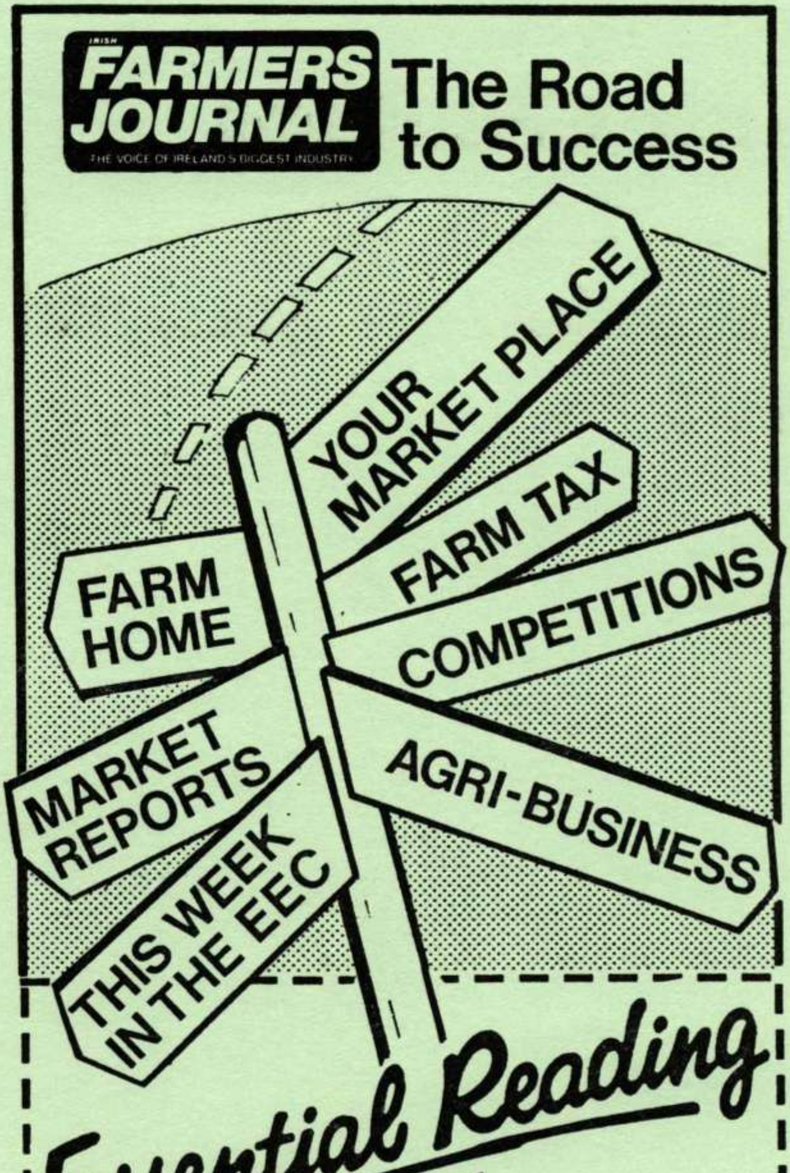
Irish Grassland & Animal Production Association Journal 1985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Beef Production from the Suckler Herd

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Following increases in the late sixties and early seventies the suckler herd consisted of 0.69 million cows in December 1974 which represented about one-third of the total cow population. However, there was a major decline in beef cow numbers subsequently resulting in only 0.40 million in December 1983. The increase in dairy cow numbers from 1974 was inadequate to offset the decline in beef cows with the result that total cow numbers have declined over the last 10 years. The introduction of the milk super levy means that dairy cow numbers will at best remain constant but are more likely to decline in the next few years due to increased milk production per cow. Therefore, if beef production is to expand in the foreseeable future the extra calves will need to come from a source other than the dairy herd. The most likely source of these extra calves is the suckler herd.

The suckler herd (cow and progeny) is presently using the equivalent of about one-sixth of the total usable land in the country but if expansion is to take place it is necessary that acceptable economic returns can be obtained from suckling.

There is no single factor in suckling which ensures good economic returns. However, having a clearly defined production plan involving sale of suitable animals at the right time is of vital importance. The most important management factors relating to beef production from the suckler herd include the following:

- Breeds used
- Re-breeding
- Time of calving
- Pasture management
- Winter feeding
- Type of system.

Breed of Cow

The most suitable type of cows available for single suckling has been Hereford x Friesians from the dairy herd. However, there is now increased usage of continental sire breeds on Friesian cows providing progeny which are also suitable as suckler dams. Comparisons of continental (Charolais, Simmental and Limousin) cross Friesian dams with Hereford x Friesians are in progress and the calf gains pre-weaning from one such study are shown in Table 1. Averaged over the first lactations the growth rates of the progeny of Charolais cross cows was about 4% greater than those from Hereford cows. Friesian cows were also included in this comparison. While calf growth rates were highest for the Friesians due to greater milk intakes, the weight and body condition of the

Friesian cows deteriorated relative to the other breed types as the study progressed which would exclude Friesians as suckler dams. In addition to better calf growth the continental crosses tend to have slightly lower calving problems, their progeny have better carcasses but the dams are usually heavier than Hereford x Friesians. However, the mature size of the Limousin x Friesian cow is quite similar to the Hereford x Friesian.

Table 1

Effect of cow breed type on calf gains (kg/day) pre-weaning

Year	Hereford x Friesian	Charolais x Friesian	Friesian
1977	0.79	0.86	0.95
1978	1.02	1.01	1.11
1979	0.92	0.99	1.00
1980	1.06	1.11	1.13
Mean	0.95	0.99	1.05

Limousin bull on heifers (1977) and Simmental bull subsequently

Breed of Bull

When a crossbred cow is used, the bull should preferably be from a third breed. The two most important factors in relation to the bull are high growth potential in the calves and a low incidence of calving problems. In addition to the breed differences for these factors, there is also wide variation within any one breed. In data collected by the Department of Agriculture the incidence of serious difficulty at calving varied from 2.4 with Friesian bulls to 6.4 with Charolais bulls (Table 2). More important, however, is the variation between individual bulls within any one breed which for Simmental bulls varied from 0.4 to 12.3 per cent. Therefore, when selecting the bull the most important point is to choose an individual known to have a low incidence of calving difficulties.

Table 2

Effect of breed of bull on calving difficulties

	Serious Difficulty (%)	
Breed of Bull	Average	Individual bulls range
Hereford	3.1	0.0 to 7.4
Charolais	6.4	1.0 to 10.4
Simmental	5.1	0.4 to 12.3
Friesian	2.4	0.0 to 9.9

Source : Department of Agriculture 1984

Calving difficulties are more common in heifers than in cows. The large breeds of bull are therefore not recommended for heifers. While adequate data were available on Limousin bulls from the above survey other information shows the expected incidence of serious calving difficulty to lie between those of Charolais and Hereford. Limousin bulls are used at Grange on heifers calving at two years of age.

Studies in the U.K. and U.S.A. have clearly shown that relative to Hereford bulls an increase in growth rate and final liveweight of about 8% can be expected from using the better continental sire breeds on suckler cows (Table 3).

Table 3
Effect of breed of bull on birth weight and final liveweight

Breed of bull	Birth wt. (kg)	Final liveweight (kg)	Difference in final liveweight (kg)
Hereford	37	469	0
Limousin	38	482	+13
Simmental	40	504	+35
Charolais	41	512	+43

Source : U.S. Department of Agriculture, 1974

In addition the progeny of continental sires may be taken to heavier carcass weights before excess fat deposition occurs. Their suitability for the higher priced markets on the continent will likely be of greater importance in the future and hopefully will be reflected in a suitable price advantage at meat factories.

Breeding

An obvious objective in suckling is to aim for a live calf per cow every 365 days. The most effective and simplest method of breeding is by using a fertile bull. For various reasons (e.g. small herd size) a bull may not be available and it is necessary to use AI. A vasectomised bull with a chin ball marker is effective for detecting cows in heat. However, as the cows are generally at pasture during the breeding season the greatest problem is assembly of cows for AI.

Time of Calving

While this is an important consideration for those starting a suckler herd, it also merits attention from producers with existing herds. The first essential is to aim for a specific 3-month calving season. There are many arguments as to what is the best calving season and it is extremely difficult to study this experimentally.

The feed allowances per cow yearly and her calf to 240 days were calculated for spring (March 1), summer (June 1) and autumn (October 1) calving herds. While there were no differences in pasture land requirements between the three systems, spring calving herds required considerably less silage than the other two systems (Table 4). To provide adequate silage the proportion of grassland which must be cut on two occasions is 40, 56 and 59 per cent for spring, summer and autumn calving herds respectively. Concentrate allowances of 90 & 270 kg are needed for summer and autumn calving herds respectively. There is a straw allowance for spring and summer calving herds. The main problems peculiar to the systems are calf scours when calving indoors in spring and in autumn calving herds re-breeding and summer mastitis.

Recent data from Northern Ireland show that 78 per cent of suckler cows calve in the first four months of the years (Table 5). It is thus reasonable to assume that about 80 per cent of suckler cows here are also spring calving. At Grange, the suckler herd is calved in the months February to April and this ensures a heavy weanling in November. The cow is dry for most of the winter, therefore feed inputs can be kept to a minimum (Table 4). This approach ensures that in the winter when feed costs are high requirements of the cow are least and when requirements are high the cow is at pasture. In addition, earlier calving in spring, particularly in smaller herds, allows the possibility of adopting an additional calf (or calves) on to the beef cow before she is turned out to grass. Such a practice would be particularly attractive at a time of low calf prices.

Table 4

Season of calving—cow for 1 year and calf to weaning

	Season of calving		
	Spring	Summer	Autumn
Mean calving date	March 1	June 1	October 1
Silage (tonne DM)	1.13	1.57	1.65
Silage (% of grassland—2 cuts)	40	56	59
Concentrates (kg)	—	90	270
Straw (kg)	180	110	—

Table 5

Distribution of beef cow calvings in Northern Ireland

	Jan./Apr.	May/Aug.	Sept./Dec.
Percent calvings	78	12	10

Summer grazing and silage making

As grazed grass is the cheapest feed for livestock, it is essential to obtain high animal performance during the grazing season. A major factor influencing production per acre is the number of animals carried. To obtain high production per unit area, the stocking rate must be

adjusted to ensure that the animals have adequate grass at all times and that it is properly utilised. Grazing studies with spring calving cows have shown that about 0.6 acres of pasture (rested from November to April) is required per cow and calf from mid-April when grass growth is highest. To maintain animal performance at a high level the stocking rate must be reduced considerably (approximately halved) for the remainder of the season. Where a herd is carried throughout the year the silage is required for the cow and weanling in winter, 1.25 acres are allowed per cow and calf. In the early part of the season, 0.65 acres is cut twice for silage and 0.60 acres is grazed. The entire area is grazed from August to the end of the grazing season.

In suckling systems it is important that silage fed to the progeny is of high quality which necessitates taking the first cut early (May 20-25) and ensuring good preservation. If the remaining silage is for dry cows and cows in early lactation, such as with a spring calving herd, then the same emphasis need not be placed on quality. In such circumstances some quality decline can be tolerated with more emphasis on yield in the second cut which will be fed to the cows.

Winter Feeding of the Cows

Feed requirements of the cows in winter will depend on whether they are dry or lactating. A suckler cow rearing one calf will require over 1.5 times as much feed as a dry cow. All cows can afford to lose weight in winter but the time at which weight is lost and the extent of the loss is important. Spring calving, mature suckler cows in good body condition at the start of winter can be restricted in feed from the time of housing to calving (about 3 months) without ill-effects. As a general rule, maintenance of cow liveweight to calving is adequate. This means that after calving, the cow will be over 50 kg lighter than at the start of winter.

Table 6

Effect of restricted feeding of cows (500 kg) in the last 2.5 to 3 months of pregnancy on liveweight changes (kg)

	YEAR 1		YEAR 2	
Silage fed before calving*	To appetite	Restricted	To appetite	Restricted
Housing to post-calving	+ 2	—57	—49	—84
Post-calving to grazing	—28	—21	—34	—32
At pasture	+55	+98	+80	+102
Housing to 180 days after calving	+29	+20	—3	—14

*Silage fed to appetite post-calving

When fed moderate quality silage alone after calving the cow will lose further weight resulting in a total loss of about 75 kg over the winter.

Studies at Grange have shown that beef cows restricted over the winter recover liveweight during the following grazing season (Table 6). Although the weight loss in winter in year 2 was greater than the recommended 75 kg loss for mature cows, the animals were only 14 kg lighter 6 months after calving than at the start of the previous winter. These weight losses had no ill-effects on calf performance or cow fertility when the cows were subsequently provided with an adequate supply of high quality pasture.

Reducing feed intake before calving is likely to reduce calving difficulties. It has been demonstrated, particularly with heifers, that animals fed on high levels of nutrition before calving have greater calving problems. With greater use of the larger breeds as sires, calving difficulties will increase somewhat and it will be more important to avoid having cows fat at calving. Of course, at the other extreme, very thin emaciated cows would also result in increased calf mortality.

Spring Calving System — Fattened at 1.5 to 2 years

While time of sale can very depending on farm circumstances a system involving fattening at 1.5 to 2 years of age can usefully be used to illustrate the management required at various periods. The system involves sale of the heifers at 18 months and the steers at end of a second winter (about 25 months).

The cows calving in February/March are put to pasture (which has been rested from November) in mid-April when the calves are 6 to 7 weeks old. Calves of this age at the start of the grazing season will be able to avail of the increased milk produced by the cows on going to pasture and will also be able to use grass themselves. In addition, an adequate supply of high quality pasture at this period ensures good fertility and rapid weight recovery in the cows. As indicated earlier a cow and calf to the yearling stage will require 1.25 acres for grazing and silage. A further 0.55 acres is required to graze the yearling and provide silage for steers during the second winter. Thus a total of 1.8 acres of pasture is required per cow unit, 54 per cent of which is grazed in the period April to August and the remainder cut twice for silage. The entire area is grazed from August until the end of the season.

Mature suckler cows are generally in good body condition at the start of winter (weaning). They are fed silage only during the winter (about 150 days) and 5.5 to 6 tonnes are available per cow. This means that silage must be fed at a restricted level until calving, but it is fed to appetite from calving to grazing. However, cows in poor body condition (which is unlikely under lowland conditions) and first calvers should be fed silage to appetite throughout the entire winter period. The cows are fed the second cut silage taken in late July. Mature cows are fed silage alone in winter whereas heifers calving at two years of age are offered up to 1.5 kg of barley daily with silage from calving to the start of grazing.

The level of meal feeding required in the first winter with high quality silage fed to appetite will be low (1 kg per head daily) as the yearlings will be going to pasture in spring. Average weights of steers and heifers going to pasture as yearlings will be about 330 kg (Table 7). Heifers are sold fat in September (mean sale date) at a carcass weight of 236 (moderate) to 260 (good) kg. The steers are housed in November and fed 4 kg barley daily during their second winter and sold fat at 25 months of age in spring when carcass weights of 340 (moderate) to 380 (good) kg can be expected.

Table 7

Animal weights (kg)

	Steers	Heifers
Age at sale (months)	25	18
Weaning weight	273	250
Yearling weight	354	309
Final liveweight	600-670	440-485
Carcass weight	340-380	236-360

Spring Calving — fattening bulls at 16 months of age

Economic analyses suggest that to achieve optimum financial returns the progeny should be taken to slaughter on the producers farm. However, in many instances this is not possible and suckled calves are often sold at weaning in autumn at a time of low prices. The provision of a better market for these animals resulting in higher economic returns to producers will encourage greater expansion in the future: These young continental cross bulls if over 300 kg in autumn could be considered suitable for fattening over an extended winter feeding period (200 days) where high quality feed is available. The performance of three-quarter continental cross suckler bulls from the herd at Grange fed high quality silage and concentrates over the past two winters is shown in Table 8. The animals were 290-300 kg at weaning and average daily concentrate intakes per animal were 4.3 and 4.1 kg in years 1 and 2 respectively. Corresponding figures were 1.21 and 1.34 kg per day for liveweight gains and 320 and 355 kg for carcass weights. The high killing-out percentage (57.1 and 58.4 for years 1 and 2 respectively) is noteworthy which is 4 to 5 units higher than for two year old Friesian animals of a similar weight. In both years carcasses were primarily 2 and 3 for fatness on the carcass classification scale. In terms of carcass conformation 83 per cent of the total carcass were graded E or U.

Table 8

Performance of young bulls fed silage and concentrates

	Year 1 1982/83	Year 2 1983/84
Feeding period (days)	218	238
Concentrates (kg/day)	4.3	4.1
Silage (kg Dm/day)	4.4	4.2
Initial liveweight (kg)	297	290
Final liveweight (kg)	561	608
Daily gain (kg)	1.21	1.34
Killing-out percentage	57.1	58.4
Carcass weight (kg)	320	355
Age at sale (months)	15.5	16

Economic returns from intensive suckling systems

Gross margins per acre were calculated for the following 3 systems.

A sale of weanlings in autumn,

B sale of steers at 2 years and heifers at 18 months,

C sale of bulls at 16 months (350 kg carcass weight) and heifers at 18 months (Table 9).

The acres of grassland (grazing and silage required per cow and progeny for Systems A, B and C) were 1.1, 1.8 and 1.56. At high levels of production without a beef cow subsidy gross margins were about £230/acre for Systems B and C but only £146 for System A. Thus, on good lowland with moderate levels of nitrogen application (150 units per acre on the grazing area) economic returns are improved by taking the animals to slaughter.

