Centre for Agricultural Strategy

Volume I

The future of upland Britain

Edited by R B Tranter

CAS Paper 2 · November 1978

4 The impact of technical advances on hill and upland cattle systems

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INTRODUCTION

In upland and hill areas cattle systems are based primarily on the beef suckler cow. The main output is the weaned calf, varying from 5-6 months to one year old at sale, when a large percentage are transferred to lowland farms. Sales are held in autumn and there is a substantial premium on size, or weight, so that lightweight calves of less than 200 kg liveweight derived mainly from hill farms are at a disadvantage.

By exploiting the ability of the suckler cow to utilise relatively poor quality and lower cost feeds, generally unsuitable for the dairy cow, and some of the by-products of the arable farm in the finishing of store calves, an efficient integration of resources is achieved.

Around 85% of the total energy input in weaned calf systems is utilised by the cow while 45-65% is similarly utilised, depending on breed and finishing system, when the slaughter animal is included.

Beef production is frequently criticised as being inefficient, based largely on the calculation that the beef cow/suckled calf converts protein into meat at a conversion ratio of 20:1 (Baker, 1975) and additionally because of a dependence on cereals. The total quantity of protein used in supplementary feeds is about 4.5 kg per kg of saleable meat from the suckled calf and if lowland grass used in the finishing system is excluded the figure is 2.9 kg (Baker, 1975). Comparable figures for calves from the dairy herd vary from 4-8 kg depending on the intensity of the system. The additional protein is derived from poor quality grass and arable by-products which have limited use. The production of two-year old beef from the suckler herd requires around 1.5-1.8 kg cereal per kg liveweight gain, including

the input to the cow. This competes favourably with systems based on calves from the dairy herd. Beef derived from the suckler herd contributes almost 30% of our domestic production and the expansion of the beef herd has undoubtedly contributed to the increase in self-sufficiency which is currently 83%.

Table 1
CONCENTRATE USAGE IN DIFFERENT BEEF SYSTEMS

	Lifetime concentrates		Slaughter weight		Concentrates per kg gain	
	Average	Top third	Average	Top third	Average	Top third
	(tonnes)		(kg)		(kg)	
Dairy calves to slaughter:						
Cereal beef	1.8	1.7	391	394	5.4	4.9
15 month grass/cereal	1.2	1.1	431	428	3.3	3.0
18 month grass/cereal	1.1	0.8	470	489	2.7	1.9
24 month grass/cereal	1.0	0.8	483	498	2.3	1.8
Beef calves to slaughter:						
15 month Autumn suckler	0.9	0.7	416	420	2.5	1.9
24 month Spring suckler	0.7	0.6	442	461	1.8	1.5

Source: Baker (1975)

The dramatic increase in beef cow numbers since the early post-war years can be attributed to a number of factors. The introduction of the hill cow subsidy and the manipulation of the levels of payment stimulated an increase in hill areas as also did the marginal production assistance paid during the 1950's and early 1960's. The deficiency payment support system which maintained end product prices was also of importance. The prospect of an expanded market within the EC was an additional reason for the increase in numbers in the early 1970's.

Compared with England and Wales, a high proportion of cows in Scotland (around 80-85%), receive the hill cow subsidy now known as the Hill Livestock Compensatory Allowance, the cost of which has been increasing. However, a detailed examination of the Scottish figures indicated that only 19% of all cows (22.4% of those granted hill subsidy), are on true hill farms. The majority are kept on 'upland' farms and numbers appear to be broadly related to the area and probably quality of the 'inbye' land.

Table 2
SOURCES OF HOME PRODUCED BEEF

	Per cent	
From the dairy herd:		
Pure-bred calves	21	
Beef-cross calves	20	
Cull dairy cows	17	
	58	58
From suckler cows:		
Beef calves	25	
Cull beef cows	6	
	31	31
Cattle imported from Ireland		11
		100

Source: Baker (1975)

USE OF RESOURCES

The majority of calf production systems are based predominantly on the utilisation of grassland, grazed in summer and conserved as silage or hay for winter fodder with either home grown cereals or purchased concentrates used as supplements. However, some of the expansion which occurred in the 1950's and 1960's was based on the purchase of hay and straw, mainly from lowland farms, and compounded concentrates and/or block feeds and liquid supplements. As a consequence of joining the EC the price of cereals has increased substantially (eg barley cost £22/ton in 1968 and £70/ton in 1976) with a consequent increase in all feed prices without a commensurate increase in end product prices.

