Technologies underpinning grass-based suckler beef systems

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Summary

- Suckler beef production is a key contributor to economic activity in Ireland.
- Key principles underpinning profitability of suckler beef systems are:
  - Attaining high performance from grazed grass while producing sufficient grass silage of appropriate quality for feeding indoors.
  - Optimising animal growth and reproductive performance by using high genetic merit animals and adopting the best management strategies available.
  - Operating production systems that optimise the genetic potential of beef cattle within grass-based production systems in order to maximise economic returns.
- Current prices and technologies can deliver the following net returns from suckler beef systems: weanling system, €100/ha, steer/heifer beef systems, €200/ha and bull/heifer beef systems, €300/ha. These margins are very sensitive to changes in weanling/beef price.
- It is important to be aware of market specifications to return the highest price – communication with meat processors is critical.
- The carbon footprint of suckler systems is ca. 10 kg CO_2e/kg beef live weight.

Introduction

Suckler beef production is the most widespread farm activity in Ireland. Suckler farms have a broad geographic distribution in contrast to many other farming enterprises and make an important contribution to economic activity in diverse regions throughout the country. The value of beef and cattle output in 2013 for Ireland was €2.1 billion, representing 30% of total agricultural output, and was the largest single agricultural sector. Approximately half of total beef production, and a greater percentage of output value, derives from suckler beef production and therefore, this sector is a key income generator for the national economy. There are a myriad of production systems operated on suckler beef farms throughout Ireland, based on markets, tradition and demographics. Ireland has a natural comparative advantage to grow grass and, consequently, grass-based beef production systems are most profitable. For the purposes of this paper some of the most typical systems, including both calf-to-weanling and calf-to-beef, are examined. However, the principles discussed are applicable to most production systems.

Key principles for profitable suckler beef production systems

Grass-based nutrition

Due to the considerably lower comparative cost of grazed grass as a feedstuff, maximising the proportion of high digestibility, grazed grass in the annual feed budget is critical. Grassland management revolves around a flexible rotational grazing system, with the objective being to achieve high animal performance from high digestibility leafy grass over a long grazing season. Grass conservation is very important due to the obvious necessity of producing silage for the indoor winter period and because a high proportion of the total

annual feed bill is for grass silage production. Additionally, silage harvesting is an integral part of grassland management on beef farms. In Grange, the objective is to produce high digestibility first-harvest grass silage for progeny (75% dry matter digestibility (DMD)) and moderate digestibility (higher yields) silage for cows (67% DMD). The annual feed budget (dry matter (DM) basis) for the Grange calf-to-weanling system comprises *ca*. 70% grazed grass, 25% grass silage and 5% concentrates and for the calf-to-beef system, *ca*. 60% grazed grass, 30% grass silage and 10% concentrates. Obviously, these proportions are largely constrained by the prevailing environment and, thus, will differ accordingly.

Concentrate supplementation is necessary to make up the deficit in nutrient supply from forage and when grass or grass silage supply declines. In integrated calf-to-beef systems, supplementation of calves (1 kg/day) occurs pre- and post-weaning; supplementation levels are typically higher (2-3 kg/d) in calf-to-weanling systems. Weanlings are generally supplemented with 1-2kg concentrate daily during the first winter to grow at ~0.6 kg live weight per day and avail of compensatory growth during the subsequent grazing season. Finishing cattle receive higher levels of supplementation daily – heifers 3-4 kg, steers 4-5 kg and bulls 5 kg to *ad libitum* concentrates. Concentrate supplementation of cows (1-2 kg daily) is confined to first-calvers, from calving until turnout to pasture.

