

Project number: 6490
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Sustainable intensification of grazing dairy systems



Key external stakeholders:

Dairy farmers, researchers and advisors
Irish Cattle Breeding Federation and AI companies
Department of Agriculture, Food and the Marine
Milk processors
Agri-consultants

Practical implications for stakeholders:

The results of the experiment highlight the benefits of increased stocking rate (SR) in terms of greater grass utilisation and milk production per hectare. Additionally, the results of the experiment indicate that high Economic Breeding Index (EBI) Holstein-Friesian Jersey (JxHF) crossbred cows achieved superior milk production, feed efficiency, and fertility compared with Holstein-Friesian (HF) contemporaries within both commercial and research farm environments. Although opportunity to improve efficiency is limited within intensive ruminant production systems, this experiment also demonstrates the superior capability of JxHF cows to maintain production efficiency per hectare and deliver increased MS production.

Main results:

- The present SR experiment was uniquely designed based on a bodyweight (BW) per hectare framework to evaluate the response to SR changes, using differing animal genotypes over a 4-yr period.
- The greater productivity per hectare demonstrated at higher SR is a consequence of increasing BW per hectare, increased grazing intensity, additional grazing days per hectare, and a greater level of grazed pasture utilisation.
- At similar BW per hectare, JxHF cows produced significantly more fat plus protein per hectare during the grazing season at each SR. The results highlight the superior productive efficiency of high genetic potential crossbred dairy cows within intensive pasture-based production systems.

Opportunity / Benefit:

- Results from this project will provide dairy farmers with a greater understanding of the impacts of breeding strategy on the future performance and efficiency of commercial Irish dairy herds.

Collaborating Institutions:

University College Dublin and INRA, France

Teagasc project team:	Dr. Brendan Horan (PI) Dr. Emma-Louise Coffey Dr. Donagh Berry
External collaborators:	Mr. Luc Delaby (INRA, France) Dr. Karina Pierce (University College Dublin)

1. Project background:

The predominant milk production system in Ireland is a seasonal, spring calving grass based system. The calving pattern is aligned with the start of the grass growing season, matching the herd's feed requirements with grass growth. Ireland has a competitive advantage over many international competitors due to the ability to grow a large quantity of grass for up to 11 months of the year, allowing grass to form the main component of the dairy cow diet across a prolonged grazing season. Grazed grass can adequately supply the nutrients required by the dairy cow to produce milk at a significantly lower cost to alternative feedstuffs. Stocking rate (SR), the number of animals per unit area (cows per hectare), is the key driver of milk production output per cow and per hectare in grazing dairy systems. Previous studies have reported a 9% reduction in milk yield per cow and a 20% increase in milk yield per hectare where SR increased by one cow per hectare. The average SR in Ireland is currently low at 1.9 cows per hectare, indicating that there is significant potential to improve efficiencies through increasing SR and grass utilisation on the existing grazing platform. At the same time, there is a growing interest in dairy cow crossbreeding as a means to further augment profitability. Crossbreeding with high EBI Jersey sires are being considered to counteract the decline in dairy cow fertility, health and survival associated with the intense selection for milk production within the national herd. Crossbreeding with high EBI Jersey sires has been shown to improve milk solids production, reproductive efficiency, feed efficiency, survivability and farm profitability within controlled experimental conditions where smaller crossbred cattle have been compared to larger Holstein-Friesian contemporaries at similar SR.

2. Questions addressed by the project:

The overall objective of this study was to quantify the effect of animal genotype on milk production and fertility performance within commercial dairy herds and to further examine the individual and interactive effects of SR and animal genotype within a detailed controlled farm systems evaluation in terms of milk production per cow and per hectare, dry matter intake (DMI) bodyweight (BW) and body condition score (BCS), grass production, utilisation and conversion efficiency and reproductive performance and health.

3. The experimental studies:

- A study was carried out to compare milk production and fertility performance of Holstein, Friesian, and Jersey purebreds, and their respective crosses on commercial spring-calving dairy herds in Ireland. A total of 24,279 lactation records from 11,808 cows from 40 dairy herds over 5 years (2008-2012, inclusive) were available for analysis.
- Separately, a controlled farm system investigation was undertaken to investigate the productivity of a range of SR and breed combinations. Three SR treatment groups were investigated, defined in terms of bodyweight per hectare (kg BW/ha): low SR (1,200 kg BW/ha); medium SR (1,400 kg BW/ha); and high SR (1,600 kg BW/ha). Within each SR treatment, two breeds (HF and HFJX) were included in the experiment. The average EBI of the experimental herd was €142, ranking them in the top 1% of the national dairy herd. The aim of the experiment was to identify the interaction between farm SR and breed on measures of the biological efficiency of spring-calving grazing systems. The low SR treatment was designed to allow each cow to express their milk production potential where grass supply was unrestricted, whereas the higher SR treatments investigated the potential response in performance per cow and per hectare to increased grazing intensity and grass utilisation.

