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The effects of stocking rate and ewe prolificacy potential on the efficiency of lamb production and grass utilization in pasture based systems

Key external stakeholders:
Sheep farmers, Advisors, Industry, Students, Scientists

Practical implications for stakeholders:
Ewe prolificacy potential and stocking rate are two primary drivers of output in grass-based lamb production systems. The aim of this study was to investigate and quantify the effect of ewe prolificacy, stocking rate, and their interaction on animal performance, pasture production and utilization and the efficiency of lamb production in a grass-based production system.

Results demonstrate that there is potential to increase ewe prolificacy along with stocking rate in grass-based lamb production systems, without affecting pasture and animal performance. Increasing the ewe prolificacy of a flock will increase lamb output and the efficiency of lamb production, although there may be some potential limitations to increasing SR above 12 ewes per hectare in grass-based systems due to lower individual lifetime lamb average daily gain. Producers should therefore match the SR of their systems to the grass growing potential of their farm.

Main results:
- Increased ewe prolificacy levels significantly increased lamb carcass output/ha while having no negative effect on lifetime lamb performance
- No difference in grass utilised between medium and high prolificacy ewes
- It takes approximately 860kg of grass DM to support a ewe and her lambs for the year
- Increasing ewe prolificacy should always be the first priority while increasing stocking rate must always be in conjunction with increased grass production.

Opportunity / Benefit:
The findings from this study demonstrate the potential to increase lamb output and the efficiency of lamb production from grass-based systems through targeted increases in ewe prolificacy and SR levels.

Collaborating Institutions:
UCD

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1. Project background:

The production of lamb in grass-based production systems is principally based upon the utilization and conversion of herbage into lamb carcass. Successful grazing systems require animals that can efficiently convert feed into a high value product. At present, lamb production systems are limited by the efficiencies at which they operate, such as number of lambs weaned per ewe and the level of herbage utilized per ha. In order to remain competitive, improvements in the efficiency of such systems are of paramount importance. Ewe prolificacy potential and stocking rate are two of the most influential factors affecting lamb output and the efficiency at which feed resources are utilized in grass-based lamb production systems.

Grass, either grazed or conserved, has the potential to supply up to 95% of the annual energy requirements of sheep, although many producers cite increasing annual herbage production and utilization in lamb production systems to be a challenge at farm level. Grass utilization is one of the most important factors influencing productivity and profitability of grass-based livestock systems. The lower associated cost of production of grazed grass relative to alternative feed sources provides an opportunity to produce lamb from a primarily grass-based diet in a cost-effective manner.

2. Questions addressed by the project:

- The effect of increasing ewe prolificacy potential and stocking rate on ewe and lamb performance and output?
- The effect of increasing ewe prolificacy potential and stocking rate on grass DM production, utilisation and animal requirements?
- What is the optimum prolificacy level and stocking rate for Irish grass based systems of lamb production?

3. The experimental studies:

A prolificacy potential by stocking rate study, consisting of two ewe prolificacy potentials ((medium prolificacy potential (MP; Suffolk X ewes; 1.5 lambs reared per ewe) and high prolificacy potential (HP; Belclare X ewes; 1.7 lambs reared per ewe)) and three SR: low (10 ewes per ha), medium (12 ewes per ha), and high (14 ewes per ha) was conducted. Each treatment was managed in a rotational grazing system. Measurements taken included; ewe body weight, ewe body condition score (BCS), number of lambs born and weaned per ewe and per hectare, lamb growth rate, days to slaughter, lamb carcass traits and output, ewe production efficiency (kg lamb live weight weaned: kg ewe live weight mated), herbage dry matter (DM; kg) production and utilization, sward quality and morphology, and DM and energy consumed.

4. Main results:

Animal

Prolificacy potential had no effect on lifetime ADG or days to slaughter (DTS) with HP lambs yielding a higher carcass weight ($P<0.001$). Low SR and MSR lambs achieved higher ADG from birth to weaning ($P<0.001$) and weaning weight ($P<0.001$) relative to HSR lambs and did not differ from each other, while post-weaning and lifetime lamb ADG was highest at the LSR, intermediate at the MSR and lowest at the HSR ($P<0.001$). High PP ewes produced a higher average born ($P<0.001$) and weaned litter size per ewe ($P<0.01$), with live weight weaned per hectare ($P<0.001$) increasing as PP and SR increased. Lambing difficulty, ewe mother ability and lamb viability did not differ by PP or SR.