This is currently causing a decline in cow numbers which it is predicted will continue. It is probable that farms keeping beef cows will have to become largely self-sufficient in bulky food supplies. The national herd may be constrained by the ability of farms to achieve this objective, unless beef prices increase substantially, which is improbable. Since no information is available on the extent to which hill and upland farms are dependent on purchased fodder, it is not possible to predict more precisely the likely trends in the national herds, but it is certain

Table 3
NUMBERS OF ALL BEEF COWS IN GREAT BRITAIN AND THOSE RECEIVING HILL COW SUBSIDY, 1962-1976

	1962	1964	1966	1968	1970	1972	1974	1975	1976
Scotland	304 (73)	304 (80)	343 (84)	368 (85)	417 (86)	456 (87)	551 (84)	566 (81)	542 (84)
England & Wales	562 (21)	553 (32)	597 (37)	606 (40)	667 (43)	746 (36)	1015 (36)	1020 (35)	944 (39)
Great Britain	866 (39)	857 (49)	940 (54)	974 (57)	1054 (59)	1202 (55)	1566 (53)	1586 (52)	1486 (56)

Note: Proportion of cows receiving hill cow subsidy in brackets (%). Source: DAFS & MAFF.

Table 4
SOURCES OF SUPPLY OF CARCASS BEEF AND VEAL CONSUMED IN THE UK, 1962-1976 (thousand tons)

	1962	1964	1966	1968	1970	1972	1974	1975	1976
Domestic	865 (71.1)	903 (73.3)	803 (70.1)	891 (77.6)	932 (72.0)	903 (70.0)	1055 (77.0)	1197 (84.0)	1033 (83.0)
Imported	343	329	310	257	261	273	245	193	210

Note: Proportion of total supply domestically produced in brackets (%) Source: MLC Quarterly Review.

Table 5

COST OF SUPPORT FOR BEEF COWS AND OF DIRECT SUPPORT TO HILL AND UPLAND FARMS FOR HILL COWS, 1967-1975

	Beef cows		Hill cows		
	Subsidy rate per cow (£)	Total (£m) subsidy	Subsidy rate per cow (£)	Total (£m) subsidy	Winter keep scheme (£m)
1967/1968	7.50	2.9	14.25	8.7	2.5[1]
1969/1970	10.00	5.0	17.25	11.8	3.0[1]
1971/1972	11.00	6.7	18.75	14.7	3.5[1]
1973/1974	11.00	9.2	24.50	16.9	7.0[2]
1974/1975	11.00	22.1	24.50	35.4	12.3[2]

1 Payments made on a headage basis.

2 Payments on an area basis which includes hill sheep.

Source: MAFF (1977)

Table 6

DISTRIBUTION OF HILL COWS BY FARM TYPE IN SCOTLAND AND THE LAND RESOURCES PER COW IN 1974

	Type of full-time farms[1]			
	Grade A	Grade B	Grade C	All farms
No of farms	480	922	2 041	3 443
No of beef cows	41 281	67 561	103 776	212 618
Average herd size	86	73	51	62
Average area of 'inbye' land (ha)	124.6	83.0	42.9	55.3
Average area of grass-mowing (ha)	24.4	19.1	10.9	15.0
Area (ha) per cow of:				
Rough grazing	2.6	6.3	22.2	
'Inbye' land	1.4	1.1	0.8	
Mowing grass	0.3	0.3	0.2	
Ratio of Rough grazing to 'Inbye' land	1.8	5.5	26.4	
Rough grazing as proportion of total area (%)	3.5	13.7	74.6	

1 Farm types as in the Winter Keep (Scotland) Scheme, 1975

Source: DAFS

that it will be the herds on the true hill farms purchasing fodder which are most vulnerable. However, the reduction or disposal of herds may substantially reduce farm gross output while not achieving a reduction in fixed costs, eg labour, machinery etc. Also, enterprise substitution on the hill farm is limited and replacement of cows with additional sheep may not be acceptable for a variety of reasons. In recent years systems of suckled calf production have become more precisely defined (MAFF, 1973) being classified on time of calving, with there being four main periods:

(i) Autumn: September – mid-October
(ii) Spring: February – March
(iii) Summer: July – August
(iv) Hill: April

Table 7
NUMBERS OF COWS AND AREA OF ROUGH GRAZING, CROPS AND GRASS, AND MOWING GRASS PER COW IN SCOTTISH REGIONS[1] IN 1974

