Irish Grassland Association

50th Anniversary

BEEF MEETING

Farm Visits and Conference

Co. Laois

13th September, 1996

50th Anniversary Programme

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50th Anniversary

BEEF MEETING

13th September, 1996

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John and Edward Culbert
Knockmay House, Portlaoise

Adviser: John Challoner, Teagasc, Portlaoise

Purpose of visit:

- To view good suckler herd efficiency
- Excellent grassland management and animal performance
- Suckler cow housing

Background

John Culbert completed his Green Cert in 1995 and commenced farming on a full time basis with his parents. At this time there were 10 Friesian suckling cows multiple suckling 30 calves kept to beef at 3 years of age, combined with 20 ha of winter and spring cereals. Cattle were self-fed and wintered in cubicles and on straw, and home grown barley was used for feed.

With the advent of higher calf prices mainly as a result of the milk quota regime the Culberts reduced the number of suckler cows and moved into store to beef production for 2-3 years. In 1989 following a number of promotional events on suckling organised by Teagasc in Laois combined with higher suckling cow premia, John and Edward Culbert commenced the purchase of heifers and putting them in calf. The target was to go to 50 cows by 1992 and finish all progeny. Tillage area has dropped from 20 ha in 1995 to zero in 1996. A suckler cow quota of 45 was established in 1992. All silage is harvested with their own machinery.

Main farm objectives

1. To produce beef and lamb more efficiently through optimum use of grass and silage
2. To slaughter steers at 24 months of age
3. To keep production costs down
4. To maximise income from subsidies - REPS

Farm size:

Total	60 ha (148 acres)	
Owned	36 ha	
Rented	23 ha	
Adjusted	56 ha	

Grazing area		24 ha (March to July)
Silage area	Cut 1	20 ha (June 4)
	Cut 2	14 ha
Hay		4 ha
Arable silage		7.3 ha

Livestock at present	No.	L.Units
Suckler cows	45	45
(0-1) yr. olds	49	19.6
(1-2) yr. olds	55	38.5
Ewes	103	15.0
Total		118.1

Stocking rate 0.49 ha/L.Unit (1.2 acres)

Calving pattern 1995-1996

October	7
November	26
December	13
January	2

Replacements purchased in mart in January

Fertilisation and grasland management

<u>Silage ground</u>

Cut 1 - 375 kg 0.7.30/ha (3 cwt./acre)
17,000 l slurry/ha (1500 gal/acre)
430 kg C.A.N./ha

Cut 2 - 17,000 l slurry/ha
375 kg Cut Sward/ha

Hay 250 kg Cut Sward/ha

Grazing ground

1½ yr. olds -	12 ha (29 ac.) divided into 6 padocks Average = 2 ha
Fertiliser	190 kg Pasture Sward/ha for early grass (1½ cwt./acre)
	125 kg Pasture Sward/ha at end of April (1 cwt./acre)

Cows and weanlings + ewes

18 ha divided into 7 sections   Average 3.4 ha (8½ acres)
190 kg Pasture Sward/ha for early grass
125 kg Pasture Sward/ha at end of April

Cattle performance 1995-1996

Heifers (16) slaughtered December 13, 1995	343 kg carcase 9 U's 7 R's
Steers (31) slaughtered March 5, 1996	395 kg 5 U's 22 R's

Sheep

Ewes (17) 100 ewes - 135 lambs
4 Suffolk Rams
Average sale price   £63/lamb

Concentrate feeding

Cows	90 kg from Jan 1 to March 1
Calf to Beef	Heifers - 465 kg (lifetime) Steers - 747 kg (lifetime)

Other details

- 8 Simmental cross heifers (450 kg) purchased and bulled each year
- Cows calve indoors and are bulled on slats before going to grass in April
- Average turn-out date is April 20
- Cows and calves out until end of November
- Calves weaned in August on to good after grass - no meals required
- Cows calve in loose shed but are back on slats (7-10 days) after calving
- Slats for 100 livestock units erected over a five year period 1991-

1995

Cattle weighings 1996

	Average weight kg	
	Heifers	Stores
1st weighing (April 3 1996)	420	434
2nd weighing (July 16 1996)	517	533
Average daily gain (100 days)	0.97	1.00

Richard and Gerard Booth
The Heath, Portlaoise, Co.Laois

Adviser: John Challoner, Teagasc, Portlaoise

Farm Size: 121 Ha (300 acres).
89 ha (220 acres) of this farm were originally owned by the Blake family who ran a very successful private racing stables during the first half of this century. They trained a number of Derby winners plus other classic winners in Ireland and England.

The farm is now a traditional mixed farm with 45 ha tillage, 228 cattle and 100 ewes. The tillage area consists of 32 ha of malting barley and seed all grown under contract, 8ha of sugar beet and 4 ha of fodder beet.

The sheep enterprise of 100 ewes is an early lambing flock, grass based, the ewes lamb outside, graze silage fields until the end of March and then move to the grazing area. Lambs are sold locally and average number of lambs sold per ewe is 1.4.

The cattle enterprise is based on a 70 suckler cow herd and 50 bought-in cattle, about 20 weanlings and 30 bullocks. Suckling was practised on this farm during the 1960's and early 70's, phased down during the 70's but never terminated. In the late 70's and during the 80's the practice was to buy cattle and finish them. Records showed that this business was:

a) diminishing in profitability
b) variable in performance from animal to animal
c) time consuming, hours in the mart for too few cattle
d) profit too dependant on buying price
e) unequal competition in the market after 1987

Cattle enterprise

Suckler quota	70
Cows	69
Cull cows	5
Suckling cows	64
Calves	72
Bought-in	10
Bulls	2
Heifers (1½ yr.old)	33
Bullocks	52

Cows are housed in mid-December and fed silage + pre-calving minerals. Calving commences in January and finishes in April. Cows and calves go to grass in the first week of April and are weaned in October. Calves are creep fed after weaning and are housed in December. Calves are weaned outside.

The weanlings are fed silage + 2 kg meal in the shed. Calves are treated for worms in June, August and at housing. Ivomec is used on this farm.

Yearlings to grass in the first week of April. Heifers are finished on grass, receive meals depending on grass supply from September 1, beginning with 2 kg and increasing to 4 kg. Finishing weight is 300 kg. We believe that the finishing of heifers needs further research due to the reduction of the beef price.

Bullocks are housed in mid-October and are fed silage, 5 kg of meal + 12 kg fodder beet. They are finished in March and April. Average carcase weight in 1995 was 385 kg. This year the bullocks will receive about 2 kg meals for 3 weeks before housing.

Grades are: 10% U, 85% R, 5% O; Fat score 4L and 4H

Fertiliser programme

24 Ha of silage first cut:	370 kg 0.7.30/ha in January (3 cwt./acre) 440 kg 27.5 NET/ha in last week March and 34,000 l/ha slurry in February (3000 gal/acre)

Silage is cut in the last week of May

12 Ha of silage second cut:	250 kg 0.7.30/ha (2 cwt./acre) 370 kg NET nitrate/ha and 22,000 l slurry/ha (2000 gal/acre)

Cut taken July 25th.

Grazing	250 kg 0.10.20/ha in January (2 cwt./acre) 190 kg 27.5/ha in February 125 kg 27.5/ha in May, June, Aug and Sept.

Stocking rate is 0.34 ha per L.U. (0.85 acre), excluding all calves

Objectives for the future

1. To survive
2. Bring average calving date forward to February 1st.
3. Three month winter for all cattle, bullocks and heifers finished i December. Cows housed
   Presently examining the feasibility of finishing heifers at 12 to 14 months
4. Develop full paddock system for better grass management
5. Future purchase of breeding stock to be based on performance tested bulls and knowledge of origin of cows and heifers for breeding

Finally, I hope that you enjoy your day. One year has made a big change in the livestock sector. Will we sustain cattle production at 80p?

Potential of Beef Production Systems Based on Grass

Edward G. O'Riordan and Padraig O'Kiely
Teagasc, Grange Research Centre, Dunsany, Co. Meath

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1. INTRODUCTION

Grassland is Ireland's greatest renewable feed resource and it provides the main feed for ruminant livestock. Over 90% of agricultural land is under grassland (including rough grazing). Grassland (excluding rough grazing) accounts for 4.3 x 10^6 hectares, of which 30% is used for silage and hay production and the remaining 70% for grazing. Grazed grass, followed by conserved grass, are the cheapest renewable feeds available (Table 1). As the majority of cattle are Spring-born, grazed and conserved grass are logically the basis for efficient beef production systems. As a producer of livestock, over 80% of which is exported, Ireland has few competitive advantages, but its ability to grow grass does offer the chance to provide cattle (and sheep) with a relatively cheap feed source. A national balance sheet by McLoughlin (1991) for the 6 year period 1983/84 to 1988/89, shows grazed grass, conserved grass and concentrates contributing 57%, 29% and 14% of dry matter intake for beef cattle, respectively, accounting for 30%, 35% and 34% of the feed costs (Table 2). The feed cost for some more intensive beef systems (Table 3) shows the proportional cost for grazed grass at 28%, conserved feeds at 42% and concentrates at 28%.

Table 1.
Unit cost of various feed sources
Cost £/GJ ME* consumed

Crop	Mean	Range
Grazed grass	3.2	2.4 to 4.9
Silage		
- 1st cut	7.0	5.6 to 9.6
- 2nd cut	7.7	6.4 to 11.8
Maize silage	7.7	6.3 to 12.2
Fodder beet roots	10.9	8.8 to 14.2
Barley		
- Spring	11.8	
- Spring (+ Area aid)	8.4	

*ME from different sources used with different efficiencies
Source: O'Kiely 1994

The key to efficient beef production from grass, now and in the future, is to operate a flexible, adjustable grassland management programme, using factual information for prompt and appropriate decision-making purposes. The system operated must clearly match feed supply to animal requirements, putting the major emphasis on increasing the proportion of cattle diets that comes from grazed grass. The aim of this paper is thus to describe the technologies by which beef can best be produced from grazed and conserved grassland, to relate these to current practices and to identify and quantify the opportunities for future improvements.

Table 2.
Quantities, proportion and cost of various feeds in beef and dairy systems (6 year average -1983/84-88/89)

	t DM/LU/year		% DM intake		Cost/t DM fed	£ Feed cost/LU		% Feed cost/LU	
	Dairy	Beef	Dairy	Beef	£	Dairy	Beef	Dairy	Beef
Concentrates	0.47	0.41	10	14	175	82	72	28	34
Conserved grass	1.32	0.87	29	29	85	112	74	38	35
Pasture grass	2.73	1.67	60	57	38	104	63	35	30
TOTAL	4.52	2.95	99	100		298	209	101	99

Source: McLoughlin 1991

Table 3.
Feed types and their proportion of the overall feed bill

		DM intake		Cost	
		t/year LU	% of total	£	% of total
Dairy*	Grazed grass	3.3	62	125	36
	Silage	1.4	26	119	34
	Concentrates	.6	11	105	30
	Total	5.3		349	
Beef**	Grazed grass	2.9	53	110	28
	Silage	1.9	35	162	42
	Concentrates	0.65	12	114	30
	Total	5 .45		386	
Sheep***	Grazed grass	3.0	85	114	66
	Silage	0.40	11	34	20
	Concentrates	0.15	4	26	15
	Total	3.55		174	

* Spring calving dairy herd (Curtin Moorepark)
** Dairy Calf to Beef (24 months) (Grange)
*** Mid season lamb producing ewes with 1.5 lambs sold per ewe (Belclare)

Table 4.
Farm profile on cattle producing farms

Farm size	22.4 ha
Family farm income	£4851
% of gross margin from cattle	60
Cattle livestock units	20.9
Average stocking rate - units/ha	1.36
% with off farm incomes	34

Source: Hickey (1996)

Table 5.
Estimated prices, output and costs per kg liveweight

	1994
Price per kg liveweight (p):	
purchases	145.3
sales	124.0
Per kg liveweight produced (p):	
market output	106.7
direct payments	49.0
Total output	155.7
Direct Costs	50.3
Overhead costs	50.2
Total producer costs	100.5
Net margin	55.2

Source: Hickey 1996

Table 6.
Estimated liveweight productivity by cattle system (1994)

	Single Suckling	Mixed Rearing	Weanlings/ Stores to Stores/Finish	Stores to Finish	All Systems
Estimated liveweight Produced (kgs):					
per animal unit	226	285	275	245	256
per feed ha	300	373	358	387	348

Source: Hickey 1996

2. CURRENT PRACTICES ON FARMS

a) Soil nutrient status

Recent soil analysis results (Gately, 1996) show that the average lime requirement for soils is 6.2 tonnes/ha. Farmers who had soils analysed as part of the Rural Environment Protection Scheme (REPS) had an average soil lime requirement of 7 t/ha, compared with 5.2 t/ha for other farms. Soil P readings were 7 and 8.7 mg/l and K readings were 108 and 110 mg/l for REPS and non-REPS sources, respectively.

b) Sward type

Most of the grassland in Ireland is old pasture. Based on the quantities of grass-seeds sold, about 3% of the agricultural land is reseeded in any year. Much of the reseeding is carried out on land primarily used for winter feed production. Cattle thus tend to graze old pasture for most of the season.

c) Management standards

Using the 1994 Teagasc National Farm Survey (NFS) data, Hickey (1996; Tables 4 to 8) described the characteristics of cattle-producing farms, and showed that beef farmers in general use low inputs of nitrogen (<65 kg N/ha/year) and other nutrients and operate a relatively low stocking rate (1.36 livestock unit/ha). He showed considerable scope to improve animal productivity and utilisation of grassland. Farm profile data for more intensive, specialised suckler farms have been compiled by Barlow and Smyth (1996) using the 1994 Beefmis survey results (Tables 9 and 10). These farms, operating at an above average technical efficiency, had a stocking rate of 2 livestock units/hectare, while performance at grass for weanlings and older progeny was 1.1 and 0.9 kg liveweight gain per day, respectively. Barlow and Smyth (1996) reported an animal output of 500 to 700 kg liveweight/ha, which is much higher than the national average figure of 350 kg (Hickey, 1996). Both sources of data show that currently average costs of production are distributed equally between fixed and variable costs.

d) Cost of grass production

Grass growth is affected by a range of factors, some of which are outside the control of the farmer. For example, factors such as weather, geographical location and soil type have a major influence on grass growth and consequently on the cost of feeding livestock. Geographical location significantly affects the date of the start and end of the grazing season and Figure 1 shows that the beginning of the grazing season in the south and south-west is at least 3 weeks earlier than the north and north-east. A time difference also exists at the end of the grass-growing season, where the south and south-west again have up to a 3-week advantage. The effects of the above factors on the costs of producing grass are shown in Table 11. For the same soil type and level of inputs, the effect of geographical location means that grass yields can range from almost 16 t DM/ha to less than 10 t DM/ha (Figure 2). Translated into feed cost terms, the effect of location results in costs ranging from £37 to £52/t DMD (digestible dry matter). Weather, which can cause considerable variation in year to year annual grass production (i.e. + or - 20% difference from the long term average), can alter production costs from £42 to £63/t DMD. Excess soil wetness can result in production costs that range from £47 (dry) to £56 (wet)/t DMD.

The main factors controlling grass growth which are directly influenced by farming practices are soil fertility, nitrogen usage and grazing management. Now more than ever, farmers have to be cost conscious and each input has to be justified. For grazed grassland, fertilisers account for 80% of the input costs associated with grass production. It is an essential requirement that each farmer knows the soil nutrient status of their land. The decision to apply fertilisers to grazing grassland, especially phosphorus (P) and potassium (K), has to be made against the background of a knowledge of soil nutrient status.

Nitrogen is the one major input at the farmers disposal which can be used to influence grass growth. The effect of nitrogen application on grass

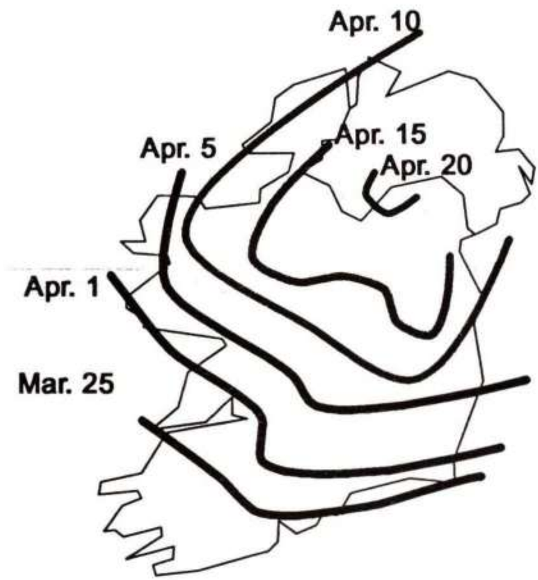


Fig 1. The estimated starting dates of the grazing season in Ireland

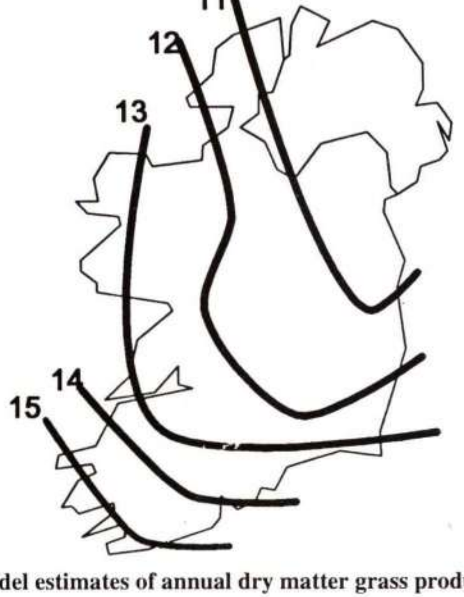


Fig 2. Model estimates of annual dry matter grass production (t ha^{-1})

Table 7.
Estimated purchase and sale prices, financial performance per kg of liveweight produced and per hectare by cattle system (1994)

	Single Suckling	Mixed Rearing	Weanlings/Stores to Stores/Finish	Store to Finish	All Systems
Liveweight Purchased per kg produced (kg)	0.14	0.27	1.86	2.27	0.82
Estimated prices (p/kg):					
-purchases	156.0	182.5	136.0	130.5	145.0
-sales	124.5	125.5	126.0	122.5	124.0
Per kg liveweight produced (pence):					
Market output	120.4	110.5	107.5	104.5	106.7
Direct payments	65.2	40.6	31.9	40.9	49.0
Total output	185.6	151.1	139.4	145.4	155.7
Costs - direct	54.4	49.7	52.8	52.9	50.3
-overhead	54.1	46.2	51.9	54.2	50.2
-total	108.5	95.9	104.8	107.1	100.5
Net margin	77.1	55.2	34.6	38.3	55.2
Per ha:					
Net margin (£)	231	214	132	146	185

Source: Hickey 1996

Table 8.
Output, costs and margins by cattle system (£)

	Single Suckling	Mixed Rearing	Weanlings/Stores Stores/Finish	Stores to Finish
Per animal unit:				
Market output	272	315	295	256
Direct payment	147	116	88	100
Total output	419	431	383	356
Producer costs	245	274	288	262
Net margin	174	157	95	94
Per hectare*:				
Animal units	1.44	1.45	1.43	1.68
Net margin*	231	214	132	146
Per £100 output:				
Producer costs	58	63	75	74

*Hill and mountain farm excluded
Source: Hickey 1996

Table 9.
Proportions of suckler farms receiving various premia payments

Premium					
Suckler cow	10 month	22 month	Slaughter	Extensification	Headage
100	88	52	21	79	85

Source: Barlow and Smyth 1996

Table 10.
Financial (£) and physical outputs for suckler farms

	Gross margin/ha		
	Top 1/3	Middle	Bottom 1/3
Output less premia (£)	924	734	600
Premia + headage (£)	329	296	254
Output + premia/headage (£)	1252	1030	855
Variable costs	338	306	284
Gross margin (£)	914	724	571
Fixed costs (£)	358	287	237
Profit (£)	556	437	334
Slaughter rate (LU/ha)	2.40	1.99	1.73
Output (kg liveweight)	697	578	506
Premia + headage as % of profit	61	72	79

Source: Barlow and Smyth 1996

Table 11.
Effect of location, weather and soil type on grass production costs

	£/Tonne digestible dry matter (DMD)
Location	37 in South West to 53 in North East
Weather	42 in best grass grazing season to 63 in worst grass growing season
Soil Type	47 on dry well drained to 56 on wet poorly drained

Source: O'Kiely 1994 and Brereton 1995

growth is shown in Table 12. These data are based on a country-wide study (Ryan, 1974) where all of the major soil types were included each year over the four years of the study. Dry matter yields continued to increase up to an application rate of 400 kg N/ha (360 units/ac). However, the grass yield response (%) in terms of extra grass grown for each 50 kg N applied/ha (45 units/ac) declined from 13% to 12%, 11%, 9%, 8%, 7%, 5%, 3% and 0% as the rate of nitrogen increased to 450 kg N/ha. Table 12 also shows the cost of producing the extra grass, in terms of £/tonne DMD, for each extra 50 kg N applied/ha. An attractive response is achieved with the lower levels of nitrogen applied but grass production costs increased with each increment of nitrogen used.

Table 12.
Effect of Nitrogen application on grass growth

Nitrogen application rate (Kg N/ha)	Relative yield (0 = 100 = 6.9 T. DM/ha)	Cost of grass produced (£/t DMD) for each 50 kg N used
0	100	
50	113	41
100	125	54
150	136	56
200	145	68
250	153	76
300	160	92
350	165	121
400	168	177
450	168	346

Source: From Ryan 1974 and O'Kiely 1994

Increasing nitrogen usage from 300 to 350 kg N/ha (270 to 310 units/ac) resulted in a yield increase of 5% and the cost of the extra grass was £121/t DMD. Grass costs of this magnitude are very expensive and alternative purchased feeds could be economically more attractive.

