics (r2 = 0.11). Many of the highest cutting fleeces were finer micron (the usual expectation is finer micron = lower wool cut).

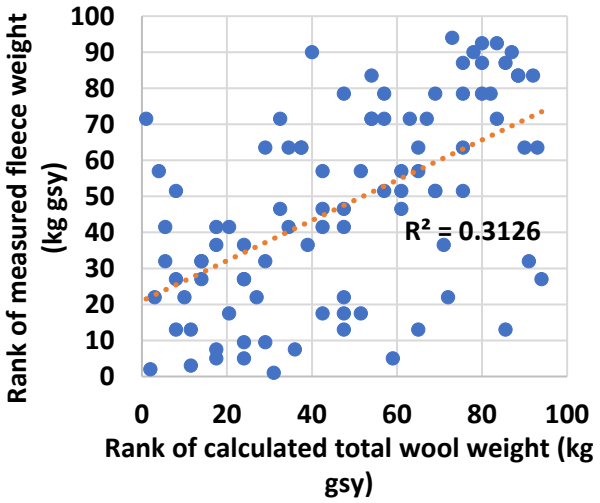

Figure 9. Ranking of calculated total wool weight against ranking of measured fleece weight (kg gsy).

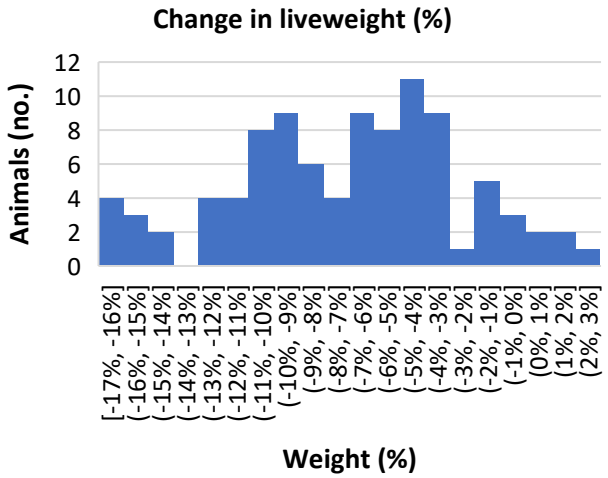

Figure 10. Percentage change in liveweight (full wool) between weighing on 2nd January and 7th January.

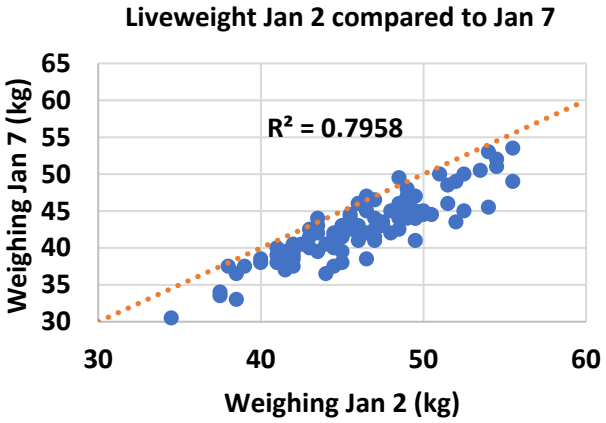

Figure 11. Correlation between liveweight on 2nd January and 7th January.

Further discussion

The results were disappointing given the apparent 'spread' in liveweights and fleece weights. While the individual eIDs enabled measurement of fleece weight at shearing, drafting of poorer performing animals from the flock, using liveweight as a surrogate for fleece weighing appears inaccurate.

Several factors are likely to have contributed to the variability in the result. The time the animal had to 'empty out' may vary, even though all sheep were off food and water for at least 16 hrs. Secondly, there is likely to be some variability in the weight of each individual belly. However, neither would be expected to explain the variation encountered.

The accuracy of the liveweights should also be considered. Sheep were weighed after being off feed and water for 16 hrs. However, because of heavy rain shearing was delayed and the sheep were returned to a paddock in full wool and then reweighed 5 days later (also 16 hrs. off feed) before shearing recommenced. The difference between the two liveweights only 5 days apart was surprisingly large. Most animals lost weight, however this ranged from zero up to 8.5 kg (Figure 7).

More unsettling was the correlation between the two weights was only r2 = 0.80 (Figure 8).

It is widely accepted animals lose about 5% to 7% 'gut fill' if prevented from feeding for 16 hrs. These results would suggest significantly more loss than 5% to 7%. This variation suggests the weights may be inaccurate, but it is uncertain if this was from the January 2 or January 7 results (or variation in both). If the off shears liveweights are compared to either the January 2 or January 7 liveweights, the variation is also very large, with three animals increasing in body weight after shearing and about 19% losing 2.7 kg or less (3.5 kg being the lightest fleece weighed plus belly).

There appears to be an inconsistency in the liveweight measurements. This would prevent any meaningful conclusion of fleece weight estimation from changes in body weight.

Future activities

The lack of repeatability in liveweights has prompted the purchase of a new weighing system. This system immobilises the sheep before weighing and automatically links the eID to the recording software. It is hoped this will minimise recording errors.

Producer knowledge post PDS

At the beginning of this PDS in 2020, Fiona judged herself to have a moderate to low level of knowledge in set up, capture and interpretation of eID data.

However, over the process of completing the PDS she judged her skills to be improving and by the end of it considered her knowledge to have increased from a 3/10 to 8/10, and for her skills in application of eID technology to have increased from a 3/10 to a 7/10.

Fiona found that the accuracy of record keeping and the ease of which it was to collect and analyze those records made for more efficient stock handling when combined with an auto drafter. Initial set up of the eID technology resulted in higher labour requirements as husbandry activities took longer to accomplish, but with good technical support this was soon alleviated.

For further information:

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