Region	No. of cows	Area per cow (ha)		
		Rough grazing	Crops and grass	Mown grass
Highland	30 095	37.7	1.0	0.2
Grampian	17 217	5.4	1.4	0.3
Tayside	22 814	16.5	1.2	0.2
Central	8 553	14.9	0.7	0.1
Fife	701	2.6	2.3	0.2
Strathclyde	59 312	10.7	0.9	0.2
Lothians	3 459	8.4	2.0	0.3
Border	19 483	9.0	1.3	0.3
Dumfries and Galloway	44 423	4.9	0.9	0.2
ALL SCOTLAND	212 618	13.4	0.9	0.2

[1] Not including Orkney, Shetland and Western Isles Islands Areas
Source: DAFS

It is the food supply which should broadly determine the appropriate system even though Howie and Broadbent (1967) did not find any relationship between time of calving and winter food inputs. However, work at Trawscoed EHF

(MAFF, 1973) clearly indicates the substantial difference in these inputs as between spring and autumn calving systems, the former requiring 0.92 tonnes of hay plus 165-216 kg concentrate compared with 7.1 tonnes of silage (2.0 tonnes hay) and 76 kg concentrates to autumn calvers.

Research is currently in progress at HFRO and the Grassland Research Institute to quantify the relationship between food inputs to the cow at different physiological phases, ie pregnancy, lactation, etc, and animal performance as related to the use of body reserves of varying magnitude. In addition, the complex relationship between milk yield and performance of the calf as influenced by birth weight, rate of growth, genotype and the quantity and quality of solid food ingested are also being investigated.

Although maximum biological efficiency implies no use of body reserves, this is not realistic in practice and maximum economic efficiency is more important but will change as input/output costs and prices vary. However, more comprehensive biological data is needed to permit systems models to be produced.

HILL FARMS

Farms of this type may have less than 10% 'inbye' land so that utilisation of rough grazing is important and winter fodder is either purchased or limited amounts are home produced so that calving in spring or early summer is general.

Opinions on the place of cattle on the hills vary. Meiklejohn (1976) stated, "without doubt cattle are excellent improvers of rough hill pasture by keeping the rougher parts in check and improving the grazings for sheep" and this reflects much of the accepted conventional wisdom. On the other hand McCreath (1963) says, "Many farmers strongly hold the view that adding appreciably to cattle numbers must eventually lead to a reduction in sheep output".

In an *ad hoc* experiment (Peart, 1962) in which sheep only and sheep plus cattle were compared, an increase of 18-37% in lamb output was obtained but this left unresolved the consequences of a comparable increase in livestock units with sheep and the changes in herbage composition, notably the dead to green ratio which would have assisted extrapolation. Nothing is known about the nutritive value and intake of the wide range of indigenous vegetation which is utilised in practical systems nor the effects of grazing pressures. Obtaining the necessary knowledge and understanding for more objective structuring of cattle/sheep systems has only started recently (Hodgson, 1977) and will take some time and will require to be related to the systems described by Eadie (1973) as well as the set-stocked system used by Peart (1962). McClelland (1977) has suggested that currently cattle are relatively uneconomic compared with the 'two-pasture' system for sheep and additional investment for several years ahead on hill farms will be best directed to an expansion of the sheep enterprise. Also, cattle enter-

prises dependent on purchased fodder will probably be eliminated if present cost/price relationships continue.

Sheep systems as traditionally practised utilise only around 15-20% of the dry matter produced (Eadie, 1973) and agistment of cattle from lowland farms, eg dairy heifers, or the integration of arable and hill farms is advocated and indeed practised, the former providing housing and winter fodder, mainly straw, and the latter summer grazing. That dual farm systems of this type have not developed, depending as it does on co-operation, may be partly attributable to the streak of independence characteristic of the hill farmer, the lack of promotion to encourage it and a suitable structure for its development as well as the increasing marginal economics due to ever increasing transport costs. A modern version of the old shieling system (Symon, 1959) is probably a pious hope.

UPLAND FARMS

This category includes farms ranging from those with no access to rough grazings, to farms with substantial areas of hill land, but the cattle enterprise normally being based on the enclosed pastures which provide most of the winter fodder and a high percentage of summer grazing and where autumn or spring calving is more general.

