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Effects of grass silage and maize silage feed value, and concentrate feed level on ewe and lamb performance



Key external stakeholders:

Sheep producers, ruminant nutritionists, agricultural consultants, extension officers, Department of Agriculture, Food and the Marine

Practical implications for stakeholders:

- The feed value of grass silage offered to ewes during pregnancy influences subsequent lamb birth and weaning weights by up to 0.6 and 1.3 kg respectively.
- Grass silage feed value is affected by harvest system and has an impact on subsequent lamb performance.
- Maize can replace grass silage in the diet of pregnant ewes and finishing lambs.
- Whilst maize silage is characterized as having low crude protein concentrations, additional dietary protein supplementation is not required by ewes until late pregnancy.
- Response to concentrate supplementation is dependent on forage feed value but not forage type.
- High feed value forage reduces concentrate requirements for ewes in late pregnancy by up to 80%.
- High feed value forage increases finishing lamb performance even when it accounts for as low as 37% of food DM intake.
- High levels of finishing lamb performance (267g/day) are achievable from *ad libitum* concentrate feeding.

Main results:

- Relative to growing maize in the open use of the complete cover plastic mulch (CCPM) system increased forage yield by up to 42% and dry matter concentration at harvest by up to 98g/kg.
- Increasing grass silage feed value offered to pregnant ewes increased lamb birth and weaning weights and reduced concentrate requirement in late pregnancy by up to 80%.
- Whilst silage harvest system had no effect on lamb performance or lamb birth weight, lambs from animals which had been offered big bale silage during pregnancy were 1.8kg lighter at weaning.
- Increasing maturity of maize at harvest, when offered to pregnant ewes tended to increase lamb weaning weight by 1kg and when offered to finish lambs tended to increase slaughter weight by 1.4kg.
- Ewes offered maize silage do not require protein supplementation until late (final 7 weeks) pregnancy.
- Ad-libitum concentrate supplementation resulted in high levels of performance (live weight gain of 267g/day) of finishing lambs.
- The response to concentrate feed level offered to finishing lambs depends on forage feed value, but not forage type.

Opportunity / Benefit:

The results of this project demonstrate the benefit of producing high feed value silages for offering to pregnant ewes and to finishing lambs. The benefits for pregnant ewes include improvements in ewe weight and condition at lambing, increased lamb birth weight, and lamb growth rate to weaning consequently increasing weaning weight which reduced age at drafting by up to 2 weeks. Furthermore, increasing forage feed value reduces concentrate requirements in late pregnancy by up to 80%. For finishing lambs the benefits to high feed value silages, which are high growth rate and dressing proportion are still apparent when concentrate accounts for up to 63% of total dry matter intake. Maize silage can replace high feed value grass silage in the diet of pregnant ewes. For finishing lambs *ad-libitum* concentrate feeding results in high levels of lamb performance.

Collaborating Institutions:

Teagasc project team: Dr. Tim Keady (PI)
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External collaborators:

1. Project background:

Grass growth in Ireland is seasonal, peaking in May and June with little daily production between December and March. Consequently, on many farms ewes are housed during the winter feeding period to enable a higher stocking rate to be achieved. During the indoor period ewes are normally offered silage, which can differ in forage type and feed value which is influenced by harvest system. The level of concentrate supplementation required by ewes in late pregnancy is dependent on forage feed value and litter size. Whilst many lambs are finished by the end of the grazing season approximately 20% are slaughtered between January and March thus providing a continuous supply of lamb to the market. During finishing use of high feed value ensiled forages many enable a reduction in the costs of production.

2. Questions addressed by the project:

- What is the impact of silage feed value on ewe and subsequent lamb performance?
- What is the potential concentrate spring effect of high feed value forages?
- What is the effect of the big bale silage system on silage feed value when offered to pregnant ewes?
- What is the feed value of maize silage for pregnant ewes and finishing lambs?
- Is additional, protein supplementation required by ewes and lambs offered maize silage base diets?
- Does stage of maturity at harvest influence maize silage feeding value?
- Is the response to concentrate supplementation influenced by forage type and feed value?
- What level of performance is achievable from finishing lambs offered *ad-libitum* concentrate diets?

3. The experimental studies:

Experiment 1. *The effects of grass silage harvest system, concentrate feed level and maize silage maturity and soyabean supplementation on ewe and subsequent lamb performance.* Ewes (n=180) were allocated at random to 12 treatments from day 58 of pregnancy until lambing in early March. The 12 treatments were 2 maize silages (low DM, high DM) x 2 protein levels (0 and 200g soya/ewe daily) and 2 grass silage harvest system (precision chop, big bale) x 2 harvests (29th May, 18th July) x 2 concentrate feed levels (18 and 27 kg/ewe during late pregnancy). Post lambing all ewes rearing singles and twins were grazed as one flock until weaning without concentrate supplementation. Ewes rearing triplets received 0.5kg concentrate for 5 weeks post lambing whilst their lambs had access to up to 300g concentrate per lamb daily until weaning.