3. CURRENT RESEARCH STANDARDS

a) Chronology of recent advances

In reflecting the national importance of the contribution of the suckler herd and the progeny from the dairy herd to the Irish beef industry, Grange Research Centre has for a considerable number of years being researching systems of producing beef from these sources. Both systems take calves from birth through to slaughter, in most cases at 20 months (heifers) or 23 to 26 months (steers) of age. Table 13 shows the progression of advancements in these systems over the past 15 years, and suggests likely output for the near future through further improved technologies (including grassland management). It is clear that through technological improvements both systems have been steadily increasing output and efficiency. Present outputs are 730 and 500 kg carcass/hectare for the Dairy Calf-to-Beef and Suckler Calf to Beef systems, respectively. These outputs contrast sharply with those reported on commercial farms (Teagasc NFS, Hickey 1996; Barlow and Smyth, 1996).

b) Current Grange systems

(i) Suckler Calf to Beef System

The present system (Drennan, 1993), based on early-March calving, finishes animals at 20 (heifers) and 24 (steers) month of age. The system is stocked at 0.84 ha per cow unit (cow + calf + year old + replacements), has a carcass output of 500 kg per hectare per year. This target is achieved by producing a steer carcass weight of 400 kg, heifer carcase weight of 300 kg and cull cow carcase weight of 400 kg. The target output (carcass/ha) is achieved from 10

Table 13.
Grange Systems Research: Target Stocking Rates (ha/animal), carcass output (kg/ha) and carcass weight (kg) during the 1980's to 2000 (projected)

Dairy Calf to Beef System					
	1980	1985	1990	1995	2000
Stocking rate	.47	.47	.50	.48	.40
Carcass output	600	680	700	730	900
Carcass weight	280[1]	320[1]	350[2]	350[2]	360[3]
Suckler Calf to Beef					
Stocking rate	.90			.85	.80
Carcass output	410			500	530
Carcass weight	340[4]/240[5]			395[4]/308[5]	395/308

[1] Friesian steers
[2] Charolais X (Friesian) plus Friesian steers
[3] Charolais x Friesian steers
[4] Steers
[5] Heifers 27

tonnes of herbage dry matter (DM) plus a concentrate input of 820 kg/ha. Herbage production is based on 230 kg N/ha, and silage being harvested from 55% of the farm in late-May, and 35% of the farm area in late July. Silage harvested in May is fed to the progeny, while the July-conserved swards are offered to the cows. Cows and calves graze separately from the older cattle. Rotational grazing, with 10-12 paddocks per animal group, is practised. The grazing season starts in mid-April, and silage areas are not currently grazed early in the season. Calves are weaned in mid-October and housed shortly afterwards, while cows typically remain outdoors at pasture until late-November. Steers are housed in mid-October while heifers are housed in September and finished by mid-December. Variable costs for the system are 92-94 p, while fixed costs are 170-180 p/kg carcass.

For the Suckler Calf-to-Beef sytem, Table 14 shows the liveweights achieved and the proportions derived from grazed grass, forage and concentrates. Two-thirds of the lifetime gain for the progeny from the suckler system is produced during the grazing season. The liveweight gain during the first grazing season amounts to 220 kg (females) and 250 kg (males) or almost 60% of the animals lifetime gain. The indoor winter period accounts for one-third of the lifetime weight gains. The proportion of gain achieved by heifers is small in the second winter as animals are slaughtered early (at 20 months of age). However, almost half of the indoor liveweight gains are achieved through concentrate feeding. All of the liveweight gain achieved on the cows is derived from grazed grass.

(ii) Dairy Calf to Beef System

The present system at Grange (Keane and Drennan, 1989) involves purchasing March born calves (7 to 14 days old) from dairy herds and finishing them

Table 14.
Weights achieved by the progeny from the Grange suckler herd and proportions of weight gained at pasture and indoors (24 month old system)

	Males		Females* *	
Period		Weight (kg)		
Birth Weight	45		43	
To grass 1st season	75		72	
To 1st winter	325		290	
To grass 2nd season	390		365	
To 2nd winter	575		(500)	
To slaughter	710		565	
Lifetime weight gain	665		522	
- From grazed grass	435 (65%)		353 (68%)	
- 1st season		250 (58%)		218 (62%)
- 2nd season		185 (42%)		135 (38%)
- From indoors	230 (35%)		169 (32%)	
- calf stage		30 (13%)		29 (17%)
- 1st winter		65 (28%)		75 (44%)
- forage		36 (55%)		41 (55%)
- concentrate		29(45%)		34(45%)
- 2nd winter	135 (59%)		65 (39%)	
- forage		67 (50%)		43 (66%)
- concentrate		68 (50%)		22 (34%)
Total indoors:				
- forage	45%		50%	
- concentrate	55%		50%	

* 100% of seasonal liveweight gain for suckler cows comes from grazed grass
**Heifers finished at 20 months of age.

24 months later. Both Friesian and Friesian/Charolais crosses are used. Calves are reared indoors for the first 10 to 12 weeks and go to grass in early May. Prior to 1995, yearlings were turned out to grass in mid-April and did not graze the areas designated for silage. However, this has now changed, with silage-ground being grazed in early Spring. Sixty percent of the farm area is cut for silage in late May, with a further 40% cut in late July. Animals are stocked at 0.45 ha/animal unit (yearling plus calf). Herbage production is about 10 tonnes DM/ha and together with a concentrate input of 2.2 tonnes/ha, produces 750 kg carcass per hectare. The concentrate input at 1 tonne per animal is made up by feeding 100 kg at the calf stage (including some at grass in the autumn), 150 kg during the first winter and the remainder during the second winter. A rotational grazing system involving 6 paddocks up to June and 8 paddocks at the end of the year has been practised. Cost of production are estimated to be £2.04/kg carcass. The main components of this cost are, 84p for the calf purchase, 91p for variable costs and 29 p for fixed costs.

In the Dairy Calf to Beef System (Table 15), lifetime weight increases of 565 and 630 kg per head are achieved for Charolais x Friesian and Friesian steers, respectively. Fifty to 55% of the gain is achieved at pasture and a further 25% is achieved from forage indoors. A greater proportion (55%) of the weight gain is achieved during the second year at pasture when compared with the Suckler Calf to Beef System. Weight gains during the final winter are almost double those achieved during the first winter.

One of the main features of both Calf to Beef Systems is the high stocking rate achieved in the early part of the season (Table 16). Both systems reach a peak in early June of 3000 kg liveweight/ha and this nevertheless results in high animal gains and provides sufficient areas to be conserved for winter feed. The long-term future of beef production systems in Ireland will depend on integrated Calf-to-Beef systems with a major proportion of the lifetime liveweight gain being derived from grazed grass.

c) Grazing management strategies

(i) General principle

The objectives of grazing management are to produce high yields of quality grass over a long grazing season and to manage both the cattle and grass so as to utilise the sward as efficiently as possible while getting high levels of animal intake and thus achieve high levels of animal output.

(ii) Producing grass

As stated earlier, grass production is affected by many factors, some outside the farmers control (location altitude, aspect etc.) and others which are directly affected by farm management decisions.

Soil nutrition Getting the basic soil nutrition such as lime, phosphorus and potassium corrected are key factors in grass production. The minimum that needs to be known is

a) soil pH, which gives a measure of soil acidity and the soil lime requirement, and

b) phosphorus (P) and potassium (K) status

A knowledge of potential trace element problems is highly desirable. In terms of lime application, its relationship with overall soil fertility, grass growth and animal production are of the greatest importance. With very few exceptions, liming of grassland to raise the soil pH to at least 6.0 is nearly always justified. The effects of lime on improved nutrient availability, increased proportions of more desirable grasses in the sward, a better response to applied fertilisers, especially nitrogen, and thus to an overall improvement in animal output is well documented and accepted. An example of the beneficial effect of lime application over the subsequent four years is shown in Table 17. More grass was produced (+28%) and more animals (+47%) were carried as a result of lime application. The net effect of applying lime was to get an extra grass production response each year equivalent to 75 kg N/ha (60 units/ac).

Table 15.
Weights achieved by proportions of weight gained at pasture and indoors (24 month old system) on the Grange Dairy Calf to Beef System

Period	Charolais X	Friesian
	Breed	
Start	50	45
To grass 1st season	85	80
To lst winter	225	220
To grass 2nd season	320	300
To 2nd winter	500	470
To slaughter	680	610
Lifetime weight gain	630	565
-From grazed grass	320(51%)	310(55%)
-1st season	140(44%)	139(45%)
-2nd season	180(56%)	171(55%)
-From indoors	310(49%)	255(45%)
-calf stage	35(11%)	35(14%)
-lst winter	96(31%)	80(31%)
-forage	53(55%)	40(50%)
-concentrate	43(45%)	40(50%)
-2nd winter	180(58%)	140(55%)
-forage	80(45%)	63(45%)
-concentrate	100(55%)	77(55%)
Total indoors:		
-forage	50%	47%
-concentrate	50%	53%

Table 16.
Grazing pressure (kg liveweight/ha) on Grange Suckler Calf to Beef and Dairy Calf to Beef Systems

	Month							
	April	May	June	July[1]	August	Sept.[1,2]	Oct.	Nov.
Suckler Calf to Beef System								
% area grazed	45	45	45	65	65	100	100	100
Liveweight (kg/ha)	2600	2800	3000	2300	2500	1400	1500	1600
Dairy Calf to Beef System								
% area grazed	40	40	40	60[1]	60	100[2]	100	100
Liveweight (kg/ha)	1700	2400	3000	2200	2300	1550	1650	1700

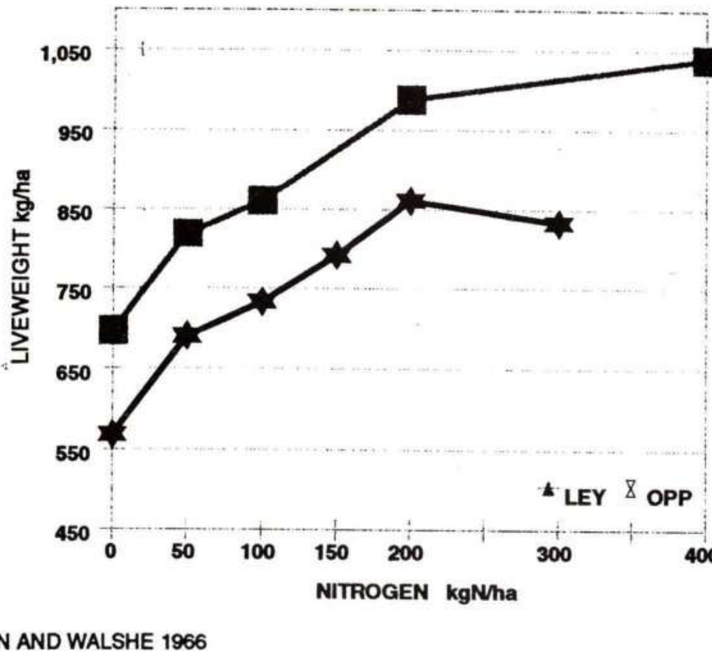
[1] Silage aftermath available
[2] Heifers housed on suckler system

Table 17.
Effect of lime on output from pastures

	Lime input Tonnes/ha		
	0	7.5(3t/ac)	Difference
Animals No./ha	4.7	6.9	+ 47%
Grass yield (t/ha)	8.0	10.2	+ 28%
% clover	5	14	+ 180%
DMD (g/kg)	665	692	+ 27 g/kg

Source: Gately and Blagden 1983

Annual dressings of phosphorus and potassium to grazed grasslands are sometimes neglected. Application rates must be related to stocking rates and soil test results. Little loss in production on grazing land will be seen by omitting one year's application of phosphorus or potassium. However, long-term studies at Johnstown Castle and Grange have shown that annual applications of 15 or 30 kg P/ha (12 to 24 units/ac) compared with no phosphorus were associated with 15 to 25% extra liveweight gain per year. Thus, an annual application of 15 kg P/ha (13 units/ac) is recommended to maintain soil P levels on grazed grassland. Animal production responses to applications of potassium (K) are



BROWN AND WALSHE 1966

Fig 3. Beef production : Effect of nitrogen

small under grazing, but its role in conservation is of great importance. For grazing an annual application of 30 kg K/ha (27 units/ac) will supply sufficient potassium for grass growth.

Numerous studies have been conducted to look at the relationships between nitrogen usage and animal output. Figure 3 summarises the results of a 4 year experiment outlining the outputs, measured as liveweight gain/hectare, in response to increasing levels of nitrogen (Brown and Walsh, 1966). Both old pasture and reseeds were compared. With old pasture, an increase in liveweight was obtained through the use of 200 kg N/ha/year (180 units/acre). However, with new swards, output continued to increase in response to well over 300 kg N/ha (270 units/acre), although at a slower rate. Data from the National Farm Survey (1994) shows the average nitrogen input on drystock farms to be less than 65 kg N/ha (55 units/acre). The output potential of these farms could readily be increased by 33% in response to additional nitrogen (if livestock were available). While national quotas have placed restrictions on the number of cattle for which premia payments are attainable, in the longer term Ireland's ability to cash-in on a natural competitive advantage depends on our ability to produce high yields of grass and efficiently convert them to beef. While most farms have the capacity to expand livestock numbers, any expansion must be done with careful management of costs.

Sward type Sward type has a major influence on output of herbage and animal output, and for the foreseeable future swards based on perennial ryegrass seem to be the obvious preferred choice of sward. With current plant breeding approaches, the present rate of advancement in dry matter yield increase is likely to remain at 0.5 to 1% per year, unless new biotechnological advances take place.

Management Management, involving timeliness of operations and a knowledge of plant response to varying fertiliser application rates and dates, will remain critical to producing high yields of grass.

(iii) Utilising grass

Grass utilisation is discussed below. The main emphasis is on:

- knowing (measuring) grass supply
- knowing animal feed requirements (kg DM/head/day)
- matching supply and requirements. This will be achieved through
  - rotational paddock grazing system
  - moving cattle when swards have been tightly grazed (target height, herbage mass)
  - knowing, identifying and storing surplus grass
  - re-introducing the stored surplus at times of deficit or, if necessary, supplementing with other feeds

Successful beef production from grazed grassland depends on having a **PLANNED MANAGEMENT SYSTEM** which allows for **FLEXIBILITY** as conditions change. As grazed grass is the main feed component, a knowledge of its growth pattern and stock-carrying capacity is important. Grass growth is seasonal and can change widely over short periods of time. The rate of grass

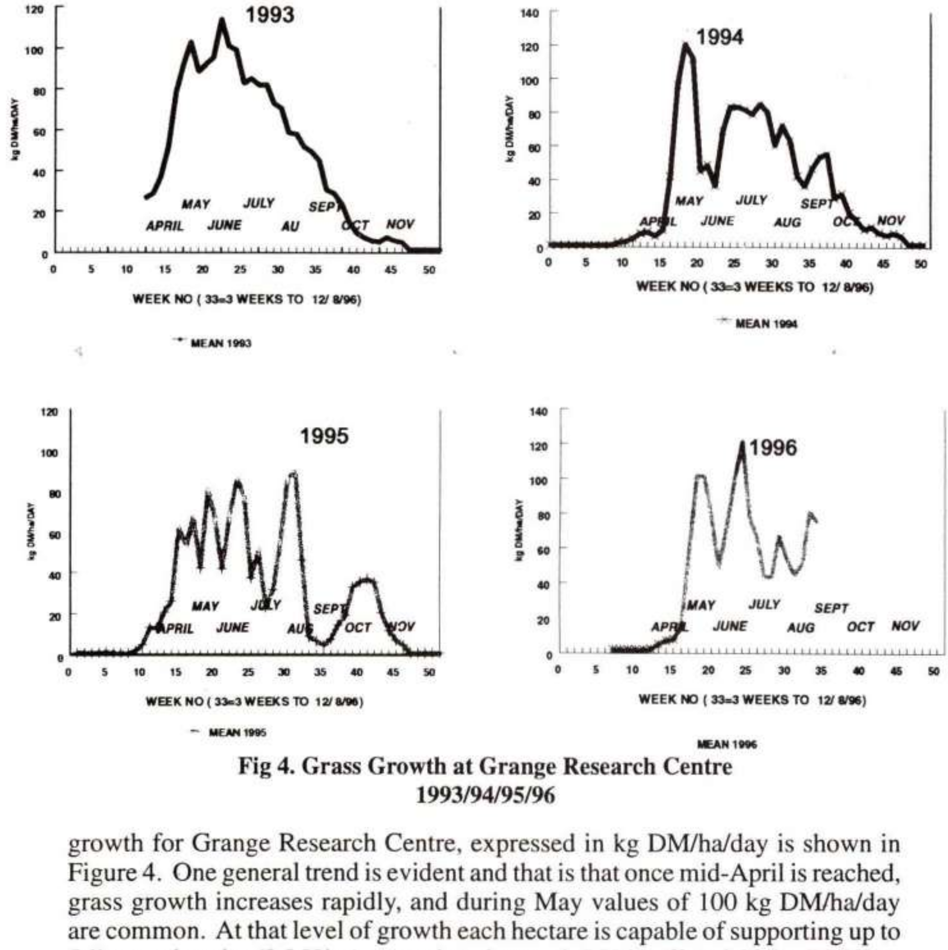


Fig 4. Grass Growth at Grange Research Centre 1993/94/95/96

growth for Grange Research Centre, expressed in kg DM/ha/day is shown in Figure 4. One general trend is evident and that is that once mid-April is reached, grass growth increases rapidly, and during May values of 100 kg DM/ha/day are common. At that level of growth each hectare is capable of supporting up to 5 livestock units (2 LU/ac) assuming that each LU is offered 20 kg DM/day. Once mid-June has passed there is an inevitable decrease in grass growth, so that by mid-August pastures will only support half of the May stocking rate. There is nevertheless big variation between years. Thus, for example, grass growth during early April 1994 and 1996 was 10 kg DM/ha/day or less compared with 20 to 30 kg DM/ha/day in 1993 and 1995. During 1994, over a 3-week period in late-April to mid-May, grass growth increased 10-fold from 12 to 120 kg DM/ha/day, but then proceeded to 40 kg DM/ha/day during the following four weeks. It then increased to 80 kg DM/ha/day within the next 3-weeks and finally decreased steadily over the remainder of the season. Similar fluctuations are evident most years. To fully exploit this changing grass supply, a flexible management system is required. A system that allows the farmer to see up-coming shortages as well as short-term surpluses needs to be practised if grass is to be utilised efficiently and economically. A rotational grazing system offers the flexibility necessary to make these management decisions. As most farms are composed of a number of fields, which vary in size, the introduction of a rotational grazing system is not necessarily too difficult. Subdivisions do not need to be of equal sizes. The greater the number of fields or paddocks that are available, the greater is the flexibility introduced into the grassland management process. While keeping control on costs, a target of 10-12 paddocks (not necessarily of equal size) in the Spring-Summer period offers sufficient flexibility to manage grass in a variable supply situation.

The aim of each cattle farmer must be to maximise the intake of grazed grass by cattle in an efficient manner and to get maximum animal gains over as long a grazing season as possible. For efficient beef production from grassland, a balance is needed between the ability of grassland to support stock during the grazing season and the provision of adequate Winter feed. Inadequate Winter feed, especially in terms of quality, is still a serious limitation on many drystock farms. Inadequate stocks of winter feed means prolonged winter grazing, with little liveweight gains (indeed weight losses will occur) and damage to pastures. Late closing of swards as a result of uncontrolled grazing in Autumn/ Winter means delayed Spring grass growth, so that when stock are turned-out early, through necessity as a result of Winter feed shortage, performance is poor and pasture production suffers as a result of over grazing. Early turnout to an adequate supply of Spring grass is highly desirable, firstly, in terms of improved animal gains, secondly to achieve a long grazing season and thirdly to reduce costs associated with the more expensive Winter period.

Knowing grass supply A knowledge of grass supply at all times of the year is essential if informed management decisions are to be made. While issues such as rotation length and rest interval are of great importance to planned grassland management, a knowledge of pasture supply or pasture cover on a weekly basis (if not daily) is essential if the best use is to be made of grass.

All grassland farmers should have the skills to quantify pasture sward height and pasture yields (sometimes referred to as pasture cover). Tables which relate sward height (compressed heights) to yield have been produced at Grange. As a simple guide, each centimeter of compressed grass above 4 cm of stubble contains approximately 150 kg DM/ha. The use of sward height for grassland measurements are more fully discussed in the attached Appendix. An assessment of pasture cover may be obtained by frequently (once per week) walking the entire grazing area and measuring sward height. The measurement can be made with a sward stick, ruler or place meter. Eye assessment can also be used to estimate pasture availability. Once the technique of pasture cover measurement is mastered, it is surprising how quickly small changes in pasture supply will be detected. An example of pasture cover (Figure 5 & 6) on the Grange Dairy Calf to Beef System for 1996 (to date) is shown. At turnout, a pasture cover of 500 kg DM/ha was present over the grazing area (40% of farm). This increased to a peak of 1500 kg DM/ha in early June when surplus grass (20% of area) was removed and a cover of 800 to 1000 kg was maintained until early August when silage aftermath became available.

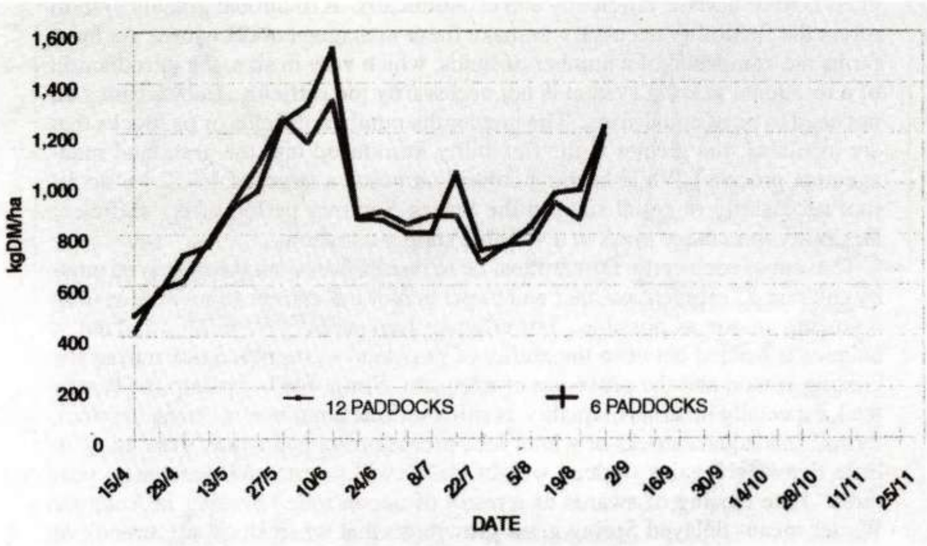
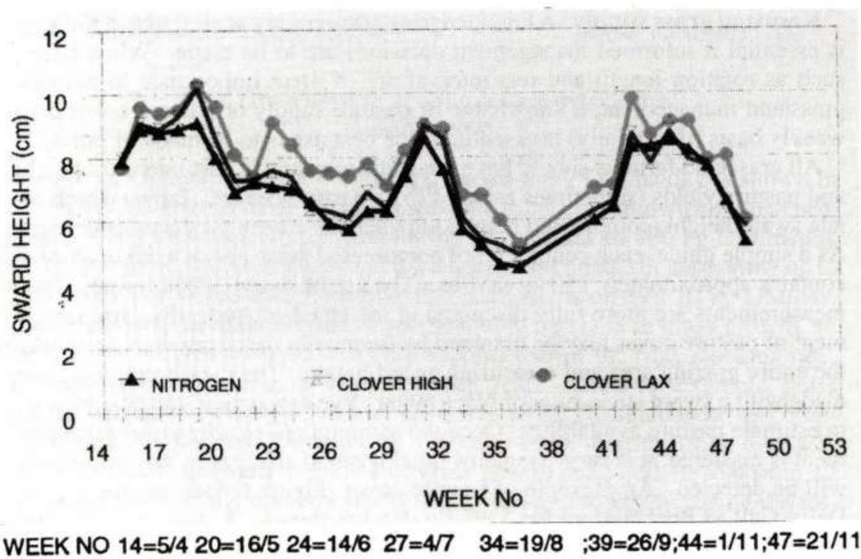


Fig 5. Calf to beef system - pasture cover



WEEK NO 14=5/4 20=16/5 24=14/6 27=4/7 34=19/8 ;39=26/9;44=1/11;47=21/11;

Fig 6. Pasture height (pasture cover) on grass/clover and N grazing systems

Start of spring grazing/autumn closing dates Late closing of swards as a result of prolonged uncontrolled grazing in Autumn/early Winter has a negative effect on Spring grass supply. Table 18 shows that when swards are closed in mid-October compared with mid-December, yields in mid-March and early April were 78% higher following the earlier closing date. Yields from mid-November closing date were intermediate. Apart from less grass in Spring, there is a total loss to the system because the amount of grass grazed in the Autumn as a

Table 18.
Effect of Autumn closing date on spring yield (kg DM/ha)

	Closing date		
	Mid-October	Mid-November	Mid-December
Mid-March	1078	830	605

Source: Carton et al., 1988

result of the delay in closing is less than the difference between the two Spring yields. It should be the aim of all livestock farmers to have some of the farm closed or rested from mid-October onwards to provide early Spring grass. A rotational grazing system facilitates an orderly closing of pastures in Autumn.

