

# A comparison of high EBI Holstein-Friesian (HF) to Jersey x HF and Norwegian Red x Jersey x HF crossbreds in spring milk production systems

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## Summary

- High EBI HF, Jersey x HF and Norwegian Red x Jersey x HF crossbred cows performed similarly in terms of milk solids, reproductive performance and health traits.
- Jersey x HF had the highest production efficiency (kg milk solids/kg bodyweight), Norwegian Red x Jersey x HF were intermediate and HF were lowest.
- There were benefits to be gained from crossbreeding in terms of production efficiencies and economic performance.

## Introduction

The historical decline in dairy cow reproductive performance, particularly in Holstein-Friesian (HF) cows, has been linked to animal selection based mainly on milk production. This has negative consequences for the economic performance of pasture-based systems, due to the requirement for compact calving. Although milk solids production and reproductive performance of the national herd has improved, the average performance is still well below industry targets. The use of crossbreeding to improve herd reproductive performance, milk composition and animal health has gathered increasing interest in recent years. In crossbred herds, the optimum mating strategy after the first cross is unclear. There are three main options: (1) backcrossing using one of the parent breeds; (2) breeding using a crossbred sire; or (3) introducing a third breed into a 3-way rotational crossing system. Jersey (JE) has been the most common breed used to cross with HF dams. However other breeds such as Norwegian Red may offer additional benefits in a 3-way rotational crossing system.

## The study

The experiment was conducted at Teagasc Clonakilty Agricultural College from 2014–2017. Three cow breeds were used for this experiment: HF, JE x HF and a 3-way cross of Norwegian Red x JE x HF (3WAY). The JE x HF cows were produced from HF cows mated with a JE sire. The 3WAY cows were produced from JE x HF F1 cows mated with a Norwegian Red sire. Each year 10 cows of each breed were assigned to one of four grazing treatments and balanced for parity (1, 2 or 3+), calving date and EBI. This created four herds of 30 cows per grazing treatment, with 10 cows of each breed used. Age structure did not differ among breeds for the duration of the experiment. All four sward types were grazed in a spring calving rotational grazing system stocked at 2.75 cows/ha receiving 250 kg nitrogen fertiliser/ha/year with a target of ~350 kg concentrate/cow/year. Cows were grazed day and night as they calved from February onwards when weather conditions allowed. The economic performance of the three breeds was modelled using the biological performance from this study with the Moorepark Dairy Systems Model.

## Animal performance

Holstein-Friesian cows produced greater total milk volume compared to JE x HF and 3WAY cows. Milk solids production was similar for HF and JE x HF, but lower for 3WAY compared

to JE x HF (Table 1). Reproductive performance was similar between the three breeds, with no significant difference in average six week pregnancy rate and overall pregnancy rate for the four years. Health traits were also similar between the three breeds with no difference in calving difficulty, or in the incidences of mastitis or lameness. Throughout lactation, HF had the greatest average bodyweight followed by 3WAY and JE x HF, while 3WAY cows had a higher BCS throughout lactation compared to HF and JE x HF. In terms of milk production efficiency (kg MS/kg bodyweight), JE x HF had the greatest efficiency (0.98), 3WAY were intermediate (0.91) and HF were lowest (0.87). Jersey x HF had the highest profit per ha, 3WAY were intermediate and HF were lowest although the differences were not as large as previous research had shown.

**Table 1. The effect of Holstein-Friesian (HF), Jersey (JE) x HF and Norwegian Red x JE x HF (3WAY) on biological and economic performance (2014–2017)**

	HF	JE x HF	3WAY
EBI	116	135	164
Total milk yield (kg/cow)	5,718	5,476	5,365
Fat content (%)	4.52	4.86	4.75
Protein content (%)	3.72	3.87	3.88
Total milk solids yield (kg/cow)	460	469	453
Average bodyweight (BW; kg/cow)	530	478	499
Average BCS	2.93	2.94	2.99
Milk solids yield/BW (kg MS/kg BW)	0.87	0.98	0.91
6 week pregnancy rate (%)	88.0	86.8	84.1
Overall pregnancy rate (%; 12 wk)	96.8	93.1	93.0
<b>Economic performance</b>			
Cow numbers	115	117	118
Land use (ha)	40	40	40
Net profit (€/40 ha farm)	98,706	104,230	99,671
Net profit (€/ha)	2,468	2,606	2,592

## Conclusions

The combination of similar milk solids production, reproductive performance and health traits indicate that all three breeding strategies are suitable for spring-calving, grass-based systems. The similar reproductive performance between the three breeds highlights the improvement made to traditional HF breeding in Ireland through the use of the EBI. There are still benefits arising from crossbreeding in terms of milk production efficiency and economic performance.