Grassland

There was no effect of ewe prolificacy potential on herbage DM production, utilization or quality. Herbage DM production (above target PGSH) and utilization was highest at the HSR, intermediate at the MSR and lowest at the LSR ($P<0.001$). Ewe PP had no effect on herbage DM production, utilization, quality, or sward morphology ($P>0.05$). The proportion of leaf in the sward (above target PGSH) was 4% greater in MSR and HSR compared to LSR ($P<0.05$).

System

The HP treatment weaned more lambs per ewe and per ha ($P<0.01$), yielded a higher average daily gain (ADG) per ha ($P<0.001$), produced an additional 50 kg of lamb carcass per ha ($P<0.05$) and required 13%

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less DM and UFL to produce a kg of lamb carcass (P<0.001) compared to the MP treatment. High prolificacy potential ewes had a 4% higher production efficiency (P<0.05) than MP ewes. Ewe prolificacy potential had no effect on the total quantity of DM and UFL consumed per ewe and lamb unit (P>0.05). It takes approximately 860kg of grass DM to support a ewe and her lambs for the year. Increasing stocking rate increased the number of lambs weaned per ha (P<0.001) and increased lifetime lamb ADG per ha (P<0.001). Lamb carcass output (kg) per ha was highest at the HSR, intermediate at the MSR, and lowest at the LSR (P<0.001). The quantity of DM and UFL consumed per ewe and lamb unit and per kg of lamb carcass produced per ha increased as stocking rate increased (P<0.001).

In conclusion, results from this study demonstrate HP ewes to be more efficient in the production of lamb. Increasing stocking rate provides the opportunity to increase lamb carcass output per ha, however achieving this increase in output required additional DM and UFL per ewe and lamb unit above 12 ewes per ha. The appropriate stocking rate for a farm will be dictated by its grass growing potential to support a given stocking rate. Increasing ewe prolificacy should always be the first priority while increasing stocking rate must always be in conjunction with increased grass production.

5. Opportunity/Benefit:

The results of this study provide new information on the optimum stocking rate and prolificacy level for Irish grass based systems of mid-season lamb production and have improved our understanding of the pasture growth, utilization, management and quality of sheep grassland swards. Potential exists to increase ewe PP and stocking rate in grass-based lamb production systems to increase the live weight of lamb weaned per ha in a grass-based lamb production. The current findings suggest some potential limitations to increasing SR above 12 ewes per ha in a grass-based lamb production system due to lower individual lifetime lamb performance. Producers should, therefore, be careful not to increase to SR levels that cannot be supported by their farm which will be influenced by its grass growing potential when making decisions to increase SR levels.

6. Dissemination:

In conjunction with Teagasc Sheep KT staff, over 30 discussion group visits were facilitated at the Sheep Research Demonstration farm in Athenry to see the study and numerous open days (2012, 2013, 2015, and 2017) to disseminate the results of the study were also held. Results of the study have been presented at Teagasc and non Teagasc conferences and a number of articles have been published in the national farming press.

Main publications:

Earle, E., McHugh, N., Boland, T. M. and Creighton, P. 2017. Effect of ewe prolificacy potential and stocking rate on ewe and lamb performance in a grass-based lamb production system. Journal of Animal Science. 95:1–11.

Earle, E., McHugh, N., Boland, T. M. and Creighton, P. 2017. Evaluation of the effects of ewe prolificacy potential and stocking rate on herbage production, utilization, quality, and sward morphology in a temperate grazing system. Grass and Forage Science (accepted 26/05/17)

Earle, E., Boland, T. M., McHugh, N. and Creighton, P. 2017. The efficiency of lamb production and dry matter and energy requirements of grass-based lamb production systems differing in ewe prolificacy potential and stocking rate. Journal of Animal Science doi:10.2527/jas2017.1427

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