Project number: 5501
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The influence of animal genetic potential across a variety of futuristic pasture-based systems of milk production

Key external stakeholders:

Grass based dairy farmers; milk processors; ICBF & AI companies; consultancy agencies; education agencies

Practical implications for stakeholders:

With land availability the likely longer term limitation to increased productivity, the objective of Irish production systems will be to increase productivity per unit of available feed through increased grass production and utilisation.

The findings of this research project indicate that:

- High Economic Breeding Index (EBI) genotypes produced greater volumes of milk solids, maintained superior body condition score (BCS) during lactation, achieved improved reproductive performance and were more feed efficient when compared to lower EBI animals
- Selection for increased genetic merit for milk and fertility related traits using the Irish EBI will result in substantial improvements in economic performance and increased tolerance to fluctuating milk prices when compared to average genetic potential genotypes

Main results:

Selection for increased genetic merit for milk and fertility related traits using the Irish EBI will result in substantial improvements in economic performance and increased tolerance to fluctuating milk prices when compared to average genetic potential genotypes

Opportunity / Benefit:

Irish dairy farmers should use high EBI AI sires to increase the future productivity and profitability of their dairy herds.

Collaborating Institutions:

University College Dublin, FBD Trust

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1. Project background:

Irish milk production systems are characterized by a pasture based diet incorporating lower production costs within a European Union (EU) context. With the proposed abolition of EU milk quotas by 2015, milk production within the EU will move to areas of competitive advantage such as Ireland. With land availability the likely longer term limitation to increased productivity, the objective of Irish production systems will be to increase productivity per unit of available feed through increased grass production and utilization. Such adaptations have occurred in other pasture-based countries and are characterized by increased stocking densities and adjustments to breeding objectives to increase production efficiency.

2. Questions addressed by the project:

- What is the impact of genetic improvement using the Irish total merit index, the economic breeding index (EBI), on overall biological and economic performance of two likely post quota pasture-based systems of milk production?
- What is the profile dry matter (DM) intake across the entire lactation within intensive pasture based systems?
- Can we establish the profile of feed efficiency over the lactation?

3. The experimental studies:

Three genotypes of Holstein-Friesian dairy cattle were established from within the Moorepark dairy research herd: LowNA, indicative of the Irish national average genetic merit North American Holstein-Friesian at the time of the study; HighNA, high genetic merit North American Holstein-Friesian; HighNZ, high genetic merit New Zealand Holstein-Friesian. Animals from within each genotype were randomly allocated to one of two possible post European Union milk quota pasture-based feeding systems (FS): 1) The Moorepark pasture (MP) system (2.64 cows/ha and 344 kg concentrate supplement per cow per lactation) and 2) a high output per hectare (HC) system (2.85 cows/ha and 1,056 kg concentrate supplement per cow per lactation). Pasture was allocated to achieve a similar post grazing residual sward height for both treatments. A total of 126, 128 and 140 spring calving dairy cows were used during the years 2006, 2007 and 2008, respectively. Each group had an individual farmlet of 17 paddocks and all groups were managed similarly throughout the study

4. Main results:

The current body of research investigated the effects a total merit index derived under Irish conditions for increased farm profitability on potential future performance of Irish production systems. A thorough examination of phenotypic performance was undertaken on three genotypes of HF to determine the potential milk production, fertility performance, DM intake capacity across lactation, feed efficiency and overall economic performance when managed under two intensive pasture based FS for a post milk quota scenario. The results clearly illustrate the potential benefits that may be achieved from increased EBI through increased genetic merit for increased MS production and improved fertility performance. The results also show the benefits of intensive pasture based systems of milk production in terms of increased pasture growth and utilisation and increased stock carrying capacity resulting in increased output per unit of land. Specifically, the main findings include:

- High EBI genotypes produced more milk solids per cow and per hectare, maintained a higher body condition score and had improved reproductive performance compared to the LowNA genotype
- Selection using the Irish EBI had no effect on DMI across lactation
- The ranking of genotypes for feed efficiency differed depending on the definition of feed efficiency used and that while differences in feed efficiency exist between strains of Holstein-Friesian, variation also exists within genotypes so that improvements in feed efficiency can be achieved
- Selection for increased genetic merit for milk and fertility related traits using the Irish EBI will result in substantial improvements in economic performance and increased tolerance to fluctuating milk prices when compared to average genetic potential genotypes

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5. Opportunity/Benefit:

Irish dairy farmers should use High EBI AI sires to increase the future profitability of their dairy herds

6. Dissemination:

During each week of the grazing season, a web update of the research activities was published on the Teagasc website to allow stakeholders to follow the project. The update was used by research and advisory staff to disseminate research findings to the wider industry. The research results from the web also featured in the mainstream agricultural media. (http://www.agresearch.teagasc.ie/moorepark/CurtinsFarm/curtins.asp)

In addition to open day events, individual discussion groups frequently visited the experiment during the project. Topics covered at these events by research and advisory staff included grassland management best practice advice, animal breeding and health recommendations and economic implications of research results.

Main publications:

Coleman, J., Berry, D.P., Pierce, K.M., Brennan, A. and Horan, B. (2010). Dry matter intake and feed efficiency profiles of 3 genotypes of Holstein-Friesian within pasture-based systems of milk production. *Journal of Dairy Science* 93:4318-4331

Coleman, J., Pierce, K.M., Berry, D.P., Brennan, A. and Horan, B. (2010). Increasing milk solids production across lactation through genetic selection and intensive pasture-based feed system. *Journal of Dairy Science* 93:4302-4317

Coleman, J., Pierce, K.M., Berry, D.P., Brennan, A. and Horan, B. (2009). The influence of genetic selection and feed system on the reproductive performance of spring-calving dairy cows within future pasture-based production systems. *Journal of Dairy Science* 92:5258-5269

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