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FEEDING THE DAIRY HERD

A Study of Practices in South-West England

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NEWTON ABBOT
DEVON

PRICE FIVE SHILLINGS

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BY

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FOREWORD

Demand and supply in the dairy industry, coupled with government policy in fixing the level of subsidies to British agriculture, make it imperative for milk producers to be continually seeking ways of maintaining farm income. They have been told that the over-riding need is to cut costs. In particular they are encouraged to make better use of grass and other homegrown foods in order to reduce feed costs and at the same time save currency on imports of animal feed. The available evidence shows the cheapness of homegrown foods but in practice, in the substitution of homegrown for purchased feed, the farmer is faced with a complex of problems not only in providing the cheap foods but in choosing the overall feeding pattern, and indeed an overall farming system which will give him the largest farm income from all the resources under his control.

This study was designed to obtain a clearer picture of the contemporary pattern of feeding dairy cows, under the price-cost relationship for milk and the factors going into milk production at the present time, on the rank and file of milk-selling farms in the South West of England; to test these practices against the theoretical considerations of feeding cows for maximum profit and to outline a method of reasoning whereby any milk producer can arrive at the most profitable system under the particular circumstances on his own farm. The basic principles discussed here have been laid down elsewhere. This is essentially a regional study and the findings are not necessarily applicable to milk production in other areas of the country, e.g., on the arable farms of the Eastern counties. The subject of feeding dairy cows still provides scope for a great deal of research and the author would not claim that this study has done any more than clarify some of the economic issues confronting the individual farmer.

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Farmer and Stockbreeder

I.

INTRODUCTION

The expansion and changes in the dairy industry of this country since pre-war years have been remarkable. Total supplies of milk increased from an average of 1,200 million gallons a year in 1936-38 to 2,200 million gallons by 1957/58—an increase of over 80% in a matter of twenty years. Not only has production increased but markets have expanded and new ideas and methods have changed the whole character of production, distribution and manufacture. In fact the United Kingdom has now developed one of the major dairy industries of the world, outstripping even New Zealand, Denmark and other traditional dairying countries. Since the United Kingdom is a densely populated industrial country importing much of its food from overseas, such an achievement is not always realised.

These developments in the dairy industry have had a marked effect on the pattern of farming in certain areas of the country. For example, in the extreme South-West dairying previously provided only for local milk supplies and the farmhouse manufacture of butter, cheese and cream. The setting up of the Milk Marketing Board and developments in transport and communications opened up an entirely new market for the livestock farms in these areas. Nowadays, one of the most significant features of the milk market is that liquid supplies for London and other large consuming centres can be drawn from the most distant parts of the country including the Far-West and Northern areas.

TABLE 1

SALES OF MILK OFF FARMS BY M.M.B. REGIONS

(England and Wales)

	1938/39	*Average of 1957/58 and 1958/59*	*Percent. Increase*
	Million Gallons		
Eastern	62	97	56
Southern	81	117	44
South-Eastern	110	140	27
Mid-Western	163	254	56
Far-Western	55	148	169
Wales	81	210	159

The above table shows the percentage increase in milk supplies during the last twenty years in a number of M.M.B. Regions. The Eastern, Southern and South-Eastern regions are the older-dairy areas since they have supplied milk to the large consuming centres for many years. During the last twenty years they have increased their production by forty per cent on average. On the other hand the increase in supplies from the newer-dairy areas such as the Far-West and Wales have been significantly greater in comparison and supplies from the Far-West are now over two and a half times greater than pre-war. Thus one of the outstanding features of agriculture in the South-West has been the growing importance of the milk enterprise and its effect on the farming prosperity of the area.

Feed Supplies

Since feed is the major item of cost in producing milk, considerations of feeding practices are therefore of fundamental importance in the farm economy. But in attempting to comment on the present pattern of feeding in dairy herds it is essential to bear in mind the changes that have been responsible for shaping the present day position and outlook, for in looking back over the course of feed supplies during the past twenty years, four periods stand out as more or less distinct phases in the feeding of the national dairy herd.