Experiment 2. *The effects of maturity of maize at harvest and soyabean supplementation, grass silage feed value and concentrate feed level on ewe and subsequent lamb performance.* Nine dietary treatments were offered to 160 ewes during mid and late pregnancy. The 9 treatments were 2 maize silages (low and high DM) x 2 levels of protein supplementation (0 or 200 g soyabean meal/ewe daily) and 2 grass silages (high or medium feed value) x 2 concentrate feed levels (15 or 25 kg/ewe in late pregnancy) and high feed value grass silage supplemented with 5kg concentrate per ewe in late pregnancy. The ewes offered the maize silage based diets received 15kg concentrate per ewe during late pregnancy. Post lambing the ewes and their lambs were managed as described in experiment 1.

Experiment 3. *The effects of supplementation of maize silage diets during pregnancy on ewe and subsequent lamb performance.* Three dietary treatments were offered to ewes during mid and late pregnancy. The diets consisted of maize silage (DM 33g/kg, starch 236g/kg DM) supplemented with either 200g soyabean meal daily during mid and late pregnancy plus 15 kg concentrate in late pregnancy (SC); 10kg soyabean meal during late pregnancy (10S) or 5kg soyabean meal during late pregnancy (5S).

Experiment 4. *The effect of grass silage and concentrate feed level on ewe and subsequent progeny performance and on potential concentrate sparing effect.* High and medium feed value grass silages were ensiled precision chopped treated with a bacterial inoculant following a 24 hour wilt on 12th May and 14th June respectively. Seven treatments consisting of medium feed value grass silage supplemented with either 15, 25, 35 or 45kg concentrate and high feed value grass silage supplemented with either 5, 15 or 25kg concentrate in late pregnancy were offered to 112 ewes during mid and late pregnancy respectively.

Experiment 5. *The effects of maturity of maize at harvest, grass silage feed value and concentrate feed level on finishing lamb performance.* High and medium feed value grass silages were ensiled on 11th May and 8th June precision chopped and treated with a bacterial inoculant. Two maize silages were produced either grown in the open (sown 8th May) or under the CCPM system (sown 16th April). Thirteen dietary treatments were offered to 260 Suffolk-X lambs for 76 days prior to slaughter. The 13 treatments were as follows: 2 grass silages (high and medium feed value) and 2 maize silages (low and high DM) x 3 concentrate feed

levels (0.2, 0.5 or 0.8kg/lamb daily) plus ad-libitum concentrate plus with 0.5kg high feed value grass silage. **Experiment 6.** *The effects of forage type and feed value, concentrate feed level and protein concentration, and shearing on lamb performance.* Maize was grown under the CCPM system and ensiled on 29th September. High and medium feed value grass silages were ensiled on 24th May and 17th June respectively. Eleven dietary treatments were offered to 264 castrated male Suffolk-X lambs for 54 days prior to slaughter. The eleven dietary treatments were as follows: 2 grass silages (high and medium feed value) and maize silage x 3 concentrate feed levels (0.4, 0.8 or 1.2kg/d) plus *ad-libitum* concentrate supplemented with 0.5kg high feed value grass silage plus maize silage supplement with 0.4kg of low protein concentrate.

4. Main results:

Experiment 1.

- Silage harvest system did not alter forage intake or ewe performance. However, lambs born from ewes effected the precision chopped silage were heavier at weaning
- Increasing concentrate by 9 kg to ewes offered the grass silage increased lamb birth weight by 0.3 kg.
- Protein supplementation of maize silage during pregnancy did not alter ewe or lamb performance.
- Increasing maturity (DM) of maize at harvest increased forage intake and ewe condition at lambing and improved lamb weaning weight by 1.05kg.

Experiment 2.

- The DMD of the medium and high feed value grass silages were 730 and 790 g/kg respectively. The DM and starch concentrations of the low and high DM maize silages were 215 and 339 g/kg and 110 and 236 g/kg DM respectively.
- Use of the CCPM system increased forage yield by 42% and forage DM at ensiled by 98g/kg, compared to maize grown in the open.
- Increasing grass silage feed value increased ewe condition and weight at lambing, and lamb weight at birth (+0.5kg) and weaning (+1.8kg) and reduced lamb age at slaughter by 13.5 days.
- Increasing concentrate feed level in late pregnancy had no effect on ewe or lamb performance.
- High feed value grass silage can reduce concentrate supplementation in late pregnancy by up to 80%.
- Increasing maize maturity at harvest increased ewe weight and condition at lambing and tended to improve lamb weaning weight by 1.1kg.
- Protein supplementation of maize silage based diets during mid and late pregnancy increased ewe condition and weight at lambing and lamb birth weight (+ 0.25kg) but did not affect lamb weaning weight.

Experiment 3

- Soyabean supplementation during mid-pregnancy did not improve ewe or lamb performance.
- Ewes offered the 5S treatment had lower condition at lambing and tended to produce lambs with lower weigh at birth.
- With maize-silage based diets concentrate supplementation can be reduced to approximately 10kg soya per ewe during late pregnancy.

Experiment 4.