Table 9

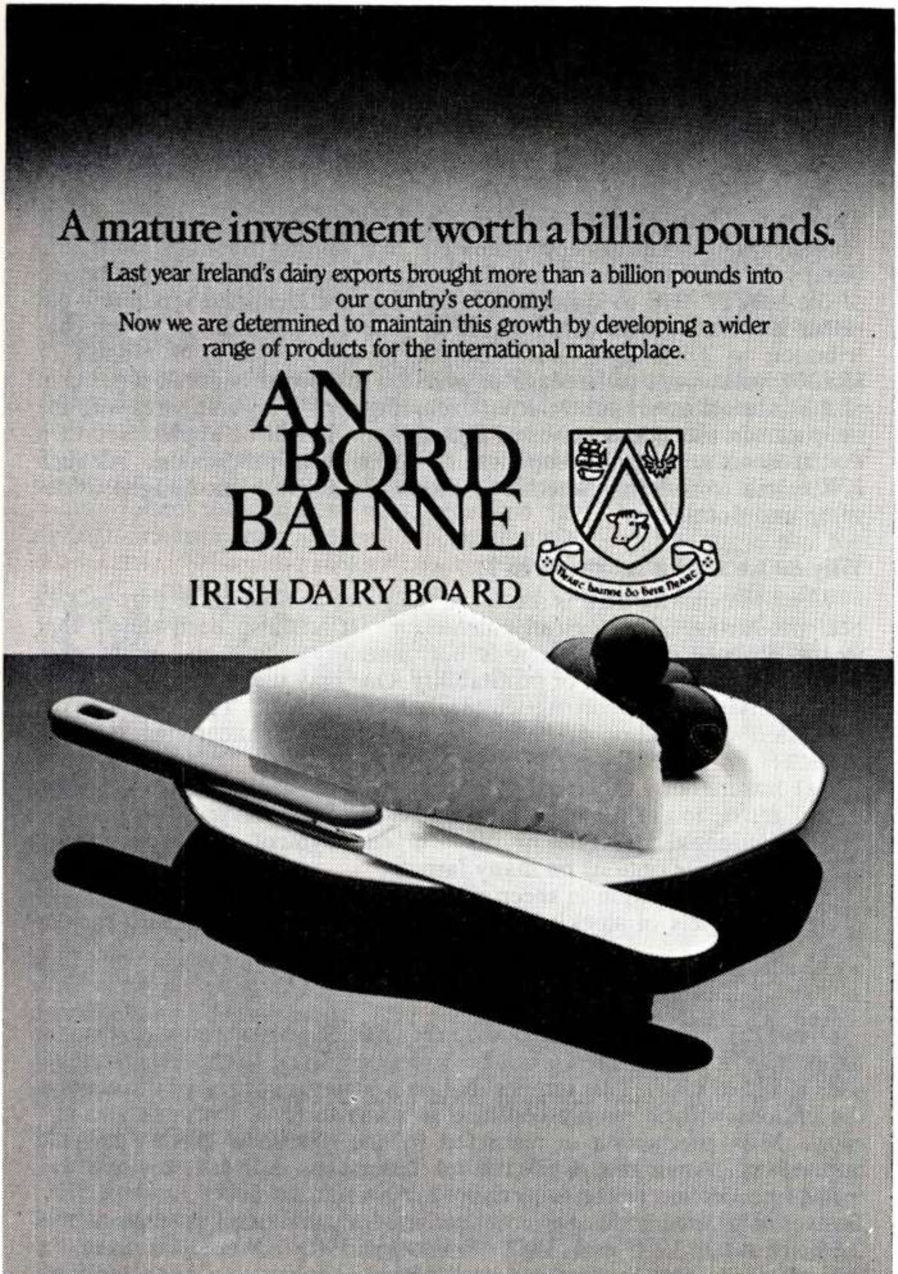
Gross margins (£/ac) from different systems

Time of sale	A Weanlings	B Steers — 25 mths. Heifers — 18 mths.	C Bulls — 16 mths. Heifers — 18 mths.
Acres/cow & progeny	1.1	1.8	1.56
Gross margin/ac.	146	185-227	230
Effect on gross margin of			
Beef cow subsidy £65	+59	+36	+42
Heifers + 22p/kg carcass		+16	+18
Continentals + 11p/kg carcass		+20	+21

Steer (or bull) and heifer carcasses valued at 247 and 203 p/kg respectively

Factors affecting economic returns and future cow numbers

Inclusion of a beef subsidy of £65 per cow increases gross margins per acre from Systems A, B. and C by £59, £36 and £42 respectively. In recent years the prices of heifers have been particularly poor relative to steers and an increase of 22p per kg of carcass for heifers would increase gross margins from Systems B and C by £16 to £18. The carcass fatness and conformation data for the young bulls indicate the quality of those three-quarters continental cross carcasses compared with standard Friesians. A premium for these carcasses of 11p per kg increases gross margins per acre from Systems B and C by about £20. The combined effect of these three factors amount to an improvement in margins of up to £80 per acre from suckling, thereby improving considerably the economic environment. If these conditions are available then it can be expected that suckler cow numbers will increase as evidenced by the response to favourable economic conditions in the late sixties/early seventies.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The Suckler Herd in the Agricultural Economy

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There are 422,000 suckler cows in the country. Between them and their progeny they comprise approximately one million livestock units and occupy 2.5 million acres of land. In the national accounts the contribution of the suckler herd to agricultural output is not identified separately but rather is included with cattle and beef. The authors estimate of the contribution to gross agricultural output in 1983 is IR£230 million or IR£207 million net of headage payments. It represents about 9 per cent of the value of agricultural output excluding turf. This compares with the output from sheep and lambs of £75 million. It will be appreciated then that it is an important component of agricultural production. As such it is worth considering whether it should be actively encouraged to develop and flourish.

Why do we need a suckler herd ?

When the suckler herd is discussed the point is often made that suckler beef production is biologically inefficient. It has also been shown that in the absence of subsidies it is not generally competitive with other farm enterprises in terms of profitability. One may then ask why it should be actively promoted in agricultural development. The case for the expansion of suckling is based on a number of underlying facts as follows:

(a) unsuitability of a high proportion of land for tillage;
(b) restriction of the dairy herd due to the Super-levy;
(c) household structure or off-farm employment restricting farm enterprise options on many farms;
(d) lack of tradition in sheep on about 75 per cent of farms;
(e) low levels of stocking rate on the majority of farms with suckler herds;
(f) expansion of suckling in the past has not been at the expense of other enterprises.

Given the trend in EEC cereals policy and the pressure on prices it is likely that in future cereals will be largely confined to the most suitable soils (35% of soils). This implies that on a high proportion of the country the options will be mainly confined to some form of livestock and forestry. Milk production is restricted by the operation of the dairying Super Levy. Arising from this, future increases in deliveries per cow will result in a decline in the total dairy herd while the Super Levy persists. Deliveries to creameries per cow increased at an annual average rate of 2.5% between 1970 and 1982 (Fingleton, 1983). Were this trend in deliveries per cow to continue until 1990 the dairy cow herd could be reduced by 16 per cent or by 264,000 head while maintaining the present level of total deliveries. Calf prices would tend to escalate, thus reinforcing the traditional extensive systems of cattle production and militating against the more intensive systems such as accelerated beef production. A decline in dairy cow numbers would be accompanied by increased retention of calves for rearing on dairy farms, resulting in a future source of decline in the supply of calves to beef producers.

Apart from restrictions imposed by soil type and the milk Super Levy about three-quarters of farmers have no tradition in sheep production. Approximately one-quarter are part-time farmers (Higgins, 1983). Others are restricted in their farm enterprise options due to a household structure, age, etc. For these reasons there are many farms on which choice of enterprise is restricted to some form of cattle production.

The argument that suckling is biologically inefficient and uncompetitive in the absence of financial aids might be sustainable if it were established that suckling, which had received aid, was displacing other more productive and remunerative enterprises. The evidence however is very much to the contrary. In a study of suckler herds in 1980 (Hickey *et al,* 1980) it was found that farmers who expanded their herds did so mainly through intensification and land reclamation (86%) or by substitution for other cattle. Where the suckler cow enterprise was substituted for other cattle this meant that the displaced cattle were kept on other farms instead, so that there was no corresponding reduction in national production. Only 5% of expansion was accommodated at the expense of enterprises other than cattle. Further evidence that expansion of the suckler herd does not greatly impinge on other enterprises is provided by the fact that the total number of grazing livestock units in the country was at its maximum in 1974 when the suckler herd reached its peak.

Other sources of increased beef production

Apart from increasing the size of the breeding herd there are some other potential sources of increased beef production including increasing the productivity of the herd, carrying animals to heavier weights and production of beef from once calved heifers.

The foregoing considerations indicate that even in the absence of a milk Super Levy the case for expansion of the suckler herd is strong from a national perspective. With the Super Levy in operation the case is overwhelming. However in order for a national agricultural aspiration to be realised it must be translated into increased farm outcome. This means that suckler beef production must be competitive with other options available to those engaged in cattle production in particular.

The suckler herd nationally

A major expansion of the beef suckler herd commenced in the late 1960s prior to which numbers had been low, although the Calved Heifer Scheme did provide a temporary impetus to the herd in 1965-66. This expansion continued uninterrupted until 1974 when the number reached 732,000 and accounted for 33% of the total breeding herd. A number of coinciding factors favoured this major expansion. Firstly, the Beef Cattle Incentive Scheme was introduced in 1969, which provided grants for breeding herds not engaged in commercial milk production and was available throughout the whole country. The level of grant from 1970 onwards was IR£21 for the 3rd cow, IR£19 for the 4th and IR£16 for each additional qualifying cow in a herd. Putting this in the context of present prices the IR£16 grant in 1970 is equivalent to IR£87 at the level of agricultural prices prevailing in 1983. A second important aspect was the high level of calf prices. Calf price was equivalent to 154 kg liveweight of finished beef in 1973, a level which has never since been approached. After 1974 the number of suckler cows declined, at first rapidly and later at a more moderate pace. This coincided with a marked decline in calf prices, which dipped to their lowest level relative to beef prices in 1975. The reduction in the level of grants payable under the Beef Cattle Incentive Scheme followed by its abolition in 1978 also contributed to making suckling less competitive with artificial rearing of cattle.

Since 1981 the numbers of suckler cows has stabilised at about 420,000. This has been accompanied by an increase in the calf to beef price ratio. The introduction of the suckler cow grant would also have been a contributory factor.

Since keeping of suckler cows can be viewed as an alternative to buying in calves and rearing them artifically, then the combination of calf price and suckler cow grant is likely to be important in determining the relative attractiveness of suckling. The attraction of keeping a suckler cow might be measured as the saving arising from not having to buy a calf plus the value of the grant for keeping the cow. This is shown in Table 1 for the years 1973 to 1984. Calf prices are derived from the Bandon

Table 1

Calf price plus suckler cow grant relative to beef cattle prices

Year	Calf price (IR£)	Suckler cow grant (IR£)	Calf & headage (IR£)	Cattle price (IR£/ 100 kg)	Calf & headage relative to cattle price (kg)	No. of other cows (000)
1973	52	16	68	33.70	202	651
1974	26	16	42	29.80	141	732
1975	13	16	29	40.11	72	637
1976	32	11	43	53.10	81	547
1977	49	11	60	64.00	94	537
1978	56		56	76.25	73	502
1979	80		80	78.60	102	484
1980	60	13.18	73	78.10	93	448
1981	80	27	107	94.50	113	424
1982	106	24	130	103.50	126	429
1983	124	25	149	112.30	133	421
1984	131	25	156	116.80	134	422

series and are unweighted averages for the months January to April. Beef cattle prices are annual averages and are derived by combining bullocks (66%) and heifers (34%). In 1973 the combined value of a calf plus the suckler cow grant was equal to 202 kg of beef, its highest level of the years shown, indicating that the keeping of suckler cows was relatively attractive. The lowest point was reached in 1975 when the combination of calf price plus grant was equal to only 72 kg of beef liveweight. At that time the number of suckler cows was declining rapidly. In 1984 the calf price plus grant is equal to 134 kg of beef, a level which is accompanied by a stable suckler cow herd.

If the price and grant parameters that prevailed in 1973 are taken as the yard stick against which to judge the attractiveness of suckling, i.e. a combination of calf price and suckler grant equal to 200 kg liveweight, then the corresponding value at 1984 beef prices is about IR£230. The grant level required to achieve this combined value would depend on the level of calf prices, but taking 1984 calf prices a total of approximately IR£100 is implied. The two components, namely calf price and suckler cow grant operate in different ways in affecting the competitiveness of suckling. By contrast an increase in the price of calves improves the competitive position of suckling by reducing the profitability of artificial rearing.

Suckler herds in the country

There were 74,000 holdings in the country in 1983 with cows other than dairy cows and with an average herd size of 5.4 (Table 2). Of these 56,000 with 6.5 cows on average were eligible for the suckler cow scheme. It is clear then that the beef cow herd is broadly based indicating that the possibilities for expansion are considerable provided the circumstances are favourable. The average herd size is very small and this would not be conducive to the use of more modern production methods.

Table 2

The suckler herd nationally 1983

	No. of herds (000)	No. of cows (000)	Average herd size (No.)	Amount grant per cow (IR£)
Total	74.2	402.7	5.4	
Suckler cow scheme	56.3	363.0	6.5	25.0
Beef cow scheme	9.1	58.7	6.5	20.8

Source : Department of Agriculture

Of the total 422,000 other cows in the country in 1983, 363,000 or 86% received grant under the suckler cow scheme. The remainder were either in herds with creamery or liquid milk or where the farmer was a part-time farmer (i.e. less than 50% of his time and less than 50% of his income from farming).

Approximately 70% of suckler cows are in the disadvantaged areas including 54% in the severely handicapped areas and 16% in the less disadvantaged areas.

Suckling as a farm enterprise

Moving from the national situation to that of the individual farm two of the main aspects that arise are:

a) suckling as an alternative to other cattle or farming enterprises; and

b) increasing the numbers of suckler cows through intensification.

First it is of some interest to consider the general level of returns being achieved on farms keeping suckler cows. Table 3 shows the average levels of output, costs and margins for 1983 from farms engaged in single suckling in the Farm Management Survey. The generally low level of out-

Table 3

Output, costs and margins — single suckling by soil group, 1983

SOIL GROUP	Wide use range	Limited use range	Extremely limited use range
No. of farms	47	70	58
Average farm size (acres)	47	38	50
Per livestock unit*			
Output	231	231	227
of which Headage grants	14	29	27
Direct costs	84	64	66
Gross margin	147	167	161
Forage acres	1.85	2.43	3.56
Per acre :			
Gross margin	79	69	45
Regular overheads	28	20	12
Return to land, labour, management and investment	51	49	33

Note : * A livestock unit is one 533 kg animal kept for one year

Source : Farm Management Survey Data, An Foras Taluntais

put and margins is striking as well as the extensive nature of stocking rate. Even on good soils the average level of stocking rate is 1.85 forage acres per livestock unit. The combination of low output per livestock unit and low stocking rate results in very low income per acre, despite very moderate farm overheads. The result is a return to land, labour, management and investment of approximately IR£50 per acre on soils with a wide to limit use range and IR£33 per acre on those soils which are extremely limited in use range.

A comparison between the average returns from Single Suckling, Multiple Suckling and Artificial Rearing, as they occur in farms on good soils is shown in Table 4. The net returns to land, labour, management and investment are IR£51, IR£69 and IR£80 per acre for Single Suckling, Double/Multiple Suckling and Artificial Rearing respectively. The lower level of margin from Single Suckling is partly due to a poorer stocking rate and partly due to lower margins per livestock unit.

The fact that a difference in margins exists between single suckling and artificial rearing implies that at the standards of management prevailing grant aid is required in order to make suckling more generally competitive. Taking the difference in gross margin per livestock unit of IR£48 and the common system of suckling involving sale at about one and a half years representing 1.5 livestock units per cow the resulting difference per cow is IR£72, or a total of IR£90 to IR£100 when account is taken of existing suckler cow grants as generally available throughout the country. This of course, is not to say that suckling is not appropriate at lower levels of grant in certain circumstances.

Table 4
Returns for suckling compared with artificial rearing, 1983

	Mainly single suckling	Mainly double & multiple suckling	Mainly artificial rearing
Per livestock unit:			
Gross margin (IR£)	147	171	195
Forage acres	1.85	1.66	1.66
Per acre (IR£):			
Gross margin	79	103	117
Regular overheads	28	34	37
Returns to land, labour, management and investment	51	69	80

It would be interesting to compare survey results from single suckling involving sale of progeny at different stages, namely weanlings, stores or finished animals. In the survey farmers sold the progeny predominantly as stores and hence there are not sufficient observations for the other stages in the various soil categories to give conclusive results on this aspect. Sale of progeny as weanlings is concentrated in poorer soils and this may be the most appropriate system where soil and topography impose severe restrictions in the options available. On soils with a limited use range the results are somewhat in favour of earlier selling, while in the better soils bringing the progeny to finish gave better results.

Range in returns

As in the case of farm enterprises generally a wide range occurs around the average due both to difference in returns per animal unit and variation in stocking rate. This is shown in the case of Single Suckling on better soils in Table 5. Farms in the bottom group not only achieved

Table 5

Output, costs and margins (IR£) per acre for single suckling on soils with a wide use range, 1983

	Bottom group	Middle group	Top group
Number of farms	11	22	11
Per livestock unit :			
Output	159	257	301
Direct costs	100	75	74
Gross margin	59	182	228
Forage acres	2.36	1.98	1.50
Per acre :			
Gross margin	25	92	152

Source : Farm Management Survey, An Foras Taluntais

lower levels of output per animal unit but also had higher costs and a poor stocking rate. By contrast farmers in the top group produced higher levels of output per animal unit, while keeping costs at an average level and also had a better than average stocking rate to generate an average gross margin of IR£152 per acre. Even amongst this group stocking rates are still moderate at 1.5 acres per livestock unit.

Suckling as an alternative to 2-year beef

Beef producers are particularly concerned with the increasing price of calves. This is especially relevant in the light of the trend in milk deliveries and the possibility of a future decline in the supply of calves from the dairy herd. In the light of this farmers engaged in 2-year-beef may consider the possibilities of well managed suckling as a partial alternative in order to reduce their exposure to high calf prices.

Table 6 sets out margins based on results from well managed commercial 2-year beef production in BEEFMIS and returns from better managed suckler herds in the Farm Management Survey with the sale of progeny at one and a half years old on average. For comparison purposes margins per animal sold are adjusted to an equivalence in terms of livestock units. It must be pointed out that it cannot be claimed that the standards in both are exactly comparable, since they are based on different sources. Nevertheless they may be of use as a general guideline. At the standards and prices prevailing the gross margin less interest on livestock and working capital per livestock unit is IR£210 for 2-year beef as compared with IR£160 for Single Suckling. The calf price in the 2-year beef budget is IR£140 net of subsidy while returns from suckling are inclusive of IR£25 suckler cow grant, but would not include other headage payments such as the beef cow grant. In the absence of extra suckler cow grant the suckling system would give an equal return with the 2-year beef system at a calf price of approximately IR£190 for Friesian bulls. With the extra suckler cow grant of IR£70 included in the National Plan for 1986 the returns from the better managed suckling system would be roughly comparable with that of the 2-year beef enterprises as budgeted.

