Sustainable Sheep Production (SusSheP) Year 3 newsletter

Newsletter Intro

2020 marks the end of the SusSheP project. Many project outputs were realized with the foundations for much more future work laid! In this newsletter we will summarise the main findings from each project work packages.

Work Package 1 – Ewe longevity

Working with data from Ireland, UK and Norway, WP1 assessed the sheep culling and death data recorded in each respective country in an attempt to identify common trends. Given the significant industry differences that exist between the three countries the main culling reasons differed although mastitis featured highly for all followed by tooth loss. A paper titled 'Factors affecting ewe longevity in three European countries' was published.

Parallel work used existing data sets to assess early life predictors for ewe longevity. The aim was to identify long lasting sheep at an early stage in life so that selection decisions can be made earlier. No consistent early life predictor was found across the three countries, although the heritability of a number of important traits (age at last lambing, tooth loss, mastitis & barrenness) influencing ewe longevity was calculated and this will be extremely valuable for future work.

Legacy of SusSheP WP1

A ewe longevity genetic index is something that is highly desired by all meat sheep producing countries worldwide. SusSheP has enabled each project partner to develop a suitable protocol for their country for the incorporation of this difficult to measure phenotype into the national breed improvement programmes. Some partner countries have developed online tools to capture the reason ewes are culled when exiting the flock.

Example of WP1 leading to action

As a result of SusShep WP1, Ireland has designed new data capture webscreens for performance recording flocks to include a wider array of culling and death reasons. They have also introduced novel ways to encourage performance flocks to record more of this important data. This data will provide the foundation for an Irish ewe longevity index in the near future.

Work Package 2 - carbon and labour efficiency in sheep systems

A large amount of on-farm data have been collected by WP2 over the first two years of SusSheP and this data were collated over the final year. A summary of some of the key outputs are below;

- At sheep flock level, a precision livestock farming (PLF) sheep system based on use of electronic identification (EID) for management was the best for reducing labour on-farm (-20%). The use of performance recording did not increase labour significantly, but the tasks undertaken at lambing time varied between production approaches that used genetic selection or not. Using High prolific breeds in meat sheep or Artificial Insemination (AI) for dairy sheep did not increase labour input at key handling events.
- At sheep flock level, the performance recording sheep system was the best for reducing carbon hoofprint. The use of PLF technology did not show an improvement in terms of carbon hoofprint. Both AI and high prolific breeds did not show any effect on carbon hoofprint.
- In terms of net margins, there was a difference of £9 per ewe per year to the benefit of the PLF approach, mostly due to labour savings. Additionally, there was a difference of £6/ewe to the benefit of performance recording systems, and £3/ewe to the benefit of high prolific breeds.

Introducing AI in dairy sheep allowed a difference of £50/ewe, mainly due to an increase in milk yield.

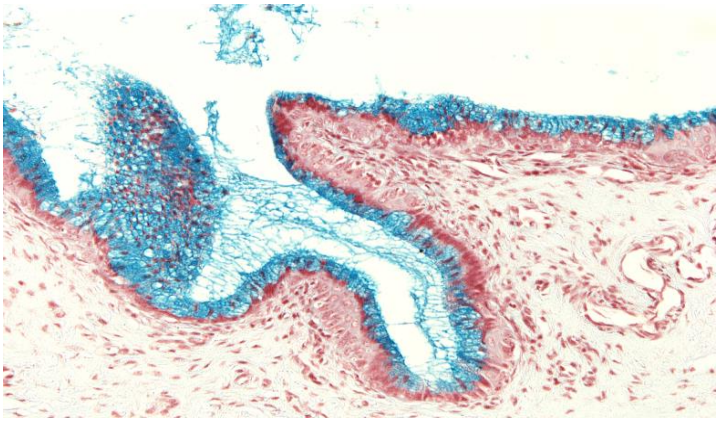
- A combination of using technology on sheep farms, as well as performance recording, would be an ideal combination in terms of labour savings, carbon hoofprint and financial sustainability.
- A survey on sheep management practices to identify factors that could encourage on-farm changes based on the work carried out in SusShep showed that
    - Age of respondents was not a major factor for on-farm change, nor was the type of production systems (hill/upland vs lowland).
    - However, past experience was an important factor, potentially emphasising the need for focusing policy effort on knowledge transfer from 'early adopters' to other farmers.