The importance of adequate Spring grass supply and of its effect on beef output is shown in Table 19. With an inadequate supply of grass on April 1, animal output was 17% poorer than when grazing started one week later, which

Table 19.
Effect of Spring starting date on liveweight gain (kg/ha) (Grange)

	April			
	1	8	15	22
Grass yield (kg DM/ha)	254	508	1261	1608
Liveweight gain (kg/ha)	833	976	1046	891
Relative	100	117	126	107

Source: Collins et al., 1977

in turn was inferior to starting grazing on April 15. Delaying the start of grazing until April 22 reduced total production for the year because the excess supply resulted in stemmy pastures of lower quality. Alternatively, the earliest grazing date resulted in inadequate grass supply and not only reduced animal performance but also resulted in the need for an earlier reduction in stocking rate in mid-summer. Consequently, when pastures have a herbage mass (yield) of approximately 1000 kg DM/ha (in the grazing horizon) or a sward height of approximately 8 cm (compressed sward height), pasture supply should, in most years, be sufficient to support the full livestock grazing requirements on the grazing areas.

Any grazing of silage swards in Spring will reduce silage yields. However, provided that the final grazing is done before April 10, a reduction in silage yield of not greater than 15% can be expected. When the amounts of herbage consumed by the animals is allowed for, the net quality effect of Spring grazing of silage swards is likely to be less than 5%. Thus, grazed grass has replaced a more expensive winter feed (but the remaining winter feed may be more expensive). Recent Grange results (O'Riordan, 1996) have shown that in a planned grazing system, up to 3 weeks grazing can be obtained on silage swards in Spring. The earlier the sward is closed after grazing the smaller is the silage yield reduction. All silage swards should be closed by April 10 at the latest. Better animal performance has been achieved through this early turnout and a net extra 10 to 15 kg liveweight gain per head has been measured at Grange as a consequence of going to grass early. In this situation, herbage mass (yield) on the silage swards was only 500-750 kg DM/ha in the grazing horizon (above 4 cm). Furthermore, a rotational grazing of silage swards, where paddocks are grazed only once, results in a series of Spring closing dates and thus a smaller yield reduction. At a pasture supply of 1000 kg DM/ha or greater in early April, silage swards do not need to be grazed because there is sufficient DM on the grazing land to carry the cattle.

Controlled grazing in Spring The ability of well-managed grass swards to produce high yields of herbage and liveweight in April/June is underestimated by most livestock farmers. It is the stage where the greatest wastage of valuable feed takes place on farms. Grass growth rates vary considerably from year to year and location to location, but over half of the annual grass yield is produced in the April/June period. In most cases, this high yield of high quality herbage is not managed correctly and its true feeding value is not well used. The failure to adequately convert this valuable feed resource has a number of consequences. Firstly, while satisfactory animal gains are achieved in the short term (April/May), the performance for the subsequent months suffers as stock are grazing poor quality, stemmy, rejected herbage. Animals do not need to have huge masses of herbage (greater than 3000 kg DM/ha) in order to give satisfactory performance. Secondly, because of under-utilisation, which in some situations is less than 50%, pasture output is depressed for the remainder of the season. Thirdly, pasture quality is poor and swards which had a DMD value of 750 g/kg in mid-May (capable of producing a liveweight gain of 1 kg or greater/ head/day) drops to around 650 g/kg DMD in June and July with the result that animal weight gains suffer. Fourthly, as pasture growth rates fall off, animals will be forced to eat into a stubble of very low quality with the result that gains in mid to late season will be poor, a phenomenon seen on many farms. This cycle of surplus grass growth early in the season and the inability to subsequently capture it in an efficient manner is repeated yearly on many farms.

Recent Grange research has shown that high stocking rates in Spring can be associated with high levels of animal performance both in the short and long term. Data in Table 20 show that over a 3 year period high performance was achieved over an extended period of time. On swards receiving 200 kg N/ha, a daily liveweight gain of over 1.1 kg was achieved from early April until mid-

Table 20.
Effect of Spring stocking rate on steer gains (kg/head/day)

	Stocking rate (kg/ha in early April)		
	2000	2500	3000
Up to mid August	1.25	1.16	1.12

Source: O'Riordan, 1996

Table 21.
Seasonability of grass growth

	April/June	July/August	April/August
% of total season's Grass growth	60	25	85

Source: O'Riordan, 1996 (unpublished)

August on swards stocked at 3000 kg liveweight/hectare at turnout. The grazing pressure had increased to 4000 kg liveweight/hectare in mid August before a stocking rate reduction took place. Similarly, clover-based swards receiving only 50 kg N/ha in February, and stocked at 2500 kg liveweight/ha at turnout, were able to achieve weight gains of over 1.1 kg/day during the period from early April until mid August. These latter swards were supporting a stocking rate of 3000 kg/ha in mid August. These animal performances at grass were achieved with animals weighing 550 kg in April, and that had gained 0.9 kg/day during the previous winter. As well as achieving these levels of animal gain at high stocking rates, the use of flexible grassland management allowed up to 25% of the grazing area be removed as surplus grass for ensiling. These high daily gains and stocking rates are achieved on the basis that most of the seasons growth (60%) takes place in April/June (Table 21) and that the feeding quality is high (750 g/kg DMD) if well managed. In Table 20, increasing stocking rate from 2000 to 3000 kg liveweight/ha, thereby releasing 50% of the land area, only depressed daily gain by 10%. In terms of response to applied fertiliser nitrogen, the best response is achieved during the months of April/June. It is then clear that most of the winter feed requirements should be obtained early in the season (May/June). Trying to achieve a large proportion of the winter feed requirement after mid summer is most likely to be unsuccessful.

Guidelines for grazing swards in Spring should centre on a rest interval of not greater than 24 to 26 days. Rest intervals greater than these, while growing more grass, will lead to poor pasture utilisation and thus lead to swards of lower quality later in the season. Data from Grange show that grazing to a stubble height of 5 to 5.5 cm (compressed sward height) or a residual mass of 500 to 600 kg DM/ha during April to July, resulted in gains of over 1.1 kg liveweight/head/day.

With proper grassland management, animals can achieve a steady rate of gain over a long grazing season. Recent Grange data (Figures 7 and 8) shows

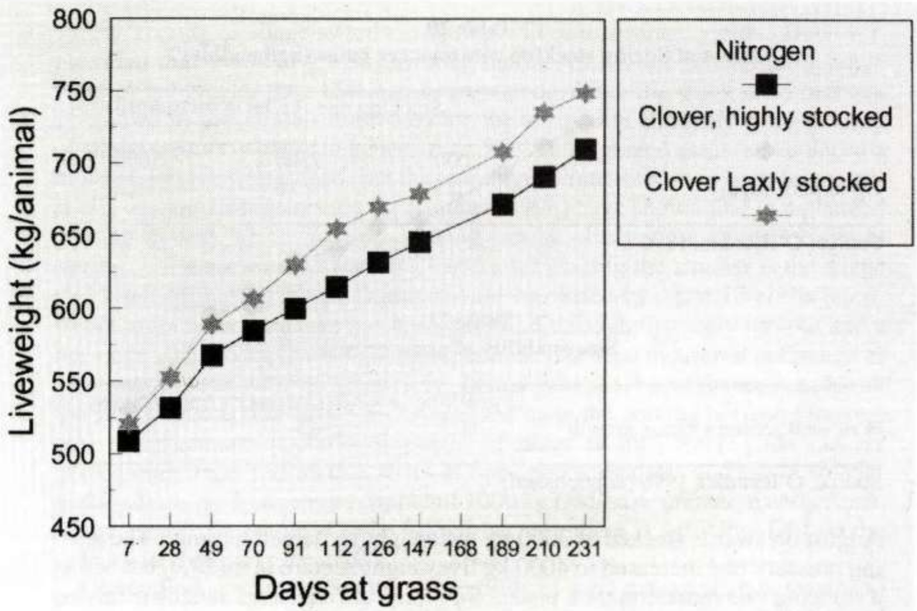


Fig 7. Animal performance at pasture (grass and grass clover swards, 1995)

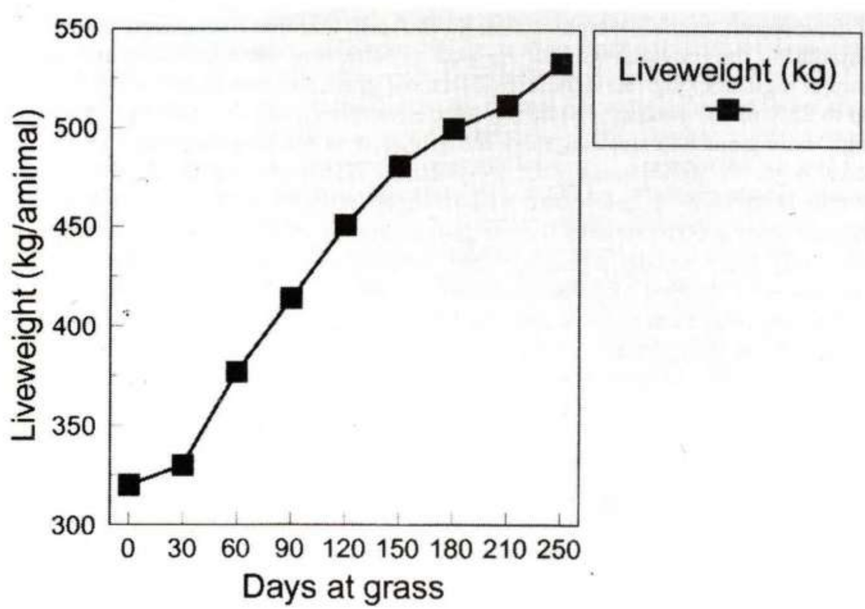


Fig 8. Animal performance at pasture (Dairy calf to beef 1995)

that where pasture quality is maintained and when herbage supply and herd demand are matched, animals can grow at a steady rate from April through to November. Similarly, where overstocking took place in Autumn, performance was poor. Most pastures will only support 1200 to 1400 kg liveweight/ha from October onwards and for higher stocking rates a carryover of pasture from earlier in the season (August/September) is necessary. A rotational grazing system makes this approach more practical. The demand and supply of grass on the Grange Suckler and Dairy Calf to Beef Systems are shown in Figure 9. The data shows grass growth rates and herd demand per hectare on a daily basis. Once grass growth starts to increase, grass supply exceeds demand for mid April onwards until late August, at which time all of the farm is needed to supply the herd demand. With, for example, a demand for grass of 20 kg DM/ha/day on the full farm or 50 kg DM/ha/day on 40% of the area a yield of 1000 kg DM at turnout has sufficient grass for 20 days. For suckler cows before the end of the first grazing cycle, all animals will be at pasture (all cows calved) and the herd daily requirement is increased from 50 to 75 kg DM/day. With 1000 kg DM/ha on offer, there are only 13 to 14 days feed available. Grass growth rates will increase each day and will exceed 75 kg DM/ha/day before the end of the first grazing cycle resulting in grass supplies building up.

Transferring grass from times of surplus to times of scarcity has been much discussed in recent years. There is surprisingly little scientific data relating to the practice of what has become known as extended grazing. Grange results over the past 3 years have shown that the grass, if available, can be carried as a standing crop in Autumn for 6 weeks or more with no advantage of a longer rotation, even though pasture quality (DMD) is maintained for periods of 9 to 10 weeks. However, Figure 9, shows that from September onwards, herd de-

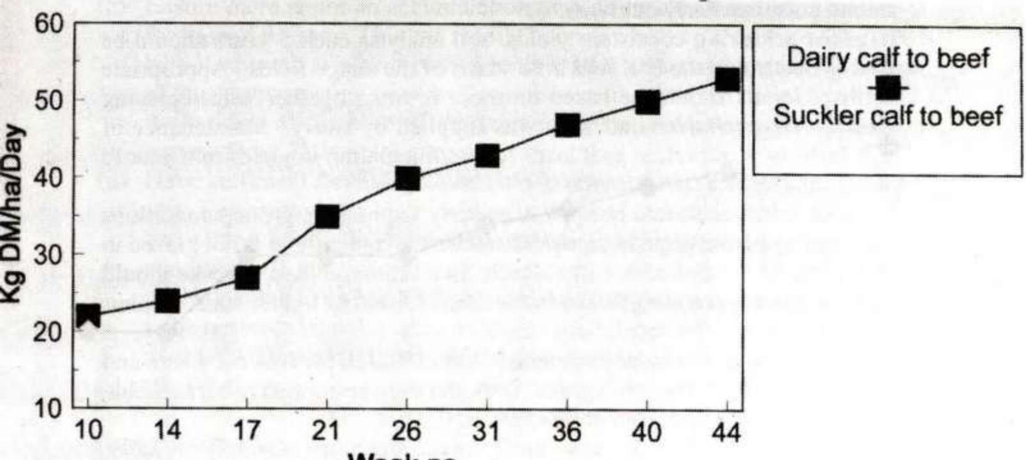


Fig 9. Herd Demand for Grass

mand matches supply, so that carrying feed supply for 6 weeks into October or November is unlikely to take place as there is not sufficient grass to do so. As provision of sufficient winter feed is a key issue in attaining high stocking rates, and conserving 35 to 40% of the farm in late July is an integral part of the management programme, the scope for surplus grass in the absence of omitting some second cut areas seems limited. However, on farms where most or all of the Winter feed comes from a single May/June harvest, the chances of carrying feed from August/September should be an option, but have yet to be assessed.

d) Forage for Winter feeding

Provision of adequate winter feed is a key to efficient, high levels of animal output. Silage quality is of major importance where farmers want high rates of animal production from silage-fed cattle. Consistently achieving well preserved silage of high digestibility (DMD) is difficult but attainable. Weather patterns, both directly and indirectly, impact in a very major way on the yield, dry matter concentration, digestibility, preservation and unit cost of silage. Consequently, there is a clear limit on the extent of the control that can be exercised over the weather-induced variability, and the flexibility of reducing variation will therefore depend on the ability to react or respond quickly and with flexibility to particular circumstances that arise due to weather. This ability to respond is often difficult to achieve, especially if it is remembered over 80% of silage is harvested by contractors.

(i) Silage yield

The following factors are important in reducing variability in silage yield:

- Perennial ryegrass swards can be managed to produce more consistent yields than other grasses. Mid and late season cultivars will give less variable second cuts than early cultivars.
- To assist achieving consistent yields, soil analysis each 5 years should be used to determine the P, K and lime status of the silage fields. Appropriate fertiliser inputs should be based on these results, together with replacing what the crop removed and what was supplied by slurry. Maintenance of high fertility is important as it leads to less fluctuation in yield from year to year.
- Nitrogen fertiliser should be applied as early as possible, ground conditions and weather permitting. In many cases where silage ground is not grazed in Spring, N can be applied in early March. In all cases, at least 6 weeks should elapse between spreading N and harvesting. On many lighter soils, sulphur should be applied for second-cut silage.
- Slurry spreading should be completed by mid March for first cut silage and should not be applied to high grass. It should only be applied to bare stubble for regrowths (rates dealt with later).
- Assuming that soil fertility, structure drainage and nutrient supply are satisfactory, the yield of a particular sward is substantially dependent on weather. At that stage, the main mechanism for achieving a given yield is by altering the harvesting date. However, delaying harvesting date to increase yield is

normally accompanied by a decrease in digestibility. The correct balance between yield and quality will depend, among other factors, on the type and intensity of enterprise on the farm and the relative costs of forage, concentrates and animal product. However, relative variability in dry matter yield can often be reduced by harvesting the first-cut in the final week of May rather than in mid May. Variable yields usually occur in July/August harvests, and on farms that are prone to severe drought this may be an insurmountable problem.

- Grass dry matter concentrations at harvesting impact on the fresh yields, as well as on effluent losses and the ease of preservation. The progression in grass dry matter concentration from 200 g DM/kg to 180, 150 and 120 g DM/kg reflects the effects of dew, a heavy rain shower and several days rain, respectively, and would increase the fresh yield at a 25 t/ha crop to 28, 33 and 42 t/ha, respectively.

(ii) Digestibility

As silage digestibility increases cattle eat more of it, utilise it more efficiently and produce correspondingly more meat or milk. Farmers who want to produce highly digestible silage on a reliable basis should incorporate the following into their management system.

(a) Use ryegrass swards. This is a long-term investment and, provided the cultivars in the seed-mix have fairly similar heading-out dates, makes identifying the optimum target harvest date straightforward.

(b) Harvest the crop when seedheads are beginning to emerge from the grass (do not wait until seed-heads have fully emerged). This is the grass growth stage that tends to give the best balance between yield and quality for farmers seeking high levels of animal production.

(c) Ensure there is not an accumulation of dead or old stemmy vegetation at the base of the crop. This can readily happen where swards were not grazed bare in autumn or where considerable winter growth occurred. The effect of thus accumulating what by silage-harvesting date will be old, low quality herbage at the base of the crop could be to decrease grass DMD at harvest from 750 to 690 g/kg.

(d) Have sufficient flexibility to be able to alter the harvesting date, if necessary. For example, if high yielding lush crops are subjected to heavy rain and strong winds they can lodge and lie on the ground under very wet conditions. If this occurs, the normal rate of decrease in digestibility can triple, leading to up to a 10% unit drop in DMD in a week. Such crops need to be harvested quickly after lodging if such large drops in DMD are to be avoided. However, the risk of lodging is reduced where excessive rate of total nitrogen-applications (including slurry) are avoided.

(iii) Preservation

The major aims in preserving grass as silage are to store the grass in a genuinely air-free environment and to then inhibit the activity within the silo (or bale) of undesirable microbes. This means fast filling and perfect sealing of silos, ensiling clean grass that is free of contamination and, if necessary, further facilitating preservation by wilting, using additives or using other management practices that encourage good preservation by producing "easy to preserve" crops. The following are the main guidelines:

(a) Use ryegrass swards. This long-term investment produces crops of higher sugar concentration that are easier to preserve than other grasses.

(b) Complete slurry-spreading by mid March, with undiluted cattle slurry being evenly spread on short grass at not more than 33 t/ha (3000 gal/ac.) - spread again **immediately** after the first-cut is 17 t/ha (1500 gal/ac.).

(c) In a two-cut silage system, apply N fertiliser as early as practicable, using rates of 110 to 140 kg N/ha (90 to 110 units N/ac) and 75 to 100 kg N/ha (60 to 80 units N/ac) for first and second cuts, respectively. In some circumstances higher rates may be justified. Reduce the above fertiliser N rates by 1.1 to 1.8 kg N/t undiluted cattle slurry (i.e. 10 to 15 units N/1000 gallons) applied in February/March. The corresponding adjustments for slurry applied after the first-cut are 0 to 1.1 kg N/t slurry.

(d) Only apply lime to silage land before March or after the silage-harvesting season is completed (i.e. do not apply to crops actually growing for silage.

(e) Wilting has both advantages and disadvantages. It should only be considered when drying conditions are good, and should **not** be attempted in large narrow rows. Ideally, if a farmer wants to wilt, the grass should be fully tedded and given complete ground-cover. At a minimum, where a large mower conditioner is being used, the gates at the back of the mower should be opened wide to allow the grass be spread in wide rows. If wilting, aim at a target of 250 to 300 g DM/kg (i.e. 25% to 30% DM), to be achieved within 24 hours of mowing. Besides its obvious effects on effluent production, successful wilting will virtually ensure good preservation, but the improved intake of dry matter is not correspondingly converted to additional animal product.

(f) Additives can be beneficial in some circumstances, but must be chosen carefully and appropriately, and applied properly, if an economic response to their use is to be obtained. Where grass is harvested at an advanced state of maturity (i.e. very stemmy) or has been heavily wilted, conventional additives are not normally justified. On the other hand, if leafy crops of grass that have received none or a little wilting are being ensiled, the following three steps should be followed:

    (i) obtain an estimate of grass ensilability. At a minimum this involves measuring grass sugar concentration (expressed as a proportion of grass juice) and preferably also buffering capacity. Sugars can be measured on farms, while both sugars and buffering capacity can be measured on samples submitted to laboratories. It is critical that the samples taken propely represent the grass to be harvested, and that they are properly processed prior to analysis. Based on an ensilability index, the category of additive required, as well as the appropriate application rate, will be indicated.

(ii) make an estimate of the fresh yield being harvested. This is necessary since the additive will be applied per tonne of weight harvested, and cannot accurately be assessed without weighing a strip or trailer-load of grass. Doing this is time well spent as a 40% underestimation of the actual yield of grass would lead to applying 40% too little additive and consequently obtaining an inferior return on the investment in the additive.

(iii) evenly apply adequate sugar or acid based additives where grass ensilability is difficult, and effective inoculants where ensiling conditions are very good. However, the recent major drop in beef prices now puts the economic merit of inoculant additives under considerable doubt on cattle farms.

(g) Fast filling and perfect sealing of the silos (or bales). This is crucial and the single most important factor in achieving good preservation.

(iv) Aerobic deterioration

The three main factors affecting aerobic deterioration once silos are opened are (1) management, (2) weather, (3) silage characteristics. Of these, management is the most important factor. The aim of management practices must be to minimise the contact time between silage and air. In bunker silos, this involves (a) moving through the silage face quickly, (b) presenting easy-fed animals with only so much silage as they can eat in a day, (c) keeping the silage face as undisturbed as possible. Rough or careless removal of silage from the silo leaves behind a tattered and tossed face into which air can penetrate deeply, (d) keeping polythene on top of the pit fully weighted down and taut to the front of the silo and (e) not covering the silage face with polythene at feeding time as this creates a mushroom-house environment. Unfortunately there are no chemicals available to spray on the silage face at feedout to prevent aerobic deterioration at and behind the face.

All else being equal, slower filling of a silo is likely to make the silage more prone to aerobic deterioration at feeding time.

With regard to weather, it has been shown in Grange experiments that warmer weather at feedout increases the susceptibility of silage to aerobic deterioration. The management recommendations already described are crucially important during periods of mild weather as deterioration is more extensive in such conditions.