Table 6

Budget to assess suckling as performed in better managed units compared with well managed two-year beef

	2 year beef	Single suckling cow and calf to 18 months
Sale weight (kgs)	590	
Concentrates per animal sold (kgs)	650	
Sale price (IR£/100 kgs)	130	n.a.
(p/lb carcase)	110	
Calf price net of grant (IR£)	140	
Gross margin per animal sold (IR£)	355	355
Interest on livestock and working capital @ 14% pa (IR£)	90	115
Gross margin less interest (IR£)	265	245
Livestock units per animal sold	1.25	1.5
Gross margin less interest per livestock unit (IR£)	210	160
Effect of IR£10 calf price change including interest (IR£)	11	
Effect of IR£70 suckler cow grant (IR£)		45

Another reason why suckling may be favoured is that it can be self contained and would not require increasing borrowings to finance the purchase of young stock which may be increasing in price.

Intensification

It is clear from Table 4 that the majority of farms engaged in suckling operate at a low level of intensity. The general level of development is also low. Considering the low stocking rates it is likely that in a great many instances stock numbers could be increased and that considerable expansion could be accommodated without major investment in farm buildings. Increasing stock numbers however means either foregoing income resulting from keeping extra stock for breeding rather than selling them, or borrowing the money both for stock and buildings, where erquired. In view of the low levels of income in general on farms engaged in suckling the scope for financing increases in stock numbers from own resources is likely to be very limited.

Conclusions

The arguments for increasing the suckler herd are compelling nationally, especially since the introduction of the Milk Super Levy. There are 74,000 herds in the country with some beef suckler cows and with generally low levels of stocking rate. It is thus a broadly based enterprise with considerable scope for expansion under favourable circumstances.

It is competing mainly with other systems of cattle production, insofar as there is any competition involved. At calf prices and levels of suckler cow grants available in recent years and up to 1984 it is not *generally* competitive with the purchase of calves coming from the dairy herd and rearing them artifically, which is seen as the main alternative, although it may be more appropriate on many individual farm situations. However the increase in headage payments from IR£32 to IR£70 for beef cows in the disadvantaged areas from 1986, as outlined in the National Plan, should considerably improve the outlook for suckling in these areas which contain approximately 70% of the herd, especially in view of the strengthening of calf prices. In the remainder of the country calf prices would have to increase further before single suckling would become an option on the generality of farms.

Future expansion of suckling is likely to be most appropriate in less developed farming situations or where soil and topography impose limitations, and more generally in disadvantaged areas with the increase in grants which have been outlined in the National Plan.

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Disease Control in the Lambing Flock

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While there are few alternatives to keeping sheep on hill land in this country, in the lowland and upland situations they have to compete with arable crops and cattle for land use. Admittedly, sheep have added benefits in improving soil fertility but their level of production must be high enough for the gross margins per hectare to match other enterprises on the farms. It is important therefore to consider performance figures which are required for them to do this (Table 1).

Table 1

Target production figures per 100 ewes to ram

Barren ewes	3
Ewe deaths	2
Productive ewes	95
Total lambs born	181
Lambs born dead	4
Lambs died around birth	5
Lambs surviving	172
Later lamb deaths	2
Lambs weaned/sold	170
Lamb growth rate to 1st August	300 g/day
Target weight at 1st August	41 kg
Proportion sold fat at 1st August	50%
Remainder sold fat by 30th September	

The major factor in the profitability of sheep flock is the number of lambs sold. We have set a target of 170 lambs sold per 100 ewes mated but the majority of flocks are not achieving this as we see from recent MLC data (Table 2). Yet with crossbred ewes this target should be quite feasible.

Table 2

Number of lambs reared by recorded lowland flocks (MLC Sheep Yearbook)

	1981	1982
Average number of lambs reared/100 ewes to ram	143	148
Top third of these flocks	149	156

The main components affecting sheep reproduction and hence number of lambs reared are :—

1) Ram fertility

2) Ewe fertility (number of ewes which lamb)
3) Ewe fecundity (number of lambs/pregnancy)
4) Perinatal mortality.

Components 1-3 are outside the scope of this paper. I should therefore like to spend most of the time discussing various aspects of perinatal mortality, i.e. deaths in lambs which occur around lambing time. Results of a survey we carried out over a three year period in the Borders and Half Bred and Greyface flocks are shown in Table 3. Stillbirths are the largest category. Most of these were associated with dystokia despite intensive shepherding at lambing time. The most common form of dystokia involved large single lambs which were presented with both fore-legs back resulting in the so-called "hung lamb". These often result from overfeeding of ewes carrying singles as the whole flock is normally fed as if all the ewes are carrying twins.

Table 3

Summary of causes of perinatal mortality in seven Halfbred and Greyface flocks in the Scottish Borders 1974-76

Diagnosis	Percentage of deaths
Stillborn	36.5
Starvation/chilling	32.7
Infectious disease	17.3
Misadventure	4.9
Congenital abnormalities	3.7
Others	4.9

If the twinning rate in the flock can be increased. obviously these deaths can be reduced. However, more emphasis should be placed on the selection of breeding stock from strains with low incidence of dystokia. Selection for fashionable conformations in certain breeds also probably exacerbates the condition.

Of lambs born alive it can be seen that by far the greatest number die from starvation and chilling or hypothermia. Recent work from the Moredun shows that over 80 per cent of these lambs could be saved by careful management at birth. This includes providing adequate shelter with facilities for warming if necessary in a flow of warm air at 40 to 45°C. Hypothermia occurs at two main periods. Firstly, before they are adequately dried through direct loss of body heat and secondly, after 10 hours of life when body energy resources are quickly used up. In the latter instances injections of 20 per cent glucose must be given before warming and adequate supplies of milk must be available afterwards or hypothermia will recur. Use of a stomach tube on the end of a large syringe greatly facilitates feeding weak lambs. Hence the reason for grouping starvation and chilling together.

Infectious disease, while accounting for approximately half as many deaths as starvation and chilling, is still very important in a lowground situation where normally ewes are brought into closely confined quarters for lambing. The most common conditions seen are scours, navel ill and joint ill.

Scouring is due to a variety of organisms including *E. coli*, viruses and protozoa. Only the first of these is sensitive to antibiotics. It should be remembered that *E. coli* is a normal inhabitant of the gut and only a few strains cause disease. Special laboratory procedures are required for the detection of these strains.

With the navel ill/joint ill syndrome, infection gains entry through the umbilicus (navel) soon after birth. The bacteria then migrate to the liver or joints to produce abscesses. In some instances these may occur in the spinal cord leading to posterior paralysis which may be mistaken for swayback unless a careful examination is carried out. In other cases the bacteria which are introduced through the navel may multiply in the blood stream causing fever and death unless suitable treatment is instigated. Antibiotics by injection are the most effective way of treating these infections but they must be given early in the course of the disease to be effective.

Watery mouth is an interesting condition which has long been recognised in South East Scotland but has now apparently become widespread throughout the country. Characteristic signs include dullness, drooling of saliva and distension of the belly. The lamb ceases to suck and, if not treated, its condition deteriorates quickly. The condition is due to slowing down of gut movement which in turn encourages the multiplication of bacteria within the gut. It is important to remember that the abdominal distension is partly due to gas formation in the stomach and despite appearing to be full, the affected lamb may actually be starving. Therefore treatment is aimed at reversing these processes as follows :—

1) Treatment with suitable antibiotic both by mouth and by injection.
2) Attempting to encourage gut movement by means of an enema—20 ml of soapy water administered by means of a syringe and cut down stomach tube placed about 5 cm into the rectum.
3) Feeding the lamb by stomach tube. A mixture of glucose and salt in water is recommended (10% glucose and 0.9% salt—i.e. 100 g glucose and 9 g common salt per litre of water). Three times daily feeding of from 50 to 150 ml of the solution is desirable with the larger volume being required if the lamb is not sucking at all.

Treatment should be continued until the lamb is sucking well from the ewe and apparently back to normal.

As with most sheep diseases, prevention of these neonatal problems is the best course to take. As there are few specific remedies for most of the conditions discussed, general principles of good husbandry and management are essential. Perhaps the most important factor is adequate feeding of the ewes before and after lambing to produce strong lambs at birth and adequate colostrum of good quality. Recent work has shown the importance of high quality protein such as fish meal and soyabean meal in the ration. Therefore as well as good quality silage, hay or roots, the ration should be supplemented with a concentrate containing high quality protein. This can either be a proprietary sheep feed or a homemix if cereals are available on the farm. The homemix which is recommended by the East of Scotland College of Agriculture is shown in Table 4. These concentrates should be fed from four weeks pre-lambing until the end of the first month of lactation starting at about 200 g per head per day and going up to about 600 g per head per day at and after lambing.

Table 4

	kg per tonne
Barley	750
Sugar beet pulp	100
Soyabean meal	75
White fishmeal	50
Mineral/vitamin supplement	25

Having got the ewes to produce ample colostrum it is essential to see that the lambs get an adequate supply as soon as they are able to suck. This will be greatly facilitated if the ewe and her lambs are moved to a small pen after lambing and kept there for about 36 hours or until the lambs are strong and the ewe/lamb bond is well established. As a general rule one small pen about 1.5 m square is required for every eight ewes in the flock. Ideally pens should be cleaned out between each ewe. Should any disease occur, pens must be thoroughly disinfected after cleaning and, if possible, left empty for a few days. It is important that ewes have *ad lib* access to clean water at all times even when restricted to small pens.

Any lamb which has not sucked colostrum one to one and a half hours after birth should be fed by stomach tube. Ewes' colostrum is obviously best but as a substitute cow colostrum may be used. If possible this should be collected from a cow which has been vaccinated with a multiple clostridial sheep vaccine before calving — 10 ml of the same preparation as used for the ewes on three occasions, i.e. three months, one month and two weeks before calving. It is best to avoid animals of the Channel Island breeds as some problems have been reported in lambs which have received colostrum from certain animals of these breeds. As a general rule the amount of colostrum, whether it be from a ewe or a cow, required for a lamb varies with the size as follows :—

Small triplet	100 ml
Average twin	125 ml
Large single	150 ml

To prevent infections occurring, navels should be treated with a strong iodine solution as soon as possible after birth. As well as acting as an antiseptic this has astringent properties to promote sealing of the umbilical vessels. The whole navel, including the junction with the body, should be immersed in the solution and allowed to soak for several seconds.

It has been shown that anything which interferes with the intake of colostrum is likely to predispose to watery mouth and possibly other neonatal conditions. Therefore manipulations such as castration and docking by rubber rings should be avoided for as long as possible and certainly not carried out within the first two days of life. They must, however, legally be done within a week of birth.

Antibiotics should only be used when required. In certain circumstances they provide the only hope in controlling diseases such as watery mouth and scours. However, if used unnecessarily they allow the infectious organisms to develop resistance to them so that when required they are no longer effective. Therefore they should not be used indiscriminately at the start of lambing but reserved until first signs of trouble are observed. Thereafter it may be necessary to use antibiotics routinely to every lamb born to try to prevent some of the diseases. However, it must be remembered that there are no substitutes for good husbandry and hygiene.

To increase numbers of lambs reared it is essential to have adequate facilities for fostering orphan lambs and triplets. While the traditional methods such a using the skin of the foster ewe's dead lamb can be very effective, they are time consuming and not always successful, by far the best method is the use of fostering pens. In this the ewe is held in a neck yoke and not allowed to smell the lambs for 48 hours. After this time the ewe's head is released and one creep bar is removed and the ewe and lambs are left in the pen for a further 24 hours. Ideally lambs should be a matched pair, not one strong lamb and one weak triplet.

Perinatal care is therefore crucial for maximising the number of lambs reared and hence the profitability of the flock. It must be remembered that good feeding, management and hygiene are of paramount importance and should take precedence over drug therapy. There are neither drugs nor vaccines which can compensate for bad husbandry.

Effect of Calving Date on Milk Production

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Introduction

In Ireland, about 80% of the manufacturing milk is delivered to the processing factories during the six month period April to September inclusive, resulting in a constantly changing daily volume of milk being processed with utilisation of about 52% of plant capacity (1). Marketing difficulties are also encountered arising from the requirements to store large quantities of products during the peak production season in order to maintain an orderly distribution of product to the various outlets during the off-peak season.

Price incentives to influence the pattern of milk supply

Until the 1970's, the Irish dairy industry generally paid an even price for manufacturing milk throughout the year and provided no seasonal price incentives. In contrast, the liquid milk trade have always paid incentives for the "out-of-season" months to ensure adequate milk supplies for consumer needs during the winter months. In recent years the liquid milk price has been 97% of the EEC target price, while the manufacturing milk price about 87% of target (2). The 10% higher price for liquid milk represents the price required by farmers to produce milk during the winter months.

The highly seasonal nature of manufacturing milk supplies imposes severe limitations on the product mix, as short-life products cannot generally be manufactured due to inadequate supplies and/or chemical quality of winter milk. During the last decade many co-operatives have introduced price incentives to increase milk supplies during the winter months. The initial approach in most cases was to offer a bonus payment for milk produced in January and February and in some instances also during November and December. The purpose of these bonus payments were two-fold; firstly extra milk was produced during the winter months and secondly lactation lengths of the cows were lengthened, thus increasing the overall yield of the cows. These incentive schemes have had modest success in the last decade.

In more recent times, some co-operatives have introduced substantial bonus schemes to encourage some autumn calving. The incentives range from an additional 16-18p/gallon bonus on all milk supplied during the months of October to March inclusive. This incentive is paid provided the farmer meets a specific quota requirement. Usually this means that at least 40% of the farmers total annual delivery is supplied during the months October-March. In addition, most co-operatives specify that at least 10% of the annual supply is delivered in November-December.

These specifications are modified during a specified transitional period. While many co-operatives introduced these schemes in recent years there appears to be less enthusiasm for these bonus payments by some co-operatives at present which may be influenced by poor monetary returns from products manufactured during the off-season months.

Comparison of three calving patterns

A study was begun at Moorepark in 1983 to compare early and late spring calving and in addition a combination of autumn and spring calving was also studied. The purpose of the study is to define the inputs and outputs of the three different calving patterns and provide production data for the economic assessment of the three systems. The data generated will allow an assessment of the present bonus payments as they influence the financial returns form dairying.

Three herds were established during 1983 but full lactation data were available only at the end of 1984 and are presented in this paper. The three calving patterns had mean calving dates of 28 January, 16 March and 19 October/27 January for treatments ES, LS and AS, respectively (40 and 60% of herd AS had mean calving dates in October and January, respectively). A total of 78 Friesian cows balanced for lactation number were allocated to the three treatment groups. Each treatment had its own farmlet of 18 paddocks, stocked at 2.90 cows per hectare and 395 kg N per hectare were applied. Silage was conserved from 8 and 6 paddocks, for the first and second silage cuts, respectively. The grazing areas of each farmlet received 18.5 kg P and 37.1 kg K per hectare in the autumn. The cutting areas received 25 kg P and 111.2 kg K per hectare in the autumn and a further 17.3 kg P and 74.1 kg K per hectare after the first silage cut. Slurry was applied to all silage areas in the autumn. The silage areas were grazed once in spring time before closing for silage in treatments ES and AS but were ungrazed in treatment LS. Earlier housing in the autumn and later turnout in spring increased the silage requirements of the LS treatment, hence the silage areas were not grazed in the spring. When the silage areas were closed for first cut silage, cows had access to 10 grazing paddocks in each treatment spending 2 days per paddock. Twelve paddocks were available during the second cut silage period and access time per paddock was one and a half days. In late July, all paddocks were available for grazing with 1 day access per paddock. The chemical composition of the silages made in 1984 and the grass dry matter yields for silage are shown in Table 1.

Concentrate feeding

In-calf heifers and first lactation cows were fed 1.8 kg of concentrates/head/day in the pre-calving period. Post calving, cows were fed 7.3 kg of 16% crude protein concentrate with *ad libitum* access to grass silage. The concentrates were phased out after turnout to pasture except for treatment LS where 1.8 kg/head/day were fed to cows from early October until the end of lactation. Concentrates were fed to all treatments from 10 July to 30 August at 3.2 kg/head/day due to drought conditions.

Table 1

The chemical composition in g/kg DM (unlsss specified) of silages and grass dry matter yields for silage

	ES		LS		AS	
	1st cut	2nd cut	1st cut	2nd cut	1st cut	2nd cut
Dry matter (g/kg)	228	204	236	202	206	204
Crude protein	164	141	165	150	172	149
Volatile N (g/kg TN)	89	75	82	81	93	82
Ash	119	85	100	79	112	77
MAD fibre	302	312	290	312	314	325
DMD	740	690	756	661	737	675
ph	3.84	3.61	3.66	3.62	3.78	3.69
Grass dry matter (tonne/ha)	6.94	5.46	7.36	5.16	6.82	5.83

Results

All silages were well preserved but dry matter digestibilities were higher for the first than second cut silages. The first silage cut for each treatment was taken on 17 May and the second cut on 11 July. First cut silage yields were increased in treatment LS by not grazing the area before closing but second cut yields were reduced in this treatment giving similar overall yields for each treatment for the two cuts.

The lactation performance for each treatment is shown in Table 2. The milk yield of the AS treatment was higher than the other two treatments but there was no significant differences between treatments. Milk fat, protein and lactose yields were not significantly different between treatments but the early spring calving group (ES) had a significantly higher fat and lactose concentration than the late spring calving group (LS).

Table 2

Lactation performance

	ES	LS	AS	SE of diff.
Milk yield (kg/annum)	4841	4902	5212	233
Peak yield (kg/day)	23.2	25.9	21.3	—
Fat yield (kg/annum)	182	175	188	8.3
Fat conc. (g/kg)	37.6	35.8	36.1	0.8
Protein yield (kg/annum)	164	163	172	6.8
Protein conc. (g/kg)	33.8	33.4	33.2	0.6
Lactose yield (kg/annum)	222	221	241	10.4
Lactose conc. (g/kg)	46.0	45.2	46.3	0.4
Concentrate (kg/annum)	815	641	1149	75.4
Calf weight (kg)	38.1	40.0	39.2	1.4
Lactation length (days)	295	305	306	—
Calving to service interval (days)	87.3	89.9	91.7	—
U.M.E. (GJ/ha)	104	111	99	—

Concentrate intakes differed significantly between treatments due to calving date and the length of the concentrate feeding period. Calf birth weights and calving to service intervals were similar for all treatments.