Mudd and Meadowcroft (1964) showed the potential of upland permanent pasture and Cunningham and Harkins (1966) demonstrated that intensification using moderately high inputs of nitrogen and controlled grazing were technically possible. Work at Liscombe EHF (MAFF, 1968) suggested that one acre (0.405 ha) per cow/calf unit could meet grazing requirements and produce a substantial part of winter feed requirements. Meiklejohn (1976) observed that on farms in South East Scotland, intensively managed grass involving paddock grazing increased stocking rate by 25% compared with set-stocking and the aim should be half an acre per cow/calf unit for grazing requirements.

Mixed grazing, usually co-grazing, is very widely practised and experimental evidence suggests that animal output from intensive grazing systems can be improved by grazing cattle and sheep together (Nolan, 1977) or in sequence (Rutter, 1975). The weight of evidence indicates (Nolan, 1977) that mixed grazing generally improves sheep performance while the benefit to cattle is more variable.

There is, as yet, inadequate information about the factors contributing to this improvement so there is no objective basis for deciding on the appropriate cattle/sheep ratio or the best overall stocking rate for particular circumstances. It is understandable therefore, that controversy exists about the merits of incorporating cattle into hill sheep grazing systems as well as grazing cattle and sheep together, as opposed to grazing each species alone in enclosed grazings.

If informed decisions are to be made about the best balance of cattle and sheep for particular circumstances, it will be essential to understand more about the place of different animal species in the soil-plant-animal complex and the degree to which they complement or compete with each other.

Hodgson (1977 & private communication) suggests that this basically consists of a consideration of species differences in diet selection and herbage intake and of the impact of mixed grazing on the control of worm parasites, although other factors may well be important (eg Monteath *et al*, 1977). On the farm the efficient use of pastoral resources will be dependent upon the effective integration of sheep and cattle enterprises when the optimum balance becomes not only an issue of biological efficiency but also of economic efficiency which can be dependent on circumstances of individual farms. This demands a much wider spectrum of information such as nutrition/production response data for both species (eg the seasonal changes in nutrition and the species response) as well as information on the biology of grazing systems.

Table 8
THE EFFECT OF SIRE BREED ON CALF 200-day WEIGHTS (kg)

	Weight at 200 days:		
	Lowland	Upland	Hill
Charolais	241	227	205
Simmental	232	222	198
South Devon	232	221	200
Devon	226	215	191
Lincoln Red	222	214	189
Limousin	215	204	187
Sussex	215	204	187
Hereford	208	194	184
Aberdeen-Angus	194	183	176
Overall	221	211	191

Source: Kilkenny (1977)

GENOTYPES

The unique system of 'stratification' whereby the so-called hardy breeds, eg Galloway, are kept on the poorest land and are used for the provision of breeding

replacements, eg Bluegrey (Shorthorn x Galloway) traditionally has been an efficient means of resource use. However, much of the expansion in beef cow numbers has been obtained using a variety of dairy-type crossbreds of which the Hereford x Friesian has been the most popular. This has been associated with the introduction of exotic breeds amongst which the Charolais, Simmental and Limousin predominate and an increasing use of native breeds, eg Lincoln Red and South Devon with high growth potential. Although the effects of the larger breeds are less apparent in the hill situation, sire breed effects become evident and are reflected in slaughter weights in finishing systems. However, widespread use of such sires is constrained because of a greater incidence of calving difficulties (Kilkenny, 1977) which may be an important disadvantage when close supervision at calving is difficult.

FIXED EQUIPMENT

Considerable advances have been made in the design, layout and fittings (eg cubicles) of buildings to house cows and calves (North of Scotland College of Agriculture, 1975) and also in systems of feeding, eg self and easy feeding, with the aim of reducing labour inputs in feed handling and in the disposal of waste which is still nonetheless a problem of some importance. There is little evidence which would suggest that investment in buildings can be justified on the basis of improved animal performance but labour inputs can be significantly reduced and the management of large herds of 100 to 400 cows become logistically feasible.

OTHER ASPECTS

Reproductive performance both in regard to calving rate and the spread and pattern of calving have a major influence on the economic and biological efficiency of suckled calf production (McCreath, 1970 and Bailie *et al*, 1977). For example, McFarlane *et al* (1977) have clearly shown the importance of nutrition during early lactation on conception rate and fertility. Research on the synchronisation of oestrus to reduce the spread of calving is being actively pursued (Wishart, 1974).

For example, (Kilkenny, 1977) showed that a seven day increase in calving spread reduced profit per cow by £3.40 and £3.80 for spring and autumn calving respectively.