Certain silage characteristics such as the degree of stemminess or dryness of silage or its density may influence susceptibility to aerobic deterioration. As demonstrated in the Grange experiments, the major chemical components in well preserved silages exert relatively little impact on aerobic stability. However, other experiments have demonstrated that small amounts of as yet unidentified chemicals are formed in some silages and do improve aerobic stability. The microbial composition of silage when exposed to air and in particular yeast numbers, has a major effect on aerobic stability. The factors which influence this still need to be defined.

4. FUTURE POTENTIAL

Irish grassland has the potential to support highly efficient beef production, and allow a competitive advantage over beef producers in other countries. Taking grass yield, quality and efficiency values under a current good-management system for a geographical location such as Grange, carcass output per ha grass can be estimated at 553 kg per year. There exists a realistic potential, as shown in Table 22, to radically increase the efficiency of producing beef per hectare of grassland by increasing grass production, increasing the proportion consumed by grazing rather than after conserving, and improving quality and efficiency of utilisation, to produce almost 1000 kg carcass/ha each year.

Strategies for achieving such an enormous improvement in productivity will depend on the adoption of improved technologies, intensive monitoring allied to the prompt use of accurate, quantified information for decision-making and the operation of newer production systems incorporating both flexibility and continuous, active management.

Critical to improving the annual yield of grass are maintaining good soil drainage, structure (i.e. prevent compaction) and fertility (P, K, lime and micronutrients). Improved grass varieties (and possibly grasses selected specifically for grazing or conserving), together with high rates of N application spread in a time-critical pattern throughout the year and the use of variable length grazing cycles to provide optimal regrowth recovery intervals, will be central to delivering the high yields. Alternatively, some clover-based systems will offer the potential to increase beef output per forage hectare compared to the current standards, but probably not as much as proposed in Table 22.

Considerable scope exists to increase the proportion of annual grass DM production consumed by grazing, and correspondingly reduce the proportion conserved, by operating systems involving as early a turnout to grass and as late a

Table 22.
Potential to increase beef carcass production per ha grassland (Grange)

		Current	Potential
Annual grass yield (t DM/ha)		10	15
% of DM yield assigned to grazing		58	70
% of DM yield assigned for conserving		42	30
Grazing efficiency (consumed as % of grown)		74	80
Conservation efficiency (consumed as % of grown)		76	82
DMD of forage consumed (g/kg)			
-grass		77	77
-silage		70	73
Carcass output (kg)/ha/year	- from grass	403	789
	- from silage	150	181
TOTAL		553	970

removal from grass as possible, staggered turnout and removal, and a manipulation of the seasonal grass supply pattern based on the cultivars used and the strategic seasonal pattern of N fertiliser use. Furthermore, the feeding of some of the supplementary concentrates at grass that would otherwise have been subsequently fed indoors, will allow the finishing of cattle off of grass, with the consequent reduction in winter forage requirements.

Improvements in the efficiency with which cattle consume the grass produced will depend on the use of rotational grazing systems involving paddocks. Selection of grasses on the basis of their palatability and intake characteristics, together with more frequent (and possibly semi-automated) allocation of fresh grass supplies during the day, will be necessary. Critical also however, will be a more comprehensive knowledge of grass growth rates, actual supplies available, grazing rate and animal behaviour. Considerable scope still exists to reduce conservation losses, and will hinge primarily on reducing losses via effluent (e.g. feeding effluent essentially eliminates this loss completely) and restricting aerobic deterioration at filling, during storage and at feedout. The scope to reduce losses during fermentation appears more limited at present.

Relatively little opportunity seems available to improve the nutritive value (e.g. DMD) of grazed grass in a situation where the aim is to increase grazing efficiency markedly. However, the use of ryegrass actively selected for higher DMD, quite possibly of late heading-out date, together with a greater extent of control on aerobic deterioration of silage at feedout, should readily achieve the improvements suggested in Table 22.

5. FINAL COMMENT

The optimal, rigorous management of Irish grassland is the route to a viable ruminant livestock industry in the future, assuming we will have to operate in a progressively more open economic market-place but where there will be greater regulations regarding food quality, animal welfare and environmental considerations. Fundamental to Irelands ability to take full advantage of the opportunities provided by our grassland is a national, co-ordinated, focussed, comprehensive and fundamental research effort to understand grass production, consumption and conversion to quality beef - we must **pursue the science of grass and beef.**

This technology must be quickly transferred to beef farmers in the form of flexible, adaptable systems (not blueprints) and management support mechanisms (that will permit prompt and appropriate decisions based on accurate knowledge) so they can **cash-in on grass.**

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APPENDIX

RELATIONSHIP BETWEEN SWARD HEIGHT AND HERBAGE YIELD

The use of POST GRAZING sward surface height as a grassland management aid has been advocated for a number of years. However, the use of PRE-GRAZING sward surface height as an estimater of the HERBAGE YIELD available for grazing animals has not been widely used in Ireland. Where pre-grazing sward height is being used, tables which relate sward height to herbage yield are those derived in other countries. During the past 3-years, research at Grange has examined the relationship between pre-grazing sward surface height and herbage DRY MATTER yields. Over this period close to 3,000 plots had both their height recorded and actual yields determined, and these height and yield data have been used to generate IRISH height to yield conversion tables. This article outlines the main results of this research.

WHY USE PRE-GRAZING SWARD HEIGHT?

The pre-grazing sward height can be used as a grassland management tool, helping the grassland manager become familiar with herbage yield and thereby facilitating a process where animals may be offered "known" herbage allowances.

MEASURING SWARD SURFACE HEIGHT

Sward surface height (i.e. the height of the grass) may be measured in a number of ways.

1. Ruler
   The simplest means of measuring sward height is with a ruler, where a ruler is inserted vertically into the standing crop and the height from the ground to the "top" of the sward is then measured. However, big variation can emerge in deciding what is the "top" of the sward.
2. Sward Stick
   A sward stick consists of a graduated metal rod (with marks each 0.5 cm) fitted with a perspex arm. The sward stick is inserted vertically into the sward and the perspex arm is lowered until it comes in contact with a leaf. The reading on the shaft is taken as the sward height. Both ruler and sward stick are somewhat slow to use, especially if large areas are to be measured, and many readings are needed. Readings are manually recorded.
3. Plate meter
   Sward height can be measured with a plate meter, of which there are many types. In general, a plate is allowed to settle on and compress the sward, the height between the ground and the plate being measured as the sward height. Readings may need some degree of manual recording, but considerable scope exists to automate and streamline this process.
4. Other techniques that for example bounce light or sound waves off the sward have also been investigated, with varying degrees of success.

The use of plate meters is becoming more common and some are now being manufactured in Ireland.

SWARD STICK

At the lower sward heights (4-6 cm) the sward stick resulted in height values which were 1 to 2 cm GREATER than those from the AFT meter. In taller swards this difference between the two approaches to measurement was increased and, as a result of these large differences, yields based on uncompressed sward height CANNOT be read from Table 1 and therefore the sward stick needs to have its own conversion tables developed.

CHARACTERISTICS OF PLATE METER

As plate meters measure compressed sward height, the heavier the plate the greater the degree of sward compression and the lower the resulting sward height. Thus, various meters need to be standardised so that each meter results in the same degree of sward compression and height. The plate meter used in the present experiment was developed by An Foras Taluntais (AFT) in the early 1980's and consisted of a 30 cm diameter plate which places a force of 2.8 kg/m^2 on the sward. The meter was designed to automatically record the sward height and calculate the average height for a large number of readings and display the results on a LCD panel.

HEIGHT/YIELD RELATIONSHIP

Table 1 shows a range of sward heights and the corresponding measured dry matter yields. The swards used were generally at the end of a 3-week rotation. The data in the Table are based on almost 3,000 plots where height and yields were actually measured. Eleven different swards were measured over the three full growing seasons during the course of the Grange study. While height was measured from the ground to the plate, the yield (in kg DRY MATTER per hectare) was measured in the grazing horizon above a stubble of 4 cm (not to ground level).

Table 1 covers sward surface heights within the range 6 to 25 cm, that is, within the limits of "normal" PRE-GRAZING conditions. At heights greater than 25 cm, the height to yield relationships are much less accurate because the sward tends to fall over and lodge under the weight of the plate. Consequently, the values in Table 1 should not be extended for use on silage swards.

The relationship between sward surface height and herbage dry matter yield DOES VARY from sward to sward (i.e. one crop (field) to the next) and also varies with season. Thus, for example, stemmy swards give a higher height reading as the plate is supported on the stems. Measurement taken on lush pastures after heavy rainfalls or in frosty conditions will also be associated with errors. The way the meter is lowered into the sward has an effect on height. Dropping the plate meter with force onto the sward will compress the sward surface to a greater extent than doing the procedure gently. When measuring sward height, the more readings that are taken the closer the average height value will be to the true field value. Aim to take at least 50 readings per paddock.

USE OF THE TABLE

Table 1 has five columns. The FIRST column is the compressed sward surface height measured in centimetres. The SECOND column relates sward surface height to HERBAGE DRY MATTER yields (in kg DM/ha) in the early part of the season and spans the Spring/Summer period from the start of the growing season to mid-June. This is the stage when grass swards are in their reproductive growth phase (after the winter). The THIRD column covers the height to yield relationship for the period mid-June to late August, when, depending on management, sward quality can vary widely and some grasses will tend to form seed heads. The FOURTH column covers the remainder of the year to late October/early November when grasses are in the vegetative stage. The FIFTH column, gives an overall yield value for the whole season for each of the sward heights.

NOTE that the yields given in Table 1 are the AVERAGE values for each sward height over the range of swards used in the study. There IS variation from one sward to the next. The analysis of the Grange data relating height and yield show that at any sward height DRY MATTER YIELD may vary by PLUS or MINUS 500 kg DM/ha from the value predicted in Table 1. **THUS, VALUES IN THE TABLE CAN ONLY BE USED AS AN INDICATOR OF YIELD AND NOT THE "ACTUAL" YIELD AT ANY SWARD HEIGHT.**

USING THE TABLE UNDER FIELD CONDITIONS

If the average pre-grazing sward height is 12 to 15 cm then herbage on offer is equivalent to approximately 1600 to 2100 kg DM/ha. At a herbage availability 2000 kg DM/ha and offering dairy cows a herbage allowance of 20 kg DM/head/day, there are 100 grazing days per hectare (40 grazing days/acre). Likewise, if 15 kg DM/head/day is being offered suckler cows or drystock, there are the equivalent of 133 grazing days/ha (or 54 grazing days/ac) on offer. If pre-grazing sward height is 18 to 20 cm, then herbage on offer is equivalent to 2600 to 3000 kg DM/ha. Herbage yields of greater than approximately 3500 kg DM/ha or a pre-grazing sward height of 23 to 24 cm, is probably indicative of surplus grass.

If grass allowances are offered on the basis of sward height, the actual allowance may be at most plus or minus 1 kg DM/head/day from the expected allowance for cattle. Consistency in measurement is important if the operator's eye is to be trained in assessing herbage yield and thus be an effective judge in estimating herbage availability. As mentioned previously, the main benefit of correctly using the plate meter is to train the grassland managers eye into assessing herbage yield in the standing crop. AS A "GENERAL" RULE EACH CENTIMETER RISE IN COMPRESSED SWARD HEIGHT WILL REPRESENT AN INCREASE IN YIELD OF 150 TO 200 KG DM/HA.

OTHER PLATE METERS

The AFT meter has been compared with a second plate meter, manufactured in Cork. The Cork meter consisted of a 32 x 32 cm, 11/2 mm, stainless steel plate which exerts a compressing force of 5.4 kg/m2 on the sward (nearly twice the force of the AFT meter). The Cork meter being heavier resulted in sward heights which were lower (10%) than the AFT meter. However, as the percentage difference was relatively small, the error associated will be of little practical consequence and the Cork meter may be used to record sward height and read from the herbage yield values in Table 1.

The plate on the Cork meter is carried on a central shaft and as the meter is lowered into the sward the plate rises on the shaft which is notched at 0.5 cm intervals. A counter with a sprocket wheel counts the notches as the plate rises (not as the plate falls as it is removed from the sward). The number of height readings taken is recorded on a second hand operated counter. Using the reading on the shaft counter and the number of individual height readings taken, the average sward surface height and herbage yield can be calculated.

If the Cork meter is to be used to estimate sward height and thus herbage DM yield from Table 1, the following procedure should take place.

1) Record the starting reading on the shaft recorder.
2) Record the final reading on the shaft recorder.
3) Record the number of height readings taken.

Then use the following formula to get the sward height (in cm):

$$\text{Sward height (cm)} = \frac{\text{[Final reading] minus [starting reading]}}{\text{[number readings taken x 2]}}$$

Example 1: 10 height readings taken, starting value = 17,096 and final value = 17,568

$$\text{height (cm)} = \frac{[17{,}568-17{,}096]}{[10 \times 2]} = \frac{472}{20} = 23.6 \text{ cm}$$

Example 2: 25 height readings taken, starting value = 19,000 final value = 19,250

$$\text{height (cm)} = \frac{[19{,}250-19{,}000]}{[25 \times 2]} = \frac{250}{50} = 5 \text{ cm}$$

NOTE that these height readings will be some 10% lower than those taken with the AFT meter. The mathematical process above is not necessary with the AFT meter, as all calculations are carried out automatically.

SUMMARY

* Sward height is a useful management aid and is a help in training the "eye" to herbage supply.
* Sward height and pasture dry matter yield available for grazing are related, but the relationship varies with pasture type and season.
* The Grange Table can be used as a guideline for farmers who want to relate sward height to herbage dry matter yield.
* Not all means of measuring pasture height - are directly comparable. Different conversion tables are needed for each instrument.

TABLE 1.

COMPRESSED PRE-GRAZING SWARD SURFACE HEIGHT AND ASSOCIATED HERBAGE DRY MATTER YIELDS.

	DRY MATTER YIELDS (kg/ha) (above 4 cm stubble)			
COMPRESSED SWARD SURFACE HEIGHT (cm)	PERIOD 1 (Spring to mid-June)	PERIOD 2 (Mid June to late-August)	PERIOD 3 (September to end of year)	OVERALL (ignoring seasonal effects)
6	684	729	470	604
7	848	876	626	773
8	1012	1023	782	942
9	1176	1170	938	1111
10	1340	1317	1094	1280
11	1504	1464	1250	1449
12	1668	1611	1406	1618
13	1832	1758	1562	1787
14	1996	1905	1718	1956
15	2160	2052	1874	2125
16	2324	2199	2030	2294
17	2488	2346	2186	2463
18	2652	2493	2342	2632
19	2816	2640	2498	2801
20	2980	2787	2654	2970
21	3144	2934	2810	3139
22	3308	3081	2966	3308
23	3472	3228	3122	3477
24	3636	3375	3278	3646
25	3800	3522	3434	3815

NOTE. Sward herbage dry matter yields and not green (fresh) yields are used

Exploitation of the Genetic Potential of the National Herd for Beef Production

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INTRODUCTION

Unlike improvements in feeding and management which have ongoing costs associated with them, genetic improvement is permanent and is largely free of on-going costs. Furthermore, genetic improvements do not have the negative connotations which often accompany feeding and management improvements (e.g. hormones and feed additives, environmental risks from excessive nutrient loads as fertiliser or as slurry, animal welfare considerations of confinement and housing). With the increasing competitiveness of the other livestock sectors such as pigs and poultry, the Irish beef industry must improve and exploit genetic potential to the maximum. Otherwise it will become even more uncompetitive relative to the pig and poultry meat industries than at present. Furthermore, it could also fall behind its international competitors in beef production whose breeding programmes are already well advanced. There are two components to the production of animals of high genetic quality (1) identification and production of genetically superior breeding stock and (2) exploitation of this genetically superior breeding stock through their widespread use within the industry. The first requires comprehensive breeding programmes while the second requires the use by commercial producers of the genetically superior animals produced from the breeding programmes.

IMPROVING GENETIC MERIT

Improvement of genetic merit involves the identification and selection of genetically superior animals in structured breeding programmes. The performance of an animal is a function of its genotype and environment. There have been considerable improvements in environmental factors such as nutrition, disease control and housing but these are not passed on from generation to generation and generally require ongoing costs in order to be maintained. The genotype of the animal on the other hand is the genetic material it inherits from its parents, half of which is passed on from generation to generation. To bring about genetic improvement, it is necessary to separate out the proportion of performance (growth, carcass traits, feed efficiency etc.) which is due to the genes it carries (genotype) and then select for the desired traits.

ESTIMATED BREEDING VALUES (EBVs)

Since true breeding value cannot be measured, estimates of it are made.

Sire: In the past the estimation of breeding value was done by the contemporary comparison method having corrected for environmental effects such as sex and age of dam. However, contemporary comparison was only applicable to animals reared under the same conditions and as pedigree herds are generally small, relatively few breeding values could be calculated and/or their accuracy was low.

The development of BLUP (best linear unbiassed prediction) has overcome the major limitations of contemporary comparison. This technique uses all the records available on an animal and on all its relatives, to partition the genetic and environmental effects and give a more reliable EBV. Genetic linkages between herds allow evaluations to be made across herds. BLUP can also account for associations between traits which further improves its accuracy. For example 200 day weight is positively associated with 400 day weight. EBVs are expressed in the units in which they are measured (e.g. weights in kg, muscle scores in points) and relative to the breed average for a specified year. EBV is an estimate of the genetic merit of the animal itself but only half of this is passed on to the progeny. It is expected that EBVs for Irish pedigree beef bulls will be available shortly.

Dam EBV: The performance of a calf is also influenced by the genetic maternal and milk production traits of its dam. BLUP can separate out these and thus produce EBVs for dams similar to those for sires. The maternal genetic traits will be passed on to the progeny of both sexes but of course they can only be expressed by the female progeny. Of particular interest is the genetic potential of the dam for milk production, a major factor determining calf weaning weight. In beef breeds this EBV is designated 200-day milk.

IRISH BREEDING PROGRAMME

The main elements of a structured breeding programme are outlined in Figure 1. They are (1) on-farm weight recording in pedigree herds, (2) central performance testing of young bulls, (3) central progeny testing of bulls, and (4) importation of genetically superior breeding stock as live animals, semen or embryos. All these elements are used in the Irish cattle breeding programme which has been described in detail by Grogan (1992). Up until now the Irish programme has been operated by the Department of Agriculture, Food and Forestry in cooperation with the breed societies and the AI stations. At present, a national cattle breeding authority is being established to take over the control of cattle breeding. In Ireland, beef bull proofs are expressed as relative breeding values (RBVs) with the breed mean = 100. The RBV for a trait is an estimate of the bull's genetic merit for that trait relative to an average bull of the breed. The superiority/inferiority of a bull is indicated by the extent to which his RBV deviates from 100. Bulls of 110 or greater are from the top 15% of the breed population while bulls of 90 or less are from the bottom 15% of the breed. One half of a bull's superiority or inferiority is passed on to his progeny. RBVs are reported separately for growth rate, carcass conformation and carcass leanness, and feed efficiency values are available for some performance tested bulls. From these an overall beef merit index is calculated. This combines the individual trait values into a single index of economic worth. AI bulls are also surveyed for calving ease, calf mortality to 48 hours and gestation length. The results are expressed as the expected levels for matings to Friesian cows.

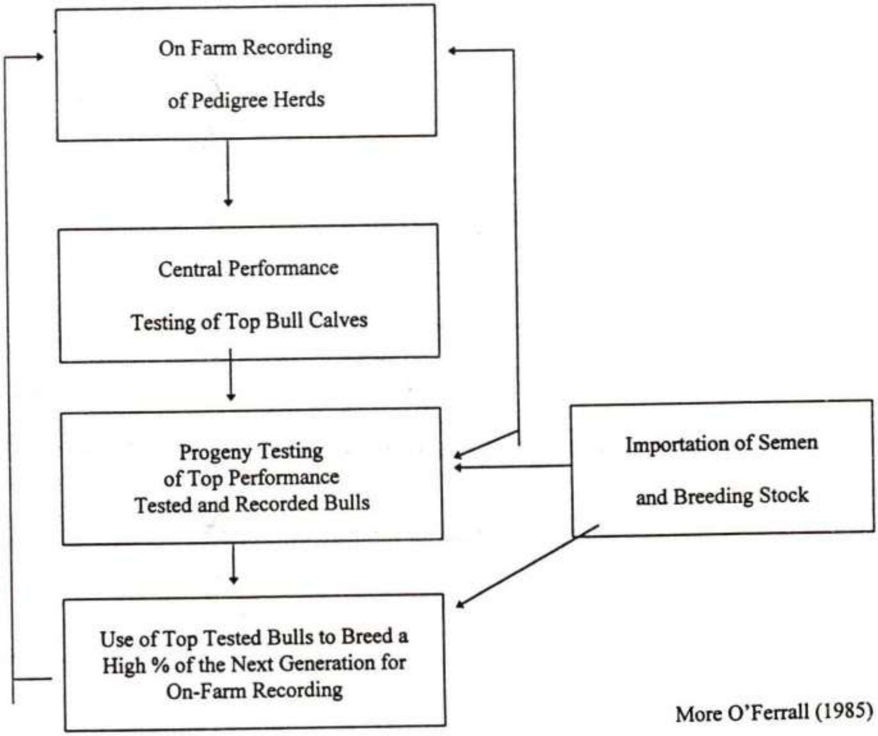

Fig. 1 Illustration of genetic improvement programme for beef cattle breeds

The relevant genetic data needed by the users of AI are published each spring in the Approved AI Beef and Dairy Bull Lists. Approved beef bulls are categorised as approved for widespread use (W) or approved for limited use (T). The W category are high genetic merit bulls which have been progeny tested and surveyed for ease of calving and for which semen is readily available. T bulls have good performance test and/or ease of calving ratings and are undergoing progeny test.

GENETIC PROGRESS

An important measure of the success of a breeding programme is the rate of genetic improvement over time. In dairying for example, the rate of genetic progress in milk fat and protein yields has almost trebled (0.4% to 1.1% per year) for sires born over the 10 year period 1980-1990 (Dillon. Crosse, Buckley and Flynn, 1996). There are no published estimates of the changes in beef breed mean values over time but some indication of genetic change can be deduced from the ratings of the bulls entering the Approved Bull List compared with those of the bulls leaving it.

Growth rate: The mean growth rate RBVs for the Charolais, Hereford, Limousin and Simmental bulls approved for widespread use in 1991 and 1996 are shown in Table I. Also shown are the RBVs for the bulls included in the list in 1991 but since removed, and the new bulls added to the list in 1996. In 1991 there were only 5 Charolais approved for widespread use and they had a mean growth rate RBV of 107. Since then, 4 of these (mean growth rate RBV 106) have been removed from the list. By 1996 there were 14 Charolais bulls (mean RBV for growth rate of 110) approved for widespread use. Only one new bull was added to the list in 1996 and he had an RBV for growth of 115. Thus, there is evidence of some improvement (107 to 110) in the genetic merit for growth rate of the approved AI Charolais bulls from 1991 to 1996. However, this improvement only brought the mean of the Charolais bulls into line with that of the other breeds.