The milk proportions produced at periods during the year are presented in Table 3.

Table 3

Milk production profile

	ES	LS	AS
January - March	.28	.11	.29
April - September	.65	.73	.55
October - December	.07	.16	.16

Discussion

The results presented are for one year only and the study will be continued for a further two years.

At high stocking rates it is essential to obtain high silage yields for adequate winter feed. For this reason, the silage area of the late spring calving herd (LS) was not grazed before closing in spring. First cut silage yield was increased in this treatment but the yield of the second cut was less than that recorded for the other two treatments, thus giving similar overall yields for the combined first and second cuts for all treatments. The reduced yield in the second cut of the LS group may be due to the high first cut yields and needs further study during the next two years of the experiments.

The highest milk production per cow was achieved in the AS treatment although lactation lengths were similar for the three calving patterns. The milk yield of the ES and LS treatments was similar. The high milk yields of the LS treatment was achieved by feeding silage and concentrates from early October until the cows finished their lactations in January/February. In farm practice late spring calving cows dry off in the autumn due to insufficient feed to maintain milk production. Feeding silage in early October is feasable only if adequate silage has been conserved. The additional feeding allows cows to have a long lactation length of about 300 days. The highest peak yield was achieved by the LS treatment and this combined with a long lactation length gave as high a milk yield as the ES treatment with a lower input of concentrates.

The pattern of milk production over the year has a major influence on the price received for milk. The yield of milk constituents did not differ between treatments but their value was influenced by the seasonal pattern of their production as influenced by milk bonus schemes operated by the co-operatives. Milk fat and lactose concentrations were significantly lower in the late spring versus the early spring group.

The level of concentrates fed to each group reflected the calving pattern. In 1984, 162 kg of concentrates was fed to each group due to the drought condition prevailing during July and August of that year. A lower UME value was obtained by the AS group due to the higher element of concentrates in their diet.

The data on the milk production profiles in Table 3 show the high proportion of milk produced by the LS group during April-September and in addition milk production was sustained during October-December. The AS treatment produced 45% of total production between October-March and would qualify for the winter calving bonus schemes operated by some co-operatives. The ES treatment had produced 93% of their total production by the end of September.

Financial implications

The milk production patterns influenced the milk receipts of the three calving groups. Higher input costs were incurred by the AS and ES groups due to extra concentrate feeding when compared with LS group. In all treatments replacements were costed at £510. Cull cows were valued at £300 in January, rising to £400 in July and falling to £320 in December. Spring-born calves were priced at £130 and £75 for male and female, respectively for those born in January and February and at £120 and £65 in March. Autumn born calves were priced at £145 for males and £85 for females.

Milk was priced at 15.6 p/kg (73.0 p/gal) for 3.60% fat. A milk bonus of 1.5 p/kg (7 p/gal) was added to milk delivered in January and 1.71 p/kg (8 p/gal) in February for treatments ES and LS. A bonus of 3.4 p/kg (16 p/gal) was added to milk delivered from October to March inclusive for treatment AS. Milk price was adjusted each month in relation to its fat content. Concentrates were costed at 17.6 p/kg for all treatments.

Table 4
Variable, fixed and depreciation costs — £/cow

	Treatment		
	ES	LS	AS
Variable costs			
Concentrates	158	127	221
Fertilisers and lime	98	98	98
Replacements	106	107	106
Machinery hire	6	6	6
Silage	42	42	42
Vet., medicine, AI	20	20	20
(p/gal)	430 (37.1)	400 (33.9)	493 (40.0)
Fixed costs			
Car and insurance	37	37	37
Electricity and phone	28	28	28
Machinery operation	87	87	87
(p/gal)	152 (13.1)	152 (12.9)	152 (12.4)
Depreciation charges			
Machinery	43	43	43
Buildings	41	41	41
(p/gal)	84 (7.2)	84 (7.1)	84 (6.8)
Total costs (p/gal)	666 (57.4)	636 (53.9)	729 (59.2)

The variable, fixed, depreciation and total costs/cow are presented in Table 4. All variable, fixed and depreciation costs were the same for each treatment except for concentrate costs which varied according to the calving pattern. These costs excluded labour, repayments on borrowed capital and income tax liabilities. The receipts minus variable, fixed and depreciation costs are shown in Table 5. Interest earned on cash flow was also included to calculate net profit per cow but excluded labour and repayments on borrowed capital.

The late-spring (LS) calving treatment had the lowest production costs but due to lower milk price and yield had a lower net margin than the autumn/spring treatment (AS). To maintain the highest net margin, the AS treatment required the bonus of 16 p/gallon for milk produced during October to March inclusive. There was no difference in the net margins between the ES and LS treatments even though the ES treatment received a higher milk price it was offset by higher concentrate costs.

Table 5
Financial costs and returns — £/cow

	Treatments		
	ES	LS	AS
Milk sales	848	837	955
p/gal (net)	72.3	70.2	77.6
Livestock sales	170	170	175
Total receipts	1018	1007	1130
Variable, fixed and depreciation casts	666	637	730
Interest earned	19	10	21
Net profit	371	380	421

Conclusions

The first year results of a long term study are presented on the effect of date of calving on milk output for creamery milk production. The experiment compared early and late spring calving and in addition a combination of autumn and spring calving was also studied. Similar milk outputs were achieved for each treatment group but the proportion of total yield produced varied during the year and this influenced the price received due the bonus payments paid by the Co-Operatives. Higher feed costs were associated with autumn/spring and early spring calving groups and must be taken into consideration in any milk pricing policy.

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Factors Effecting Herbage Intake of Cows

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Introduction

Maximising the grass and silage component of the total annual feed intake of the dairy cow improves the profitability of the milk production enterprise. Such factors as silage quantity and quality, early spring grass, low concentrate inputs and good grassland management help to achieve this aim.

The cow's requirement for nutrients is determined principally by such factors as milk yield, stage of lactation, metabolic size and condition (degree of fatness). At pasture, however, a variety of sward and management factors operate to effect the herbage intake of the cow.

Sward factors

The main sward factors which effect the intake of the grazing dairy cow are digestibility of the herbage, the mass and spatial distribution of the herbage and the species of plants present in the sward.

Sward mass

The effect of sward mass on intake was examined in two trials in the spring and summer of 1984 at Moorepark. Table 1 outlines the digestibility of the sward grazed by the cows in both spring and summer. The digestibility figures refer to the top and bottom of the grazed horizon. The primary spring sward showed no differentiation in digestibility as the animals grazed down the horizon in contrast to the summer sward which was very much depressed in digestibility as the animals grazed closer to ground level.

Table 1

Digestibility of the grazed horizon of the sward (OMD%)

	Spring	Sumer
Top of sward	82.0	76.0
Bottom of sward	81.0	65.0
Average	81.5	70.5

Tables 2 and 3 outline the intakes of the various groups of cows for the spring and summer periods respectively. Increased herbage mass in both seasons increased intake of herbage especially at high herbage allowance. The increased intake with increased herbage mass was associated with increased rates of herbage utilisation reflecting the fact that the spatial distribution (particularly height of sward) was now more favourable for ease of prehension by the animal. The much reduced intakes at high herbage allowance with low herbage mass is considered significant as it clearly demonstrates that although effective stocking rate (herbage allowance) may be adjusted in a practical situation due to scarcity of herbage, restricted herbage intake could still result due to the aerial distribution of the herbage.

Table 2

Daily intake (kg organic matter/head) of cows grazing two contrasting herbage masses (kg organic matter/ha) at two daily herbage allowances (kg dry matter/head) in spring

	Herbage mass	
	2900	3500
Allowance		
16	11.8 (88)	12.6 (93)
24	14.7 (73)	16.2 (77)
( ) % utilisation		

Table 3

Daily intake (kg organic matter/head) of cows grazing two contrasting herbage masses (kg organic matter/ha) at two daily herbage allowances (kg dry matter/head) in summer.

	Herbage mass	
	3500	4600
Allowance		
16	11.6 (79)	12.5 (85)
24	13.6 (62)	16.6 (76)
( ) % utilisation		

Concentrate feeding

Responses in milk production from concentrate feeding of cows at pasture has generally been poor and uneconomical. It is widely reported in the literature that concentrate feeding reduces herbage intake but there is little information in the case of grazing cows at very high stocking rates (low herbage intake). Experiments were conducted in 1983 and 1984 to examine the effect of grazing dairy cows in spring, summer and autumn at high and low herbage allowances. Table 4 shows the effects of concentrate feeding at high daily herbage allowance (24 kg herbage dry matter).

The concentrate consisted of a barley molasses nut (95 : 5) and was fed daily at 3.2, 3.6 and 3.8 kg organic matter per head in spring, summer and autumn respectively. The concentrate increased total intake in all seasons but with a much reduced herbage intake. The herbage intake for

Table 4

The effect of concentrate feeding on daily herbage intake (kg organic matter/head) at high herbage allowance

	Herbage intake Grass only	Herbage intake Grass + Conc.	Total intake Grass + Conc.	Replacement rate
Spring	16.2	14.1	17.8	0.57
Summer	16.6	14.1	17.8	0.67
Autumn	16.9	15.0	18.2	0.59

the grass only groups was high. The results indicate very substantial replacement of concentrate for herbage at high herbage intake.

Table 5 shows the effect of concentrates at low daily herbage allowance (16 kg of herbage dry matter). Concentrates again reduced herbage intake but by a much smaller amount. The replacement rates were about half of those found in the previous case. The existence of substitution rates of this degree at these low intakes is surprising. Smaller substitution rates may be the case with higher yielding cows. However, the principal result is that substitution of concentrates for grass occurs regardless of season (sward type) and its magnitude depends upon the level of herbage intake.

Table 5

The effect of concentrate feeding on daily herbage intake (kg organic matter/head) at low daily herbage allowance

	Herbage intake Grass only	Herbage intake Grass + Conc.	Total intake Grass + Conc.	Replacement rate
Spring	12.6	11.4	14.9	0.34
Summer	12.5	11.0	14.7	0.40
Autumn	12.8	12.0	15.2	0.28

Factors of animal origin

Previous work at Moorepark found that lactating pregnant cows consumed 22% more herbage than pregnant dry cows. However, with lactating animals, the level of milk production and the stage of lactation have a substantial effect on the intake of nutrients. Peak intake of dairy cows lags behind peak milk yield. High producing dairy cows do not reach peak intake until 100 days post-calving. Information suggests that the lag between peak intake and peak yield may be longer with first lactation than with other animals and shorter with low yielders compared to high yielders.

The relationship between level of milk production and intake is difficult to define as the effects on milk production due to lactation stage and the

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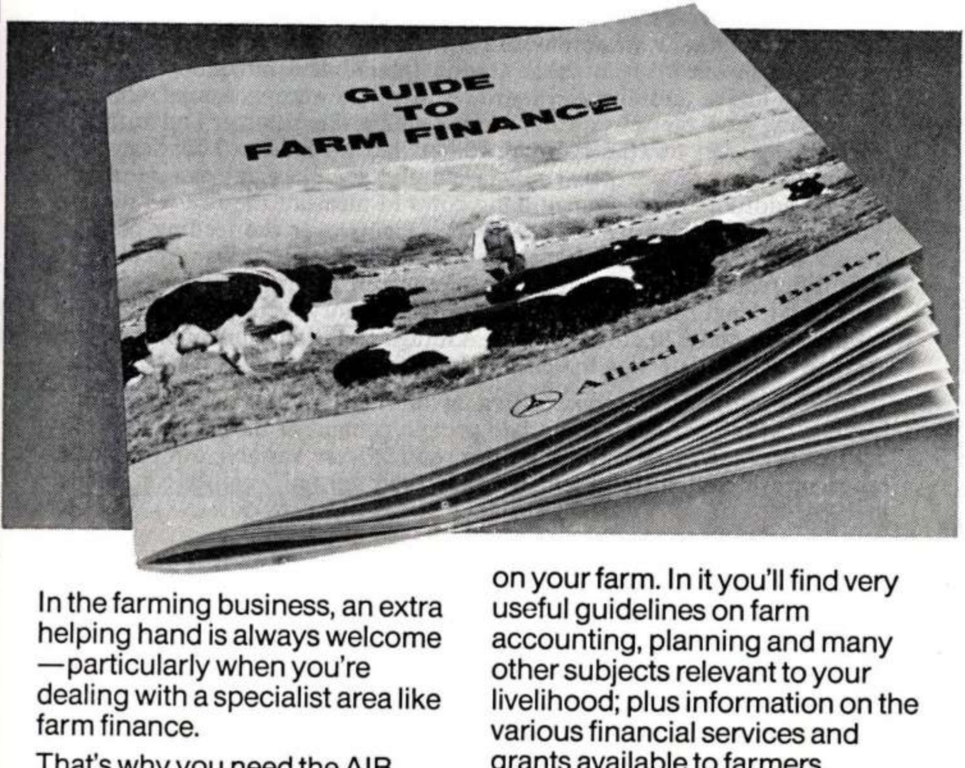

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effects on milk production due to genetical factors are often confounded in experiments. Additionally, when cows are fed according to yield it is difficult to construct relationships between yield and intake. Metabolic size and liveweight are highly correlated and at comparable degrees of fatness large cows eat more food than small cows. The degree of increased feed intake with increasing size depends on the source of feed (roughage concentrate ratio or mixed diets).

An experiment carried out at Moorepark in 1984 examined some of animals' factors which determine the herbage intake of stall-fed cows. Four feeding periods of twelve days in duration were used. The sward was composed mainly of perennial ryegrass and white clover and herbage was cut fresh each day of each feeding period and fed indoors to the cows. The intake and digestibility of the herbage were measured. Cutting and feeding took place in spring, early summer, late summer and autumn. Herbage was fed to 10 large and 10 small cows balanced for lactation number, calving date, current milk yield and degree of fatness. Herbage was fed additionally to four milking cows to measure the *in vivo* digestibility of the cut herbage. Average liveweights over the feeding periods were 570 and 510 kg for the large and small frame size cows respectively. This difference in bodyweight was reflected in a large difference in the height and length of the cows. The large category were on average 139 cm in height and 130 cm in length. Average lactation number was 5 and average calving date was the end of January.

Table 6 outlines the composition of the herbage fed during the four feeding/cutting periods. The crude protein content of the primary spring cut was very low. Ash and dry matter content were variable but the small range in ash content reflected the drier than normal weather conditions in 1984.

Table 6

Composition of the cut herbage (g/kg)

	Cutting period			
	S	ES	LS	A
Dry matter	203.0	175.0	220.0	155.2
Ash	84.0	113.6	108.6	91.5
Crude protein	136.2	180.2	183.9	204.2
MAD-fibre	214.2	298.7	250.3	262.0
'In-vivo' DMD	784.5	768.6	695.5	766.3
'In-vivo'	821.8	798.1	750.3	801.2

S=Spring; ES=Early Summer; LS=Late Summer; A=Autumn

The digestibility values showed very similar trends to those found previously in other cutting and feeding experiments at Moorepark. The primary spring sward was very high in quality and progressively declined throughout the summer and recovered somewhat in the autumn.

Table 7

Total milk production characteristics (kg) of the two groups of cows (compositional percentage in brackets)

	Large category (C)	Small category (C_2)
Milk	4262	4244
Fat	155 (3.64)	154 (3.63)
Protein	146 (3.43)	153 (3.61)
Lactose	196 (4.60)	191 (4.50)

Production of milk and milk constituents was similar for both groups of cows except that the small cows yielded slightly more protein and lactose due to higher protein and lactose percent in the milk. Daily milk production during the feeding periods was similar for both groups and averaged 20.0, 17.0, 14.0 and 10.0 kg of milk/cow for spring, early summer, late summer and autumn respectively.

Table 8

Daily intake of nutrients per animal over the season

	Feeding periods			
	S	ES	LS	A
Dry matter (kg)	16.7	17.3	16.9	16.2
Organic matter (kg)	15.3	15.3	15.0	14.7
Digestible organic matter (kg)	12.6	12.2	11.3	11.8
Digestible energy (MJ)	230.2	237.7	220.7	221.8

Feeding periods S, ES, LS, A as per Table 6

Intakes over the four feeding periods for both groups are shown in Table 8. Peak intake of dry matter and digestible energy was achieved in June (120 days approximately from calving). Intakes of organic matter and digestible organic matter were modified due to ash content and digestibility.

Table 9

Daily intake of nutrients/cow for both large (C_1) and small cows (C_2)

	Feeding period							
	S		ES		LS		A	
	C_1	C_2	C_1	C_2	C_1	C_2	C_1	C_2
Dry matter (kg)	17.0	16.3	17.5	17.1	17.0	16.7	16.6	15.7
Organic matter (kg)	15.6	15.0	15.5	15.1	15.1	14.8	15.1	14.3
Organic matter/100 kg Liveweight (kg)	2.85	3.01	2.78	2.98	2.64	2.87	2.61	2.77
Digestible energy (MJ)	235.0	225.4	240.1	234.4	222.7	218.7	227.8	215.8

Feeding periods S, ES, LS. A as per Table 6

Table 9 shows that over all the feeding periods the large cows consumed 0.5 kg of dry matter and 8 MJ digestible energy more than the smaller cows. However, the small cows consumed more herbage per unit of metabolic size than the large cows. The differences in intakes were small in all cases and amounted to about 0.8 kg dry matter per extra 100 kg liveweight above 500 kg.

The ranges in intake between cows within a given category were quite large reflecting the wide spread of calving dates and level of milk yield. An example of this for dry matter intake is shown in Table 10.

Table 10

Ranges of daily milk yield and intake of dry matter (kg) for both categories of cows

Period	Milk yield	Intake
S	25.0 - 10.8	20.4 - 13.7
ES	22.8 - 9.2	20.4 - 13.4
LS	18.5 - 7.2	19.4 - 12.4
A	15.8 - 4.3	18.8 - 10.5

The range in milk yield was 13 kg per day while the range in intakes was 7 kg per day. These ranges show that within a herd some cows consume about 50% less feed than other cows. This assumes a random spread of milk yields around the mean. The average increase in dry matter intake for each one kilogram increase in daily milk yield was 0.35. An extension of this work has commenced in 1985 with the assembly of a high yielding herd of cows in order to measure their maximum intake of a high concentrate to roughage ration over the whole year and to compare this to the maximum intake achievable with a similar group of cows on unrestricted herbage during the grazing season and conventional silage/concentrate rations indoors prior to turn out.

