Pasture-based dairy systems in temperate lowlands

TEAGASC research looked at the challenges inherent in pasture-based dairy systems, and opportunities for the future.

Improved efficiency in dairy systems is a significant challenge for the future, to meet increased food demand while competing for resources, adapting to climate change, and delivering ecosystem services. Future grazing systems can play a major role to supply healthier foods within systems with a reduced reliance on fossil fuels and chemical inputs, while also delivering environmental, biodiversity and animal welfare benefits. We identify three pertinent opportunities for temperate, pasture-based, dairy systems to deliver efficient levels of output based on a lower reliance on imported concentrates and inorganic fertilisers, and an increased reliance on extended grazing seasons and high-quality forage.

Matching the cow to the system

In low-input pasture-based systems, more than others, the dairy cow is a feed-to-food transformer who must possess critical attributes associated with the conversion of grass to milk. The available feed resource is primarily forage characterised by a higher fill value and a low energy density. In addition, achieving high levels of grazing efficiency requires a low post-grazing residual height, which restricts animal intake, and pasture supply is naturally seasonal and varies both in supply and in quality. In consequence, such systems fail to fully meet the nutritional requirements of high genetic merit dairy cattle for milk yield within a predominantly pasture diet. At the same time, and as a consequence of the seasonality of grass growth, dairy farmers are highly motivated to synchronise herd demand with

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grass availability using compact calving in spring to maximise pasture utilisation. On that basis, the Economic Breeding Index (EBI) in Ireland has successfully produced dairy cows capable of both increased productivity and improved compactness of calving within Irish dairy herds. Building on this success, specifically at grazing, the selection of animals that exhibit greater longevity within such systems, and are resistant to lameness and parasitism to limit the use of antibiotics and anthelmintic products, is an opportunity for the future. At the same time, more erratic grass growth patterns due to climate change will increase pasture supply variability and will require future dairy cattle that can withstand periods of nutritional restriction. The ideal dairy cow in low-input pasture systems should

have the inherent capability to reduce milk yield during periods of restriction and rebound when forage supply recovers. Genetic selection on this capability will be a key attribute for grazing dairy cattle for the future. Finally, a well-adapted dairy cow must achieve greater longevity to produce high fat and protein content milk from pasture with a low replacement rate to reduce environmental impacts such as greenhouse gas (GHG) emissions from the dairy system (Dall-Orsoletta *et al.*, 2019). Ultimately, the dairy cow required for future climate-smart grazing systems will be placed in a less controlled, less artificial environment and, consequently, should be more adaptable, with increased health and robustness to prosper within the changing environment.

Multi-species pastures: benefits of diversity

There is renewed focus on the role of legumes within intensive grassland-livestock systems to increase pasture productivity and reduce inorganic nitrogen (N) requirements and production costs. The inclusion of forbs within grass-legume swards can bring extra yield and more complete feeding value, especially of minerals and bioactive secondary metabolites (Delagarde *et al.*, 2014). On a broader scale, by diversifying plant species, the risk of deficiency in any aspect of an animal's diet is reduced, resulting in positive effects on animal performance (Roca-Fernandez *et al.*, 2016). Compared to monocultures, sward diversity enhances grassland yield stability under drought (Finn *et al.*, 2018), contributes to increased carbon sequestration, and reduces weed invasion and associated reliance on herbicides (Connolly *et al.*, 2018).

Biodiversity and ecosystem service provision

Much of European biodiversity is associated with extensively managed farmland, while agricultural intensification has been a major driver of recent biodiversity loss through conversion to cropland or single-species grasslands. There is a growing expectation from society for agricultural systems to improve their environmental sustainability, and to respond to the climate and biodiversity crises. Lower-input pasture-based dairy systems can support and improve biodiversity by protecting existing natural habitats, enhancing the wildlife quality of degraded farmland habitats through improved management, and creating new wildlife habitats. The benefits of such actions extend beyond the improvement in allocation of space for biodiversity. For example, for hedgerows and wooded areas that are characteristic to Ireland, wider benefits include the provision of shelter and shade for animals, improved carbon sequestration, water infiltration and pollination services, and the control of agricultural pests and diseases, while simultaneously reducing reliance on chemical methods of weed and pest control.

Conclusion

Future pasture-based systems must be realigned to extend beyond food production to deliver additional benefits to farmers, consumers and society at large. Such systems will need to rely less on imported feed and chemical inputs and more on high-quality home-produced forage. Such systems will require:

- more robust animals that are healthier and adapted to the specific requirements of grazing;
- more diverse swards, which support improved animal performance and require fewer fertiliser and chemical inputs; and,
- the further development of systems to support higher biodiversity, reduced nutrient losses and enhanced carbon storage.

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Authors

Luc Delaby
INRAE, Agrocampus Ouest, Physiologie, Environnement, Génétique pour l'Animal et les Systèmes d'Elevage, 35590 Saint Gilles, France

John A. Finn
Teagasc, Environment, Soils and Land Use Research Department, Johnstown Castle, Co. Wexford
Correspondence: john.finn@teagasc.ie

Guylain Grange
Teagasc, Environment, Soils and Land Use Research Department, Johnstown Castle, Co. Wexford, and School of Computer Science and Statistics, Trinity College Dublin

Brendan Horan
Teagasc, Grassland Research Science Department, Animal & Grassland Research and Innovation Centre, Moorepark, Fermoy, Co. Cork