TABLE 1.
Relative breeding values of bulls approved for widespread use in 1991 and 1996

	Charolais		Hereford		Limousin		Simmental	
	1991	1996	1991	1996	1991	1996	1991	1996
No. approved bulls	5	14	22	16	12	15	11	15
Mean growth RBV	107	110	109	110	109	108	110	109
No. removed+/added++	4	1	14	7	4	2	6	4
Mean growth RBV	106	115	109	110	106	102	107	105

\+ Bulls present in 1991 but not in 1996
++ Bulls present in 1996 but not in 1995

In 1991 there were 22 Hereford bulls with a mean growth RBV of 109 approved for widespread use. Since then 14 of them (also with a mean growth RBV of 109) have been dropped from the list. By 1996 there were 16 Hereford bulls approved for widespread use. Their mean growth rate RBV of 110 was little different from the 1991 value. The 7 new bulls added in 1996 also had a mean growth RBV of 110. Thus, there has been little change in the growth RBV of approved Hereford bulls over the past 5 years so the only change in genetic merit of approved AI Hereford bulls is that which has occurred in the breed mean.

For the Limousin and Simmental breeds, mean growth RBV for approved bulls was in fact one point lower in 1996 than in 1991. In both breeds also, the bulls dropped from the list were 3 points below the list mean suggesting that to some degree it was the poorer bulls which were dropped. However, it is also true for both breeds that the bulls added to the list were below the list mean.

Generally, there is little to suggest that there has been any significant increase in RBV for growth rate over the last 5 years in the approved AI bulls. There is little difference between the breeds in the growth RBVs of the bulls approved for widespread use. Therefore, the only improvement in genetic merit of AI bulls has been that which has occurred in the breed means (of which there are no published estimates).

Calving ease: It might be argued that improvement in growth RBV was constrained by selection for ease of calving. The mean calving difficulty scores for 1991 and 1996 for the Charolais, Hereford, Limousin and Simmental breeds are shown in Table 2. Mean calving difficulty score for Charolais actually increased (4.1 to 5.7) from 1991 to 1996 but most of this was due to a single bull with a high calving difficulty (19.8%) which was added to the list in 1996. For all the other breeds there was little change in mean calving difficulty percentage between 1991 and 1996.

TABLE 2.
Calving difficulty percentage for bulls approved for widespread use in 1991 and 1996

	Charolais		Hereford		Limousin		Simmental	
	1991	1996	1991	1996	1991	1996	1991	1996
No. bulls	5	14	22	16	12	15	11	15
Mean calving difficulty	4.1	5.7	1.9	2.1	3.9	3.7	3.3	3.6
No. removed+/added++	4	1	14	7	4	2	6	4
Mean calving difficulty	4.0	19.8	1.9	2.2	3.7	2.9	3.5	4.3

+ Present in 1991 but not in 1996
++ Present in 1996 but not in 1995

EXPLOITING GENETIC POTENTIAL

At producer level, genetic improvement comes mainly from the widespread use of genetically superior sires. This is discussed under two headings (1) the mean differences between beef breeds and (2) the genetic differences between sires within a breed. In addition to the genetic merit of the sire, breed type of the suckler dam is also considered.

DIFFERENCES BETWEEN SIRE BREEDS

The relative merits of the different beef sire breeds have been well documented and are summarised in Table 3. Other than the Angus which had a lower value, slaughter weight for age differed little between Friesian, Hereford, MRI, Limousin and Blonde, while Simmental, Belgian Blue and Charolais were 4-7% superior to these. All beef crosses had higher kill-out values than Friesians with the continentals having higher values than the British breeds. Hereford, MRI and Limousin were 4%-5% superior to Friesians and Angus in carcass weight for age while the other breeds were 8%-11% superior. Muscle weight for age was similar for Friesian and Hereford even though the latter had 4% more carcass. All continentals produced 11%-19% more muscle than Friesian and Hereford with the Belgian Blue having the highest production of muscle. Muscle size essentially paralleled muscle weight for age. There was relatively little difference across breeds in the proportion of higher value muscle which was identical for the dairy and British breeds and was 2%-3% higher for the continentals. All beef crosses had considerably superior conformation to

Friesians. Limousin, Belgian Blue and Charolais had the best conformation. Fat score was considerably higher for the British breeds than for the dairy and continental breeds. There was little difference in fat score between Friesian, MRI, Limousin and Simmental, but Blonde d'Aquitaine, Belgian Blue and Charolais had lower fat scores than the others.

TABLE 3.
Ranking of progeny from different sire breeds and Friesian cows.

Sire Breed	Sl. Wt./ Age	KO	Car.Wt./ Age+	Muscle Wt./ Age	Muscle Size	Higher Value Muscle	Conf.	Fat Score
Friesian	100	100	100	100	100	100	100	100
Angus	96	102	99	94	100	100	127	120
Hereford	102	102	104	100	102	100	131	124
MRI	102	103	105	106	107	100	118	102
Limousin	99	105	104	110	118	103	140	101
Blonde	102	105	107	116	119	103	132	91
Simmental	106	103	109	114	118	102	134	101
B. Blue	104	105	109	119	122	102	140	91
Charolais	107	104	111	117	123	103	144	95

Sl. Wt. = Slaughter Weight; KO = Killing-out proportion; Car. Wt. = Carcass Weight Conf. = Carcass Conformation

DIFFERENCES BETWEEN SIRES WITHIN A BREED

The mean productivity differences between the breeds described above are now widely appreciated by producers and there has been a large change in beef breed usage from predominantly British breeds 10-15 years ago to predominantly continental beef breeds at present. This change has been accompanied nationally by a marked increase in mean carcass weight and an improvement in carcass traits. The next major improvement in productivity must now come from the identification and widespread use of genetically superior bulls within each breed. For some traits, the difference between bulls of the same breed can be as great as the mean differences between breeds. The AI bulls approved for widespread use are on average 11% (Angus), 8% (Belgian Blue), 10% (Charolais), 10% (Hereford), 8% (Limousin) and 9% (Simmental) above their respective breed means for growth rate. Thus, a change from a bull of unknown genetic merit (and therefore assumed to be average for the breed) to an average approved AI bull automatically improves performance of the progeny by about 5%. A further change from the average approved AI bull to the best approved AI bull within a breed would give about a further 3% improvement in performance. Therefore, within a breed, performance can be improved by 8-10% by using the best approved AI bull compared with a an average bull of that breed. In suckled weanling production, a bull with an EBV of +30 kg for weaning weight would produce weanlings 15 kg heavier than the average bull. This would be worth about £700 annually in a 50 cow suckler herd or £3000 to £4000 more over the lifetime of the bull.

RANKING BULLS ACROSS BREEDS

Where bulls have beef ratings they can be ranked for performance across breeds. This permits the best or most suitable bull to be selected for use almost irrespective of breed. The 1996 Approved AI Beef Bull List (Department of Agriculture. Food and Forestry, 1996) contains 127 bulls of which 71 are approved for widespread use. All these have RBVs for growth rate, carcass conformation and carcass leanness and some have a feed efficiency rating. In addition they all have been surveyed for ease of calving.

TABLE 4.
Ranking (Angus=100) of beef breeds for growth rate, conformation and leanness.

	Angus	Hereford	Limousin	Simmental	Charolais	B.Blue	Piedmontese
Growth	100	104	105	108	111	109	102
Conformation	100	100	111	103	112	112	106
Leanness	100	96	119	119	124	132	141

TABLE 5.
Relative across - breed values (Angus = 100) for approved bulls of different breeds

Breed	Bull	Growth	Conformation	Leanness	% calving Difficulty	% calf Mortality
Angus	Mean	100	100	100	2.7+	2.0+
	RUH	108	97	93	2.1	0.7
	RHD	116	118	97	4.0	1.9
Hereford						
	LRA	105	94	98	2.7	2.0
	SDB	121	106	99	1.6	0.8
Limousin						
	FL10	104	115	120	4.0	2.2
	DWB	123	117	121	4.5	2.6
Simmental						
	HGO	110	100	121	7.5	2.6
	SUE	127	111	113	1.1	2.0
B.Blue						
	CRK	115	125	128	4.2	2.6
	IOS	119	105	136	4. 1	3.0
Charolais						
	BOA	115	102	128	2.2	2.9
	CF44	130	115	120	3.9	2.0

+Mean values for Angus bulls approved for widespread use (1996)

Using a combination of the Beef Progeny Test Data included in the Approved AI Beef Bull List, and the data from the Grange Beef Breed Evaluation Programme, an across-breed beef value (ABV) was calculated for all the AI bulls approved for widespread use in 1996. This was done using the Angus breed mean as the baseline (i.e. Angus breed mean = 100) for growth rate, carcass conformation and carcass leanness (Table 4). Feed efficiency was not included because only a small number of bulls have feed efficiency ratings. From this, together with the published within breed RBVs, ABVs were calculated. A sample of the values for the poorest and best growth rate bulls of each breed are shown in Table 5 and the results were expressed as the expected superiority/ inferiority (£ per head) of the male progeny (ideally it should be the mean of the male and female progeny) of a bull. A sample of these values relative to the breed mean for an Angus calf are shown in Table 6.

TABLE 6.
Value (£) of male calves+ from approved bulls relative to Angus breed mean.

Breed	Bull	Growth	Carcass	Calving	Total
Angus	Mean	0	0	0	0
	CUO	22.5	1.2	-0.3	23.4
	RHD	40.0	9.9	-1.1	48.8
Hereford					
	CWR	22.5	-0.5	0.6	22.6
	SDB	52.5	2.7	3.5	58.7
Limousin					
	FL10	10.0	13.5	-1.7	21.8
	PYR	55.0	18.5	2.4	75.9
Simmental					
	HGO	25.0	6.3	-6.6	24.7
	SUE	67.5	9.4	1.6	78.5
B.Blue					
	CRK	37.5	20.9	-3.3	55.1
	JAT	45.0	21.1	-4.8	61.3
Charolais					
	BOA	37.5	9.4	-2.2	44.7
	CF44	75.0	13.5	-1.2	87.3

+Value of females calves should also be considered

While recognising the greater suitability of certain breeds to certain production systems no account could be taken of this, and the bulls were compared directly on the basis of growth rate ABV. The range in ABV was as follows: Angus 108 to 116, Hereford 105 to 121, Limousin 104 to 123, Simmental 110 to 127, Belgian Blue 115 to 119 and Charolais 114 to 130. Of the total 71 bulls approved for widespread use in 1996, 19 had growth ABVs of 120 or greater (10 Charolais, 2 Hereford, 3 Limousin, 4 Simmental). Thus, about one-quarter of the AI bulls approved for widespread use were more than 20% superior in growth rate to the mean of the Angus breed.

Compared with the Angus breed mean, all bulls approved for widespread use increased male calf value for beef production. This increase ranged from £23 to £49 for Angus, £23 to £59 for Hereford, £22 to £76 for Limousin, £25 to £75 for Simmental, £55 to £61 for Belgian Blue, and £45 to £87 for Charolais sired calves. Calves from the best Angus bull were more valuable than those from the poorest bulls of all other breeds except the Belgian Blue. At the top of the scale the male calves from the best Charolais bull were about £10 more valuable than those from the best Simmental and Limousin bulls which were similar. These in turn were £15-£20 more valuable than the calves from the best Hereford and Belgian Blue bulls which in turn were about £10 more valuable than the calves from the best Angus bull. At the extremes the calves of the best bull (Charolais CF44) were worth about £65 per head more than those of the poorest bull (Angus CUO).

GENETIC MERIT OF SUCKLER COWS

Suckler cows should be of moderate size and should produce a calf of high weaning weight every year. Due to hybrid vigour, crossbred cows are superior to purebreds for suckling. Compared with purebreds, crossbreds have earlier puberty, better fertility, shorter calving interval, better calf survival and better calf growth rate. In a large scale US experiment (Cundiff, Gregory and Koch, 1982), crossbred (Hereford x Angus) cows were compared with purebred cows (Hereford and Angus) both rearing calves from the same sires. Weaning weight was 23 kg (15%) greater per cow exposed to breeding for the crossbred cows than for the purebreds. There were two components to this superiority. Two-thirds of it was due to an increase in the calf crop weaned reflecting better overall fertility in the crossbred cows. The remainder was an increase in weaning weight, reflecting higher milk production by the crossbred cows. This increased production from crossbreds over purebreds was due to heterosis or hybrid vigour. Increasing heterosis in the calf by using a sire of a third breed on crossbred cows further increases calf weaning weight. In the US study referred to above, the addition of the heterosis of the crossbred calves (8%) to that of the crossbred cows (15%) resulted in a 36 kg increase (23%) in the weight of calf weaned per cow of which about two thirds was due to the crossbred cows. Clearly, therefore, in suckled beef production the cow should be crossbred and the bull should be from a third breed.

Dairy cross cows

Certain beef x dairy cows are quite suitable as suckler dams because they are crossbred (heterosis), are of moderate size (low maintenance costs), and are good milkers (good calf growth rates). In terms of these criteria the more suitable beef x dairy suckler cow types are Angus x Friesian, Hereford x Friesian and Limousin x Friesian. Other continental x Friesians (e.g. Charolais x Friesians) are larger and have higher maintenance requirements. In the past, the most common suckler cow was the Hereford x Friesian. With the decline in the use of Hereford, and the increase in the use of continental breeds in dairy herds, Hereford x Friesian cows are now less readily available and the closest continental cross in size is the Limousin x Friesian. These two breed crosses were compared in an experiment at Grange.

TABLE 7.
Comparison of progeny Hereford x Friesian (HF) and Limousin x Friesian (LF) suckler cows.

	Males+		Females	
Weights (kg!	HF	LF	HF	LF
Birth	45	44	41	41
Weaning	329	338	288	292
Slaughter	610	620	545	547
Carcass	345	360	296	299
Kill-out (g/kg)	566	579	541	544
Carcass gain (g/d)	721	755	476	483
Conformation	3.8	3.7	3.2	3.2
Fatness	3.5	3.2	4.2	3.7

+ Reared as young bulls

Drennan, M.J. (personal communication)

Mean cow liveweight throughout the year was 16 kg (507 v. 523 kg) greater for the Limousin cross cows. There was very little difference between the two breed types in the performance of their female progeny (Table 7), but when the males were reared as young bulls where they had the opportunity to express their full growth potential, the Limousin cross progeny were 15 kg carcass weight heavier. This was mainly due to a better kill-out for the progeny of the Limousin cross cows rather than to a better growth rate. Carcass fat score was 0.3 (males) and 0.5 (females) lower for the Limousin crosses indicating that they could be taken to a greater weight than the Hereford crosses without becoming overfat. In summary, therefore, substituting a Limousin x Friesian for a Hereford x Friesian suckler cow would increase mean cow liveweight by about 3%. However, carcass output per cow would also be increased by about 3% at the same age and carcass quality would be better. The progeny of the Limousin cross cows could also be taken to a heavier weight, thereby further increasing carcass output per cow.

Sources of suckler herd replacements

The breeds of sire used on dairy cows are about 50% Friesians, 20% early maturing beef breeds, 10% Limousin and 20% other continental. Thus, the number of beef x dairy heifers suitable as suckler herd replacements (early maturing plus Limousin crosses) is about 150,000 in total. Inevitably, some of these are slaughtered as maiden heifers for beef so in practice not more than about 100,000 suckler herd replacements can come from the dairy herd annually. Since the suckler herd requires up to 200,000 replacements annually, at least half of these (100,000) must come from within the suckler herd itself. Indeed, to minimise disease risks and simplify management, many farmers prefer to replace from within, rather than buying-in. This raises the question of how replacement heifers with the desired attributes of heterosis, milkiness, and moderate size can be produced within a suckler herd where the main objective must be the production of high quality meat animals.

TABLE 8.
Comparison of dairy cross and upgraded continental suckler cows.

	Dairy cross+	Upgraded++
Cow liveweight (kg)	598	695
Calf birthweight (kg)	48.6	50.6
Milk yield (kg/day)	12.2	7.9
Calf growth rate (kg/day)	1.17	1.08

\+ Mix of Hereford x Friesian and Limousin x Friesians
++ Charolais Drennan, M.J. (personal communication)

Where an existing crossbred cow herd is being mated to a terminal sire of one of the large continental breeds (e.g. Charolais), retention of the heifer progeny for breeding will ultimately result over a few generations in cows which are almost pure bred and which are quite large. Such cows (upgraded Charolais) were compared with Hereford x Friesian cows in an experiment at Grange (Table 8). Mean cow liveweight was about 100 kg heavier for the upgraded Charolais but their milk yield was only two-thirds (7.9 vs. 12.2 kg/day) that of the dairy crosses. Consequently, their calf growth rate was lower (1.08 v. 1.17 kg/day) during the suckling period and weaning weight was 20 kg lower. Although not evident in this experiment, later puberty and lower fertility would also be expected in the upgraded Charolais cows. While the superior genetic potential of the upgraded Charolais progeny would manifest itself in a higher post weaning growth rate and superior carcass merit at slaughter, this may not be sufficient to compensate for the higher maintenance requirement and poorer fertility of the dams and the poorer pre-weaning growth rate of the calves.

Where replacements are kept from within the herd, ideally they should have the desired suckler cow attributes (heterosis, milk, moderate size). This could be achieved by criss-crossing two beef breeds one of which is of moderate size and one of which has reasonable milking ability. Two such breeds are the Limousin (moderate size) and the Simmental (milkiness). Then, any of the other large breeds (Charolais, Belgian Blue, Blonde d'Aquitaine) can be used as a terminal sire thus maximising heterosis in the calf and ensuring good calf growth rates both before and after weaning, and good carcass quality.

Where the existing herd is beef x Friesian, replacements could be produced by using a Limousin AI bull on 40%-50% of the cows. In genotype, the resultant progeny would be 50% Limousin, 25% beef and 25% Friesian (the 25% beef could also be Limousin giving 75% Limousin). Such animals would maintain heterosis for reproductive traits and milking ability and would still be of moderate size. To produce the next generation of replacements, these would be crossed with a Simmental AI bull giving heifers which would be 50% Simmental and 50% other. These in turn would be crossed with Limousin and so the genotype of the herd would fluctuate between about two-thirds Simmental plus one-third Limousin and two-thirds Limousin plus one-third Simmental.

Where AI cannot be used, an effort should still be made to maintain heterosis in the suckler cow herd. This could be achieved by rotational use of a different breed of bull every few years when the bull is replaced. Unfortunately, this involves some compromises in both cow and progeny potential but judicious selection of the breed mix should ensure good overall herd performance .

In summary, using replacements from the dairy herd permits the use of the best beef bulls on all the suckler herd thereby maximising the value of the calves or beef produced. However, the dairy herd can provide only about half of the replacements required by the suckler herd, so producers must provide up to half of their own replacements. Suitable replacements can be produced by a strategic cross breeding programme based on the use of selected AI sires from the appropriate breeds on 40-50% of the herd. Alternatively, where AI cannot be used, heterosis can be maintained by rotational use of a different breed each time the bull is replaced.

CONCLUSIONS AND RECOMMENDATIONS

1. The National Cattle Breeding Authority should be established and functioning as quickly as possible. On-farm recording followed by performance and progeny testing of the commercially important beef breeds should be expanded in a rigidly integrated breeding programme. Superior bulls must be used to produce the next generation of breeding stock and inferior bulls must not be used for breeding.

2. Because of the small pedigree herd size and the lack of genetic linkages between herds, it will not be possible to produce EBVs for all pedigree bulls. Nevertheless provided the level of accuracy is reasonable, EBVs should be produced for as many pedigree bulls as possible. This would facilitate producers who are not using AI to identify and purchase genetically superior bulls. As is currently the case in Britain, EBVs would increasingly determine the price of pedigree bulls which in turn would lead to breeding programmes in pedigree herds designed to improve EBVs. Thus the generation of EBVs would itself act as a catalyst for increased genetic progress.

3. Every effort must be made to ensure that the current and future cattle identification systems are used in such a way as to contribute to genetic progress. With accurate and reliable records, at least a proportion of commercial animals could contribute genetic information. A huge source of potential genetic improvement will be wasted if the data from commercial cattle cannot be used.

4. The international trade in semen (and also in embryos and breeding stock) has contributed enormously to the genetic improvement of dairy cattle, particularly in Ireland. While similar progress is not possible in beef (because of the multiplicity of breeds, absence of genetic linkages between countries etc.), nevertheless the Irish beef industry would benefit greatly if it could avail of semen from the genetically superior animals being identified through much larger and more sophisticated breeding programmes abroad. This would require the testing of bulls in a number of different countries using internationally agreed and uniform evaluation criteria. From this conversion formula could be derived which would allow the conversion of breed-

ing values from one country to another. This would permit objective comparisons of bull ratings across countries.

5. There are large genetic differences both between and within breeds. The between breed differences have been widely recognised and exploited by producers but the within breed differences have not. This should be the next area of progress. Genetically superior bulls of all breeds are available through AI and it will be possible to identify genetically superior bulls for natural service when EBVs are produced. Producers must become more aware of the genetic differences between animals and ways must be sought of passing on the information on genetic merit from calf to weanling to store to finishing producer. This would facilitate pricing on the basis of genetic merit.
6. There should be a definite replacement policy in suckler herds. Replacements may come from outside the herd as beef x dairy heifers or as specially bred beef x beef heifers. Where replacements are produced within the herd they should have heterosis, good milking ability and be of moderate size. This can be achieved by criss-crossing 40%-50% of the herd with selected AI bulls of appropriate breeds. The remainder of the herd should be bred to a terminal sire breed to maximise beef output and carcass quality. Where AI cannot be used rotating the breed of bull can go some way towards ensuring heterosis and some other desirable attributes in the replacement heifers.

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Developments in the Australian Beef Industry

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1. Introduction

The Australian red meat industry commenced in January 1788, when the two Africander bulls, six cows and 44 fat-tailed sheep imported from the Cape of Good Hope by Governor Phillip arrived in Sydney. History records that five months after the landing, only one sheep was alive and all of the cattle had strayed when their convict keeper fell asleep! Surprisingly the lost cattle were recovered seven years later, when it was found that they had multiplied to a herd of 60.

From this very modest beginning, livestock numbers in Australia have increased to 26.2 million cattle, including 2.8 million dairy cattle, and 121 million sheep, producing beef and sheep meat worth almost $5 billion annually. (In August 1996, an Australian dollar was equivalent to 0.49 Irish punts). Beef exports alone are worth $2.85 billion per year. Although not the largest producer, Australia is now the largest net exporter of beef in the world and the second largest exporter of sheep meat.

Sheep in Australia are kept primarily for wool production, and of the 730,000 tonnes of wool (greasy) produced annually, 65% is exported for a return of some $4 billion. Sheep numbers are currently the lowest for almost 50 years because of the depressed world wool market. The prime lamb industry is virtually a 'by-product' of the wool industry, and is based on 'first-cross' ewes (Border Leicester x Merino) mated to a terminal sire breed, usually Dorset or Poll Dorset. In 1995, lamb and mutton production in Australia was valued at $833 million.