Firstly there was the pre-war period, prior to 1939, which was largely characterised by a plentiful supply of relatively cheap good quality imported feedingstuffs. During this time there was little incentive for dairy farmers to attempt to grow a high proportion of their cattle food on the farm. The second phase started when the whole outlook and circumstances changed with the outbreak of war. Soon human food supplies became a major consideration and in the national interest milk was given high priority. Expansion of supplies from the national herd was imperative and yet at the same time there was a severe restriction in the supplies of imported animal feed since any available shipping space was ear-marked for food in the form of the finished product rather than raw materials for producing it. Animal feedingstuffs were rationed, prices were controlled by the aid of a subsidy and consequently farmers were forced to grow more feed at home to maintain their cattle and the supply of milk.

The military siege of the war years was virtually replaced by conditions of economic siege. In the post-war years of this third phase this country experienced acute balance of payments problems and general economic difficulties due to the substantial drain of the war effort on the country's financial reserves. During this time there was a gradual expansion in the output of milk, but the degree of self-sufficiency in animal feed achieved during the later war years as a result of the ploughing-up campaign was still vitally important. Finally, the fourth phase dates from the period 1952/54 when rationing and control of foodstuffs came to an end. Animal feedingstuffs were also decontrolled, the subsidy gradually withdrawn and prices began to rise steeply. Nevertheless, in the following years there was a significant increase in the consumption of imported feed.

Information on the rates of feeding in the 400—500 herds in the National Milk Costs Investigation is available to illustrate these trends and feeding data covering a twenty-year period are set out in Table 2. This table shows that in 1938/39 the average dairy cow in England and Wales was fed nearly 23 cwt. of purchased concentrates, which for a yield of 643 gallons, represented a rate of feeding of over 4 lb. of concentrates for every gallon of milk produced. Under 1 cwt. of homegrown corn was fed to each cow in addition. By the later war years the quantity of purchased concentrates had fallen to below 10 cwt. per cow—less than half the pre-war figure—and partly to make up for this the average cow received 7-8 cwts. of homegrown corn. As feed supplies eased after the cessation of hostilities, the total quantity of concentrates per cow began to rise gradually, but a substantial part of the ration was composed of homegrown corn in 1950/51. Since the derationing of feed the amount of purchased concentrates fed per cow has risen fairly rapidly and had

nearly reached the pre-war levels by 1955/56. It is also significant to note that the quantity of homegrown corn fed has fallen as the quantity of purchased concentrates has risen. A very similar story is indicated by the feeding data for herds in the South-West in Table 3.

TABLE 2

AVERAGE RATES OF FEEDING PER COW AND PER GALLON IN ENGLAND AND WALES*
1938/39 — 1955/56

	Per Cow				*Per Gallon*			
	1938/39	1944/45	1950/51	1955/56	1938/39	1944/45	1950/51	1955/56
Concentrates	*cwt.*				*lb.*			
Purchased	23·0	9·9	14·2	19·1	4·0	1·9	2·2	2·7
Homegrown	1·0	7·5	8·1	5·9	0·2	1·4	1·3	0·8
Total ..	24·0	17·4	22·3	25·0	4·2	3·3	3·5	3·5
Hay	—	18·9	17·1	19·2				
Silage ..	—	4·7	21·9	30·7				
Straw ..	n.a.	6·4	3·7	1·6				
Roots and Greenfodder	—	60·4	42·8	45·0				
Other ..	—	—	2·1	1·3				
Average Yield per cow (galls.)	634	592	721	803				

*Source: National Investigation into the Economics of Milk Production. Figures for the two earlier years are averages constructed from groups of herds classed as wholesale, graded and producer-retailers.

n.a.=not available.

TABLE 3

AVERAGE RATES OF FEEDING PER COW IN THE SOUTH-WEST
1938/39 — 1956/57

	1938/39	1944/45	1950/51	1956/57
Concentrates	*Per cow (cwt.)*			
Purchased	16·8	8·4	12·9	16·3
Homegrown ..	3·5	5·3	2·9	2·7
Total	20·3	13·7	15·8	19·0
Hay	16·7	12·6	17·7	15·1
Silage	1·2	3·0*	21·6	25·3
Straw	2·2	7·6	1·9	0·9
Roots and Greenfodder	26·4	52·4	57·2	66·3
Other	—	—	—	—
Yield per cow (gallons)	596	546	656	780
No. of farms in group	61	60	64	62

Source: National Investigation into the Economics of Milk Production. Bristol II Province for Cornwall, Devon and Dorset.

