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Pluridisciplinary study for a robust and sustainable Improvement of fertility in dairy cows



Key external stakeholders:

Dairy farmers
Scientists
Dairy advisors
Stakeholders in the cattle breeding industry
Veterinarians

Practical implications for stakeholders:

- Examined effects of stocking rate on cow bioenergetic status, oestrous cyclicity, uterine health and reproductive performance in a multi-year study.
- Examined effects of the type of carbohydrate included in concentrate feed on cow indicators of bioenergetics status, uterine health and reproductive performance.

Main results:

- Within pasture-based systems, operating an overall farm stocking rate between 2.5 to 3.3 cows per ha did not affect indicators of bioenergetics status or reproductive performance.
- Feeding a concentrate ration based on non-structural carbohydrates (starch) during the early postpartum period was not beneficial to subsequent reproductive performance.

Opportunity / Benefit:

The results are beneficial for farmers that are achieving high levels of pasture production, as it is possible to achieve good reproductive performance at high stocking rates. There is no apparent benefit of altering the type of carbohydrate in concentrate rations fed to postpartum dairy cows on reproductive performance.

Collaborating Institutions:

University College Dublin
INRA
DairyNZ
Cognosco

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1. Project background:

Appropriate pasture management must optimise pasture growth, utilisation, and quality, while cow management must optimise feeding and milk production. Excellent reproductive performance will maximise the overall efficiency of the system. The objective of herd nutritional management is to maximise the

proportion of grazed grass in the diet by matching the seasonal variation in grass supply to herd demand. This necessitates a compact period of calving to coincide with the onset of spring pasture growth. The breeding period begins on a pre-determined calendar date in late spring regardless of the previous calving date for individual cows. Increasing evidence suggests that cows selected solely for milk yield have poorer fertility performance. Reduced reproductive performance may result in increased replacement costs and reduced voluntary culling within the herd and might eliminate some of the economic benefit that can be achieved from selection for milk yield.

One suggested method of increasing milk production, is by increasing stocking rates (SR) on grazing platforms. Stocking rate is defined as the number of animals per unit area of land (cows/hectare, ha) during a defined period of time. Stocking rate has been recognized as the primary driver of milk production per hectare and profitability in grazing systems. The implications of increasing SR for cow fertility need to be carefully studied.

Concentrate supplementation can be used to increase milk production per cow, increase SR and milk production per unit of land, improve the use of pasture with increasing SR, maintain or improve body condition score (BCS) to improve reproduction during pasture shortage and prolong lactation during periods of pasture shortage. There is some evidence from trials with small numbers of animals that non-structural carbohydrate supplements ('insulinogenic') can improve fertility performance. It is necessary to test the effect of a non-structural carbohydrate supplement on fertility performance in a statistically well-powered study with pasture-based dairy cows.

2. Questions addressed by the project:

- Does stocking rate affect cow level indicators of postpartum bioenergetics status, resumption of cyclicity, uterine health and phenotypic fertility?
- Does the type of carbohydrate in concentrate feeds affect cow level indicators of postpartum bioenergetics status, interval to first oestrus, uterine health and phenotypic fertility?

3. The experimental studies:

Study 1:

- The objective was to compare the performance of two different cow breeds (Holstein Friesian (HF) and Jersey crossbreds (JEX); n = 69 per breed) managed under three different SR (Low: 2.5 cows/ha; Medium: 2.9 cows/ha; and High: 3.3 cows/ha; n = 46 per treatment) for three consecutive years.
- Measurements were taken to identify effects on resumption of cyclicity, oestrus intensity, blood indicators of bioenergetic status, uterine health and fertility performance.