Conclusions

1. Sward mass (kg organic matter/ha) has a significant effect on the herbage intake of grazing dairy cows. Reduction in herbage intake occurs at low sward mass even though herbage allowance may be liberal.
2. Concentrate feeding to grazing dairy cows depresses their herbage intake. The magnitude of the depression depends on the level of herbage intake which in turn is largely determined by herbage allowance. Substantial replacement of herbage by concentrate occurs even at low levels of herbage intake.
3. Milk yield and liveweight differences account for significant differences in herbage intake between cows, 0.8 kg dry matter intake/100 kg liveweight above 500 kg and 0.35 kg of intake for each additional 1 kg increase in milk yield.

Do it Yourself Artificial Insemination (DIY AI)

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The recent introduction of legislation allowing the use of "do it yourself" Insemination (DIY AI) by farmers for use in their own herds, has stimulated considerable interest. Already after only one season of training courses the Department of Agriculture has received 100 applications for licences. From the dairy farmer's point of view there are several reasons why he might wish to become involved in DIY AI. These reasons are:

1. Better timing of AI;
2. Convenience;
3. Improving conception rates;
4. Disease control;
5. Costs.

While some of these reasons are more valid than others, all should be considered carefully before making the final decision.

1. Better timing of AI

In the dairy cow ovulation occurs 26 to 32 hours after heat onset (Hafez, 1980). The fertile life of the ovum lasts for approximately 24 hours and the spermatozoa have a fertile life span of approximately 30 to 48 hours. However it is suggested that optimal fertility is achieved when insemination takes place 6 to 24 hours before ovulation. This information is of little value to the dairy farmer since he has no means of knowing when this will occur. On the other hand it has been suggested that optimal fertility will be obtained if inseminations are performed 12 to 24 hours after heat onset. In those herds where frequent heat observations are made during the day it would be possible to be reasonably accurate as to when heat onset began. However since 50% of heats occur in the period 6 p.m. to 6 a.m. it is much more difficult to be precise. Bull fertility has also an important affect on time insemination since it has been shown that high fertility bulls are less affected by early post oestrous inseminations than low fertility bulls. The difference in fertility appears to be related to sperm livability with the high fertility bulls producing semen with longer viability.

2. Convenience

In addition to possibly providing a better timed AI service, DIY AI is also more convenient. It avoids having to hold in cows for quite prolonged periods of time and also reduces any associated stress which may have a detrimental effect on fertility.

3. Improving conception rates

With the possibility of better timing of AI through using DIY the inference is that conception rates will be improved relative to the commercial AI service. While there are little published data available on direct comparisons between DIY AI and the commercial service, what information is available would suggest that fertility on average is reduced. A comparison of DIY AI and the inseminator service in the UK showed that more services were required per conception and more cows failed to conceive, as a result of DIY AI (Lamont and Foulkes, 1981). AI technician and dairy men insemination comparisons in the US have also shown similar results. On average it would appear that conception rates to DIY AI are 10 to 15% lower than to commercial AI. However some farmers may get better results but in general fertility levels would tend to drop.

Another reason why fertility on average would tend to dis-improve is because there is no standard set for DIY AI. The DIY training programme which costs £170 provides training, a booklet, and a certificate but no evaluation of skill or competence is made. Thus the licence only means that the person has gone through a training course and is now licenced to practice DIY AI in their own herd. Since no evaluation is made or standard set during this course, it is likely that people who are totally incompetent at the technique will obtain licences. Thus the likelihood of conception rates improving as a result of converting to DIY AI would seem to be fairly remote for some farmers.

4. Disease control

While disease control would not be one of the main reasons for converting to DIY AI, it would be advantageous in a situation where movement was restricted due to disease control regulations. The possibility of disease being introduced to a farm by an AI operator is also possible but very remote. What danger exists in this regard could be removed through going to DIY AI.

5. Costs

The major reason for converting to DIY AI would be the potential savings in economic terms. The current commercial AI fee of £11 includes the first service and two free repeats, but semen is extra, except for bull of the day and for some beef bulls. Thus the average cost of a nominated service for commercial and DIY AI is £19 and £8 respectively. For bull of the day and beef bulls the cost for commercial AI and DIY AI is £11 and £3 respectively. Taking a 100 cow herd, 1.65 services per pregnancy and where 50% of inseminations are nominated, 20% bull of the day, and 30% to beef bulls, the relative costs of commercial AI and DIY AI are calculated in Table 1. The capital costs of the DIY course and the nitrogen container is £150 and a years supply of liquid nitrogen is included + £100 per year. The costs per cow in calf for commercial AI and DIY AI are £18.44 and £11.52 respectively. This saving of £7 is substantial but is only true if existing pregnancy rates are maintained by changing to DIY AI.

Table 1

Comparative costs of commercial AI and DIY AI in a 100 cow herd with 50% nominated semen (£19), 20% bull of the day (£11) and 30% beef sires (£11). (Assuming 1.65 services/pregnancy).

	Commercial AI	DIY AI
	£	£
50% nominated	1250	656
20% bull of the day	242	99
30% beef sires	352	147
SUB TOTAL	1844	902
Capital Costs		
Course and container		
(depreciated over 5 years)		150
Nitrogen supply/year		100
TOTAL	1844	1152
Cost/cow in calf	£18.44	£11.52

If on the other hand, as seems to be the more likely case, a 10% fall in fertility occurs, the costs per cow in calf including milking days lost as a result of later calving is almost £22 (Table 2). Thus DIY AI costs an extra £3 per cow in calf over the commercial service. In this situation, the other reasons mentioned for converting to DIY AI would hardly justify this additional cost.

One of the other factors which must be considered, especially for those dairy farmers serviced by the Munster Cattle Breeding Society, is the loss of the fresh semen service. This fresh semen service provides semen from the top quality dairy bulls during the peak breeding months at relatively low cost. This is something which has not been included in the initial comparative costs of the two systems. The final decision as to whether a farmer should convert to DIY AI depends on his herd size and whether he would be capable of maintaining current conception rates. For those farmers who have the technical skill and expertise necessary for good AI, the benefits would be substantial but for those who lack ability, the costs would be prohibitive. An assessment of a farmer's potential skill as an AI operator should be made at the end of the training programme and rated against a set standard. Only those farmers who achieve this standard should consider converting to DIY insemination service.

Table 2

Comparative costs of commercial AI and DIY AI in a 100 cow herd (as in Table 1) except with a 10% drop in conception rate for DIY AI (1.65 services per conception versus 1.82)

	Commercial AI	DIY AI
	£	£
50% nominated	1250	720
20% bull of day	242	109
30% beef sires	352	162
SUB TOTAL	1844	991
Capital Costs (Table 1)		250
Milking days lost		
(630 days @ 2 gals./day x 0.75p/gal.)		945
TOTAL	1844	2186
Cost/cow in calf	£18.44	£21.86

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Financial Management on Dairy Farms —The Weak Link?

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Financial management is as important in farming as in any other business.

It is primarily of importance to the farmer himself, whether or not he has any borrowings, to facilitate an accurate appraisal of the current state of his business and to help him plan the future effectively.

Most business people, and especially dairy farmers, that I have met are hard-working. However, not all dairy farmers have been successful. Therefore, the first point I wish to emphasise is that the ability to work hard should not be confused with the ability to manage a farm business successfully. There is a German saying, 'All intelligent people are lazy'. The intelligent lazy manger gets the maximum output from the minimum hours and he exploits the time that he is not 'working' by using the intelligence which won him the time; in other words he thinks. As you think you will demand, and ultimately provide, the essential ingredient for managing a successful business — INFORMATION. Provision of information begins with accurate *record-keeping* or as a visiting speaker (1) at a previous Grassland meeting put it — 'a short pencil is better than a long memory'. Cheque books should be used to record all payment transactions and all receipts should be lodged to individual customer bank accounts; the true business turnover can be confirmed in these circumstances.

Let us examine briefly the farm business. However large and diverse (in terms of enterprise mix) your dairy farm is, it ultimately reduces to OUTPUT and INPUT terms. The successful manager is the one who consistently maximises the difference between the two sides of the equation. This difference is the ultimate aim of any business, i.e. to make adequate CASH PROFIT to meet essential commitments such as: living expenses, interest/repayments, savings, re-investment and taxation. The need for greater efficiency in terms of cost control is more necessary than ever in a Super Levy environment, hence the relevance of improved financial management. Skills such as farm planning, cash flow control, and the keeping of detailed management records form a package which the dairy farmer of today needs to identify increased profitability opportunities. Unfortunately too often in the past these were regarded as unnecessary and the emphasis was exclusively on technical coefficients. Many dairy farmers seem to excuse the absence of financial information by suggesting they have a 'feel' for the way the business is going.

Typical profile of a difficult farming account

1. Absence of Records and/or Milk Statement not used effectively.

2. No recent Farm Accounts.
   Accounts are important to the farmer (businessman) because they show :
   (i) The financial strength of the business at the time of preparation of Accounts—Balance Sheet;
   (ii) The trading performance over whatever period the Accounts cover, i.e. Profit and Loss Statement.
   (iii) Quantification of *fixed* costs and drawings. Fixed costs usually range from £50/£100 per acre owned (excluding non-family labour and con-acre).

3. Absence of any Farm Plan.
   Most dairy farmers have not taken farm planning seriously and more often than not they perceive it as a necessary evil to keep Bank Managers satisfied . However, in other situations problems have arisen despite preparation of Farm Plans due largely to inadequate expenditure control.

4. Failure to monitor progress and react. Examples would be :
   (a) Inadequate control of costs, e.g. over-feeding, inflated machinery running costs, etc.
   (b) Changed circumstances which may require adjustment in or even drastic revision of what was originally a soundly based plan, e.g. Super Levy.
   (c) Low retention of profits in easily realisable assets, e.g. stock vs. concrete.

5. Unbudgeted expenditure from cash flow :
   (a) Inclusion of extra development work which was not part of an original Farm Plan, e.g. erection of a 100-space cubicle shed rather than a 60-space and additional yard concrete/slurry accommodation.
   (b) Change of car/machinery without proper appraisal resulting in a shortage of working capital or the emergence of a hard core in the overdraft.
   (c) Construction of new dwelling house or substantial extension to original without appropriate financing arrangements.

6. Misuse of sanctioned funds :
   Loan used for purpose other than that requested, e.g. Stocking Loan used to discharge undisclosed creditors.

7. Dispensation with the rules of logic and economics, e.g. expectation that milk yield will improve by 200 gallons per cow within one year despite the fact that silage quality, herd composition, and calving patterns were to remain essentially unchanged.

8. Drawings:
   These have to be related to the stage of development and the profit margins being generated on the farm. The German standard of living, however desirable, may not be possible on Irish farming margins.

9. Split Financing:
   Loans from several sources, e.g. Bank, A.C.C., Co-Op, Merchant, H.P. Company, etc.

   In many cases, at any given time, the farmer simply did not know how much money he owed and to whom. Strict Current Account control and/or refusal to sanction further funds by the Bank has too often in Ireland been interpreted by individual dairy farmers as a restriction on their 'spirit of independence'. Instead of pausing to examine whether such a negative response might validly represent an accurate assessment of their repayment position they have sought further finance from whatever source and sometimes at substantially higher cost.

Cash flow forecasting

A Cash Flow Projection is simply a Statement setting out the expected cash receipts and payments for a future period. A Cash Flow disregards all non-cash elements, e.g. stock changes. It not only projects the *total* amount of cash required over the year but more importantly it identifies the seasonal flow pattern which can provide the following information:

(1) An indication whether there are any periods where cash may be scarce or run out.

(2) Confirmation of Overdraft required or other seasonal financial needs. Most farmers under estimate the difficulty of accurately planning their financial requirements.

(3) Aid to proper Planning of Capital Expenditure Programme, e.g. indication of a cash shortage early in the season would suggest deferral of equipment purchase until later or alternatively the need for a loan to cover such requirement.

(4) Indication of surplus which can be used for any necessary capital expenditure or to take advantage of discounts from suppliers for immediate payment.

(5) Confirmation to Lending Institution of customer who is on 'top of the job', thereby improving credit rating.

(6) Facilitates comparison between projected and actual performance. On a monthly basis this is the most effective financial control mechanism available to any dairy farmer.

As a means of spotting trouble, the measurement of cash flow is vital. Despite the fact that dairying is a relatively strong cash-flow business the periods of major inflow are not synchronised with the periods of major outflow.

The amount of information sought by a bank is sometimes claimed to discourage the potential borrower. He may feel that the preparation of a detailed submission is a waste of management time. If a farmer cannot provide all the requested information for his Bank Manager easily. then the Manager knows that the farmer cannot provide it easily for himself—he does not know all that he should about running his own business. It is information the farmer should know. If it takes time to uncover all the details, then it is time well spent. Dairy farmers can no longer leave their financial planning to their local branch managers. Failure to discharge fully a seasonal loan which may relate to fertiliser/feed purchase and/or stock retention and an evident build-up of hard core overdrafts should be recognised as at least a hiccup in the business. Early questions /answers on the reasons are a more sensible approach to dealing with a potential problem which may not go away. Reluctance to face up to impeding financial difficulties often leads to friction and misunderstanding between dairy farmers and their lending institutions, partly because "by the nature of their work, bankers must reduce everything to figures. They are made uneasy by factors which cannot be measured". (2)

Regular communication is the key to a good working relationship between a farmer and his Bank Manager. Some farmers tend to the view that the less they meet the bank the better. This is a mistaken approach. In communication terms it is even more important that there should be a strong family involvement in the farm business — this is a feature of successful dairy farms and the converse is true of problem cases in many of the latter we have found that wives had not been aware of the full extent of the financial situation until a crisis had arisen.

Financial analysis

In this section I have summarised three large dairy farm situations where farm accounts were available. The financial information has been extracted selectively to illustrate profit performance over a 3-year period and to examine certain ratios which can assist in an evaluation of the financial stability of the farms. The adjusted profit is defined as net profit + interest + depreciation, i.e. cash flow. Current assets consist largely of livestock but valuations differ somewhat due to accounting treatment between farms.

Farm 1 would represent an acceptable debt : disposable asset ratio in the context of a well-managed farm. On the other hand, Farms 2 & 3 are over-borrowed and represent high risk lending situations on the basis of this ratio. However, top efficiency has enabled Farm 2 to meet commitments. The interest : G.F.I. ratio comparisons similarly indicate the marked contrast between Farm 1 and the other two. Generally, an interest : G.F.I. ratio of 20% upwards rings the warning bells whereas 10% would be a comfortable situation. The gross profit margin indicates the proportion of total output absorbed by direct (variable) costs, i.e. the higher the ratio the better the efficiency on the farm.

EXTRACTS FROM FARM ACCOUNTS (200 acres, mainly dairying) :

FARM 1 (100 cow-herd @ 1,100 gallons + tillage)

YEAR ENDING	**31.3.1982**	**1983**	**1984**
Adjusted Profit £	31,500	47,500	34,500
Interest	11,000	12,000	7,000
Drawings/Tax	9,000	12,000	17,000
Surplus (Deficit)	11,500	23,500	10,500
Current Assets	74,000	81,000	65,000
Total Liabilities	75,000	65,000	57,500
Debt : Disposable Asset Ratio (%)	101	80	88
Gross Farm Income (GFI)	80,500	106,000	115,500
Interest : G.F.I. Ratio (%)	13	11	6
Gross Profit Margin (%)	59	64	52

FARM 2 (100 cow-herd @ 950 gallons + beef)

YEAR ENDING	**31.3.1981**	**1982**	**1983**
Adjusted Profit £	31,000	30,000	36,500
Interest	16,000	18,500	20,000
Drawings/Tax	9,500	10,000	9,500
Surplus (Deficit)	5,500	1,500	7,000
Current Assets	70,500	59,500	59,500
Total Liabilities	122,000	119,000	122,000
Debt : Disposable Asset Ratio (%)	172	200	205
Gross Farm Income (GFI)	75,000	81,000	88,000
Interest : G.F.I. Ratio (%)	21.5	23	22.5
Gross Profit Margin (%)	59	56	60

FARM 3 (100 cow-herd @ 850 gallons + pigs)

YEAR ENDING	**21.12.1981**	**1982**	**1983**
Adjusted Profit £	27,000	24,000	40,500
Interest	24,000	27,500	13,000
Drawings	8,000	10,000	14,500
Surplus (Deficit)	(5,000)	(13,500)	13,000
Current Assets	80,500	84,000	100,000
Total Liabilities	164,000	183,000	188,000
Debt : Disposable Asset Ratio (%)	204	217	187
Gross Farm Income (G.F.I.)	68,000	92,500	98,500
Interest : G.F.I. Ratio (%)	35.5	30	13
Gross Profit Margin (%)	57	39	57

Summary : Financial Management Guidelines

1. Provide up-to-date information by keeping good records.
2. Have farm accounts prepared, preferably within 3 months of trading year end.
3. Consider the preparation of a monthly cash flow projection for effective financial control on your farm.
4. Do not undertake major expenditure from cash flow.
5. Adhere to budgets and loans sanctioned. Don't discard a farm plan after facilities have been sanctioned.
6. Non-conforming overdrafts should not be ignored by recourse to other sources of finance.
7. Identify your cost structure so that you can take steps to improve enterprise efficiency.
8. Be aware of level of drawings. In general, many farmers have little accurate estimate of living expenses and frequently under estimate them by overlooking items such as educational expenses. The opening of a separate household account to which regular (monthly) agreed transfers are made, simplifies considerably the control and budgeting of drawings.

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Challenges to the Irish Dairy Industry

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During the past two years I have been meeting with Dairy Co-operative leaders in a number of capacities. Out of these discussions a number of issues relating to the future of the Irish Dairy Co-operatives have surfaced. Interestingly, I recently met with two dairy co-operatives in Nova Scotia, Canada, which are about the same size as the co-operatives included in the so-called 'Big Six' here in Ireland. It was a unique opportunity to compare the co-operatives in Nova Scotia and the co-operatives here in Ireland. My observations are based upon: discussions with leaders in the Irish co-operative community; analysis of the annual reports of several major co-operatives including all of the "Big Six"; limited research in which Dr. Garoyan and I have been involved; some 30 years of experience in working with boards and management of agricultural co-operatives including many dairy co-operatives and the recent meetings in Nova Scotia.