* Estimated breakdown of roots and greenfodder.

Tables 2 and 3 also give information on other foods fed. For example, in the national sample the evidence suggests that the quantity of hay fed per cow has remained remarkably level, but more silage has been fed and there have been some changes in the quantities of roots and green fodder. Although these tables give only part of the story, one important fact emerges however, which is that when the substantially higher milk yields are taken into account the level of concentrate feeding per gallon is still below the pre-war level. Therefore, either the efficiency of food conversion is now higher, or else there has been a greater contribution from homegrown fodder crops and grass—or both. It would seem that war-time pressures and the economic climate of post-war years have brought about a virtual revolution in dairy cow feeding. No longer are the majority of dairy farmers content to rely almost entirely on purchased concentrates. In other words, one of the most significant features in the developments in feeding for milk production has been the increasing role of homegrown foods.

Current Economic Outlook

In recent years official government policy for agriculture has stressed the need for increasing the net output of the industry by reducing costs and using improved techniques and better farm management. The 1959 White Paper[1] on the determination of guarantees specifically mentions that the aim should be for less milk than is at present in prospect and also states that there should be reliance on homegrown feed for livestock. The 1960 White Paper[2] states that milk production should be geared to a level more closely in line with requirements for liquid consumption including the necessary reserve and more or less repeats the earlier warnings. The latest White Paper[3] on talks between the Agricultural Departments and the Farmers' Unions during 1960 states that for milk the scope for profitable expansion is directly related to producers' ability to expand the size of the market at prices which are remunerative and economically justifiable. Whilst there may be room for argument as to the optimum level of milk supplies, no one can doubt that efforts to improve efficiency in feeding and to reduce unit costs are steps in the right direction.

(1) Cmnd. 699, p. 4.
(2) Cmnd. 970, p. 5.
(3) Cmnd. 1249, p. 7.

II.

CONSIDERATIONS IN THE CHOICE OF FOODS

Milk costs surveys and other feeding studies have shown that the feeding of dairy cows in the West Country is largely characterised by the use of grass as grazing during the spring, summer and early autumn months and by the use of conserved grass products, roots and other forage crops during the late autumn and winter. During the main part of the grazing season, grass provides the bulk of the feed requirements for the dairy cow on the majority of farms and in normal seasons no other bulky foods are fed. On the other hand, during the winter months cows are fed a wide variety of homegrown foods such as hay, grass silage, arable silage, rape, kale, swedes, turnips, mangolds, fodderbeet and the residues or by-products of other arable crops. In addition these foods are supplemented by varying quantities of concentrates (including home-grown cereals). In other words, the variations in the type and combination of homegrown foods fed during the winter and the contribution of these foods to milk production tend to highlight the different feeding patterns on individual farms. The increasing emphasis on winter milk since the early war years has also focussed attention on the importance and problems of winter feeding.

What are the main factors which influence the choice of foods on individual farms? From the management point of view there are probably five factors which have an important influence and it is essential to comment briefly on these considreations before attempting to look at the present pattern of feeding. The factors are:—

(a) Season of use
(b) Quality and cost
(c) Acreage requirements
(d) Labour requirements
(e) Bulk and nutrient intake.

(a) Season of use

One of the main aims of the dairy farmer must be to provide his herd with a continuous supply of feed, while at the same time there are great seasonal differences in the periods when individual crops are available for feeding. In the past, the usual practice on many farms was to provide ample grazing during the spring, summer and early autumn and then to rely almost entirely on hay for the maintenance part of the ration and purchased concentrates for production during the late autumn and winter. In recent years, however, particularly in view of the emphasis on winter milk, the general aim has been to provide a significant contribution to feeding from homegrown foods throughout the year.

(b) Quality and Cost

Much of the impetus behind the increasing use of homegrown feed in milk production stems from the widely accepted fact that homegrown foods are a cheaper source of nutrient than purchased concentrates. For broad comparisons the quality of a food is generally expressed in terms of Starch Equivalent (S.E.) and when this is related to cost it is possible to compare costs per unit of S.E. in different foods. The general relationship prevailing at the present time (under average conditions and practices) is outlined in Table 4.