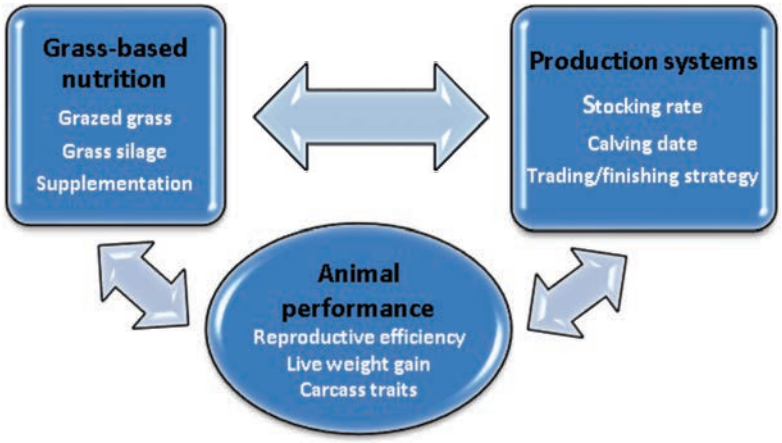

Figure 1: Key principles underpinning profitable suckler beef production systems

Animal performance

The overall objective is to maximise the value of carcass beef produced per suckler cow exposed for breeding. The breeding policy should exploit breed differences and hybrid vigour or heterosis (advantage to crossbreds over the average of the parent breeds). The advantages of hybrid vigour from crossbreeding are due to a combination of enhanced reproductive performance, lower calf mortality and higher calf growth. Research shows that the advantage expected from using a cross-bred suckler cow as opposed to a purebred in terms of kg of calf weaned per cow put to the bull is about 13%. In addition, using a sire from a third breed increases the weight of calf weaned per cow exposed for breeding by approximately a further 8 %. Animals of high genetic merit should be used and sires selected on the basis of the new beef breeding indexes: Replacement Index where replacement heifers (homebred or purchased) are selected for breeding and Terminal Index where progeny are produced for slaughter. Good reproductive performance (i.e. producing close to one healthy calf per cow exposed for breeding) is critical, and ideally cows need to first calve at 2 years old. High lifetime live weight gain of progeny, i.e. attaining high weight for age during pre-weaning (combining cow milk yield and the animal's own genetic capacity for growth) and post-weaning (genetic merit, feeding management and exploiting compensatory growth) coupled with good carcass traits (high kill-out proportion, good carcass conformation and adequate carcass fat score and meat quality traits), is essential.

Production systems

The objective is to maximise financial returns by enabling the potential of beef cattle to be met within grass-based systems. Economic analysis of calf-to-beef production system comparisons at Grange has shown that where individual animal performance remains high, stocking rate is the main driver of farm profitability. Consequently, operating at a relatively high stocking rate is important. Mean calving date should coincide with the start of the grass growing (grazing) season. Research at Grange has shown that in general, earlier calving and turnout to pasture improves farm net margins by reducing the proportion of more expensive grass silage (and concentrates) in the annual feed budget and replacing it with cheaper grazed grass. Furthermore, slurry handling costs are reduced. However, earlier calving and turnout will only increase farm net margin where an adequate supply of grass is available and soil conditions permit grazing i.e. calving too early, or too late, reduces profitability. An important issue surrounds market specifications particularly for bull beef production systems. It is critical to be aware of market requirements for gender, age, carcass weight and carcass fatness. Markets outside of these specifications may be limited or lead to reductions in beef price payable and, therefore, communication with meat processors is essential.

Production systems comparisons

A weanling system and four integrated calf-to-beef suckler spring–calving production systems were compared (Table 1). In the weanling system, weanlings were sold at 9 months of age following a 90-day creep feeding (210 kg/calf) period. For all integrated calf-to-beef systems, heifers were finished indoors at 20 months of age, at the end of the second grazing season and at a carcass weight of 310 kg. Two steer systems were compared: in the first system, steers were finished off pasture at 20 months of age after receiving 5 kg concentrates daily for the final 75 days of the grazing season. The second system involved finishing steers at 24 months of age following a second indoor winter. Two bull systems were compared: in the first system weaned bulls were housed and offered high digestibility grass silage and concentrates prior to slaughter at 15/16 months of age. In the second system, weaned bulls were stored for the first winter, turned out to grass for a 100 day grazing period and then housed for finishing on *ad libitum* concentrate at 18/19 months of age. For all systems, the farm area was 40 hectare and mean calving date was 12 March. Replacements (16% replacement rate) were purchased as maiden heifers, 12 months prior to calving. A 2-harvest silage strategy was assumed and total herbage utilised was set at 10 t DM per hectare.