Firstly, the dairy co-operatives in Ireland are alive and well. They can have a great furture as is clearly demonstrated by their growth — some greater than others. Most have latent growth in contrast to those in other countries where growth is in mature stages and fine tuning is taking place. In Ireland there are a number of opportunities for the dairy co-operatives which have not been fully exploited. There are adjustments that must be made by the co-operatives to take full advantage of the potential. Adjustments by other integers of the dairy community are also needed, i.e. Bord Bainne, to provide a more complete service to the dairy industry. Farmers themselves may have the biggest adjustments to make.

The asset base for each co-operative has grown materially. As a group for the "Big Six", total assets grew from £161.9 million in 1977 to £365.5 million in 1983. This was far greater than inflation. Co-operative boards, farm organization leadership, labour and bankers can contribute to increasing this asset base by accommodating to prudent requirements for a healthy growth. Let us first examine the public financial statements of the "Big Six" in the context of the growth issue. An analysis was made for the ten year period 1974-1983. During this period out of £363.8 million funds raised by the "Big Six": 66.2% came from operations, 22.3% came from borrowings, 8.0% came from grants, 3.5% came from members; 69% was used for fixed assets, 29.6% was used for working capital and 1.4% was invested in other businesses.

The shocking statistic is that only 3.5% of the capital raised during this period came from the members. This is probably the lowest in the world. Only two co-operatives of the "Big Six" have had a revolving fund in recent times. Avonmore had a revolving capital fund (discontinued in 1984) and Waterford has a revolving loan fund. There are two other alarming trends. Cash flow as a percentage of sales is trending sharply downward and trading surplus as a percent sales is also trending sharply downward. Both of these trends continued downward in 1984. If these trends continue, how will future investments be funded? Or how will debt be serviced? Currently, interest is devouring a large proportion of trading surplus. Another statistic that is a warning signal is the size in creditor financing. In terms of total liabilities, creditors as a percentage of Total Liabilities have increased from 18.5% in 1977 to 26% in 1984. Some serious questions need to be raised relative to this statistic, although just looking at in the raw form does not tell us what the construction of that creditor number is.

If there is to be continued development of the industry to the extent to which it is capable, major input of additional capital is needed. This infusion of new capital would be used for research and development, capital cost in relation to new value-added products and new processes, including brand names, rationalization of assembly, processing, and distribution facilities, energy conservation measures, and investments in new technology for existing processes.

To obtain the most advantagous financing for these investments, co-operatives might pool their needs. By this I mean that if all of the co-operatives were to combine together and seek a pool of funds for their total needs the chances of their entering some of the capital markets, not only in Ireland but in other European markets, would be much greater. Interest rates might very well be lower and the length of term of the borrowings might also be longer particularly long term bonds. The Irish banking industry could very well examine innovative financing programmes of co-operative banking systems that exist in most other countries. I believe that long term loans—up to 30 years—are needed for the co-operatives in Ireland to plan effectively and to develop like their competitors in other countries.

Another area which bears some study is that related to overhead costs and profit centre analysis. Such analysis might lead to more rationalization but I have not studied this area. Performance is frequently—and mistakenly—measured only on trading surplus. Trading surplus is only one dimension of economic results of a co-operative. Another relevant measure is price paid to suppliers for their milk or prices charged for purchases by them. It is probable that some co-operatives paid a relatively higher blended price with a resultant lower surplus. Other co-operatives may end the year with a relatively higher surplus but farmers on the whole may have received a lower blended price.

In a true co-operative this phenomena would have made no difference because the surplus would be allocated at the end of the year. In Ireland patronage refunds are not paid to farmers. There are two reasons why this might be the case (perhaps neither one of them was in fact the reason why patronage refunds are not paid) : (1) that a high price is paid at the delivery of milk—sometimes at a price higher than is justified since it is not known whether or not there will be a surplus earned during the year and (2) that if patronage refunds are paid to farmers the farmer incurs a tax liability. Again Ireland is unique in this regard because in most countries the tax is paid either at the farm or at the co-operative level. In Ireland, if it remains in the co-operative, for the most part no tax is paid.

In most other countries the price paid initially is a competitive price. It is not set by the Board of Directors. It is set by Operating Management and at the end of the year any surplus generated by the co-operative is distributed as patronage refunds. This means that in the final analysis the prices received by farmers are increased once the patronage refund is distributed—partly in cash and partly in equity paper—at the end of the year.

By taking the responsibility and authority of setting periodic milk prices the Board cannot hold management accountable for year end results because a major function of the size of surplus or deficit is the up front price paid for milk. As in co-operatives and companies in most other countries operating management of ordinary companies in Ireland —not the Board—sets the price.

From a broader perspective I would now like to identify what causes stagnation in agricultural industries. Based upon about 20 years of analysis and observation I can safely say that some of the reasons for stagnation are: weak management, low member equity, high cash patronage refunds (same as high price), and being slow to adjust to changing economic and market conditions. The question could be raised: "Why grow?" There are some important reasons for growth. They include opportunity for diversification, economies of scale, more flexibility to implement opportunities, reduction of the need for price competition (competition rather that relates to more services, broader lines of products, etc.).

There are some dangers to growth, however. These include an increased tendency toward bureaucracy, possible loss of member control, and earnings becoming the sole goal.

It is difficult to distinguish between the economic position of dairy co-operatives and the industry of which they comprise a dominant position. The production sector (farmers) have been experiencing reduced production and lower returns and many are financially weak. Many dairy co-operatives are also in a poor financial condition due to problems within the dairy industry. While some of the big dairy co-operatives are diversified into non-dairy products, the heavy dependence on the dairy industry far overshadows any non-dairy revenues. While profits from non-dairy activities are always helpful, questions remain about the profitability potentials of existing non-dairy ventures. Some co-operatives appear to be in lower margin activities. These ventures often require a

level of managerial skill not yet proven in the existing co-operatives. Retail activity of co-operatives often competes with supermarket chains —the co-operative's customers. Finally, the risks of capital losses in some of the non-dairy ventures seems to be larger than the potential gains in annual profits. Although dairy production has slowed, the huge inventory of products available world-wide still serves as a dampness on profitability. Production is down within the E.E.C. and the U.S. Production was up in Australia, New Zealand and Canada. There are signs of increased consumption for some products — mainly cheeses — while lower demand exists for butter and skim milk powder. How quickly the world-supply demand comes into balance will determine how profitable will be the Irish dairy industry.

The industry in Ireland seems to be driven by production considerations rather than by markets. Apparently excess capacity exists and co-operatives are manoeuvering to obtain volume from a shrinking total supply base. Some wounds exist but they are minor compared to future conflicts that may arise unless the industry comes to grip with the problems.

As co-operatives becomes more concerned about producing products for consumer consumption rather than for intervention storage, a number of changes will follow. Shifts will be required from butter-powder, to various types of cheeses and other consumer products. They may even learn that the market for yoghurt is limited, too. As production shifts to more perishable products, basic changes in seasonal farm milk supplies will be needed. The supply base for the industry will need to change, i.e. the nature, type and size of dairy farm will change to produce a more uniform seasonal milk supply. Co-operatives will need to reward farmers for responding, as several co-operatives are now doing.

There is a need to move more to value added products. This does not mean value added in the sense of only consumer products. It might mean value added in the industrial line such as where some increased processing takes place but the product is sold to other firms for further processing into consumer or other end products.

Joint marketing might be another way of approaching the export issue. An Bord Bainne is in place as the marketing arm. However, co-operatives are not fully utilizing Bord Bainne. Each seeks to find its own markets for its own products and only a limited amount of product produced by the co-operatives is going through Bord Bainne. This is highly unfortunate since a marketing organisation can only be effective when it has the whole of the production of its owner-members to market so that negotiations can effectively be made with buyers. Unless the co-operatives make a major change in this direction Irish exports from the dairy industry will continue to deteriorate against other competitors. If Bord Bainne is not doing the job the co-operatives wish it to do, they should in fact require that necessary changes take place—they sit on the Board of Directors of Bord Bainne. The bottom line is that "Bord Bainne is not being given a chance by the co-operatives to perform".

The Directors of co-operatives have a major responsibility of shifting the utilization of their energy and time resource. Rather than taking time each month to set the price of milk (this can easily be done by operating management within parameter policies established by the Board of Directors), they should devote more attention to carrying out the major functions of Boards, i.e. planning and control. They should also identify their information needs. Model information systems exist that are specific on key performance areas and provide key indicators that are appropriate for planning and control as well as other decision making by Boards of Directors. Virtually no Board of Directors in Ireland has set performance goals for their co-operative and then monitoring the achievement of those goals. Some of the key issues that were found in the two years of discussions with co-operative leadership are:

(1) there is a deep rooted mistrust between members and the Board/ Management team;

(2) there appears to be a total lack of sense of ownership of their co-operative by members;

(3) strategic planning may be in the minds of operating management but Boards are not involved in setting directions for those plans and evaluating the implementation consequences;

(4) today's co-operative structures may not be suitable to take advantage of the opportunities;

(5) should Irish farmers create bargaining associations and let co-operatives become companies?;

(6) the decision process within co-operatives becomes highly interwoven with agricultural politics, i.e. groups of producers take actions which damage their own co-operative;

(7) clear understanding of the rights of the member in relationship to his co-operative, the responsibilities of the co-operative to the member, the rights of the co-operative, and the responsibility of the member to his co-operative appear to be absent.

Summary

(1) A number of co-operatives are large enough as dairy processors—none are large enough to be a significant force in export markets. Either joint efforts are needed by co-operatives or they must continue individually to find specific market niches for a specific product.

(2) Value added products offer significantly greater profitability but require marketing skills, heavy investments, and entail risk. Additionally the question needs to be raised, "are the co-operatives equipped with the necessary managerial and marketing competencies"?

(3) Low retention levels and lack of members contributed equited capital and sources for long term financing will result in the industry not being able to move forward competitively.

(4) It is doubtful if any of the co-operatives studied (in the Sources and Uses publication) can continue needed growth by holding fast to traditional capitalisation and financing methods.

(5) Concurrent with new approaches to financing, two additional moves are needed: away from production orientation to market orientation and change from fierce individualism by co-operatives in marketing to more group or joint effort in export marketing.

(6) Polarisation between diverse groups (which as a whole own the co-operatives) create the most adverse climate for orderly growth and competition I have ever seen. One option might be to convert the co-operatives to companies—so that they could perform as a business with all of its attendant competitive consequences, and have farmers form bargaining associations. This is not too far from where you are today and countries which use this approach—or modifications thereof seem to be managing.

(7) One or more of the co-operatives might use a strategy of picking off the largest, most efficient producers. This approach could result in greater economic benefit to both the co-operative and the supplier-member. It would play havoc in the industry, though. This becomes particularly relevant as co-operatives must establish policies and criteria to meet the constraints dictated by the Super Levy. This approach could result in fewer but larger co-operatives.

(8) The alternative co-operative approach would be for the co-operatives to work together for the benefit of their members—a study may be undertaken on how to rationalise milk supply on a geographic basis to minimise transport costs (in a study for Oregon dairy co-operatives, rationalising milk routes saved about eight cents per gallon back in 1967/68). Another study would be to assess the differences in manufacturing costs of each product by each co-operative to determine which co-operative has lowest manufacturing costs per unit. Also, which of the lowest cost co-operatives had available capacity to expand. Finally, a third study would be to take a look at making it economically profitable for higher cost units to function as a standby and use lowest cost to capacity under contract to share benefits of economies of scale. Implementing results of these studies could materially improve the competitive posture for Irish dairy products and world markets.

(9) Having raised all of these questions, one might conclude that I am pessimistic about the future of dairy co-operatives. Well, I am not; I am very optimistic. However, there will be many changes. I am confident in the leadership that continues to rise to the top. Many in this Association will be agents of change which can result in the Irish dairy farmer and his co-operative becoming more competitive and stronger in world markets. What those changes will be is left to good judgement and leadership.

The Management of a Large Dairy Herd in the U.K.

J. M. SLATER

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Dairy House Farm has been owned by ICI for 50 years and over that time has been used for many fertiliser experiments, and in the last few years has been run as a commercial/demonstration farm. The research work for the Company is now carried out at Jealott's Hill in Berkshire and Ravenscroft Hall Farm in Cheshire.

Dairy House Farm comprises 400 acres of grassland and 50 acres of buildings and woodland. The farm is a compact block of ground with the main London to Glasgow railway line and the Shropshire Union canal running through it. The majority of the land is typical of the Cheshire Plain, heavy clay. A small percentage of the farm, however, is on steep slopes falling to the River Weaver and this land is particularly light and sandy. There are two main sets of buildings centrally placed within the farm boundaries, with all the dairy cows now housed at Dairy House itself, where three dairy men look after 320 cows milked through a one-man operated 24/24 Gascoigne parlour. All silage is forage box fed and the cows are housed in kennels and a clear span cubicle building. There is accommodation for 3500 tonnes of silage at Dairy House and it is proposed to raise this to 5000 tonnes within the next year.

The main aim of the farm is to maximise grass output and farm profitably, and this necessitates on heavy wet soils large storage capacity for both silage and slurry. The total farm staff comprises five men, three herdsmen previously mentioned with a tractor driver/relief milker and a full time tractor driver.

With the necessity for maximising grass yields on heavy land floatation equipment is used to enable fertiliser to be applied in the early part of the year when conventional equipment would cause damage. As part of the grassland management within the farm, zero grazing is practised at the start of the season and at the end, and here again tyre configurations are most important to allow zero grazing to start in the early spring. There are some 60 acres of land bordering roads that we cannot stock and these are continuously cut for either zero grazing or silage. The leys comprise predominantly Augusta with a small quantity of RVP Hay Pasture and Frances. The ability to zero grass at this time of year enables economies in concentrate use and total silage use.

Most of the farm is sown to a mixture of late and intermediate ryegrasses. This is used for either cutting or grazing. The current mix is 9 lbs of Melle, Meltra Morenne and Talbot to give a total seed rate of 36 lbs/acre. The very heaviest fields are sown to a mixture of late perennials to allow an extra week in the spring before first cut silage.

With a heavy soil and a moderately high rainfall there is a high risk of sward damage due to ruts. Therefore, as the only time in the rotation to rectify this problem is at reseeding, we conventionally plough and take the opportunity to level the soil surface. Also, as we need to break a soil pan in many fields, subsoiling is carried out prior to ploughing.

Our heavy clay soils are inherently difficult to break down into a fine firm seed bed and therefore we aim to plough in mid-August and allow any rain in late August to aid tilth formation. Autumn sowing of grass seed is conducted in the last week of August and the first week of September. A minimum of 60 units of P_2O_5 and K_2O are applied to the seed bed along with 12-15 units of nitrogen to help the young plant get established.

Post emergence care of the ley is most important with weed control primarily for chickweed and pest control for fritfly necessary in most autumns.

The general fertiliser policy on the farm is to aim for an average of 400 units/acre on the cow grazing area and up to 450 units on the zero-grazed Augusta leys. The aim is to apply two-thirds of the total nitrogen by end of May and thus enable the nitrogen to be around the rooting zone of the grass during the middle of the summer.

On silage fields for four cuts up to 400 units of nitrogen are applied along with 180 units of K_2O. A typical fertiliser policy would be :—

	N	P	K
1st cut	145	32	56
2nd cut	110	0	72
3rd cut	85	0	54
4th cut	60	0	0

Of the total grass acreage the aim is to conserve as silage approximately 75% of the total with some 25% only allocated to grazing up to the end of first cut silage. This creates a large logistical problem in handling approximately 2500-3000 tonnes of grass for silage in the late May period. Our own silage making team comprises a 8′ 6″ mower conditioner and a precision chop forage harvester serviced by three silage trailers. With this team approximately 1750 tonnes of silage can be made within a given period at a given quality. Therefore, we call in a contractor to harvest a proportion of our first cut. In 1984 by following this practise we were able to harvest all first cut at a quality of 71 'D'.

Silage performance in 1984 was :

	Acres cut	Tonnes/Acre	Total Tonnage
1st cut	260	9.2	2400
2nd cut	220	7.3	1600
3rd cut	60	3.3	200
4th cut	60	5.0	300

Immediately following the clearing of a silage field fertiliser will be applied to enable the next cut to get away just as quickly as possible. In this way three or four cuts of silage are taken throughout the growing period.

The current stock numbers at Dairy House are 320 dairy cows with 198 young stock. The cows are split into two herds, the first calving September/October and early November, and these have been managed this last winter on an ad lib silage and flat rate concentrate level of 4 kg/head/day. The anticipated silage consumption per cow will be 12 tonnes for the winter period. During the summer this herd is set stocked aiming at a maximum stocking rate for the early part of the season of no more than 0.3 of an acre per cow. The milk yield of these animals at turn-out will be 4 gallons. With the potential in grass of over 5 gallons, this stocking density must be held as tight as possible.

The spring herd calving January/February and early March are on easy fed silage and concentrates flat rate of 5 kg/head/day. At turn-out these animals will be stocked at 0.35 of an acre per cow as their demand is slightly greater than the autumn calving animal and they will have consumed approximately 10 tonnes of silage through the winter period. At the present time the margin per cow over bought feed is £585. This figure is steadily rising as our margins recover from the effects of the poor silage fed in the 1983/1984 winter. The stocking rate for the cows is 0.9 of an acre and thus the margin over feed and fertiliser costs is £580 per acre.

The heifer calves produced by one herd are reared and return to the same herd at 2 years old to calve down. To achieve good weights at calving a target is set at 350 kg for heifers at 15 months being served. The necessitates a live weight gain of 0.7 kg/day. The calves are reared on cold acidified milk replacer and weaned by weight at 85 kg when they should be consuming 0.9 kg per day of dry feed. By 8-9 weeks of age they are switched on to a grass cube/cereal cube mix reducing concentrate costs. At 11-12 weeks silage is introduced for the rest of the first winter.

In the second winter if good silage is available minimal extra feeds will be needed.

For the first three weeks heifers are served with Friesian semen and then we allow the beef bulls to sweep up. This coupled with a six week period for the cows ensures that all heifer calves are born in two periods: September to the first half of October and January to the first half of February, allowing two definite batches to be reared per year.