- Increasing silage feed value increased ewe weight and condition at lambing.
- Increasing concentrate feed level with the medium feed value grass silage linearly increased ewe condition and weight post lambing and lamb birth weight.
- Concentrate level offered with the high feed value silage did not alter lamb birth or weaning weights.
- Each 1 kg increase in concentrate feed level for ewes offered the medium and high feed value grass silages increased lamb birth weight by 0.015 and 0.019kg respectively.
- In terms of lamb birth weight the potential concentrate sparing effect of the high feed value grass silage supplemented with either 5, 15 or 25kg concentrate was 9, 7 and 5kg respectively.

Experiment 5.

- Dietary treatment had a large effect on lamb performance (daily live weight gain varied from 46 to 267g/d).
- Use of the CCPM system increased forage DM yield by 36% and forage DM concentration at ensiling by 65g/kg.
- Increasing grass silage feed value increased lamb daily live weight (71g) and carcass (37g) gain.
- Increasing concentrate feed level increased lamb performance.
- Increasing maturity of maize at harvest tended to increase lamb performance.
- There was a greater response to concentrate supplementation from lambs offered medium feed value maize and grass silages (+ 33 and 62g live weight gain per lamb daily) relative to those offered the high feed value maize and grass silage respectively.
- Forage type had no effect on the response to concentrate feed level.
- Relative to the medium feed value grass silage supplemented with 0.2kg concentrate/lamb daily the potential concentrate sparing effect of the high feed value grass silage and the medium and high feed

value maize silages were 0.41, 0.10 and 0.25 kg per lamb daily respectively.

Experiment 6.

- Maize silage based diets resulted in the highest levels of lamb performance.
- Response to concentrate depended on forage feed value. The response was linear for lambs offered the high feed value grass and maize silages and quadratic when offered the medium feed value grass silage.
- Whilst the response to forage feed value declined as concentrate feed level increased. There was still a benefit to high feed value forage when it accounted for as low as 37% of total feed intake.
- Reducing concentrate protein concentration to 144g/kg DM did not alter lamb performance.

5. Opportunity/Benefit:

- Greater precision can be exercised when formulating winter diets for pregnant ewes and finishing lambs.
- A number of options are developed that enable the same levels of ewe and lamb performance to be achieved, therefore the least cost option can be implemented to improved individual farm profitability.

Dissemination:

Main publications:

Keady, T.W.J. and Hanrahan, J.P. (2008). 'The effects of grass silage harvest system, concentrate feed level and maize silage maturity and soyabean supplementation on ewe and subsequent lamb performance'. *Proceedings of the British Society of Animal Science* p125.

Keady, T.W.J. and Hanrahan, J.P. (2009). 'An evaluation of the effects of maturity of maize at harvest and soyabean supplementation, grass silage feed value and concentrate feed level on ewe and subsequent lamb performance'. *Proceedings of the Agricultural Research Forum* p16.

Keady, T.W.J. and Hanrahan, J.P. (2009) 'The effects of maturity of maize at harvest and soyabean supplementation, grass silage feed value and concentrate feed level on ewe and subsequent lamb performance'. *Proceedings of the XVth International Silage Conference* pp. 133-134.

Keady, T.W.J. and Hanrahan, J.P. (2009). 'The effects of supplementation of maize silage diets during pregnancy on ewe and subsequent lamb performance'. *Proceedings of the British Society of Animal Science* p51.

Keady, T.W.J. and Hanrahan, J.P. (2010). 'An evaluation of the effect of grass silage and concentrate feed level on ewe and subsequent progeny performance and on the potential concentrate sparing effects'. *Proceedings of the British Society of Animal Science* p38.

Keady, T.W.J. and Hanrahan, J.P. (2011). 'An evaluation of the effects of maturity of maize at harvest, grass silage feed value and concentrate feed level on finishing lamb performance'. *Proceedings of the Agricultural Research Forum* p63.

Keady, T.W.J. and Hanrahan, J.P. (2012) 'An evaluation of the effects of forage type and feed value, concentrate feed level and protein concentration and shearing on lamb performance'. *Proceedings of the XVI International Silage Conference, Hameenlinna, Finland* pp168-169.

Keady, T.W.J. and Hanrahan, J.P. (2012). 'Effects of forage type and feed value, concentrate feed level and protein concentration, and shearing on lamb performance'. *Animal* (under review).

Keady, T.W.J. Marley, C.L. and Scollan, N.D. (2012). 'Grass and alternative forage silages for beef and sheep: effects on animal performance'. *Proceedings of the XVI International Silage Conference, Hameenlinna, Finland* pp152-165 (invited paper).

Keady, T.W.J. and Hanrahan, J.P. Marley, C.L. and Scollan, N.D. (2012). 'Silage production – factors affecting the utilization of ensiled forages by beef cattle, dairy cows, pregnant ewes and finishing lambs'. A review. *Agricultural and Food Sciences* (under review).

Popular publications:

Keady, T.W.J. (2010) 'Finishing store lambs: what diet to offer'. *Irish Farmers Journal* 63, (49): 28-29.

Keady, T.W.J. (2011) 'Late pregnancy nutrition – the key to flock profitability'. *Irish Farmers Journal* 64, (4): 28-29.

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