Redefining Key Performance Indicators for sheep production systems

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- UK is the 6th largest lamb meat producer in the world and the largest in Europe[1]
- Sheep farming is a sector which has historically been associated with low profitability[2]
- On farm profitability is influenced by implementation of management decisions
- To make informed decisions, accurate monitoring of production performance is necessary[3]
- Currently no consensus on most effective way of measuring performance on sheep farms

1. Colby L, Garnier J-P and Eckley J 2016. World Sheep Meat Market To 2025.
2. Lima E, et.al. 2018. Drivers for precision livestock technology adoption. PLoS ONE 13, 1-17.
3. Banhazi TM and Black JL 2017. Precision livestock farming. Australian journal of Multi-disciplinary engineering, 1-13.

Average age at weaning

Empty ewes

Lambs died 48hrs

Eight week weight

Lambing period

Current KPIs
Body condition score
Change in body condition score
Ewe weight change
8 Week Weight of lambs
Combined 8 Week Weight
% of lambs failing to reach 85% of the 8ww target weight
Weaning weight of lambs
Combined weaning weight of lambs
Ewe to Ram ratio
Scanning percentage
% empty ewes at scanning
Lambing percentage
Lambs alive 48hrs
Lambs died 48hrs
Lambs weaned
Lambs reared
Lamb losses from scanning to birth
Lamb losses from birth to turnout
Lamb losses from turnout to weaning
Lamb losses from scanning to rearing
Average age at weaning
Average daily liveweight gain to weaning
90 day lamb weight per ewe to ram
Weight of lamb reared per ewe to ram
Empty ewes
Ewe mortality
Percentage of ewes culled
Flock replacement rate
Lambing period
Percentage of ewes lambing in first 3 weeks

Weaning weight

Ewe to ram ratio

Combined weaning weight of lambs

Birth weight

Body condition score

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Aim of this study

To rank metrics for sheep production systems according to the economic value of information. Focus on individual lamb performance.

Materials and Methods

- Data collected from North Wyke Farm Platform farm-scale grazing trial 2014-2018

Singles	Twins	Triplets	Quads	**Total**
156	1160	296	4	**1616**

 Charollais X  Suffolk x Mule

- Lambs weaned at 13 weeks and finished on pasture at 45 kg
- Mean slaughter age: 170 ± 1.08 days
- Carcass quality and value information was obtained from the abattoir

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Rigorously defining KPIs

Key Performance Indicators

- Finishing age
- Carcass conformation
- Fat class

Profitability

- Predictors
- Outcomes
- ~~System descriptors~~

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Ability to manipulate

Premium score

Economy score

Benefit				
	Outcome 1.	Outcome 2.	Outcome 3.	Gross Benefit
Predictor 1.				
Predictor 2.				
Predictor 3.				
Predictor 4.				
Predictor 5.				
Predictor 6.				

Marginal profitability

Prediction accuracy

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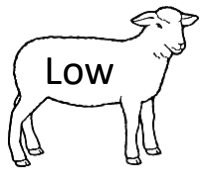
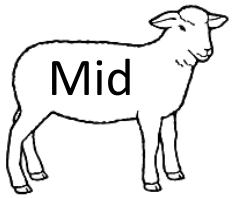
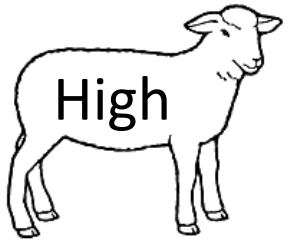
Defining potential value of information

Birth weight
2.2kg – 8.5kg

	Slaughter age
	188.8 days
	169.8 days
	151.2 days

151.2 – 188.8 = **-37.6**

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Information value for each predictor

	Outcomes		Benefit	
	Slaughter age (days)	Carcass score (%)	Carcass value (£)	Carcass value/day (£)
Birth weight	-37.58***	-0.35	1.90***	0.13***
A4ww	-65.57***	0.69	-0.53	0.19***
A8ww	-75.31***	2.46	-0.23	0.22***
Weaning weight	-77.42***	5.41**	0.41	0.23***
DLWG birth to four weeks	-60.76***	2.25	-1.69**	0.17***
DLWG birth to eight weeks	-73.73***	3.82	-0.46	0.22***
DLWG birth to wean	-74.66***	8.39***	0.25	0.22***
DLWG four to eight weeks	-60.34***	6.09**	1.27.	0.19***
DLWG four weeks to wean	-64.59***	8.69***	0.79	0.20***
DLWG eight weeks to wean	-40.31***	6.79**	1.49*	0.13***
Ewe BCS at lamb	-8.70**	0.40	3.17***	0.05***
Ewe BCS at wean	-10.34***	-2.45	2.39***	0.06***
Ewe BCS at tupping	13.28***	-4.77.	1.96***	-0.02
Ewe weight at lamb	-19.20***	0.40	2.75***	0.07***
Ewe weight at wean	-16.39***	-1.69	2.04***	0.07***
Ewe weight at tupping	-5.72	0.83	2.05***	0.03**
Ewe BCS change tup to lamb	-17.03***	3.57	1.52**	0.06***
Ewe BCS change lamb to wean	1.92	-4.58*	0.08	0.01
Ewe BCS change tup to wean	-17.03***	-0.24	-0.23	0.05***
Ewe weight change tup to lamb	-20.58***	5.74*	0.26	0.05***
Ewe weight change lamb to wean	4.86	-4.39*	-1.21*	-0.01
Ewe weight change tup to wean	-7.99*	-3.27	-1.54**	0.02*

Signif. codes: *** p < 0.001; ** p < 0.01; * p < 0.05; . P < 0.1

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Costs

Premium

vs

Economy

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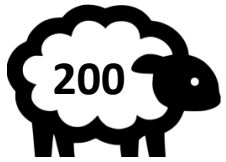
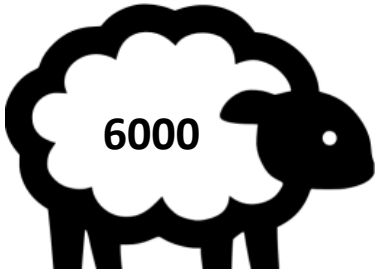
Costs

Birth weight value of information = £1.90

- £100/20 years = £5
- Labour = £20/hr
- 90 lambs/hour
- 22p per lamb + equipment

- £11,500/20 years = £575
- Labour = £10/hr
- 500 lambs/hour
- 2p per lamb + equipment





Cost = £0.25 Net benefit = **£1.65**	Cost = £2.90 Net benefit = **-£1.00**
Cost = £0.22 Net benefit = **£1.68**	Cost = £0.12 Net benefit = **£1.78**

Flock-size threshold between economy/premium

2900 lambs

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Summary

- The value of recording information at various stages of the production cycle was assessed by defining the potential economic value of the information
- Ranking of performance predictors was different when slaughter age and therefore cost of production was considered
- Ranking of performance predictors must take into account the cost of collecting the information, and cost is influenced by the type of production system, which has an interaction with flock size
- This study investigated the potential benefit of measuring performance at various stages – a future study will investigate the cost and viability of manipulation

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Thankyou for listening

Happy to answer any questions

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This study was supported by AHDB Beef & Lamb (61100030) and BBSRC (BBS/E/C/000I0320)
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