TABLE 4

ESTIMATED AVERAGE COSTS OF PRODUCTION OF STARCH EQUIVALENT FOR VARIOUS CROPS IN 1956/57

	Cost per Ton of Starch Equivalent £
Grazing	12·6
Meadow Hay—in stack	21·8
Grass Silage—in clamp or pit	23·0
Dried Grass	39·8
Kale—grazed	17·6
Turnips and Swedes	34·6
Mangolds	36·6
Arable Silage	32·0
Barley	19·6
Oats	25·8
Dairy Cake (65% S.E. @ £30 per ton purchased price)	46·2

Source: National Investigation into the Economics of Milk Production 1955/57 (Provincial Agricultural Economics Service)

When costs in terms of S.E. are compared, grass in the form of grazing is cheaper than all other feeds. Kale takes second place and is closely followed by barley and grass silage. On this basis the root crops such as mangolds, turnips and swedes are expensive forms of feed and the cost of S.E. in dairy cake is the highest cost of all. It is generally accepted that these relationships represent the average position but the position on individual farms may differ because of:—

(i) the relative yields of crops under given circumstances and

(ii) the relative cost of growing and harvesting crops under particular conditions.

(iii) the cost of transporting foods from storage point to feeding point.

If the cost per unit of S.E. were the only criterion to be considered the choice of foods would be a relatively simple matter. Unfortunately the farmer must take into account some other important considerations in addition.

(c) Acreage requirements

There is a need to think in terms of land use or acreage requirements as well as cost. This is because one particular food may not be quite so cheap per unit of S.E. as another food but the total yield per acre of S.E. may be much higher. In other words its outstanding advantage may be the volume of production that can be supported off an acre of land at a reasonable cost. This is often a vital consideration on many of the smaller dairy farms where an adequate volume of turnover is an important factor. These farms are often making intensive use of land (i.e. combining relatively large amounts of labour and capital with a relatively small amount of land) and in this case the yield of food nutrients per acre may be equally if not more important than the unit cost of those nutrients. The following table gives an indication of the yield of nutrients per acre from a variety of crops to illustrate this point and provides a further reason why kale is such a popular crop, particularly on many small and medium sized dairy farms. For with the yield levels assumed here, kale compares favourably with all crops from the point of view of both S.E. and P.E. per acre.

TABLE 5

YIELD OF NUTRIENTS PER ACRE FOR VARIOUS CROPS

Crop	Yield per acre under good conditions			
	Fresh Crop	*Dry Matter*	*Starch Equivalent*	*Protein Equivalent*
	tons	*lb.*	*lb.*	*lb.*
Fodder Maize (as harvested) ..	22	9,000	4,900	490(a)
Kale—cut and carted	25	8,000	5,000	750
Kale—grazed	20	6,400	4,000	560
Mangolds	28	6,900	3,500	240
Swedes	25	6,000	4,000	400
Fodder Beet	20	8,000	6,000	330
Cereal-legume mixture (for silage)	8	4,500	2,400	250
Lucerne	15	5,700	2,500	800 (a)
Grazed grass (utilised) ..	11	5,000	3,000	600

(a) Digestible crude protein.

Source: Report of the Committee on Grassland Utilisation 1958. Cmnd. 547.

(d) Labour Requirements

In the same way as the farmer short of land has to consider the yield of nutrients per acre, the farmer using labour intensively has to consider the man hours per ton or unit of nutrients produced. On a farm where relatively large quantities of land and capital are associated with relatively small amounts of labour, the labour requirements per ton of S.E. may be almost if not more important than the cost of the nutrients. Table 6 gives an indication of the labour requirements of different crops, and in this comparison grazed grass again occupies first place followed by grass silage and then grazed kale. At the other extreme, the table illustrates the very high labour requirements for fodder roots grown and harvested in the traditional manner.

