Factors affecting productivity of grass-based systems

Productivity of grass-based systems is dependent on achieving a balance between the competing objectives of high grass intake to maximise milk production per cow, and increased grazing intensity to maximise grass utilisation and milk production per hectare.

Within intensive grass-based systems, stocking rate (SR) is widely acknowledged as the primary lever of productivity. As SR increases, there is a linear increase in milk production per hectare. Additionally, higher SR systems are conducive to greater grass production and utilisation, and improved sward quality. While SRs on Teagasc dairy research farms are high (2.5-3.3 livestock units (LU)/ha) compared with the national average dairy farm (1.9LU/ha), high SR experimental comparisons provide important evaluations of the biological impact of intensification ahead of industry uptake. Although high economic breeding index (EBI) dairy cows are commonplace on many Irish dairy farms, little is known about the impact of intensification of farm systems on the performance of high-merit dairy cows. The appropriate cow for intensified grazing systems must be robust and fertile, and have the capability to convert scarce feed resources efficiently to high-value milk solids (MS). In this regard, the increased productivity of Jersey x Holstein-Friesian crossbreds (JxHF) over conventional Holstein-Friesian (HF) cows has been substantiated internationally. This is primarily due to their superior productive efficiency, fertility, and longevity. Notwithstanding these benefits, little is known about the relative impacts of increased SR on the performance of such genotypes. Consequently, the objective of this research was to compare the performance of high EBI HF and JxHF cows within a range of intensive grass-based production systems on both research and commercial farms.

Performance of HF and JxHF in commercial herds

A study was carried out to compare milk production and fertility performance of HF and Jersey purebreds, and JxHF cows on commercial spring-calving dairy herds in Ireland. A total of 24,279 lactation records from 11,808 cows from 40 dairy herds over five years (2008-2012, inclusive) were available for analysis. JxHF first-cross cows produced 25kg more 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.

Teagasc researchers investigated productivity in three SR treatment groups.

Curtin's research farm experimental comparison

A follow-up experiment on Teagasc's Curtin's research farm investigated 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 (1,200kg BW/ha); medium SR (1,400kg BW/ha); and, high SR (1,600kg BW/ha). Within each SR treatment, two breeds (HF and JxHF) were included in the experiment. The average EBI of the experimental herd was €142, ranking them in the top 1% of the

Table 1: Biological performance of the Curtin's herd (2013-2016).

Breed	Holstein-Friesian			Jersey x Holstein-Friesian		
Stocking rate	Low	Medium	High	Low	Medium	High
Bodyweight (kg)	510	492	483	467	466	443 (KG)
Milk production (kg)						
MS yield/cow	454	425	408	459	438	419
MS yield/ha	1,090	1,228	1,338	1,152	1,323	1,433
Production efficiency (kg)						
Daily intake/100kg BW	3.42	3.29	3.19	3.63	3.52	3.50
Daily MS/100kg BW	0.37	0.36	0.35	0.42	0.40	0.41

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 its 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.

Biological performance

Mean biological performance (bodyweight, milk production, and production efficiency) for each treatment for the four years (2013-2016, inclusive) of the experiment is presented in **Table 1**. MS yield per cow was greatest for low SR, intermediate for medium SR, and least for high SR. In contrast, MS yield per hectare was greatest for high SR, intermediate for medium SR, and least for low SR. As SR increased from low SR to high SR, dry matter intake and milk production per kg bodyweight decreased.

HF cows were on average 36kg heavier than JxHF cows. Similar to the commercial farm evaluation, MS production per cow and per ha was greater for JxHF cows. The JxHF cows consumed 8% more feed per kg bodyweight and produced 14% more MS per kg bodyweight than their HF contemporaries. Although the percentage of the herd in calf during the first six weeks of mating was greater for JxHF cows (73%) than HF cows (67%), there was no difference in overall pregnancy rate between the two breeds.

Grass production

Detailed grazing measurements were carried out to investigate the effect of SR and grazing intensity on grass production, utilisation, and quality. Although there was only a minor difference in overall grass production (**Figure 1**), increasing SR increased the proportion of grass utilised in the form of grazed grass.

Implications for industry

The results of the experiment highlight the benefits of increased SR in terms of greater grass utilisation and MS production per hectare. Additionally, the results of the experiment indicate that high EBI crossbred cows achieved superior milk production, feed efficiency, and fertility compared with HF contemporaries, within both commercial and research farm environments.

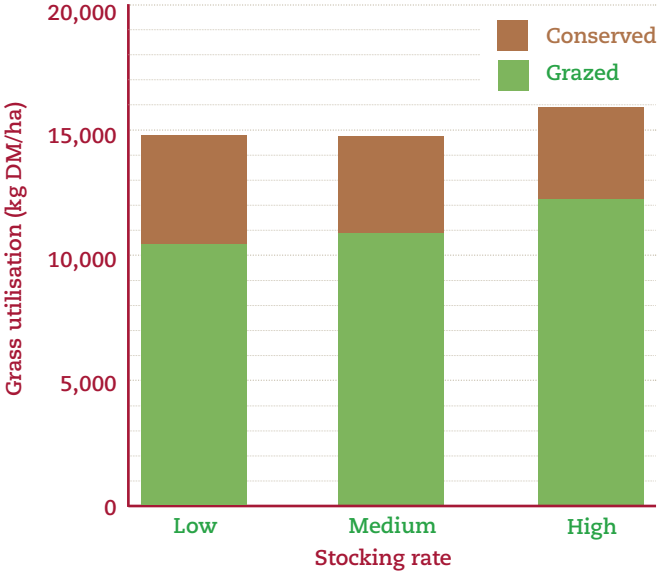

FIGURE 1: Grazed (green) and conserved (brown) annual herbage production (2013-2016).

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