Work Package 3 - Ewe breed differences in cervical function

Work in Ireland has demonstrated that the reason cervical artificial insemination (AI) with frozen-thawed semen works in Norway but nowhere else in the world is due to the breed of the ewe in Norway and specifically the inability of frozen-thawed sperm to traverse the cervix of some ewe breeds. SusSheP set out to perform an in-depth characterization of the differences in the biology of the cervix of six economically important ewe breeds across Norway, France and Ireland. These included Suffolk (low fertility) and Belclare (medium fertility) in Ireland, Ile de France and Romanov (both with medium fertility) in France and Norwegian White Sheep (NWS) and Fur (both with high fertility) in Norway (n = 28 to 30 ewes/ breed).

A summary of the main findings of WP3 are as follows;

- A detailed assessment of the anatomy and morphology of the cervix of the six ewe breeds was carried out initially. Differences in the length of the cervix between ewe breeds was evident but this was more related to the mature body size of the ewe and not related to pregnancy rates following cervical AI with frozen-thawed semen.
- There was no relationship between the ewe breed pregnancy rates and the amount or viscosity of cervical mucus collected around the time of ovulation.
- *O*-linked glycans were correlated with mucus viscosity and thus likely to affect sperm progression. High fertility ewe breeds (NWS and Fur) had higher percentage of neutral *O*-glycans (without sialic acid). Sialic acid content of cervical mucus appears to be an important modulator of sperm transport.
- Key genes involved in sialic acid and O-glycan biosynthesis (*MUC5AC, ST6GAL2, SIAE, NEU1*) showed differences in gene expression between high and low fertility ewe breeds.
- Low fertility breeds have a heightened immune response as evident by a more diverse cervical microbiome as well as the upregulation of key inflammatory genes (*CCL5, CXCL16, TLR4, IL1A*) in cervical tissue.
- This work has identified a number of biomarkers which appear to be key to sperm transport across the cervix.
- SusSheP has generated a large databank of samples for future analysis / projects.



Cervical tissue section at the microscope level (Alcian Blue – PAS stain, 40X). In blue: mucin- mesh secreted by the cervical epithelium (red).

Work Package 4 – Validation

The objective was to ascertain farmers' views on alternative Sheep Production Systems (SPSs) and complete a life cycle assessment of the differing SPSs. A survey of 145 UK and Irish farmers attitude to change was conducted. The surveys focused on the following;

- Farm overview: country, production system, enterprises, main outputs, farmer age, farm size and breeds
- Flock production: flock size, scanning rate, weaning rates, rearing of triplets, culling reasons & replacements strategy
- Management practices: purchasing rams, ranking traits of importance, data recording, labour requirements
- Technology adoption: future intensions, use of genetic indexes, electronic devices (EID) and artificial insemination.

Some of the key survey results include;

- Flock size: Ireland (191 ewe) and UK (576)
- Enterprise: sheep only (36%), sheep & beef (43%), sheep & other enterprise (21%)
- Hill (30%), lowland (60%), mixed (10%)
- Farming full time (51%) versus part time (49%)
- Age: <40 (32%), 40-60 (44%), >60 (24%)
- Flock intentions: Maintain numbers (46%), increase numbers (40%)
- Labour availability: Sufficient (64%)
- Greatest labour requirements: lambing (85%), shearing (4%), pregnancy scanning (3%), health treatments (3%)
- Use EID: 44%
- Use genetic indexes: 69%

A life cycle assessment (LCA) of different SPSs was also carried out. This assessed aspects including;

- Environmental impacts associated with all the stages of sheep production
    - on- and off-farm impacts
- Scenarios:
    - Prolificacy and stocking rates (Irish research data)
    - Use of performance recording (UK research data)

- Impact on: labour input, carbon hoofprint and net or gross margins

In summary, intensive sheep systems are producing more CO2 equivalent output per ha as expected. However, when viewed as CO2 per kg of lamb carcase produced the more prolific flocks offered significant efficiencies. This was replicated when Net profit was assessed, with higher prolificacy flocks performing much better in this regard.

Work Package 5 – Dissemination

Over 80 unique dissemination events were carried out during the 3 years of SusSheP. These events included conference presentations, farmer meetings and a wide range of publications across various media. Our Twitter page @SusSheP chronicles many of our projects activities since it began in 2017.