TABLE 6

AVERAGE LABOUR REQUIREMENTS OF VARIOUS CROPS

Crop	*Man Hours per Acre per Annum*	*Man Hours per ton of Starch Equivalent*
Grass—grazed	10	7
Grass—silage	22	20
Kale—grazed	40	22
Lucerne (as hay)	28	25
Arable Silage	30	28
Grass—hay	30	37
Fodder-beet	115	43
Kale—cut and carted	100	45
Grass—dried	100	50
Swedes	100	56
Mangolds	150	90

Source: Report of the Committee on Grassland Utilisation 1958. Cmnd. 547.

(e) Bulk and nutrient intake

It is always necessary to remember that the foods generally fed to dairy cows fall into the two broad groups already mentioned, namely bulky foods and concentrates. Since there is a limit to the physical capacity of the cow's stomach, rations composed entirely of bulky foods such as hay, kale, silage and roots may set a limit to the cow's intake of food nutrients. Hence it is often essential to control the quantity of these foods and to feed more concenrated foods such as ground cereals, meals and cakes in order to provide the cow with the required level of nutrients. This problem is particularly important in high yielding herds.

Nevertheless, the previous considerations highlight the important role of grazed grass, grass silage and kale in the farm economy and arising out of these and other comparisons it has been suggested[1] that where land is the limiting factor the emphasis on silage should be less than that on kale and grazing. Where land might be more plentiful relative to labour, the emphasis should then be on grazing, grass silage and kale in that order.

Finally, it should be noted that although these considerations do provide a useful guide to the choice of foods, there is a danger in taking the statistical comparisons too far since the position on individual farms will often call for closely argued farm management decisions based on the actual conditions present and that the emphasis to be put on certain foods, or the order of preference, may change quite quickly and appreciably as conditions vary. In addition there is the danger of assuming that different foods are necessarily complete substitutes for one another. Mention has been made of season of use, quality and cost, acreage and labour requirements and the question of bulk. Capital is also a further consideration. Individual foods cannot be selected on the basis of one criterion for it is the aim of the farmer to make the best use of all the resources under his control.

(1) "Silage in the Economy of the Farm" by H. T. Williams. Agriculture, April, 1956.

III.

AN INVESTIGATION INTO FEEDING PRACTICES IN DAIRY HERDS IN THE SOUTH-WEST

(A) OBJECTIVES OF THE STUDY

Surveys of actual feeding practice in commercial herds, together with a comparison of results and a close examination of successful methods, can show how profitable certain techniques are in the field and how widely they are being applied. This report, based on a study of feed and associated labour use in a number of dairy herds and written mainly for farmers in the South-West, attempts to outline the economic considerations every milk producer should bear in mind in feeding his herd. The general objectives of the study are (a) to determine the contemporary pattern of feeding, (b) to pin-point recent trends and changes in feeding practices, (c) to assess the relative advantages of different feed policies in the light of present economic conditions and (d) to guide farmers in their choice of feed policy.

(B) METHOD OF INVESTIGATION

The study was undertaken on milk-selling farms in Devon during the 1958/60 period. In the first instance a random sample of 72 milk producers was contacted, the names being drawn from a list of producers registered with the Milk Marketing Board. It was hoped that this sample would portray a useful cross section of milk producers in the county. The only restriction imposed was that all herds were to be of 15 cows or more. Whilst the high proportion of small herds in the West Country is a well known fact, recently there has been a significant upward trend in herd size and today the aim of many farms is to organise the dairy herd into a more economic unit from the labour point of view. For these and other reasons therefore, it was considered that the study should be concentrated on all but the smallest herds.

General information on farming systems was noted for each of the 72 herds. The primarily beef herds were then eliminated and recording confined to 60 mainly milk-selling farms. Using this sample, a study was then made of the pattern of feeding during the 1958/59 winter and these results form the basis of an analysis of the pattern of feeding with bulky foods. Following on from this, physical and financial data on feeding were recorded for 46 of the 60 herds for a twelve months period from April 1959 to March 1960. During this time efforts were made to pay special attention to the more unusual feeding systems. The results for this period provide data for the comparisons and contrasts in feed policies outlined later in this section and the individual results for the 46 herds are set out in the Appendix (Table 6) together with an analysis of the sample according to margins per cow, size of herd, yield per cow and feeding systems.