Table 1:
Australian Meat Production and Exports, 1995 (AMLC). (Thousand tonnes carcase weight)

	Production	Exports
Beef and Veal	1719.5	1104.6
Mutton	292.2	209.6
Lamb	255.1	55.1

Australia is a large country with a land area similar to that of north America, but vast areas of the continent are unproductive due to inadequate rainfall or low soil fertility. Livestock are produced in production environments ranging from the tropical summer rainfall areas of northern Australia to the temperate, winter rainfall zone of southern Australia. Livestock producers receive no government subsidies, and must contend with the effects of climatic and environmental extremes. Various forms of government assistance in times of drought, bushfire and flood are rapidly being phased out

With a population of only 19 million people, Australia is heavily dependant on exports, and livestock producers are also exposed to the vagaries of world markets. The beef industry is currently suffering a serious downturn due to depressed prices on the Japanese market. This has occurred primarily in response to massive over-production in the United States, resulting in intense competition with Australia for market share. Problems have been exacerbated by the strength of the $A, high grain prices in Australia and reduced beef consumption generally associated with the British 'mad cow disease' scare.

Almost half of the national cattle herd, but very few sheep, are now run in the tropical and subtropical regions of northern Australia. Over the past 20 years, Bos indicus breeds of cattle have largely replaced British breeds in these regions because of their heat tolerance, tick resistance and capacity to utilise low quality roughage. The beef industry in northern Australia is characterised by large herds (1,000 breeding cows is considered necessary for a viable family operation) extensively managed on very large properties (2,000 to 100,000 ha or more, depending on location). Historically these herds have produced large quantities of low grade manufacturing beef for the American Hamburger trade. Over the past decade however, both herd productivity and product quality has been increased significantly as the result of improved breeding and management, and improved pastures.

With a temperate climate and more reliable rainfall, conditions in southern Australia are more favourable for high quality pasture production, and livestock are managed more intensively on smaller properties (around 500 ha). Beef cattle are usually run as a sideline to a sheep or cropping enterprise, and the average herd size is about 134 head. British and European beef breeds and their crosses predominate, and are used to produce high quality pasture fed beef and as a source of feeder cattle for feedlots throughout Australia. Perennial ryegrass and white clover pastures are grown in the higher rainfall areas, but much of southern Australia has been sown to phalaris, cocksfoot and subterranean clover. Pasture productivity is currently well below potential.

As the production environment and nature of the beef industry in northern Australia bears little resemblance to that in southern Australia, and is far less relevant to the situation in Ireland, most of the technical information presented in this paper relates to the beef industry in southern Australia.

2. Structure of the Australian Beef Industry

Planning, Policy Setting and Industry Development

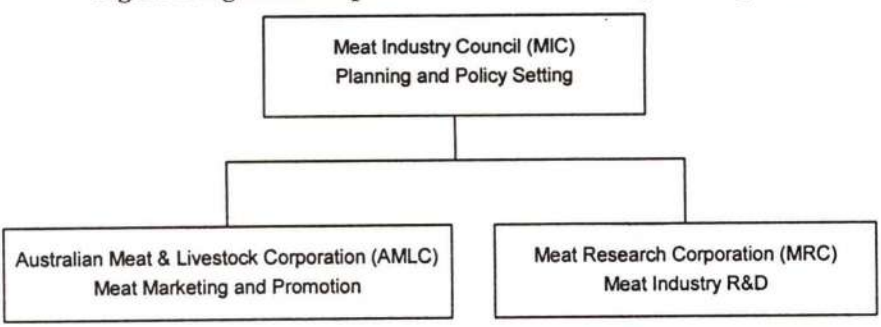
The Commonwealth Government's Meat and Livestock Industry Act (1995) established the Australian Meat Industry Council (MIC) to:

- develop the vision and strategic direction for the industry
- formulate broad industry policy (particularly across sectors)
- approve strategic plans for meat marketing, promotion and R&D
- set the funding levels for industry activity

• evaluate the performance of industry
• develop directions for industry self regulation
• resolve issues which run across industry sectors

The MIC board is comprised of 17 members representing all major sectors of the industry, including cattle and sheep producers, feedlotters, export and domestic abattoir operators, retailers (butchers and supermarkets), the federal government and the meat industry employees union. A 'Meat Industry Strategic Plan' developed by the MIC earlier this year will be implemented mainly through the activities of the Australian Meat and Livestock Corporation (AMLC) and the Meat Research Corporation (MRC). The AMLC is responsible for the marketing and promotion of meat both on the domestic and export markets, and the MRC establishes priorities and manages the funding of research and development (R&D). The MRC is currently finalising its Corporate Plan comprised of 17 'Key programs' designed to address the issues identified in the Meat Industry Strategic Plan.

Figure 1: Agencies Responsible for Meat Industry Development.



Meat industry R&D in Australia is funded by levies on livestock producers and meat processors, matched by an equal contribution from the Commonwealth Government. Last year the MRC managed a budget of some $51 million.

Over the past decade, a more systematic and thorough approach to planning R&D has been adopted by the meat industry. In 1986 the MRC implemented the first of a series of 'Five Year Plans' designed to maximise returns to the industry investment in R&D. Prior to the completion of the first plan, a comprehensive 'Research and Development Investment Study' was conducted as the basis for the second 'Five Year Plan', which commenced in 1991. An on-going industry auditing process is now being considered as a means of benchmarking progress and identifying industry strengths, weaknesses and opportunities.

All levy payers now have an opportunity to contribute to industry planning and the identification of R&D priorities through the various organisations represented on the MIC board, and through MRC advisory committees. The MIC and the MRC use a range of techniques to assess opportunities and industry R&D needs. Consultants and market analysts are engaged to conduct international benchmarking studies and to collect and analyse data from around the world. Staff are sent overseas on 'fact finding missions' and to identify new technology which may have application in Australia. Extensive consultation with industry occurs at a variety of levels, from the 'Annual General Meeting' through to workshops and seminars on specific subjects and invited submissions. All new R&D project proposals are subjected to a rigorous benefit-cost analysis and scrutiny by industry through 'Technology Transfer Advisory Groups', prior to funding.

In the past, the MRC has invited research organisations to submit R&D proposals for their consideration on an annual basis, and a significant proportion of the total MRC budget has been allocated to these submitted projects. Although this practice continues, the emphasis now is on commissioned R&D that addresses industry priorities identified in the strategic plan. This year for example, only 2% of the budget ($ 1 million) will be available for submitted projects.

Production Sector

Most beef in Australia is produced from cows kept exclusively for beef production. The majority of the calves born to the nation's 2.8 million dairy cows, that are surplus to dairy industry requirements, are slaughtered for veal production at less than 2 weeks of age. A very small 'pink veal' production system in which dairy/beef calves are artificially reared and lot fed for 20 weeks before slaughter and export to Europe, is struggling to become established in the face of high production costs.

Australia has vast tracts of land suitable only for grazing, and the meat industry has therefore always been pasture based. In southern Australia, the cost of pasture dry matter production is in the vicinity of $25/tonne, whereas in recent years, the cost of feedlot rations has varied from $130 to $220/tonne of dry matter.

Despite this, Australia has had a small feedlot industry since the late 1960s, located mainly in northern Australia. In response to the increased demand for grain-fed beef since the liberalisation of the Japanese market in 1988, the industry has grown rapidly to the current capacity of 825,000 head. Last year, 82% of cattle in feedlots were fed for the Japanese or other export markets, but the demand for grain-fed beef on the domestic market, particularly for use by the hotel restaurant trade, is also expected to grow.

In formulating feedlot rations, the aim is to maximise feed intake and liveweight gains, and to minimise health problems and digestive upsets, at the least possible cost. Key ingredients are:

• Roughage or fibre, which is required to maintain normal rumen function. This requirement conflicts with the need to maximise the grain component of the diet to achieve high growth potential, but the risk of acidosis and severe digestive upsets is greatly increased when the proportion of roughage in the diet is less than 20%.

• Energy, which determines growth rate. For rapid growth, steers under 12 months of age need a ration containing 12 megajoules (MJ) of metabolisable energy (ME) per kilogram of dry matter, and yearling cattle need 11 MJ/kg.

• Protein is essential for growth, and to maintain health and appetite. Young cattle need more protein than older cattle, and feedlot rations contain 11 to 15% crude protein, depending on the age and weight of cattle being fed.

• Minerals are required to maintain feed intake, health and feed conversion efficiency. The ratio of calcium to phosphorous is particularly important for feedlot cattle, as grain contains high levels of phosphorous but low levels of calcium. Extra calcium is therefore included by adding agricultural limestone to the ration at the rate of 1%. Depending on the amount of protein in the diet, extra sulphur may also be required, and salt is normally included at the rate of 0.5 to 1% to provide sodium, stimulate appetites and reduce urinary problems.

• Trace minerals are necessary for enzyme function, protein transport, blood composition and for the action of rumen microbes and vitamin synthesis. These are normally provided by using commercially available 'premix'.

• Vitamins are also essential to maintain the health of feedlot cattle, which have a daily requirement for the three fat soluble vitamins A, D and E. These are also provided in a commercial 'premix'.

Feedlot rations in northern Australia are based on sorghum, barley, maize (silage and grain), cottonseed meal and lupins, whereas in southern Australia, wheat, barley, triticale, lupins and peas are the main ingredients. Rations are commonly comprised of up to 80% processed grain, 15 to 20% roughage and a 'premix' of minerals, vitamins and ionophores and buffers to reduce the risk of acidosis. The feedlot industry currently competes with the milling and brewing industries for wheat and barley and there is considerable interest in the establishment of a stock feed industry based on new high yielding varieties of red wheat.

Because of their superior carcase characteristics and greater propensity to produce marbled meat, the feedlot industry has a clear preference for British beef breeds (particularly Angus and Shorthorn) and Murray Greys (a composite breed developed in Australia from Angus and white Shorthorns) in meeting the stringent quality requirements of the Japanese grain fed beef market. The potential to increase growth rate and carcase yield by using European breeds is now widely recognised however, and European by British cross-bred cattle are commonly fed for markets where marbling is not required (such as the domestic and Korean markets).

In southern Australia, beef calves are typically weaned at 8-11 months of age and 240 to 300 kg liveweight. Depending mainly on breed, fatness and seasonal and marketing conditions, these calves may then be:

- slaughtered immediately for the domestic supermarket trade
- transferred to a feedlot and fed for the domestic market
- grown out and finished at heavier weights on pasture for either domestic or export markets

• grown out at pasture to a heavier feedlot entry weight (typically 450-500 kg) prior to feeding for export markets.

Approximately 60% of slaughter cattle in southern Australia are still sold through saleyards, normally by liveweight auction after pre-sale weighing. Saleyard throughputs are declining however, in favour of modern, more objective direct marketing systems, including various forms of 'over the hooks' selling. This trend is expected to continue as more producers recognise the potential to improve their returns by breeding and managing cattle to accurately meet market specifications, and then using marketing systems in which price is determined by objective assessment of carcase weight and quality.

A similar trend is evident in the marketing of store cattle and feeder steers. At present, over half of these cattle are sold by auction through saleyards, and the majority are not weighed but simply sold on a per head basis. However, changes to store cattle marketing are being driven by feedlot managers, who are now well aware of very large differences in performance between lines of cattle from different properties. Feedlots are now showing a clear preference for purchasing cattle direct from farms, and particularly from producers who are able to supply reliable information about the genetic potential and health of their cattle.

The declining role of saleyards in the marketing of both slaughter and store cattle is also related to the higher cost of saleyard selling, the stress associated with the extra transport and handling of stock through saleyards, and the inability of saleyards to provide 'feedback' to producers on the true quality of their cattle.

Farmers throughout Australia face rising costs, record levels of farm debt and declining terms of trade. Last year and before the current downturn, the Australian Bureau of Agricultural Resource Economics reported that over the 3 years to 1995, 71% of beef enterprises in Australia were not profitable. Other studies have demonstrated enormous differences in profitability between beef herds operating in similar production environments (-$29 to $296 per hectare in southern Australia), with larger herds and improved management practices being associated with greater profitability. There is evidence to suggest that herds of less than 200 cows are no longer viable in southern Australia. Large numbers of producers have left the industry in recent years, and many of those remaining now rely on off farm income to survive. Further 'rural adjustment' is inevitable.

In southern Australia, 'livestock equivalent' systems are used to compare the feed requirements of different classes of stock, and livestock enterprises in different production environments. The 'Dry Sheep Equivalent' (DSE) system is widely accepted, where a 'dry sheep' is a non-pregnant and nonlactating two year old sheep weighing 45 kg and maintaining its present weight. Thus for example, a dry cow weighing 500 kg is rated at 7 DSE, while the same cow lactating and with a 3 month old calf at foot is rated at 15 DSE. Average beef cattle production costs per DSE in southern Australia are shown in Table 2, and average prices received for cattle and gross margins are shown in Table 3.

Processing and Wholesale Sector

There are 111 export abattoirs in Australia, and approximately 140 abattoirs producing solely for the domestic market (domestic abattoirs).

The export processing sector throughout Australia is regulated by the Australian Quarantine and Inspection Service (AQIS)7 which is responsible for monitoring food safety and hygiene standards. AUS-MEAT, the national authority for the uniform specification of meat, carcases and livestock, sets standards for and monitors product description in export (compulsory) and domestic (voluntary) abattoirs. Abattoirs slaughtering beef cattle for export are required to meet different standards, depending on the country of destination, in terms of plant, equipment and management practices in order to maintain their export registration. Export abattoirs normally operate as exporters, and as such, must obtain licences and entitlements from the AMLC for export to

Table 2:
Beef Cattle Enterprise Costs per DSE in Southern Australia, 1995
(Monitor Farm Study)

	Average ($)	Highest ($)	Lowest ($)
Animal health	0.70	2.63	0
Contract services	0.10	0.60	0
Supplementary feed and agistment	6.92	14.28	0.31
Pasture costs	1.88	2.61	0
Freight and cartage	0.15	0.45	0
Casual labour	0.02	0.22	0
Sundries	0.08	0.48	0
Total excluding selling costs	9.85	17.64	1.66
Selling costs	0.86	2.26	0
Total including selling	10.71	19.47	2.53

Table 3:
Beef Cattle Prices and Gross Margins in Southern Australia, 1995
(Monitor Farm Study)

	Average ($)	Highest ($)	Lowest ($)
Young Cattle prices#			
cents/kg carcase weight	237.4	248.6	214
$/head	427	498	342
Cull cow prices+			
cents/kg carcase weight	186.3	191	179.5
$/head	428	497	361
Stocking Rate (DSE/ha)	11.2	20.9	3.7
Gross Margin			
per DSE	$7.25	$16.55	$-2.04
per hectare	$83	$296	$-29

Young cattle under 200kg hot standard carcase weight
+ Cows 201-260kg hot standard carcase weight

different overseas markets. Most export abattoirs also supply meat to the domestic market. Domestic abattoirs are regulated by State Meat Authorities, and may on a voluntary basis become accredited under AUS-MEAT.

All export and some domestic abattoirs incorporate their own boning rooms. In recent years, with the rapid expansion of the hospitality and food service industry and the decline in the number of butcher shops, there has been a move towards centralised boning. The number of independent boning rooms has also increased.

International benchmarking studies have demonstrated that processing costs in Australia are considerably higher, and in some cases, almost double that of our major competitors (notably the United States and New Zealand). Australia has surplus processing capacity with many out-dated and inefficient plants still in operation and there is little doubt that failure to invest in modern plant and equipment is a contributing factor. Similarly the high cost of the on-line inspection service contributes to higher processing costs. The efficiency of abattoir management is often questioned, but high labour costs and poor industrial relations has long been a serious issue. Most abattoirs, under pressure from the Australian meat workers union, still work under a 'tally' system, which effectively means that they only operate for a few hours each day. By contrast, abattoirs in the United States and New Zealand are commonly working two shifts, enabling far more effective use of plant and equipment.

Replacement of the on-line inspection service provided by AQIS with a system of industry self regulation based on 'Hazard Analysis and Critical Control Point' (HACCP) and quality assurance principles is seen as an important mechanism for reducing the cost of processing meat in the future.

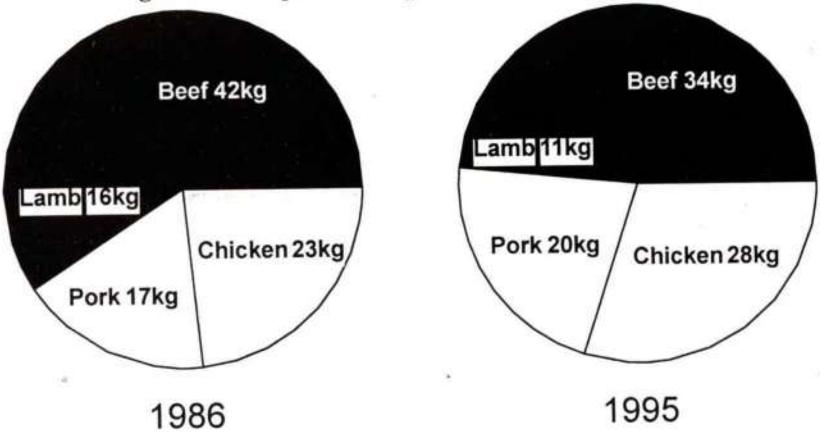
Australian meat processors have also recognised the need to adopt brand name marketing, and many are now working to establish their own brands on both domestic and export markets. Product brands are a particularly important component of marketing strategies in Japan, and individual meat company brands are being used in conjunction with the already well accepted generic 'Aussie Beef' brand.

Retail Sector

In the past, red meat in Australia has been sold mainly through an extensive network of butcher shops, but in recent years, the proportion of meat sold through supermarkets has increased to 37% nationally (up to 70% in some States). Community pressure for extended trading hours and the convenience of 'one stop shopping' at supermarkets has forced the closure of many butcher shops, and this trend is expected to continue. The reluctance of many butchers to adapt to changing consumer requirements has possibly also contributed to the demise of some butcher shops.

As indicated in Figure 2, the per capita consumption of red meat in Australia has also declined over the past decade, in favour of pork and chicken. Concerns about the relationship between saturated fat intake and heart disease have been

Figure 2: Per capita consumption of meat in Australia (kg)



partly responsible, and the industry has attempted to counter this by actively promoting the virtues of lean red meat as a healthy source of highly digestible protein and iron. The increased demand for 'convenience' foods and variability in the eating quality of beef are also likely to be contributing factors.

As in other developed countries, the changing lifestyle in Australia has also contributed to the decline in red meat consumption, with important implications for meat retailers. With almost 70% of Australian women now in the workforce, and 58% of two parent families having both parents working, there has been a growing preference for meals involving little or no preparation. Money spent on 'dining out or fast food' has increased from 22% to 33% of total food expenditure over the past decade. Relative to other food industries, the red meat industry has been slow to adapt to the increased demand for 'oven ready' and takeaway food.

3. Markets for Australian Beef

Last year, 64.2% of total Australian beef and veal production was exported, and the major destinations are indicated in Figure 3. Exports to the EU accounted for less than 1% of total production.

Each market requires quite different types of beef, and for each market destination, a range of specifications are required to meet the needs of different segments of that market. Thus the domestic market, for example, has three main sets of specifications reflecting the needs of the local butcher trade, the supermarkets and the 'hotel-restaurant' trade. Similarly, the Japanese market has at least 8 sets of specifications for grain and pasture fed beef.

Market specifications are expressed primarily in terms of carcase weight and fat depth at the P8 (rump) site, but for most markets, butt shape, fat colour, meat colour, and dentition specifications must also be met. Specifications for the very high quality Japanese grain fed beef market also include marbling scores and minimum periods of feeding a ration comprised of at least 70% grain.

Figure 3: Destination of Australian beef and veal production by volume, 1995

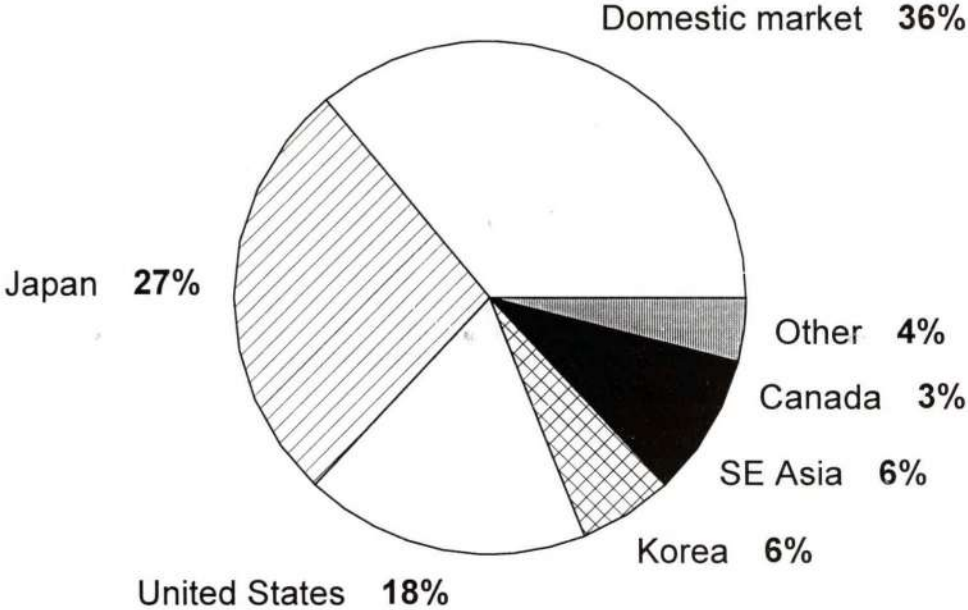


Table 4:
Basic Specifications for the Major Markets for Australian Beef.

DOMESTIC						
Butcher	140-180	4-8	0-3	1A- 1C	steer/heifer	0
Supermarket	180-240	5-9	0-3	1A-2	steer/heifer	0
Hotel/Restaurant	220-300	7-14	0-4	Fig. 1B-3	steer/heifer	0-4
EXPORT						
Japan						
Grain fed	320-400	8-26	0-2	Fig. 1B-4	steers	0-6
Pastured fed	300-400	7-25	0-5	Fig. 1B-4	steers	0-6
Korea						
Grain fed	220-340	13mm	0-5	Fig. lB-5	steers	0-6
(average over carcase)						
Pasture fed	180-280	5-12	0-5	Fig. 1B-5	steer/heifer	0-6

1. HSCW = hot standard carcase weight
2. Fat Colour is assessed on a scale of 0 (white) to 9 (yellow)
3. Meat Colour is assessed on a scale of 1 (pink) to 7 (very dark)
4. Animals showing secondary sex characteristics are not acceptable
5. Dentition (number of permanent incisor teeth)

Note that all markets have a requirement for a butt shape of C or better, on a scale of A (extremely heavy muscling) to E (very poorly muscled).

The Japanese grain fed market also specifies a marbling score of 2 to 3, on a scale of 0 (no marbling) to 6 (very heavy marbling).

The United States and Canada purchase predominantly low grade manufacturing beef from Australia, for which the only specifications are for a high percentage (90% or more) of chemical lean. General specifications for other important markets are indicated in Table 4.