There are changes occuring within the industry that have to be planned for now and we must all face up to the new financial situation for dairying. Our total output of milk has been capped; we have lost 4.5 pence/gallon on our milk value. Therefore, to maintain margins is difficult and to improve them to cover the increase in labour and machinery costs is exceptionally difficult. For anyone with a tight stocking rate the production of extra grass and the reduction of the concentrate input must be the answer. For some people there could be no alternative but to go to a no concentrate feeding system. The most worrying aspect of the changes in costs is within the fixed cost structure and many dairy farmers will have to look to reducing paid labour and simplifying machinery within their own systems. It could be a great advantage for farmers to not have so heavily invested in building and machinery and that their dairy industry is on a much lower capital base. We find it necessary for some operations to use a contractor and in the future this may become a larger part of many farm operations.

Looking to the future the aim must be to improve the quality of the cattle that we have so that they can utilise large quantities of forage and depend very little on concentrate feeding. Margins of £550 and above will be needed to cover the true fixed costs and this will only be achieved with respectable yields and low feed costs. One of the major difficulties farming with cows in Cheshire compared with southern Ireland is that we have to budget for a 200 day winter and thus our conservation of grass primarily as silage has to be a very efficient and effective job. The current strengthening of controls on slurry and silage effluent disposal will have a serious impact on all our operations and there will be some cases where slurry systems will have to be abandoned in favour of straw bedded systems of housing.

Having painted a fairly gloomy picture let us hope that we can produce as much milk from our own resources as possible. The target should be 900 gallons per acre and above to produce a margin of over £600 per cow and thus enable the dairy industry to remain profitable for the future.

ABSTRACTS

THE EFFECT OF SWARD MANAGEMENT AND COMPANION GRASS ON THE PERFORMANCE OF WHITE CLOVER

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The research was undertaken to obtain data on the factors affecting the ecological stability of grass/white clover swards. The objective was to monitor the changes in the level of clover dominance within and between seasons under different managements. The changes were compared with concurrent changes in the density of grass tillers. The results showed that clover dominance was reduced as grass tiller density increased. Management and companion grass effects were explained in terms of their effect on grass tiller density. Clover dominance was maintained over three years in swards cut at 28-day intervals during the growing season. Clover declined progressively in swards cut at 14-day intervals. This decline was related to an increase in grass tiller density. Under the conditions of the experiment clover was suppressed when grass density exceeded 5,000 m^{-2}. At lower tiller densities clover was generally dominant. The transition from clover to grass dominance was sensitive to small changes in grass tiller density in the region of 5,000 m^{-2}. It was concluded that the instability observed in grass/clover swards under rotational grazing is due to the sensitivity of clover to grass tiller density within the normal range found in swards. The results provide a basis for developing management practices suited to the establishment and maintenance of the grass/clover association.

INCREASING EFFICIENCY OF GRAZED SWARDS

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The primary factor affecting the output of animal product per hectare in a grazing system is the amount of herbage produced. The efficiency with which this herbage is utilized is controlled by stocking rate (SR). In the standard rotational grazing system stocking rate is adjusted during the season as the silage ground becomes available for grazing. While this system achieves a reasonable balance between feed supply and herd feed requirements, periods of feed surpluses and deficits occur. Deficits imply reduced animal performance while surpluses imply grass is carried from one grazing to the next with associated losses in feed value. Ideally the SR should be adjusted continuously. Thus a balance is achieved between feed supply and demand and all the herbage produced is utilised. The inherent flexibility of the paddock system of grazing can be used to adjust the grazing time per paddock therefore achieving a continuously adjusted SR. However within this system surpluses (too many paddocks) and deficits (too few paddocks) can occur. In times of surplus the excess herbage can be conserved and this can then be fed in times of deficit.

THE EFFECT OF HERBAGE ALLOWANCES, HERBAGE MASS, AND CONCENTRATE FEEDING ON THE INTAKE OF COWS GRAZING MID-SUMMER PASTURE

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An experiment is described in which 40 spring-calving dairy cows were on four grazing treatments (two levels of daily herbage allowance with and without concentrate feeding). The treatments were imposed for 16 days in August 1984.

Daily herbage allowances from ground level were 24 and 16 kg dry matter/head. Concentrates were individually fed once daily to two groups at 4.5 kg/head. Daily intake of concentrate organic matter was 3.8 kg/head. Herbage intake was measured by estimating herbage before and after grazing.

Herbage mass increased significantly ($p<0.001$) from 3394 to 4319 kg of organic matter/ha for the 1st and 2nd half of the experimental period. Realised daily herbage organic matter allowances were 21.9 and 14.6 kg/head for the high and low allowance groups, respectively.

Herbage mass, herbage allowance and concentrate feeding all had a significant effect ($p<0.001$) on herbage intake. There was a significant interaction between the effects of herbage mass and herbage allowance ($p<0.001$) and between herbage allowance and concentrate feeding ($p<0.05$) on herbage intake.

Increased herbage mass increased herbage intake from 13.6 to 16.6 and 11.6 to 12.5 for the unsupplemented groups at high and low herbage allowance, respectively. The increase for the supplemented groups was 11.0 to 14.1 and 10.6 to 11.0 for the high and low allowance groups, respectively. Concentrate feeding reduced herbage intake by 0.67 and 0.33 per kg of concentrate fed at high and low herbage allowance, respectively.

CROP LOSS MODEL FOR SILAGE MECHANISATION

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A microcomputer based model for evaluating the opportunity cost of crop losses, arising from delayed silage harvesting, is described. The algorithms of the model determine the equivalent quantity of concentrate feedstuffs required to offset a good reduction in the net-energy value of forage. Three enterprise types are considered, viz. beef and dairying (autumn and spring-calving); and the inclusion of this model in the total cost analysis of a silage mechanisation system is explained. Examples are given of the application of this model : Results indicate that a minimum harvest area of 20 ha./yr. is required in order to justify system ownership. In addition, it was found that the opportunity cost of crop losses, arising from delayed harvesting, is a critical factor in the evaluation of silage mechanisation systems; and can account for up to 50% of the total system cost.

PREDICTION OF 1st CUT SILAGE QUALITY FROM THE RATE OF DECLINE OF GRASS DIGESTIBILITY FOR THE YEARS 1982 - 4

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The aim of this study was fourfold.

1. To establish year to year variability in the decline of grass DMD prior to first-cut silage making.
2. To compare patterns obtained in the East as against the West of Ireland.
3. To contrast results from farms with Grange data.
4. To determine the decrease in DMD at farm level between first-cut grass and silage made from it.

The procedure adopted was to sample grasses throughout the country, in collaboration with ACOT and other bodies. Samples were taken in the early part of May and at cutting time and dispatched to Dunsinea for DMD analysis. Later on each year silage made from these grasses was also sampled for analysis.

The results showed that considerable year to year variability exists. The rates of decline in digestibility measured for 1982, '83 and '84 were 0.58, 0.2 and 0.33 respectively. Comparison of patterns between the East and the Western regions revealed little difference when swards of a similar nature were considered. In general samples taken at weekly intervals at Grange tended to have higher DMD values than those from the farm study. Some surprisingly high differences in DMD were observed between grass cutting time and silage made from it, the mean values for 1982, '83 and '84 being 2.5, 4.5 and 4.5 units respectively.

MICROSCOPIC AND CHEMICAL CHANGES DURING THE FIRST 22 DAYS IN SILAGES MADE IN LABORATORY SILOS

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Two factorial experiments (2 x 8 x 2) were carried out where ryegrass (*Lolium multiforum,* CV Meritra) and cocksroot (*Dactylis glomerata,* indigenous) were ensiled in laboratory silos (capacity 0.2 kg) under pressure (0.7 kPa) using two treatments (with and without 85% formic acid at 3.3 l/t) by eight sampling intervals (1, 2, 3, 4, 7, 10, 14 and 21 days) in duplicate.

Chemical and microscopic changes were followed, the latter by hand-sectioning blade transverse sections, mounting them, followed by photography through a microscope. The negatives were projected and the diameters of cells and their protoplasts measured in two directions at right angles.

Both grasses at day 21 had undergone lactic acid type fermentation but the same amount of lactic acid gave a pH of 4.3 in ryegrass but only 4.6 in cocksfoot. The formic acid treatment, relative to the untreated grass, gave a rapid (1 day) shrinking of the protoplast within the cell, a quicker release of effluent and loss of cell turgor pressure, and an increase in electrical conductivity due to additional ions in solution. All the above were statistically significant ($p<0.01$) for the first 4 days.

The results suggest that formic acid penetrates the plant cuticle, damages the mesophyllic cell membrane and causes a leakage of cell nutrients for subsequent fermentation as well as provide H^+-ions to lower pH.

USING SILAGE EFFLUENT

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Interest has been expressed in using a layer of straw under silage to collect/trap effluent so as to reduce the effluent problem and improve straw quality. An experiment was conducted to quantify the value of such a practice.

One layer of barley straw bales were placed beneath herbage being ensiled in an unwalled clamp in October. Both ammoniated (54.4% DMD) and non-ammoniated (47.5% DMD) bales were used and each was placed either on the flat or on its side. The silage DM content was 15% and it contained 26% crude protein. The untreated straw retained 1.7 kg and 1.1 kg effluent per kg straw when placed on the flat or on its side respectively. The ammoniated straw had corresponding effluent retentions of 2.4 and 2.3 kg effluent per kg straw. Effluent increased the crude protein content of straw dry matter by 7.6 per cent units on average. Untreated straw digestibility (in vitro DMD) was 3.9 units higher and ammoniated straw digestibility was 5.2 units lower following storage under silage.

Friesian stores (500 kg) were fed 6 kg barley and 2 kg straw per head daily. Fresh water and silage effluent were both available ad libitum. Animals consumed up to 10 gallons per day of well preserved effluent but only 1 gallon per day when preservation was bad. There was a growth response to the effluent consumed.

Due to the great variation of the output effluent per tonne herbage ensiled and because of the large amount of straw required to retain all of the effluent from wet herbage, this technique of retaining effluent is both impractical and unreliable. Feeding silage effluent to beef cattle would not be applicable on most farms due to the problems of storing a large volume of effluent until it would be practical to feed it. Spreading silage effluent onto grassland still seems the most realistic method for disposing of it on the beef farm. However. it may be easier to organise the feeding of silage effluent to cows on a dairy farm as they come in for or go out from milking.

EFFECT OF ENVIRONMENTAL FACTORS ON ANIMAL PRODUCTION

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Heat-energy exchange between animals and their surroundings are governed by the laws of thermodynamics. Homeotherms maintain a stable deep body temperature over a range of environmental conditions. There is a critical temperature at the lower end of the range below which the energy required to maintain deep body heat increases. Critical temperature may be calculated from Baxter's equations.

$T_c = T_r + HI_t + (E-H)\, I_e$ where T_c=critical temperature °C;

T_r=Rectal temp.=39°C;

H=Heat arising from metabolism (Mj $m^{-2}d^{-1}$); I_t=Tissue Insulation (°C m^2 d Mj^{-1});

E=Minimal loss of heat by vaporising moisture (Mj $m^{-2}d^{-1}$);

I_e=External insulation (°C m^2 d Mj^{-1})

Adverse environmental conditions affect animal production by raising the critical temperature. Critical temperature is influenced by several factors including coat thickness, insulation, wind, wetness, etc. When critical temperature is higher than environmental temperature homeotherms use some of their total energy intake to maintain deep body heat. This may mean loss of LWG or ill-health. Data from the 1st cycle of a grazing experiment at Johnstown Castle 1977-'84 were used to study this effect. Blaxter's equations were used to calculate critical temperature for 2 coat thicknesses, with and without continuous wetting at variable wind speeds. The calculations showed that coat thickness has a greater effect than wetness but this effect declines as wind speed increases. Critical temperatures higher than environmental partly explained some losses in ADG in 1978, '79 and '83. More detailed studies of environmental effects over the grazing season are planned.

THE CELLULARITY OF MUSCLE DEVELOPMENT IN MALE CATTLE

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Skeletal muscle, produced by cattle, sheep, pigs and poultry, is the raw material of the meat industry. The practical goal of animal production is the production of lean meat in an efficient manner.

Basic factors, which limit the rate and extent of muscle growth and protein synthesis in meat animals need to be defined. An understanding of these factors in cellular and molecular terms would permit the optimisation and maximisation of meat production. In keeping with such a requirement, this communication reports results from two studies on the cellularity of skeletal muscle development in male cattle, during which samples of *L. dorsi* muscle taken at 24 h *post mortem* from carcasses of bulls and steers were examined. The histochemical muscle fibre types, β-Red, α-Red and α-White were identified and quantified.

The cardinal finding in one study was that both endogenous and exogenous anabolic agents increased significantly the sizes and proportions of Red, or aerobically metabolising, myofibres, thereby facilitating a more efficient deposition of protein in the myofibers.

In another study, during which the effects of genotype and slaughter weight were examined, significant genetic differences in the myofibre type profiles were observed. Considerable and distinctive breed differences were found in the development patterns of all myofibre types.

Our findings indicate that the radial and longitudinal components of myofibre growth operate in different modes for Hereford x Friesian, Charolais x Friesian and pure Friesian steers.

RESPONSES OF FINISHING STEERS TO EXOGENOUS GROWTH HORMONE AND OESTRADIOL

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The administration of exogenous growth hormone has been shown to stimulate nitrogen retention and enhance growth rate in a number of species. There is however, comparatively little information regarding its effects on growth in cattle. The present experiment examined the effects of growth homone, either alone or in combination with oestradiol, on growth rate and a number of endocrine and metabolic parameters in growing Friesian steers.

Groups of steers (N = 16) were either kept as untreated controls implanted with 45 mg oestradiol, injected daily with bovine GH of pituitary origin or treated with a combination of oestradiol and GH. The growth hormone was administered subcutaneously in the neck region in a carbonate buffer vehicle (pH 10.0 = daily at 9.00 h for a period of 22 weeks. The dose of GH (0.05 u/kg/day) was adjusted bi-weekly to the mean liveweight of the animals under treatment. The animals were tied up in individual stalls and their intake of grass and silage and supplementary concentrates was recorded 3 times weekly. After 22 weeks, GH treatment was terminated and the animals retained for a further week's observation following which they were slaughtered.

Blood samples for determination of oestradiol and growth hormone concentrations as well as levels of glucose, non-esterified fatty acids, blood urea nitrogen and creatinine were taken from all animals on a number of occasions during the experiment.

Treatment with oestradiol alone significantly improved growth rate and feed efficiency by 13.6 and 8.3% respectively; the responses in these parameters to treatment with GH were 5.6 and 4.8% respectively but neither were statistically significant. The responses to the combination treatment indicated that the effects of oestradiol and GH on growth rate and feed efficiency were additive. There was a carry-over effect of GH treatment on carcass composition in terms of the % internal fat which was reduced in response to this treatment.

Plasma levels of GH were elevated within 15 minutes of GH injection and were 3-7 ng/ml higher than the controls for >8 h following which they returned to baseline. Endogenous GH secretion was stimulated by implantation with oestradiol. Blood urea nitrogen levels were reduced by both oestradiol and GH treatment and the effects of the two hormones were additive in this respect. There was no evidence for treatment effects on plasma concentrations of glucose, non-esterified fatty acids or creatinine.

RESIDUE ANALYSES FOR ANABOLIC AGENTS IN BEEF

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Anabolic agents are used widely in beef production where they are found to give increased carcase yield. Two anabolic agents of particular interest are the synthetic agents trenbolone ("Finaplix") and zeranol ("Ralgro") since their continued usage is being considered, currently, by the EEC. These two anabolic agents are given as ear implants, often in combination, and carry a recommended with-holding period of 60 to 65 days.,

The residue levels of trenbolone and zeranol were determined in the edible tissues (muscle, fat, kidney and liver) of 12 Friesian steers at slaughter. 6 being non-implanted (control) animals and 6 being implanted with 300 mg trenbolone acetate and 36 mg zeranol 67 days before slaughter. Residue analyses were carried out on small samples of tissues (2-3 g) by extraction. purification and radioimmunoassay.

The results of the analyses show that significantly higher ($P<0.01$) residue levels are determined for trenbolone in muscle, fat and kidney samples and for zeranol in kidney and liver samples from implanted animals, compared with samples from control animals. Use of an anti-serum specific to the major liver metabolite of trenbolone, 17α-trenbolone, would be expected to show significantly higher residue levels in liver, also, as has been reported in other studies. Zeranol levels in muscle and fat are not different from tissue blank levels (i.e. levels in control animals) after the with-holding period. In all cases residue levels are at less than 0.3 ng/g ppb) at slaughter.

EVALUATION OF COMPUDOSE 200 AS AN ANABOLIC AGENT FOR CALVES, GROWING AND FINISHING STEERS

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Three experiments, one each with entire male calves, yearling steers at pasture and housed finishing cattle fed silage plus concentrates were carried out to evaluate Compudose 200, a silicone rubber ear implant impregnated with 24 mg oestradiol (Elanco, Dun Laoghaire, Ireland). Its stated duration of effectiveness is 200 days. The animals were predominantly Friesians.

In Experiment 1, 204 calves (initial liveweight 100 kg) were assigned at random to the following 3 treatments for a 168 day experimental period : (1) Control, (2) Compudose 200 on day 0, (3) Ralgro on days 0 and 82. Liveweight gains for the treatment groups as listed were 125.8, 121.5 and 127.8 (SE=1.85) kg respectively. There was no significant effect of either implant treatment.

In Experiment 2, 264 yearling steers (initial liveweight 303 kg) were assigned at random to the following 4 treatments for a 168 day experimental period : (1) Control, (2) Compudose 200 on day 0, (3) Compudose + Finaplix on day 0 and Finaplix on day 82, (4) Ralgro + Finaplix on days 0 and 82. Liveweight gains for the groups, as listed were 141.1, 153.2, 174.7 and 174.7 (SE=3.02) kg respectively.

In Experiment 3, 250 finishing steers (initial liveweight 468 kg) were assigned on the basis of weight to the following 5 treatments for a mean 163 day experimental period : (1) Control, (2) Compudose 200 on day 0, (3) Compudose 200 + Finaplix on day 0 and Finaplix on day 70, (4) Ralgro + Finaplix on days 0 and 70, (5) Synovex-S + Finaplix on days 0 and 70. Carcass gains for the groups as listed were 63.9, 84.7, 92.5, 91.4 and 94.2 (SE=2.93) kg respectively.