CONCLUSION

Beef cattle have a valuable role in that the movement of stock from hill to upland and/or lowlands, exploits the range of farm environments (MLC, 1976) since cattle utilise rough grazings which otherwise might not be used, and produce high quality and acceptable protein from land which cannot grow food for direct

human consumption. As Wilson (1977) has recently observed, competition between animal and human feed is now a cause for socio-political concern. He suggests that it is likely there will be a return to the situation in which the animal feed industry utilises materials surplus to, or non-competitive with human food.

The National Economic Development Office (1973) stated, "from the data available on production costs and returns it was not feasible to measure the relative economic advantages to the nation of expanding cattle and sheep production in the hills, uplands and lowlands".

An expansion of cattle in the hills is improbable in the near future and the current retrenchment may continue unless policies are implemented to contain numbers at their present level. This is due to: the collapse of the beef market in 1974; the current adverse relationship of costs and prices for beef production compared with the situation for lamb; and an EC surplus of beef compared with a deficiency of lamb.

REFERENCES

Baker, H K (1975) Competitive meat from British farms. Paper presented to the MLC National Meat Conference at Stratford-upon-Avon on Meat in Tomorrow's World.

Bailie, J H, Dury, N S & Norman, J A (1977) The significance of herd conception rate in the economics of beef suckler cow management. *Animal Production*, **24**, 130. (Abstract).

Cunningham, M M, & Harkins, J (1966) Intensive production from suckler cows on marginal land. *Scottish Agriculture*, **46**, 106-110.

Eadie, J (1973) Sheep production systems development on the hills. In: *Colloquium Proceedings No. 3.* Henley-on-Thames: The Potassium Institute Limited.

Hodgson, J (1977) Factors limiting herbage intake by the grazing animal. Paper presented in Dublin to an international meeting on animal production from temporary grassland.

Howie, A & Broadbent, P J (1967) Factors affecting single-suckled calf production in the North-East of Scotland. *Animal Production*, **9**, 285 (Abstract).

Kilkenny, J B (1977) Economic evaluation of breeds. Paper presented to a National Agricultural Centre Conference, Stoneleigh.

MAFF (1973) *Liscombe E H F; report and guide to experiments.* London: MAFF.

MAFF (1973) *Trawsgoed, E H F; report and farm guide.* London: MAFF.

MAFF (1977) *Annual review of agriculture.* London: HMSO.

MLC (1976) *Beef from the hills and uplands.* MLC Leaflet. Milton Keynes: MLC.

Meiklejohn, A K M (1976) *The agriculture of South East Scotland.* Bulletin No. 15. Edinburgh: East of Scotland College of Agriculture.

McClelland, H (1977) Hill cattle – not on. *Scottish Farmer,* 13 August 1977.

McCreath, J B (1963) Hill cattle in the West of Scotland. *Journal of the Chartered Land Agents Society,* 62, 130-139.

McCreath, J B (1970) *Calves from the hills.* Report No. 130. Auchencruive: West of Scotland College of Agriculture.

McFarlane, J S, Somerville, S H, Lowman, B G & Deas, D W (1977) Effect of nutrition and other factors on the reproductive performance of beef cows. *Animal Production,* 24, 131 (Abstract).

Monteath, M A, Johnstone, P D & Boswell, C C (1977) Effects of animals on pasture production. *New Zealand Journal of Agricultural Research,* 20, 23-29.

Mudd, C H & Meadowcroft, S C (1964) Comparison of the improvement of pastures by the use of fertilisers and by reseeding. *Experimental Husbandry,* No. 10, 66-84.

National Economic Development Office (1973) *Evaluation of the economic significance of the hills and uplands of Great Britain.* London: NEDO.

Nolan, T (1977) An ecological appraisal of mixed grazing. Paper presented to the 28th Annual Meeting of the European Association for Animal Production.

North of Scotland College of Agriculture (1975) *Housing of the single suckled cow.* Farm Buildings Division Advisory Leaflet. Aberdeen: North of Scotland College of Agriculture.

Peart, J N (1962) Increased production from hill pastures. *Scottish Agriculture,* 41, 147-151.

Rutter, W (1975) *Sheep from grass.* Bulletin No. 13. Edinburgh: East of Scotland College of Agriculture.

Symon, J A (1959) *Scottish farming: past and present.* Edinburgh: Oliver and Boyd.

Wilson, P N (1977) The composition of animal feeds. *Journal of the science of food and agriculture,* 28, 717-727.

Wishart, D F & Young, I M (1974) Artificial insemination of progestin (Sç21009) treated cattle at predetermined times. *Veterinary Record,* 95, 503-508.