Study 2:

- The objective was to assess the effect of increasing dietary starch for approximately 30 d postpartum on reproduction outcomes in pasture-grazed, seasonal-calving dairy cows. Cows (n = 948) from 3 commercial herds were blocked by age (2, 3, and >3 yr), breed, and expected calving date and randomly assigned to 1 of 2 postpartum treatment groups: high starch ($34.7 \pm 1.9\%$ nonstructural carbohydrate; mean \pm SD) or low starch ($22.5 \pm 0.4\%$ nonstructural carbohydrate).
- The high-starch group in all 3 farms received 4.0 to 4.5 kg/d of a 75:25 cracked corn:barley grain mixture in the dairy parlor, split evenly between the morning and afternoon milkings. The low-starch cows received 5.0 to 5.5 kg/d of a 50:50 mixture of palm kernel meal:soy hulls (herds 1 and 3) fed in the parlor; low-starch cows in the remaining herd (herd 2) did not receive a concentrate feed.
- Cows were cogenerated on ryegrass-white clover dominant pastures and were offered corn silage (herds 1 and 3) and canola, corn distillers grain, and palm kernel meal (herd 1) throughout the study. At 1 mo before the start of the seasonal breeding period, the high-starch supplement was removed, and within each herd treatment groups were managed similarly through breeding.
- Presence of purulent vaginal discharge was assessed at 28 DIM, and tail paint was assessed weekly from 2 to 6 wk postpartum for signs of estrus.

4. Main results:

Study 1

- Neither SR nor breed affected postpartum interval to resumption of cyclicity or oestrus intensity.
- The different SR treatments and breeds had little or no effect on blood metabolites or metabolic hormones, indicating minimal treatment effects on bioenergetics status.
- There was a significant effect of SR and breed on body weight, but there was no effect of SR or breed on BCS.
- Neither SR nor breed affected the proportion of cows with endometritis at week 6 postpartum or the overall phenotypic fertility performance during the breeding season.

- Providing that nutritional requirements are met and cows are genetically suited to seasonal-calving pasture-based systems, it is possible to increase stocking rate without causing adverse effects on cow metabolic health or reproductive performance.

Study 2

- The interval to first observed estrus was unaffected by treatment, but there were tendencies for a herd × treatment interaction for proportion of cows pregnant to first service and for pregnancy within 6 wk. This interaction was significant for the proportion of cows finally pregnant; a lower proportion of high-starch cows were pregnant to first service, pregnant by 6 wk, and pregnant by the end of the seasonal breeding period in herd 1, but diet did not affect these outcomes in the other herds.
- The results do not support a positive effect on reproduction from increasing dietary starch in seasonally bred grazing dairy cows. However, the interactions indicate variability in the herd response to dietary starch early postpartum and imply that pregnancy rate could potentially be compromised through the provision of starch to grazing dairy cows in early lactation (i.e., pre-breeding).

5. Opportunity/Benefit:

- The results of study 1 indicate that on well managed dairy farms that are capable of growing sufficient quantities of grass and that utilise cows with good genetic merit for fertility traits, there is no effect of increasing stocking rate on indicators of bioenergetics status, BCS or reproductive performance.
- The type of carbohydrate fed to cows during the postpartum period does not have a strong effect on subsequent reproductive performance.

6. Dissemination:

International conferences

Presented at American Dairy Science Association Annual meeting (2015) and the New Zealand Dairy Cattle Veterinarians Annual Conference (2015).

National Conferences and seminars

Presented at the Agricultural research Forum (2015) and Teagasc Moorepark Open Day (2015).

Main publications:

Leane, S., Lonergan, P., Kenneally, J., & Butler, S. (2016). The effect of stocking rate and cow breed on resumption of cyclicity, blood indicators of energy status, uterine health and reproductive parameters in pasture-based dairy systems. *Journal of Animal Science*, 94(suppl_5), 528-528.

McDougall, S., Leane, S., Butler, S. T., Roche, J. R., & Burke, C. R. (2018). Effect of altering the type of dietary carbohydrate early postpartum on reproductive performance and milk production in pasture-grazed dairy cows. *Journal of dairy science*, 101(4), 3433-3446.

Popular publications:

Leane, S. and Butler, S. (2015). The effect of stocking rate on reproduction performance for pasture-based dairying. *Irish Dairying - Sustainable Expansion Moorepark15 Open Day 1/7/15*. Teagasc IE pages 93-94 ISBN 978-1-84170-6 33522 B3

Shane Leane: A Touch of the Irish in Fertility Research. *Inside Dairy: Dairy NZ*, October 2014.

7. Compiled by: Dr. Stephen Butler