4. Main results:

From the commercial farm analysis, the results indicated that Jersey x Holstein first-cross cows produced 25 kg more fat plus protein (milk solids; MS) and had a 7.5 day shorter calving interval compared with the average of the purebred parent breeds, which corresponds to additional profit of €162 per cow per lactation. The results of this analysis were consistent with the controlled farm system evaluation which was undertaken concurrently. Holstein-Friesian cows were on average 36 kg heavier than HFJX cows.

Similar to the commercial farm evaluation, the effects of SR, high EBI breed group, and their interaction on milk production/cow and per hectare, BW, BCS, and grazing characteristics were analysed within the controlled farm systems experiment. Total pasture utilisation per hectare consumed in the form of grazed pasture increased linearly as SR increased: least in low SR (10,237 kg of dry matter/ ha), intermediate in medium SR (11,016 kg of dry matter/ha), and greatest in high SR (11,809 kg of dry matter/ha). Milk and milk solids (MS) yield per hectare was greatest at high SR (15,942 and 1,354 kg, respectively), intermediate for medium SR (14,191 and 1,220 kg, respectively), and least for low SR (13,186 and 1,139 kg, respectively) with similar trends evident for fat, protein, and lactose yield/ ha. At higher SR (MSR and HSR), MS yield per kg of BW per ha was reduced (0.85 and 0.82 kg of MS/ kg of BW, respectively) compared with low SR (0.93 kg of MS/kg of BW/ha). Holstein-Friesian cows achieved fewer grazing days per hectare (-37 d), and produced more milk (+561 kg/ha) but less fat plus protein (-57 kg/ha) compared with JxHF cows; the JxHF cows were lighter. At similar BW per hectare, JxHF cows produced more fat plus protein/ha during the grazing season at low (1,164 vs. 1,113 kg), medium (1,254 vs. 1,185 kg), and high (1,327 vs. 1,380 kg) SR. In addition, JxHF cows produced more fat plus protein per kg of BW/ha (0.90 kg) compared with HF cows (0.84 kg). The results highlight the superior productive efficiency of high genetic potential crossbred dairy cows within intensive pasture-based production systems.

5. Opportunity/Benefit:

As a novel multi-disciplinary study, this project has demonstrated that high EBI crossbred Holstein-Friesian Jersey animals are delivering significantly increased individual animal productivity in addition to improved reproductive performance and feed conversion efficiency within both commercial dairy herds and controlled research trails when compared to pure-bred contemporaries. The project reinforces the confidence of dairy farmers to breed more efficient animals which can contribute to increase the productivity and environmental efficiency of Irish grass-based dairy systems.

6. Dissemination:

International conferences

Presented at many international conferences, invited and contributed, such as the International Farm Management Association and British Society of Animal Science

National Conferences and seminars

Presented at the Agricultural Research Forums through the duration of the project and at national farmer conferences.

Open Day

Presented at all Moorepark open days.

Farmer discussion groups

Discussed at many farmer discussion groups and at advisor in-service training

Press

Results regularly presented in the Irish Farmers Journal, Farming independent, Today's Farm, TResearch, and Moorepark News.

Main publications:

Coffey, E.L., B. Horan, R.D. Evans, D.P. Berry. 2016. Milk production and fertility performance of Holstein, Friesian, and Jersey purebred cows and their respective crosses in seasonal-calving commercial farms. *J. Dairy Sci.* 99: 5681–5689.

Coffey, E.L., L. Delaby, S. Fitzgerald, N. Galvin, K. M. Pierce and B. Horan. 2017. Effect of stocking rate and animal genotype on dry matter intake, milk production, body weight, and body condition score in spring-calving, grass-fed dairy cows. *J. Dairy Sci.* 100: 7556–7568.

Coffey, E.L., L. Delaby, C. Fleming, K. M. Pierce and B. Horan. 2018. Multi-year evaluation of stocking rate and animal genotype on milk production per hectare within intensive pasture-based production systems. *J. Dairy Sci.* 101:2448–2462.

Popular publications:

Coffey, E-L., Horan, B., Evans, R.D., Pierce, K.M. & Berry, D.P. (2015). Milk production and fertility performance of Holstein, Friesian, Jersey, Holstein x Jersey and Friesian x Jersey crossbred cows on

commercial Irish farms. ADSA/ASAS, Joint annual meeting, Orlando Florida, July 12-16.

Coffey, E-L., Horan, B., Evans, R.D., Pierce, K.M. & Berry, D.P. (2015). Milk and fertility performance of Holstein, Jersey and Holstein x Jersey cows on Irish farms. European Federation of Animal Science, Warsaw, Sept 1-4.

Coffey, E-L., Fitzgerald, S., Pierce, K.M. & Horan, B. (2016). Effect of stocking rate and animal genotype on milk production in spring-calving dairy cows. European Federation of Animal Science, Belfast, Aug 29- Sept 2.

7. **Compiled by:** Dr. Brendan Horan, Dr. Emma-Louise Coffey