Australia also has a small, but rapidly growing, live cattle trade. Last year, 510,000 head of cattle were exported, mainly to South East Asian feedlots. Australia competes with Ireland for a share of the Egyptian live cattle market; almost 20,000 head were shipped to that market from Australia in 1995.

Asian markets for both beef and live cattle are forecast to continue expansion to the year 2000, but Australian exports are expected to be restricted by intense competition from the United States in particular. Cuts to EU subsidies and the 'foot and mouth disease' status of South American countries are also likely to impact on the future level of Australian exports.

Specifications for the various beef markets are ultimately determined by the end user. Thus, for example, supermarkets in Australia engage market analysts to survey customers and to carefully monitor changes in consumer requirements. As a result, carcase weight specifications for supermarket trade cattle have increased from a maximum of 180 kg to 240 kg, and fat depth specifications have been reduced by at least 30% over the past 15 years.

4. Developments Over the Past Decade

The opening up of the Japanese beef market in 1988 was the catalyst for significant development within the Australian beef industry. Until that time, the United States market for predominantly low grade manufacturing beef was the principal destination for Australian beef exports. By contrast, the Japanese and other Asian beef markets require a very large volume of high quality grain and pasture-fed beef, and this has provided the incentive for industry to improve product quality and competitiveness. On-going financial pressure to increase farm productivity and community concerns about food safety, animal welfare and protection of the environment have also stimulated considerable change. As a consequence of these developments over the past decade, the Australian meat industry has commenced the transition from a commodity based industry to a customer orientated, sophisticated and highly competitive food industry. Much remains to be achieved, but a start has been made.

Feedlot Industry

Investment in the rapid expansion of the feedlot industry has probably been the most tangible consequence of the liberalisation of the Japanese market. Between 1988 and 1994, the industry grew at a rate of approximately 15% per year, and current Australian feedlot capacity is 825,000 head in feedlots ranging in size from 50 to 50,000 head. With high grain prices and depressed returns from beef in 1996, feedlot utilisation has fallen to 56% of capacity. There has also been a recent shift in focus from the Japanese market to the domestic market, where grain feeding is seen by some processors as a solution to problems with continuity of supply of consistently high quality beef.

National Product Description and Trading Language

The establishment of AUS-MEAT in 1987 is widely regarded as one of the most important initiatives in the history of the Australian meat industry. AUS-MEAT, the authority for the uniform specification of meat and livestock, was introduced to develop a national language for the description of livestock, carcases and meat, and to facilitate improved communication up and down the entire marketing chain. The two way flow of information between livestock producers and agents, processors, wholesalers, retailers and consumers is a central theme. Use of the AUS-MEAT language is compulsory in export but not domestic abattoirs. Although it was seen as the imposition of additional costs and was resisted by industry at first, it is now more widely accepted as being a key element in better marketing.

Since its inception, the AUS-MEAT language has evolved as new technology became available. In 1991 for example, the new 'chiller assessment' system was introduced for the assessment of marbling, meat colour, fat colour, the measurement of eye muscle area and rib fat depth and the estimation of lean meat yield. Evidence for the value of measuring pH as means of identifying unacceptably tough meat is becoming available, and it is likely that this too will become part of the AUS-MEAT language. Similarly, recent research in which video imaging technology has been successfully used for the rapid assessment of carcase quality and yield could result in the further refinement of the AUS-MEAT language.

The AUS-MEAT language is a description system, not a grading system. Australia does not have a grading system as such, although the matter is currently the subject of intense debate and two grading systems are under development by different industry groups. Until now, industry policy has been to encourage individual meat companies to use the AUS-MEAT language as the basis for their own product brands. However the alternate view, that consumers need a simple, uniform grading system to assist them with purchasing decisions, now seems likely to prevail.

Livestock and Meat Marketing

Consumers on both domestic and export markets have become more demanding in terms of meat quality requirements, and as a result, more stringent carcase specifications have been imposed. A major problem facing the Australian meat industry however is that there has been no effective mechanism for communicating these specifications to producers. As a result, the industry has not been successful in consistently meeting customer expectations. The AUS-MEAT language was introduced to help resolve this, but the fundamental problem has been the manner in which livestock are traded.

Detailed information on the requirements of different markets and livestock and meat prices both in Australia and overseas is readily available to producers and people servicing the meat industry in a plethora of AMLC publications. However, producers respond to clear 'price signals', not marketing publications, and these signals have not been a feature of the dominant marketing systems used in the past.

The majority of slaughter cattle in southern Australia have been sold by liveweight auction, where an average price (cents/kg liveweight) is paid for each 'lot' or group of animals. Although livestock agents draft animals on the basis of similar weight and body condition, there is no attempt to identify superior animals and price them accordingly. Vendors receive no information about their cattle other than the average liveweight and the average price. Having received no clear 'price signals' from the market, producers are unable to respond by altering their breeding or management systems.

To address this problem, the industry is steadily moving to adopt various 'value based trading' systems. Key elements of these systems are objective measurement of carcase weight, quality and sometimes yield, price related to this objective assessment and the feedback of information to the producer.

'Computer Aided Livestock Marketing' (CALM) was released to the meat industry in 1987 and incorporates the principles of value based trading. In this system, livestock for sale are assessed on farm by an accredited CALM assessor, who prepares a detailed description of the livestock and makes this available to potential buyers on the CALM computer network. During the designated sale period each week, registered CALM buyers throughout Australia can then participate in a computer auction', using their own personal computers to bid on the various lots on the basis of the description provided. Vendors receive feedback on actual carcase quality after their stock are slaughtered. CALM now accounts for around 15% of sheep and 3% of cattle sold in Australia.

Other value based trading systems usually take the form of an 'over the hooks' transaction, with price determined according to a 'quality grid', such as the example provided in Figure 4. This grid provides the premiums and discounts in cents per kg for Yearling (0 dentition) male or female cattle. The base price is represented in the grid as a zero; this is adjusted weekly and is readily available from the abattoir. Conditions of sale specifying acceptable breed types and trading terms accompany the quality grid.

Figure 4:
A Quality Grid Currently Used in Southern Australia.

HSCW (Kg)	FAT CLASS (mm)						
	0-2	3-5	6-10	11-12	13-15	16-17	18-27
16--170	20	-15	-10	-10	-15	-20	-40
170.1-180	-15	-10	0	0	-10	-15	-40
180.1-200	-10	-5	+5	+5	-5	-10	-40
200.1-220	-10	-5	+5	+5	-5	-10	-40
220.1-230	-15	-10	0	0	-10	-15	-40
230.1-240	-20	-15	-10	-10	-15	-20	-40
240+	-25	-20	-15	-15	-20	-25	-40

ButtShape	A	B	C	D
	+5	+5	0	-15
Meat Colour	1A	1B	1C	2 Plus
	+5	+5	0	0

In the southern Australian environment where approximately 75% of total annual pasture dry matter production occurs in the 3 spring months, continuity of supply of pasture-fed beef and lamb has always been a problem. To encourage out of season production, over the past 3 years processors have offered forward contracts to producers for the delivery of both beef and lamb to specification, during months of under supply. These contracts enable producers to 'lock in' to a satisfactory price some months in advance of delivery, giving them the confidence to incur the additional expense of 'out of season' feeding systems. Forward contracts also provide a means through which processors can accurately communicate their requirements to producers. Early experience with forward contracts has been extremely positive.

As a further means of improving the level of communication and building trust between the various sectors of the meat industry, the concept of 'strategic alliances' is now starting to be taken up. The 'Festival Alliance' established in southern Australia earlier this year is an example. In this alliance, 8 producer groups are supplying beef and lamb to specification to 4 domestic abattoirs, who are now supplying branded beef and lamb carcases to the 'Festival' chain of supermarkets, comprised of some 82 retail outlets. Customers are being offered a '200% guarantee' (product exchanged and money refunded if they are not satisfied), and they are being actively encouraged to provide feedback on the product. Retailers provide regular feedback to processors on the extent of compliance with carcase specifications. Processors purchase livestock over a quality grid, and producers receive detailed information about the quality and price of their livestock. Forward contracts with a choice of 4 pricing options are being offered to producers. In return for their commitment to the alliance, producers able to consistently meet specifications have 'preferred supplier' status, and receive preferential treatment when livestock are over supplied.

The ultimate objective is to develop marketing systems in which price is directly related to saleable meat yield and the eating quality of meat, of which in Australia, tenderness is by far the most important component. Recent research on the use of video image analysis to predict the carcase yield has been extremely promising, but the accurate prediction of tenderness remains elusive. Extensive research on the development of a 'tender tech' probe to measure tenderness on the kill floor has now been abandoned.

Consumer Perceptions of Meat Quality

The meat industry is confronted with two major challenges in this area.

The first is that the type of uncooked meat that consumers select is quite different to the type of meat they prefer to eat. In response to messages from health professionals about the potentially harmful effect of saturated fat intake, consumers generally prefer to purchase very lean cuts of meat with no visible marbling. Numerous studies have shown however that these same consumers prefer to eat meat from fatter animals, and with at least moderate levels of marbling.

The second issue is that although consumers prefer to eat beef over alternative meat products, they do not regard it as being reliable in terms of consistency of eating quality. By contrast, chicken does have a reputation for being reliable, and is often selected by consumers who would otherwise prefer to eat beef. Overcoming the unacceptable variation in product quality for both domestic and export markets will be the subject of a considerable research effort in future years.

Breeding and Genetics

A recently completed study of the performance of steers fed for the Japanese grain-fed beef market has concluded that a sustained and co-ordinated approach to improving feeder steer genetics is needed in Australia. Almost 5000 steers produced from 371 beef sires of 6 breeds and breed crosses were evaluated in terms of feedlot growth, carcase quality and yield. Significant breed differences were found in all traits, but breed alone was no guarantee of performance. Within breeds, the difference in commercial performance between the top and bottom 5% of individual steers, vendor lines and sire progeny groups was \$270, \$130 and \$120 respectively when fed for 200 days.

Breedplan, a world class genetic evaluation system based on 'Best Linear Unbiased Prediction' (BLUP) technology, was released to the industry in 1985 and is now the main avenue for the genetic improvement of beef cattle in Australia and New Zealand. Since its introduction, Breedplan has been expanded to include the 'estimated breeding values' shown in Table 5.

Table 5:
Breedplan Estimated Breeding Values

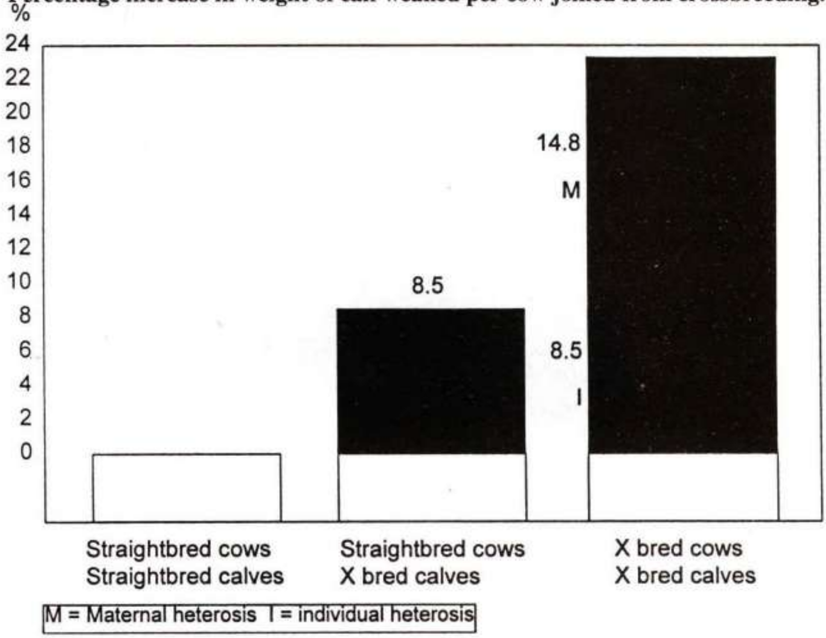
Weight	Fertility	Carcase
Birth weight (optional)	Scrotal size	Eye muscle area
200-day milk	Days to calving	Fat thickness
200-day growth	Gestation length	
400-day weight	Calving ease	
600-day weight 14		

After a relatively slow start due mainly to resistance to change within the stud cattle industry, Breedplan is now being used and actively promoted by 13 breed societies. Largely as a result of pressure from commercial beef producers wanting reliable information on sale bulls, some 1,500 mainly seedstock producing herds are now registered with Breedplan. A recent evaluation has found that herds using Breedplan technology are producing calves up to 10% heavier at the same age than they were before implementing the genetic improvement program, giving a benefit-cost ratio of 15: 1 .

The potential to increase productivity through the use of crossbred females (Figure 5) has been well known for over 20 years, but prejudice against crossbred cattle and concern about the complexity of crossbreeding programs has inhibited the rate of adoption of this technology.

Figure 5:

Percentage increase in weight of calf weaned per cow joined from crossbreeding.



A four year comparison of the profitability of straightbred Hereford, Angus X Hereford and Fresian X Hereford cows mated to Hereford bulls for autumn calvings in southern Australia during the 1980's produced the results summarised in Table 6.

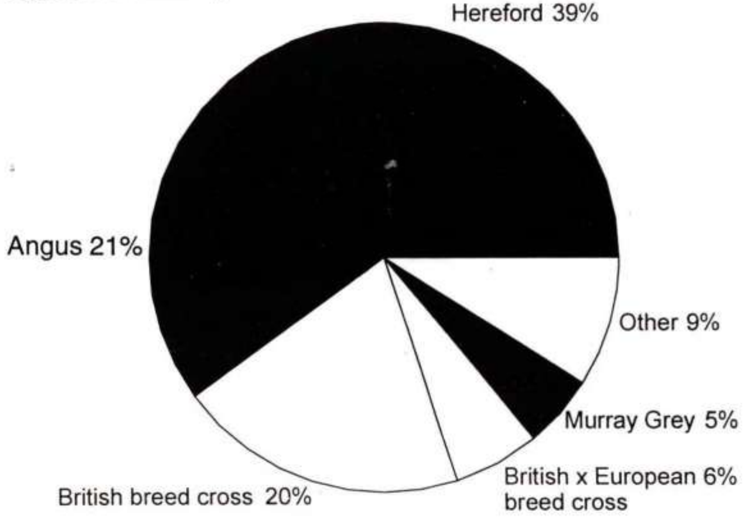
Table 6:

Average production and profitability for cows of different milking capacity

Stocking rate (cows/ha)		**0.9**	**1.3**	**1.7**
a)	Calf weaning rate (kg)			
	Hereford	287	252	236
	A X H	301	292	264
	F X H	334	308	268
b)	Calving rate (%)			
	Hereford	99	88	90
	A X H	99	93	91
	F X H	99	82	66
c)	Gross margins (S/ha)			
	Hereford	128	132	105
	A X H	143	165	143
	F X H	152	144	33

In recent years there has been a steady increase in the adoption of crossbreeding, as producers have recognised the need to increase productivity and adjust their breeding programs to target the requirements of different markets. In 1994, 33% of beef cattle in Australia were crossbred, and of these, 58% were Bos indicus x Bos taurus cross in northern Australia. Data for southern Australia in 1994 are summarised in Figure 6.

Figure 6: Breed composition of the beef herd in southern Australia, 1994



Approximately 65% of commercial beef producers in southern Australia are now practising crossbreeding with at least some of their cattle.

Pasture Productivity

Over the past 20 years, only 3-4% of pastures in southern Australia have been upgraded, and as a result, many pastures are dominated by unproductive species of low nutritional value. Research has highlighted the need to focus on:

- the introduction of improved species such as clovers and perennial grasses
- ensuring a high and balanced soil fertility status (particularly soil phosphorous level)
- ensuring that stocking rates are high enough to effectively utilise the extra pasture produced.

The relatively high cost of upgrading pastures (over $150/ha) combined with the risk of failure has been a major barrier to adoption, and numerous demonstration trials have been established in recent years to help overcome this. These trials have invariably demonstrated spectacular improvements in productivity, with stocking rates and gross margins/ha for upgraded pastures frequently double those for 'typical pasture'. There is little doubt that for the foreseeable future, the largest productivity gains to be made in southern Australian beef herds will come through upgrading pastures.

Out of Season Feeding Systems

The increased demand for high quality pasture fed beef for export markets and the requirement for branded product to be available all year round has focused industry attention on the related issues of continuity of supply and consistency of product quality. Forward contracts combined with cost effective pasture based 'out of season' feeding systems are seen as the means by which the southern Australian beef industry can increase the supply of suitable cattle during winter and early spring.

Historically hay and to a lesser extent grain have been the main supplements fed to cattle at pasture, but research conducted over the past 2 years has highlighted the potential for increased use of high quality pasture silage (Table 7).

Table 7:
Profitability of 'Out of Season' Feeding Systems in Southern Australia

	Average Daily Gain (kg/day)	No. Carcases Meeting Specifications	Profit ($/ha)
Control, pasture only	0.45	4/12	-$5.30
Pasture plus whole triticale fed daily	0.8	11/12	$45.32
Pasture plus ad lib hay and ad lib grain fed through a 'Waste Not' feeder	0.8	12/12	-$5.03
Pasture plus whole grain with virginiamycin fed once weekly, stocking rate 2.1 steers/ha	.69	10/14	-$7.74
Pasture plus whole grain fed through a 'Limit Lick' feeder	.86	12/12	$49.72
Pasture plus oats and 'Rumentek' fed daily	.81	11/12	-$33.00
Pasture plus whole grain with virginiamycin once fed weekly, stocking rate 1.5 steers/ha	.73	8/12	-$10.88
Autumn deferment using silage followed by winter grazing on Concorde ryegrass	.81	9/12	-$16.57
Pasture plus ad lib silage	.90	12/12	$112.57
Pasture plus rolled grain with virginiamycin fed once weekly	.73	12/12	$20.34

Virginiamycin is an antibiotic used to reduce the risk of acidosis in cattle being fed grain. 'Rumentek' is a feed supplement containing high levels of protected fat and protein.

Food Safety

Incidents involving contamination of meat with organochlorines (dieldrin and DDT), chlorfluazuron and veterinary chemicals, and isolated but extremely serious cases involving microbial contamination of meat around the world have focused consumer attention on the issue of food safety.

Australia has had a national property registration and compulsory tail tagging system in place since the early 1970's when the Brucellosis and Tuberculosis Eradication Campaign began. Both brucellosis and TB have since been eradicated from all but a few isolated properties in northern Australia, but the property identification and tail tagging system has been retained to facilitate the traceback to property of origin of carcases found to be contaminated or affected by disease. This, combined with abattoir monitoring, enables the Australian meat industry to respond to breaches in food safety issues that may occur.

Cattle in Australia commonly change ownership and may be grazed on a number of properties between birth and slaughter, and the lack of a national system for the permanent identification of cattle is a significant deficiency in existing traceback procedures. State and federal governments have agreed to establish a national permanent cattle identification and tracking system. Last year consultants were engaged to review the cost and feasibility of cattle identification systems currently available, including electronic devices, and to develop recommendations in consultation with government and industry. The consultants have since recommended a dual tagging system in which cattle would be permanently identified by the breeder with a whole of life 'birth tag' and, in addition, would be identified with a temporary transaction tag at the time of each sale or dispatch for slaughter. This system is now being field tested against an agreed set of standards, including a retention rate for permanent identification of at least 99% over 3 years. Four identification methods are being tested, including intra-rumen radio frequency capsules, metal tags, small plastic radio frequency ear tags and medium sized radio frequency plastic tags.

At this stage only one market, the EU, specifies that beef must not be produced from animals treated with hormonal growth promotants (HGP's). Although the EU is a very small market for Australia, a declaration system for the identification of HGP free cattle, using special pink ear or tail tags, was introduced in 1994. Legislation controlling the sale and use of HGP's has also, been introduced.

In July this year, a voluntary national 'vendor declaration' system was introduced, enabling producers to declare the chemical residue status of their cattle. Meat processors have strongly endorsed the system by indicating that they will not compete for sale lots without vendor declarations, and in the first few weeks of operation, the compliance rate at saleyards has been in excess of 90%. Cattle without declarations have been discounted by up to $100/head.

Animal Welfare and Environmental Considerations

In addition to food safety, community concern about animal welfare and environmental issues has increased dramatically over the past decade, and this is now reflected strongly in government policy.

By comparison with the intensive livestock industries where issues such as battery cages for laying hens and the tethering of sows have evoked a strong reaction, the cattle and sheep industries have generally not been targeted by the animal welfare lobby. Both state and federal governments have produced 'Codes of Practice' for the welfare of sheep and cattle, but the only significant issues to emerge have been drought and feedlot management. It is no longer acceptable to simply allow livestock to die due to drought, and producers are now prosecuted for failing to either provide adequate feed and water for livestock or having them humanely destroyed. The welfare issues in feedlots are mud in winter, provision of shade in summer and the identification and care of sick animals. In practice, most 'animal welfare cases' involving sheep or cattle occur on small 'hobby' farms where absentee owners or people without adequate animal husbandry skills are responsible for the care of animals.

Land degradation due to soil erosion and salinity, and water quality are now serious issues in Australia, and government spending on addressing these problems and promoting sustainable agricultural practices has increased. Rabbits have been responsible for massive environmental damage throughout Australia, and it is hoped that the recently released rabbit calicivirus will achieve effective biological control. In northern Australia, overgrazing by cattle is a major cause of soil erosion, and in southern Australia, the planting of deep rooted perennial pasture species and agro-forestry is being promoted to lower the underground water table and help to prevent soil salinity problems. Feedlots are also a sensitive environmental issue. State governments strictly regulate the location, design and operation of feedlots to prevent the contamination of soil and both surface and underground water with feedlot waste, and to avoid problems with air pollution (odour and dust).

Quality Assurance

The Australian meat and livestock industry is now moving to embrace a culture of quality, with all sectors now either developing or actually implementing quality assurance (QA) programs. Many are 'Hazard Analysis and Critical Control Point' (HACCP) based programs certified to the International Standards Organisation (ISO) 9002 standard.

From an overall industry perspective, food safety is of paramount importance, and QA is seen as the foundation on which to build consumer confidence in meat products. Some sectors have also been motivated by the need to meet community expectations in relation to animal welfare and protection of the environment, and to reduce the cost of government regulation.

Under criticism from the community in relation to animal welfare and environmental issues, the Australian Lot Feeders Association (ALFA) was one of the first organisations to adopt the principles of self regulation through QA, largely to avoid the burden of government controls. The ALFA/AUS-MEAT national 'Feedlot Accreditation Scheme' commenced operating in August 1995, and already 763 feedlots are accredited. There is a requirement that all grain-fed beef for export must be sourced only from cattle fed at accredited feedlots.

Meat processors are also moving to implement QA. The potential to reform the regulation of export abattoirs is constrained by the requirements of our overseas customers, but the domestic processing sector has begun to reduce costs by replacing traditional on-line inspection with QA. In 1993 the Victorian State government established the Meat Industry Act which provides for the implementation and auditing of QA programs in domestic abattoirs. Already two major domestic abattoirs have achieved ISO 9002 accreditation, and others are working towards this goal.