There was a significant ($P<0.05$) response to Compudose 200 alone and a further significant response to the use of Finaplix with Compudose 200 in both yearling and finishing steers. Responses to Compudose 200 + Finaplix, Ralgro + Finaplix and Synovex-S + Finaplix were similar. A total of 10 (3.3%) of the 300 Compudose 200 implants inserted were not palpable in the animals' ears 10-12 weeks after implantation. It was assumed that these implants were lost but all the data were included in the analyses.

PHENOTYPIC AND GENETIC PARAMETERS OF CARCASS AND MEAT QUALITY TRAITS IN PROGENY TEST CATTLE

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The overall appearance and eating quality of beef is of increasing importance to consumers. This paper reports the phenotypic and genetic parameters of carcass and meat quality traits in 2 groups of progeny test cattle in 1982 and 1984. Meat quality was assessed in the intact carcass by measuring the pH value ot 3 hr and 48 hr post slaughter and on fibre optic probe values at 48 hours post slaughter, and on samples of the *longissimus dorsi* (LD) muscle taken at the 12th/13th rib, for shear force, drip loss and taste panel assessment.

A total of 182 samples, representing 3 breeds and 32 sires (Friesian 27), Charolais (4) and Hereford (1)) were analysed by the method of least squares. Because of the small number of Charolais and Hereford sires genetic parameters were calculated among Friesian sires only. The effect of breed, year and breed x year interaction were accounted for in the complete data set, and year in the genetic analysis. The inclusion of a regression on slaughter age or slaughter weight had no effect on the meat quality traits. The only significant differences between breeds in meat quality traits was for drip loss % and drip loss g/100 cm^2, with Charolais x steers having twice the drip loss of Friesians (2.31% and 2.84 vs 1.12% and 1.34 respectively). Drip loss in Herefords was intermediate (1.66% and 2.02). This higher drip loss in Charolais indicates poorer water holding capacity of the muscle and this could have considerable commercial significance for the vacuum packing and supermarket trades. Due to negative sire variances, heritabilities could not be calculated for many of the meat quality traits. The heritabilities and their standard errors obtained were $pH_u = 0.25 \pm .27$; cooking loss % = $0.19 \pm .26$; texture = $0.09 \pm .24$; flavour intensity = $0.45 \pm .30$; and acceptability = $0.09 \pm .24$. Estimates of phenotypic and genetic correlations between carcass and meat quality traits tended to be low also. These results (based on a relatively small number of sires and progeny per sire) indicate a relatively low level of genetic determination of meat quality traits and relationship between carcass performance and quality traits. The breed difference in drip loss requires further investigation.

A COMPARISON OF THREE CALVING PATTERNS ON THE PRODUCTION OF DAIRY COWS

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Milk for manufacture is produced from seasonally calving herds in Ireland with distinct seasonal patterns of milk supply. The present study examined three calving patterns. A total of 78 Friesian cows were allocated to three treatments with a mean calving date of 28 January, 16 March and 19 October/27 January for treatments ES, LS and AS, respectively (40 and 60 per cent of herd AS calved in October and January respectively). Each treatment had its own farmlet of 18 paddocks, stocked at 2.90 cows per hectare and 395 kg N per hectare was applied. Silage was conserved from 8 and 6 paddocks, for the first and second silage cuts respectively. Cows were fed 7.3 kg/head/day of concentrates post calving with ad libitum access to grass silage. The concentrates were phased out after turnout to pasture except for treatment LS where 1.8 kg/head/day were fed to cows from early October until the end of the lactation. The mean lactation milk, fat, protein and lactose yields (kg) were 4841, 4902, 5217 (SE 223), 182, 175, 188 (SE 8.3), 164, 163, 172 (SE 6.8), 222, 221, 241 (SE 10.4) and the mean milk fat, protein and lactose concentrations were 37.6, 35.8, 36.1 (SE 0.8), 33.8, 33.4, 33.2 (SE 0.6), 46.0, 45.2, 46.3 (SE 0.4) for treatment ES, LS and AS, respectively. The ES group had significantly higher fat and lactose concentration than the LS group. Concentrate intakes of 815, 641 and 1149 (SE 75.4) for treatments ES, LS and AS respectively differed significantly. The first year's results show that calving patterns had little influence on lactation performance but autumn and early spring calving cows had higher feed inputs.

THE SLOPED FLOOR CATTLE HOUSING SYSTEM

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About half the national beef cattle herd is outwintered in the fields. A lot more winter housing is needed for cattle. Various alternative housing systems exist, e.g. straw bedded shed, cubicle yard without or with roof, all three in combination with either mechanical feeding or self-feeding of silage, slatted house. All have several positive features in their favour but most also have several negative features. The slatted system is widely accepted as the ideal but it has one major negative feature, i.e. high capital cost.

In 1980 we began to develop a new alternative housing system which would incorporate many of the positive features of the ideal slatted system but which would be a cheaper system to construct. About half the capital cost of the slatted system is spent on housing and feeding arrangements for the animal, the other half is spent on the collection and storage of slurry. The alternative system retains positive features of the slatted system like : minimum floor area per animal, minimum roof area per animal, minimum perimeter fencing and service roadways per animal, and seeks to combine these with a cheaper slurry collection and storage system.

It achieves the latter objective by :

(a) Eliminating slats,

(b) Eliminating underground reinforced concrete tank and its internal slat support walls,

(c) Replacing the tank floor with a floor at ground level which is cast in sections which slope towards channels cast into the floor which collect the waste from the floor and channel it to a slurry store outside the building with compacted earth.

A preliminary experiment with cattle compared sloping floor sections which were either 4m or 2m wide. The results showed that the 2m floor sections produced cleaner cattle which grew faster.

Ideally pen dimensions are as in conventional slatted houses. Channel dimensions are 300 mm wide and at least 300 mm deep. The channel is covered with a steel grid. The channel collects slurry from floor sections 1.5m wide on either side of it. The slope in the floor towards the channel is about 1 in 12.

Four animal production experiments have shown similar animal performance on the sloped floor as described above and the conventional slatted floor (similar floor area per animal in both systems). Daily liveweight gain averaged 0.87 and 0.84 kg and final carcase weights averaged 260 kg and 262 kg on the sloped floor and slatted floor respectively. Hide weights were recorded at the end of all experiments as an index of cleanliness. Hide weights have averaged 40.6 kg and 39.1 kg off the sloped floor and slatted floor respectively.

The sloped floor system may be considered as either a new housing system or as a system for incorporation to existing haysheds/lean-to's to convert them to animal housing, particularly on smaller farms.

Gross capital cost of the sloped floor system is at least £70 per animal (2 M^2 floor) cheaper than the slatted system.

EFFECT OF IMMUNISATION AGAINST SOMATOSTATIN AND BREED ON GROWTH RATE AND CARCASS COMPOSITION OF LAMBS

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The object of the experiment was to examine the effect of immunisation against somatostatin on growth rate and carcass composition using different breeds. Thirty lambs were given an injection of 750 μg of a somatostatin - human serum albumin conjugate, made up of 5 ml in Freunds Complete Adjuvant, at 3 weeks of age followed by 4 booster injections of 250 μg conjugate at 14 day intervals in Freunds Complete Adjuvant. Twenty-nine control animals were given placebo injections at similar intervals. The 59 animals comprised 12 Texels, 16 Suffolks and 31 Scottish Blackface X Suffolk crossbreds. At the time of primary injection the ewes and lambs were housed and the lambs were given access to a concentrate pellet. The lambs were weaned at about 5 weeks of age and group fed for one week. All lambs were then individually penned and feed intake was recorded for 4 days per week over a period of 10 weeks. The lambs were slaughtered when they reached 38 kg, approximately. After slaughter half-carcass dissection was carried out on 26 animals.

There was no significant breed or treatment effect on final weight or on daily growth rate from initial injection to final weighing 84 days later although immunised animals did grow at a lower rate than controls (248 versus 233 g/day). Immunisation did not affect feed intake. However, there was a breed effect with Texel lambs consuming significantly less than the crossbred group ($P<0.01$). Mean daily feed intakes (g) were 919 ± 52, 105 ± 45, 1140 ± 33, 1017 ± 34 and 1059 ± 35 for Texel, Suffolk, crossbred, immunised and non-immunised animals, respectively.

Immunisation against somatostatin, while not affecting growth rate, did increase carcass length (58 versus 56 cm; $p<0.05$) and total bone weight ($P<0.05$) but had no effect on any other carcass traits measured. The carcasses of Texel lambs contained significantly less fat ($P<0.01$) less bone ($P<0.05$) and more lean meat ($P<0.001$) than Suffolk lambs.

INCREASING REPRODUCTIVE PERFORMANCE BY IMMUNISATION: FACTORS INFLUENCING THE RESPONSE TO FECUNDIN

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Steroid hormones are part of the complex network of physiological controls on the process of reproduction. Hormone binding antibodies provide a convenient tool for manipulating reproductive function and both active and passive immunisation against cestrogens and androgens has increased ovulation rate in sheep. An immunogen for raising antibodies against androstendione in sheep has been developed for commercial application and is called Fecundin (Glaxo Animal Health). The recommended procedure for immunisation involves two s/c injections (2 ml each), 4 weeks apart, in the first year while one booster injection suffices in subsequent years.

Starting in 1982 we have used this immunisation procedure in conjunction with various mating protocols and including a comparison with PMSG. Breeds studied have included Galway, S. Blackface, Greyface, Belclare Improver, Improved Galway and Finnish Landrace. In most trials involving Institute flocks both ovulation rate and litter size were measured but for farm trials only litter size was obtainable.

An overall summary of litter size of Galway ewes shows that Fecundin gives a significant and consistent increase in litter size of the order of 25% of the control mean. When estrus is synchronised with progestagen sponges, both the incidence of estrus and conception rate are depressed unless the interval between booster injection and synchronised mating is greater than 21 days. For ewes conceiving at 14 days post-booster the results suggest that embryo survival is impaired.

With S. Blackface ewes significant responses in ovulation rate have been obtained consistently but results, to date, on litter size have been disappointing.

While most of our trials have involved mature parous ewes, results in two trials involving 2-tooth multiparous and older parous ewes failed to show any interaction between age and ovarian response to Fecundin. The results of a trial involving Belclare Improver and Improved Galway ewe lambs showed that both breeds responded to immunisation.

Immunisation can also be used to increase ovulation rate in out-of-season breeding and the effects on ovulation rate are additive with the effects of PMSG.

Our conclusions at this stage are that Fecundin will increase ovulation rate in all breeds regardless of age or physiological state and is an effective tool for increasing lamb output per ewe in the spring lambing flock. With proper choice of boost-to-join interval the incidence of barren ewes is reduced by Fecundin treatment.

APPRAISAL OF CURRENT DEVELOPMENTS IN SHEEP HOUSING

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The provision of housing for overwintering sheep has recently gained acceptance in Ireland as an integral part of intensive sheep production. It was considered necessary to determine the state of development of housing in the country and to evaluate the environment prevailing in the houses built in order to objectively plan further development in this area. This project sets out to identify and evaluate the house types being used.

A survey of sheep houses in Galway and Wicklow was carried out and the main house types identified as being of the A-roof type and the haybarn type, with a tendency towards the former in Wicklow and the latter in Galway. Internal layouts and management techniques associated with these houses were also recorded.

In order to determine whether or not the house types identified were providing a satisfactory environment for the external relative humidity and temperature were recorded in four typical sheep houses during the winter of 1983/84. The environment prevailing in each of the houses monitored was found to be consistent with the environment recommended.

Airflow patterns in sheep houses were studied in Water Table, and a ventilation problem in a sheep house in Wicklow was identified and solved using the table.

Feeding routines were also observed in a number of houses and hay feeding was found to be significantly faster than silage feeding.

THE MEASUREMENT AND DISPERSAL OF AGRICULTURAL ODOURS

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Malodours from livestock units, particularly pig and poultry have been the subject of increasing controversy in Ireland in the past five years. Resolution of controversy, including litigation, can be helped by an objective measurement of the odour. An olfactometer is the term used to describe an apparatus for the measurement of odours.

An olfactometer was constructed by the Department of Agriculture and Food Engineering at U.C.D. giving dilution factors of up to 6000. Samples of contaminated air (i.e. the malodourous air) are collected at the source in a teflon coated bag and brought to the olfactometer. The olfactometer is designed to expose 4 panellist to the malodour simultanously. The samples are analysed in terms of detectability, intensity and offensiveness. Each sample is analysed by a panel of 6-8 persons and is replicated 3 times. In this way samples collected from pig, poultry, cattle, sheep, slurry tanks and even samples from air contaminated by spreading operations are collected and analysed.

In addition to the measurement of odours generated, their rate of dispersal is also under study. A dispersal mathematical model adapted from one developed for the atmospheric pollution industry is being tested with a view to identifying the areas of nuisance, the level of nuisance and the number of occurrence thereof, around an existing unit or a proposed unit.

ILIONE ALBISETA — POTENTIAL BIOLOGICAL CONTROL AGENT OF LIVER FLUKE ?

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Studies over the last 30 years have shown that all reared sciomzyids such as Ilione albiseta feed exclusively on molluscs as larvae. The quantitative data needed to evaluate the potential effectiveness of Sciomyzidae in biological control began to accumulate with preliminary observations of sciomyzid life-cycles and biology. The significance of these observations however was limited because of variable temperature and light conditions. When it was discovered that *I. albiseta* predated *Lymnaea truncatula* (vector of fascioliasis in Ireland), research into its biology was initiated under controlled conditions of temperature and light. This type of information gained under controlled conditions aids in defining optimal laboratory rearing conditions which would provide an essential foundation for the culture of the organism on a continual basis.

Each stage of the year-long life-cycle, i.e. (a) adult fly, (b) egg. (c) the three larval instars and (d) pupae were subjected to a range of constant temperatures (14°, 17°, 20°, 23°, 26° C) under a 16 hour light - 8 hour dark lighting schedule. By using the following combination of temperatures, it was discovered that it was possible to complete the life-cycle in approximately half the time taken by individuals in the field (% survival $\geq$70%) : (a) 17°C, (b) 23°C, (c) 23°C (first and second instar) and 17°C (third instar), (d) 26°C. In the case of egg incubation period, it was found that 70% of embryonated eggs hatched after 15 days when placed in reducing medium of 0.1% ascorbic acid at 23°C. This is considerably shorter than the duration of the egg stage in the field (67.3 days). Adult fecundity was highest at 17°C where a mean of 57.8 eggs per female was laid. It was also discovered that newly hatched larvae can survive up to a month without food at 14°C. The rate at which *I. albiseta* larvae predate snails increases as temperature rises but the total weight of snail tissue consumed during the larval stage remains approximately the same regardless of temperature. This may help to assess the number of larvae needed to control a known snail population over a given period of time during a biological control experiment.

THE EFFECT OF AGE AND LIVEWEIGHT AT STIMULATION BY BOAR CONTACT WITH OR WITHOUT PMSG + HCG ON PUBERTY ATTAINMENT AND REPRODUCTION IN GILTS

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Groups of gilts fed *ad libitum* during rearing were stimulated for puberty at one of four ages, namely 130, 150, 170 or 190 days. Within each age group littermate pairs were allocated to two treatments: (1) relocation, mixing and mature boar contact; (2) these stimuli plus an intramuscular injection of 400 i.u. PMSG + 200 i.u. HCG (PG 600, Intervet). Gilts were mated at puberty and slaughtered 34±3 days *post coitum*. Interim results for 180 gilts are presented in order of ascending age at stimulation. The mean liveweights at stimulation and the number of gilts involved were 72.5 kg, 38; 88.5 kg, 38; 98 kg, 52; 115.5 kg, 52. The proportion of gilts which attained puberty, the proportion mated are shown in parenthesis, within 60 days of stimulation for treatment 1 were 0.78 (0.56), 1.0 (0.88), 1.0 (0.96), 0.96 (0.96). The proportion of gilts which attained puberty (mated) within 6 days of stimulation for treatment 2 were 0.89 (0.83), 0.79 (0.74), 0.96 (0.92), 1.0 (0.84). The intervals in days from stimulation to puberty (mating) for the gilts on treatment 1 were 23.3 (29.4), 11.0 (17.3), 9.6 (11.8), 8.5 (8.5) and for the gilts on treatment 2 the corresponding intervals were 4.6 (4.9), 4.7 (4.8), 4.4 (4.5), 4.4 (4.8). The conception rates for treatments 1 and 2 with increasing age at stimulation were 0.80, 0.93, 0.83, 0.90 and 0.71, 0.71, 0.71, 0.74. The corresponding ovulation rates were 12.9, 13.6, 12.1, 12.9 and 14.6, 19.9, 16.6, 20.6. The corresponding number of embryos alive at 34 days *post coitum* were 9.7, 9.5, 8.9, 9.9 and 8.1, 10.2, 9.3, 11.3. The effects of liveweight within age at stimulation were small and mainly non-significant.

THE EFFECTS OF HIGH FEED INTAKES IN EARLY PREGNANCY IN SOWS

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Multiparous sows were classified subjectively at farrowing according to body condition as either fat or thin. The difference in body condition between the two groups was increased by feeding the 'fat' sows generously during lactation and restricting the feed of the 'thin' sows to a maximum of 4 kg per day of a diet containing 12.5 MJ DE/kg. After weaning all sows were fed this diet at the rate of 3 kg daily until mating. The depth of skin plus subcutaneous fat was measured ultrasonically at the P_2 position. At conception the thin sows weighed 159 kg with a P_2 measurement of 13.8 mm with corresponding values for the fat sows of 165 kg and 19.4 mm. Following mating half of each group was allocated at random to feed allowances of either 2 or 4 kg per day for 30 days. Thereafter all sows were given a common allowance of 2.2 kg per day until parturition. A total of 62 sows completed the experiment.

There was no effect on the number of pigs born per litter. The fat sows produced heavier pigs than the thin sows but the response of this parameter to generous feeding was greater in the thin sows. Both the gross and net liveweight gains in gestation were greater in the fat than in the thin sows at equal feed intakes. From conception to day 110 of gestation subcutaneous fat thickness increased slightly more in the fat than in the thin sows. From day 110 to parturition the losses of subcutaneous fat were higher in the fat sows such that the overall net gain from conception to parturition was similar for fat and thin sows given identical feed allowances. Calculations based on this data suggested that the daily nitrogen retention at equal feed rates was lower in thin sows than in fat sows. The thin sows showed no evidence of compensatory growth.