Table 1 highlights the key findings from the production systems comparison. The number of cows calving per hectare was lower where progeny are retained on the farm for longer e.g. there are more cows calving in the weanling system than in the calf-to-beef systems. Feed budgets differed considerably across systems with the proportion of grazed grass being lower and proportion of concentrate being higher for calf-to-beef systems, especially bull/heifer systems, when compared to the weanling system, reflecting the concentrate feed requirements of the finishing phase. Live weight produced per ha was similar for the weanling and steer/heifer beef systems and somewhat higher for the bull/heifer systems due to the higher daily live weight gain achieved in the bull beef systems.

Analyses of costs indicate that the annual cost per suckler cow calving is approximately €700. This includes all variable and fixed costs and, additionally, the cost of replacement heifers. Given these costs and the output generated at the weanling stage, the calf-to-weanling system was least profitable within the three price scenarios investigated. Although variable costs for the bull beef systems were highest, higher sales more than offset these costs and, therefore, gross and net margin were highest when compared to the other systems (bearing in mind the aforementioned potential market sensitivities to bull beef).

Table 1 — Comparison of alternative suckler beef production systems[1].

Male age at sale (months; m)	9m	20m steer	24m steer	16m bull	19m bull
Heifer age at sale (months; m)	9m	20m	20m	20m	20m
Cows calving/ha	2.28	1.64	1.49	1.83	1.69
Grazed grass – % total feed	67	62	63	58	61
Concentrates/cow calving (kg)	258	411	529	853	784
Male carcass weight (kg)	–	338	397	372	398
Live weight output[2] (kg/ha)	1,014	1,064	1,027	1,202	1,145
Carcass output[2] (kg/ha)	86	567	556	660	630
Variable costs (€/ha)	947	924	923	1,157	1,040
Of which: Concentrates	174	152	180	362	295
Grazing	184	180	181	178	182
Grass silage	372	411	397	414	377
Other	217	181	165	203	186
Fixed costs (€/ha)	624	645	659	669	629
Total farm costs (€/ha)	2,046	1,911	1,892	2,209	2,022
Total farm costs (€/kg[3])	2.02	3.37	3.41	3.34	3.21
Gross margin[4] (€/ha)					
Base price[5]	708	845	846	926	968
High price[6]	909	1,097	1,096	1,222	1,251
Low price[7]	508	592	597	631	685
Net margin (€/ha)					
Base price[5]	85	200	190	257	339
High price[6]	285	453	437	552	622
Low price[7]	-116	-52	-58	-38	56
GHG emissions (kg CO_2e/kg live weight)	10.8	10.5	10.9	10.0	9.9

[1]**Assumptions**: Grass utilised, 10 t DM/ha. CAN, €320/t. Urea, €360/t. Concentrate feed ration, €260/t. Maiden heifer cost, €1,000/hd. Opportunity costs for owned land and family labour are not included. [2]Includes cull cow output. [3]Costs per kg live weight for the weanling systems, costs per kg carcass weight for the systems taking progeny through to beef. Includes replacement heifer costs. [4]Gross margin = sales – replacement heifer costs – variable costs. [5]Base price; €2.50/kg live weight for the weanling systems, €4.00/kg carcass for the finishing systems. [6]High price; €2.75/kg live weight for the weanling systems, €4.50/kg carcass for the finishing systems. [7]Low price; €2.25/kg live weight for the weanling systems, €3.50/kg carcass for the finishing systems.

Fitting the system to the farm

It is critically important that beef farms have a farm plan in place and that this plan sets out the production strategy for the farm including calving date, planned turnout dates, grazing management, planned housing dates, trading system (weanling, store, finish, etc.) and replacement strategy. Clearly, it is necessary to incorporate flexibility within the plan since factors like turnout and housing dates are subject to weather volatility, and date of sale must allow for opportunistic selling during high price periods.