In 1995, the 'Cattlecare' on-farm QA program for beef producers was launched, and 'Flockcare' is currently under development for sheep meat producers. Cattlecare currently incorporates 15 key elements addressing the contamination of beef with chemical residues, carcase bruising and hide damage, but the program will be developed further to include other aspects of quality. Producer organisations are now moving to provide ISO 9002 certified third party auditing services for participating beef producers.

The 'Q Award', a HACCP based and externally audited QA program for retail butchers, was launched in May this year. The program includes advanced product handling techniques, a systematic approach to hygiene and food safety and improved methods for product display.

Other sectors of the industry, including livestock transporters and saleyard operators, are also beginning to develop QA programs.

5. Future Challenges Facing the Australian Meat Industry

By comparison with their counterparts in many other countries, Australian beef and lamb producers operate in an open market, without government subsidies. Their products must compete not only on international markets with red meat produced in other countries, but also with alternative sources of food protein, particularly pork and chicken meat. To remain viable in this environment, the industry must meet consumer expectations in terms of food safety, quality and consistency, and at a competitive price. Further structural change will also occur, with a move to fewer but larger and more efficient livestock enterprises and processing facilities.

The 'Meat Industry Strategic Plan' released by the Meat Industry Council this year recognises that despite past success, the profitability and competitiveness of the meat industry are currently not at acceptable levels, and that further change is urgently required. Future prosperity depends on the industry 'doing things better and differently', and the plan identifies strategic directions and actions for achieving this to the year 2001.

The overall aim of the Meat Industry Strategic Plan is to 'increase industry competitiveness and profitability in a sustainable way', and to achieve this, six strategic imperatives have been identified. These are:

1. Achieve 'best in class' marketing

To achieve food industry 'best in class' performance from enterprise and industry marketing and access activities.

2. Guarantee eating quality

To guarantee palatability to domestic consumers of beef and lamb.

3. Guarantee food safety

To guarantee food safety through a 'plate to paddock' quality assurance system.

4. More consistent supply

To achieve a consistent (quality and volume) and predictable supply of product that meets customer specifications at all stages of the production and marketing chain.

5. Facilitate structural change

To facilitate rationalisation and development of alliances that will achieve the optimal industry structure for international competitiveness.

6. Improve leadership and management

To achieve leadership in innovation and cost efficiency through improved management, training and a culture of partnership within enterprises and between industry sectors.

Rapid and substantial progress in all six areas will be required for a significant impact on profitability, and the Meat Research Corporation is now developing a comprehensive R&D plan comprised of 17 key programs to address all elements of the Meat Industry Strategic Plan.

Options for Cattle Farmers

Tony Pettit, Cattle Specialist, Teagasc
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The current beef crisis will force many producers to examine their cattle enterprise and assess their options. The major challenge facing producers is to:

- maintain a viable stable income as best they can
- avoid significant deterioration in overall farm finances

This paper highlights some of the key issues a producer should consider and what advice Teagasc might give. The main points addressed are:

1. Lower versus higher stocking rate systems
2. Importance of farm efficiency
3. Which cattle system
4. Borrowing capacity
5. Overall viability

ASSUMPTIONS

- The producer is already operating a relatively intensive system
- Adequate housing and facilities are available
- Costs, output and performance levels are generally based on the excellent level of efficiency in the Teagasc Management Data for Farm Planning 1996
- Premium rates are at 1996 levels. It is assumed that the Deseasonalisation Premium will be available for the immediate future.

1. LOWER VERSUS HIGHER STOCKING RATES

What are the merits of higher stocking versus lower stocking rate systems? This decision is primarily dependent on individual farm circumstances. In this paper the relative profitability of lower versus higher stocking rate is compared for a 40 ha. farm. It is assumed that the farmer is already operating a high stocking rate system and adequate buildings and facilities already exist for either option.

The lower and higher stocking rate systems are classified as follows:

Lower Stocking Rate:

- Physical stocking rate approximately 1.66 LU per ha. (1.5 ac./LU)
- EU stocking density less than 1.4 LU per ha.
- Eligible for maximum REPS payment
- Eligible for basic EU (Suckler cow and Special Beef) Premiums and Extensification and Deseasonalisation Premiums

Higher Stocking Rate:

- Physical stocking rate approximately 2.5 LU per ha. (1 acre/LU)
- EU stocking density 2.0 LU/ha. maximum
- Eligible for basic EU Premiums and Deseasonalisation Premiums
- Not eligible for Extensification Premium or REPS payments

Two systems of cattle production (Suckler to Beef and a non breeding system - Weanling to Beef) were compared using these criteria. Full details are given in Appendix 1 and 2. A summary table is presented below.

Table 1.1:
Income From Lower Versus Higher Stocking Rate Systems

	Steer Beef Price £ per kg Carcase			
System	£1.80 (82p/lb)		£2.10 (95p/lb)	
Suckler to Beef	Total	Per ha	Total	Per ha
Lower Stocking Rate	£12,990	£325	£16,130	£403
Higher Stocking Rate	£12,120	£303	£17,320	£433
Weanling to Beef Lower Stocking Rate	£12,193	£305	£15,554	£389
Higher Stocking Rate	£11.563	£289	£17,295	£432

The higher stocking rate systems are dependent on a high beef price to maximise income. With the lower stocking rate systems maximising support payments (Premiums and REPS) is crucial.

In a low beef price environment the lower stocking rate systems have significant advantages such as:

- Greater income stability (in the short term at least) if a higher proportion of income comes from support payments.
- Reducing stock numbers may facilitate a reduction in borrowings.
- Reducing winter feed costs, grazing costs and maximising individual animal performance at grass.
- Lower stocking rate systems are also more environmentally friendly.

Disadvantages include:

- If implemented, proposed changes in the Extensification Premium Stocking density levels will adversely affect the lower stocking rate option.
- For larger farms the capping of REPS payment at 40 ha dilutes the overall REPS income benefit per hectare.
- Participation in REPS involves commitment to a five year plan.
- Tax implications of destocking must be considered.
- Longterm implications of very heavy reliance on support payments.

Comment

Beef prices are likely to remain depressed for the forseeable future. It is clear that even intensive cattle farmers must assess the income implications of lower stocking versus higher stocking rate systems. The merits of either option will be unique to each farm situation and cattle system. In practice farmers may meet REPS and Extensfication Premium requirements with less change in stocking levels than shown here, depending on the ratio of overall area owned to adjusted area farmed.

Note: Lower stocking rate levels do not and should not imply a general lowering of efficiency standards. Key efficiency factors (e.g. cow productivity, animal performance, cost control) still apply. There is an even greater challenge to utilise grassland efficiently.

2. THE IMPORTANCE OF FARM EFFICIENCY

Cattle farmers face an enormous challenge if beef prices remain at their current levels. Production costs equal or exceed the current beef price in some systems. (See Table 2.1)

Table 2.1
Production Costs - Suckler to Beef System

Costs	Cost per kg Carcase (£)	(p/lb)
[1]Replacement/Mortality Charges	£0.11	(5)
[2]Variable Costs	£1.08	(49)
[3]Fixed Costs	£0.63	(29)
Total	£1.82	(83)

[1]Adapted from Teagasc Management Data for Farm Planning 1996
[2]Assumed to be £220 per cow

Scope for Efficiency Improvements

The Teagasc BeefMIS Report on Suckler Farms indicates that there is further scope to improve even on farms operating at a good level of efficiency. See Appendix 3 for detailed breakdown. A summary of the main conclusions is given below.

- fixed costs are generally too high
- silage quality needs considerable improvement
- meal costs per kg. liveweight gain are too high reflecting a need for increased emphasis on silage quality and grassland management
- calving spread is much too wide
- Calving interval and calf mortality also require considerable improvement on some farms

The two major components of efficiency are:
- level and quality of output
- cost structure

Increased Output?

Stocking rate, animal performance and cow productivity determine output.
- Intensification beyond the basic EU stocking density limits (2.0 LU per hectare) is not advisable if substantial investment in housing and livestock is required.
- There is considerable scope to improve animal performance (particularly at grass) on many cattle farms. For intensive integrated systems (calf to beef, weanling to beef, suckler to beef) a swing to lighter carcasses could reduce output per animal.
- In breeding herds cow productivity remains a key efficiency factor (Calving

rate, calving interval, compactness of calving and calf mortality). A five per cent change in calving rate changes output per cow by £30 in a suckler to beef system.

Cost Structure

Fixed Costs

A reduction in fixed costs is difficult to achieve in the short term. Machinery costs are the significant component of fixed costs. Teagasc National Farm Survey data indicates machinery costs of almost £100 per ha for certain categories of cattle farms.(See table 2.2). Cattle farmers will have to critically assess how much machinery investment they can carry.

Table 2.2:
Breakdown of Fixed Costs

Fixed Costs	% of Total	Per ha Cost (£)
Rent of Conacre	8.5	20.00
Car, Electricity, Phone	12.5	29.00
Hired Labour	4.0	9.50
Interest Charges	10.0	23.50
Machinery Operating and Depreciation	40.0	94.00
Buildings Maintenance and Depreciation	10.0	23.50
Land Improvement Maintenance and Depreciation.	4.0	9.50
Other	11.0	26.00
Average level of Fixed Costs per ha		235.00

Source: Adapted from Teagasc National Farm Survey 1994. Based on Cattle Non Rearing Systems in the 40 to 80 ha category, Soil Group One.

Variable Costs

Winter feed costs are the dominant variable costs in most cattle systems (See Table 2.3)

Table 2.3:
Breakdown of Variable Costs

Variable Cost	Suckler to Beef % of total	Weanling to Beef % of total
Silage	50	38
Concentrates	17	38
Grazing	18	11
Other	15	13

Source: Adapted from Teagasc Management Data for Farm Planning Book 1996

Factors to be considered in reducing winter feed costs include:

Silage:	Ensure adequate quantities of good quality silage. Maximise area available for first cuts. Utilise animal slurry for maximum benefit. Soil test regularly. Minimise wastage. Use cost effective additives when required
Concentrates:	Use economic levels of concentrates. If the beef price is £1.90 per kg carcase and concentrate price is 14p per kg (£140/t) then breakeven response rate is approx. 13:1 (kg concentrate:kg carcase). Unless concentrates can be purchased significantly cheaper, the optimum concentrate feeding level will be about 3-4.5kg on good silage. The cost per tonne of concentrates is very important and producers must ensure good value.
Extending Grazing:	Extending the grazing season (earlier spring turnout and extended autumn grazing) will reduce winter feed costs.

Table 2.4:
Impact of Changing Winter Feed Costs Weanling to Beef System

Factor	Improvement	Impact
Silage Quality	DMD 50g/kg DM	£35
Silage Cost	£1 per tonne	£9
Concentrate Cost	£20 per tonne	£17
Extended Grazing	One tonne silage less	£12

[1]per animal sold

Grazing Costs

The feed costs per kg liveweight gain are substantially lower for grazed grass relative to indoor feeding. (See Table 2.5)

Table 2.5:
Feed Costs per kg Liveweight Gain Weanling to Beef System

	Indoor Period	Grazing Period
Gain First Winter (kg)	90	-
Gain Grazing Season (kg)	-	170
Gain Second Winter (kg)	140	-
Total Gain (kg)	230	170
Feed Costs	£242	£35
Cost per kg Liveweight Gain	£1.04	£0.21

• Maximise weight gain at grass. This is the most important efficiency message for cattle producers.

3. WHICH CATTLE SYSTEM

Switching systems can have major implications on cashflow, borrowing requirements, tax liability, housing requirements etc. Radical changes need to be carefully scrutinised. As a broad guideline the majority of producers should pursue systems that:

- Provide a reasonable income.
- Maximise support payments.
- Minimise risk (see Table 3.1).
- Have realistic investment (buildings and livestock) requirements.
- Meet market requirements (carcase weight, carcase quality, Quality Assurance)

Table 3.1:
Effect of Price Fluctuations on Finishing Systems

	Effect on Gross Margin per Hectare	
System	Sale Price (±5%)	Purchase Price (±5%)
Suckler to Beef	£40	-
Weanling to Beef	£87	£45
Autumn to Autumn	£80	£50
Summer Grazing	£170	£140
Winter Finishing	£220	£135

Based on Teagasc Management Data for Farm Planning 1996 with top grade steer prices at £2.02 per kg carcase.

Suckler Systems

Suckler to beef systems comply with most of the above requirements. In the current climate suckler to weanling or store systems are more vulnerable to market forces. However a high proportion of suckler systems are located within the Disadvantaged Areas. This further enhances support payments and provides a buffer against market forces. The majority of cattle producers will continue to need a suckler herd to supply some or all of their raw material.

Long Term Trading Systems

Integrated systems (calf to beef and weanling to beef) are considerably less risky than short term trading systems. They can also maximise support payments. Autumn to Autumn store to beef systems have the advantage that buying and selling occurs at the same time. This lowers the risk factor. Autumn to Autumn systems are compatible with existing EU stocking density requirements for the Extensification Premium.

Short Term Trading Systems

Both winter finishing and summer grazing systems involve a high degree of price speculation. This makes them particularly vulnerable to sudden market changes. It is more difficult to maximise premium payments in these systems. As the risk factor is considerably higher these systems are more suited to specialised producers or particular situations.

Optimum Finishing Age

Premium considerations can have a major influence on the choice of finishing age in an integrated system. In a spring calving suckler to beef system for example;

- Finishing (steers) at 24 months of age maximises 10 and 22 month Special Beef Premium payments and the Deseasonalisation Premium.
- Finishing at 30 months increases the land requirement. The Deseasonalisation Premium is not available. The margin hectare does not increase. The 30 month system is less compatible with the trend towards lighter carcasses.
- A trend towards lighter carcasses may encourage early finishing systems. If finishing earlier than 24 months of age, the 22 month Special Beef Premium and possibly the Slaughter Premium are not collected. This represents a loss of up to £150 in support payments. Bull beef is most suited to early finishing systems. However, the market opportunities for bull beef appear limited.

4 BORROWING CAPACITY

The scope for investment or expansion is limited. The majority of drystock farms cannot carry any significant level of long term borrowings (See Table 4.1).

Table 4.1:
Maximum Level of Longterm Borrowings per Farm

Farm Size (ha.)	Income per Hectare	
	£200	£300
	Max Level	Max Level
40	0	0
60	0	£8, 500
80	0	£30,000

Assumes:

- Interest rate of 13%, 12 year loan period
- Living expenses £12,000
- Allowance made for tax payments
- Producers should not borrow up to maximum levels

5. OVERALL VIABILITY

Viability will be dependent on many factors including; farm size, cattle prices, overall efficiency level of borrowings and family income requirements (See Table 5.2). Farm size is a major determinant of overall viability. Data from the Teagasc 1994 National Farm Survey representing 80 - 85,000 farms with cattle (and without milk) indicates that:

- 45% are less than 20 ha in size
- 18% are over 50 ha in size
- On 40% of cattle farms the holder or spouse had an off farm job. This percentage was considerably higher within certain categories of cattle farming. (See Table 5.1)

Table 5.1:
Percenhge of Cattle Farms where Farmer/Spouse has other Job

Size (Ha)	< 10	10 - 20	20 - 30	30 - 50	50 -100	> 100
Cattle Rearing	56 (50)	45 (41)	27 (15)	57 (40)	-	-
Cattle Other	33 (33)	35 (30)	36 (28)	33 (26)	14 (4)	-

(Figures shown in brackets refer to farmer only)

Source: Teagasc National Farm Survey 1994

Table 5.2:
Viable Farm Size (ha.)

	Current Income Per Hectare	
Farm Income Required	£200	£300
£12,000	60 ha.	40 ha.
£18,000	90 ha.	60 ha.

Income of £300 per ha based on excellent level of efficiency (Teagasc Management Data for Farm Planning 1996) at current prices.
Note: Assumes no significant longterm borrowings.

Many cattle farmers must supplement their farm income with off farm income to meet overall income requirements. This applies even at very high levels off efficiency. At moderate levels of efficiency only the biggest farms can generate a viable income.

CONCLUSIONS

1. Stocking Rate Levels

The major decline in beef prices favours "lower stocking rate" systems which maximise EU support payments. Schemes such as REPS help stabilise and provide a guaranteed income for the immediate future. Even intensive farmers must consider the "lower stocking rate" option and its implications.

2. Efficiency

High levels of efficiency remain crucially important even if lower stocking rate systems are adopted.

The scope to increase output on intensive farms through higher stocking levels is limited. There is scope to improve animal performance particularly at grass. In breeding herds cow productivity remains a key efficiency factor.

Fixed costs must be controlled. Machinery costs account for the major share of overheads costs.

In many cattle systems winter feed costs can account for over two thirds of total variable costs. Cattle farmers must adopt practices which minimise winter feed costs.

The feed costs per kg liveweight gain are substantially lower at grass relative to indoor feeding. Maximising weight gain at grass is a priority.

3. Cattle Systems

Suckler systems and longer term trading systems maximise EU support payments and are generally more stable. Short term trading systems involve the most risk.

A trend towards lighter carcases will militate against long term (over 2 years of age) production systems.

4. Borrowing Capacity

The scope for investment or expansion is limited. The majority of drystock farms cannot carry any significant level of long term borrowings.

5. Overall Viability

Many cattle farmers must supplement their farm income with off farm income to reach a viable income level.

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APPENDIX 1
Suckler to Beef System
Impact of lower versus higher stocking rates

	Present Situation A	Alternative Situation B
Farming System	Higher Stocking Rate	Lower Stocking Rate
Farm Size (Area Aid)	40 ha.	40 ha.
Stocking Rate (Physical)	2.5 LU/ha. approx.	1.6 LU/ha. approx.
Stocking Density (EU Schemes)	2.0	1.38
Stock Numbers	50 cows, progeny reared to beef	35 cows, progeny reared to beef
Steer Beef Price (£/kg carcase)	1.80 (82 p/lb)	1.80 (82 p/lb)
Sales (£)	30,900	21,630
Replacement + Mortality (£)	2,250	1,575
..Output (£)	28,650	20,055
Premiums		
-Suckler Cow (£)	7,000	4,900
-Special Beef (£)	4,320	3,060
-Deseasonalisation (£)	1,200	850
-Extensification (£)	-	2,070
Output (include Premiums) (£)	41,170	30,935
Variable Costs (£)	18,550	11,445
Gross Margin (£)	22,620	19,490
Fixed Costs (£)	10,500	9,000
Net Margin (£)	12,120	10,490
REPS (assumes 50% retained income)	-	2,500
Net Margin (incl. REPS) (£)	12,120	12,990
Net Margin (incl. REPS) if Steer Beef price £2.10/kg (95p/lb) carcase (£)	17,320	16,130

Budget Assumptions

Assumptions	Situation A	Situation B
Silage Cost/tonne (£)	12.50	12.00
Silage Requirement per cow unit (tonnes)	15.0	14.5
Concentrates + Calmag cost per cow unit (£)	74	74
Grazing Cost per cow (£)	60	30
Transport Mortality, Bull per cow (£)	49	49
Fixed Costs per ha. (£)	263	225
Carcase Weight - Steers (kg)	390	390
-Heifers (kg)	305	305

Note: Assumed 50% REPS payment retained as farm income. Deseasonalisation Premium averaged at £50 per steer. Heifer price 5 p/kg carcase lower than steer price.

APPENDIX 2
Weanling to Beef System
Impact of lower versus higher stocking rates

	Present Situation (A)	Alternative Situation (B)
Farming System	Higher Stocking Rate	Lower Stocking Rate
Farm Size (Area Aid)	40 ha.	40 ha.
Stocking Rate (Physical)	2.5 LU/ha. approx.	1.6 LU/ha. approx.
Stocking Density (EU Schemes)	2.0 LU/ha.	1.38 LU/ha.
Stock Numbers	66 steers, 40 heifers	46 steers, 25 heifers
Steer Beef Price (£/kg carcase)	1.80 (82 p/lb)	1.80 (82 p/lb)
Sales (£)	67,682	45,638
Purchases (£)	34,270	23,200
Market Output (£)	33,412	22,438
Premiums Special Beef (£)	11,880	8,280
Deseasonalisation (£)	3,300	2,300
Extensification (£)	-	2,760
Output inc. Premiums (£)	48,592	35,778
Variable Costs (£)	27,199	17,235
Gross Margin (£)	21,393	18,543
Fixed Costs inc. Interest (£)	9,830	8,860
Net Margin (£)	11,563	9,683
REPS (40% retained as income) (£)	-	2,500
Net Margin (inc. REPS) (£)	11,563	12,183
Net Margin (inc. REPS) if Steer Beef Price @ £2.10 per kg (95 p/lb) carcase (£)	17,295	15,554

Assumptions	Situation A	Situation B
Farming System	Higher Stocking Rate	Lower Stocking Rate
Silage Cost/tonne	£12.50	£12.00
Silage Requirement		
-Steers/hd.	9.0 t	8.5 t
-Heifers/hd	5.5 t	5.0 t
Concentrates @ £140/t		
-Steers/hd.	£122	£122
-Heifers/hd.	£48	£48
Grazing (per ha.)	£75	£37.50
Dosing/Marketing etc.		
Steers/hd.	£42	£42
Heifers/hd.	£32	£32
Fixed Cost (per ha)	£246	£222
Carcase Sale Weight (kg) - Steers	390	390
-Heifers	305	305
Purchase Weight Weanlings (kg)		
Steers	300 @ £125/100 kg	300 @ £125/100kg
Heifers	280 @ £85/100 kg	280 @ £85/100 kg

Note: Deseasonalisation Premium averaged at £50 per steer. Assumed 50% REPS payment retained as farm income. As a maximum of 66 steers are eligible for 10+22 Special Beef Premium on 40 ha, heifers are included to make up additional stocking rate. Assumes heifer beef price 5p per kg carcase lower than steer price. Borrowing requirement for fifty per cent of livestock purchased. Purchase prices of £145 per 100 kg for weanling males and £100 per 100 kg for heifer weanlings are used at £2.10 kg carcase beef price.

APPENDIX 3
TEAGASC SUCKLER BEEF MIS REPORT

Principal Components of Fixed Costs Per kg Liveweight (P/Kg)

	Top $^1/_3$	Middle	Bottom $^1/_3$	Top V Bottom
Tot. Fixed Costs	51	50	47	+4
Machinery & Car	21	24	25	-4
Interest& Labour	11	7	6	+5
Total	32	31	31	+1

Averages and Ranges for a Number of Parameters

Parameter	Av.	Range
Calf Mortality (%)	6.8	19% > 10%
		19% < 4%
St. Rate (Ac/LU)	1.24	21% > 1.4
		21% < 1.0
Silage DMD (%)	64.6	12% < 60 DMD
		18% > 70 DMD
Weanling ADG*	1.10	27% < 1.0 kg
		14% >1.2 kg
Stores ADG*	0.90	20% < 0.8 kg
		30% > 1.0kg *

* Performance at grass

Calving Compactness (% of Herds with Cows Calved within 70 Days)

Top $^1/_3$	Middle	Bottom $^1/_3$
88%	63%	45%

Source: Paper presented to Teagasc National Suckler Conference, M. Barlow, Teagasc Chief Adviser Beef, B. Smyth, Teagasc Farm Management Specialists

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