The production systems presented in Table 1 can be categorised as 1) weanling system, 2) calf-to-steer and -heifer beef systems, and 3) calf-to-bull and -heifer beef systems. Many of the underlying management decisions are the same for these systems particularly regarding the suckler cow component of the system, e.g. calving date and replacement strategy. Thus, in the context of these 5 options, the decision largely rests around identifying the most appropriate production system for the male progeny for a given farm. The risk factors to take into consideration for producing male progeny from the suckler herd are identified in Table 2. The decision-making process includes the following components:

- **Market risk**. Market risk refers to the uncertainty surrounding product (weanling live or beef carcass) price and marketability (particular issue for production systems which do not conform to generic, e.g. Meat Industry Ireland (MII), market specifications) at sale, and in the price of inputs (Table 2). For example, in the production systems outlined, finishing bulls older than sixteen months requires close communication with processors and preferably a contracting arrangement should be put in place. Similarly, finishing bulls at less than 16 months of age and/or steers at 24 months of age should take into account prevailing industry specifications around age and carcass weight limits. Weanling production systems are also subject to large market risk since this market is dependent on the live export trade, which varies considerably from year to year. The sensitivity of gross and net margin to weanling and beef price is highlighted in Table 1. It is clear that all systems are highly sensitive to prices.
- **Weather risk**. The production systems outlined above assume "normal" or average weather conditions for Grange. It is assumed that the grazing season begins in early March and that cattle are housed in early November. Average herbage yield is approximately 12 t DM/year. Clearly, any deviation from these targets can have very severe impacts on productivity and profitability of the production systems. A particular example is the winter/spring of 2013 when commencement of the grazing season was delayed until mid-May resulting in a very significant increase in purchased feed costs and reductions in animal live weight performance owing to longer than anticipated store periods.
- **Level of management skills**. Each of the systems in Table 1, and the economic returns achieved, assume that grassland management, animal genetics, breeding and husbandry and, farm business management skills are of a very high standard. Each system requires a cow type with good maternal (calving, fertility and milk) traits. The requirement for grazing management and animal performance are elaborated on somewhat in Table 2. Additionally, silage quality requirements differ with moderate digestibility silage adequate for weanling systems, whereas very high quality silage is essential for finishing systems. Where these factors are less than optimal, very considerable productivity and profitability reductions are likely. In particular, bull beef, especially 16 month production systems, are subject to high risk largely due to the requirement for high growth at all stages in the life cycle.
- **Expectancy of income**. Highest returns are possible from the production systems producing bull beef. However, as noted above these systems are more volatile with respect to management skills and market risk. An additional consideration is facility requirements and safety concerns with handling bulls, which do not arise to the same extent with weanling and steer beef production systems. In contrast, although economic returns are lower for the steer beef systems, these systems predominate nationally, are less risky and are likely to appeal to most farmers.

Table 2 — Risk factors for finishing male progeny from the suckler herd.

System	24m steer beef	16m bull beef	19m bull beef
Market risk	Highest volume demand; suitable for all markets. Industry specifications around age & carcass weight critical.	Lower volume demand; primarily targeting UK market. Age specification critical.	Lower volume demand, primarily for Continental EU markets.
Concentrate price risk	Lowest exposure to concentrate price changes	High exposure to concentrate price changes	High exposure to concentrate price changes
Contract selling	Lowest requirement for contracts.	Lower volume market; contract selling advisable.	Lower volume market; contract selling strongly recommended.
Income potential	Moderate.	High – see above regarding market risks.	Highest – see above regarding market risks & contracts.
Grazing management	Excellent grassland management required for a full grazing season; high grazing demand in autumn	Lowest grazing demand	Excellent grassland management required for spring grazing
Live weight performance	System incorporates a "store" period & average life time gain of ca. 0.9 kg/day	High live weight performance at all stages in the life cycle (ca. 1.3 kg/day)	System incorporates a "store" period & average life time gain of ca. 1.2 kg/day
Animal injury	Lowest risk of animal injury	Risk of animal injury during the indoor finishing period	Risk of animal injury, following turnout & rehousing
Farmer safety	Vigilance to animals required	Very high level of vigilance to bulls required at all times	Very high level of vigilance to bulls required at all times

Environmental sustainability

A key issue at present is the environmental sustainability of production systems particularly greenhouse gas emissions, more commonly known as the carbon footprint (Table 1). There are many different greenhouse gases generated in livestock systems each of which has a different global warming potential and, therefore, the potency of these different gases are measured in carbon dioxide equivalents (CO_2e). Results indicate that suckler beef systems generate approximately 10 kg of CO_2e per kg of beef live weight produced. The lowest carbon footprint was for the 19 month bull/20 month heifer system, thus highlighting the importance of both achieving high daily live weight gains and maximising performance from grazed grass. The 24 month steer/20 month heifer system and the weanling system had the highest carbon footprint.