(C) FEEDING PRACTICES

(1) Bulky Foods

The average ration of bulky foods (excluding grazing) fed per cow during the winter six months period October 1958 to March 1959 inclusive contains approximately 1 ton of hay, 15 cwt. of silage, 2 tons of kale and 15 cwt. of other roots. But this average ration is derived from sixty individual sets of rations varying widely in content and quality. Table 7 sets out the number of herds receiving each individual type of food (together with a similar distribution for a sample of 62 other herds in the South-West for supporting evidence).

TABLE 7

NUMBER OF HERDS RECEIVING INDIVIDUAL FOODS

	Random sample of 60 *Devon Herds* 1958/59	62 *Milk Costs Herds* 1956/57*	*Total of* 122 *Herds*
	Number of Herds		
Hay	59	57	116
Kale	50	44	94
Silage	25	30	55
Mangolds ..	25	18	43
Turnips and Swedes	12	8	20
Cabbage ..	10	9	19
Straw	6	11	17
Fodder Beet ..	5	2	7
Rape	1	3	4
Potatoes	1	—	1
Maize	1	—	1

* Bristol II Province. National Investigation into the Economics of Milk Production.

The main point suggested by this table is that the four main foods which are relied on for the winter feeding of dairy cows in the South-West are hay, silage, kale and mangolds, and between them these foods provide a substantial proportion of the total feed nutrients supplied by all bulky foods. As a check on this, the average ration mentioned in earlier paragraphs has been set out in Table 8 and a calculation of the total S.E. supplied by the individual foods has been made by applying average feeding standards to the quantities of the different foods. This indicates that hay alone accounts for nearly 50% and hay, silage and kale together account for about 90% of the estimated S.E. contributed by bulky foods excluding grazing. In other words, hay, silage and kale are the three important bulky foods in winter feeding.

To assist in commenting briefly on each of the individual foods in Table 7, some further analyses have been set out in Tables 9 and 10. Table 9 shows the average quantities fed per cow in the herds receiving these foods, together with the ranges and distribution of herds by quantities fed, while Table 10 gives some data on the distribution of the 60 herds according to the date the feeding of individual foods commenced and the length of the feeding period. These data are used to support some general comments on these foods which have arisen as a result of questioning the 60 milk producers on feeding patterns.

TABLE 8

THE AVERAGE WINTER RATION PER COW AND THE ESTIMATED CONTRIBUTION OF INDIVIDUAL FOODS TO THE FEED SUPPLY (EXCLUDING GRAZING)

	Quantity fed per cow (cwt.)	*Assumed Analysis S.E.%*	*lb. of S.E.*	*Percent. of Total S.E.*	
				in Bulky foods %	*in Bulky foods and concs. %*
Hay	21·0	34·0	692	47·5	30·3
Kale	40·8	9·5	434	29·8	19·0
Silage	14·7	12·6	207	14·2	9·0
Mangolds	7·0	6·8	53	3·6	2·3
Cabbage	3·4	8·0	30	2·1	1·3
Other..	5·2	7·0	41	2·8	1·8
			1457	100	
Concentrates ..	11·4	65·0	830	—	36·3
			2287	—	100·0

Hay

One of the outstanding features of Table 7 is that hay was fed on no less than 59 out of 60 farms. Admittedly some farmers were feeding small quantities but the conclusion to be reached is that hay is still the most popular winter food for dairy cows. Haymaking as traditionally practised has been severely criticised by scientists and farmers as a wasteful and uneconomic method of grass conservation, particularly in difficult seasons.

TABLE 9

THE AVERAGE QUANTITIES OF THE MAIN BULKY FOODS FED PER COW (IN THOSE HERDS RECEIVING INDIVIDUAL FOODS) TOGETHER WITH THE RANGES AND DISTRIBUTION OF HERDS BY QUANTITIES FED.
(October to March)

	Hay	*Kale*	*Silage*	*Mangolds*	*Turnips and Swedes*	*Cabbage*
	cwt. per cow					
Average quantity fed	21·4	49·0	35·3	16·8	17·2	20·2
Range (lowest to highest) ..	0·2–49·8	12·5–132·3	2·3–105·5	1·2–60·5	5·5–33·1	2·4–53·2
	Number of Herds					
Quantity fed per cow						
Nil	1	10	35	35	49	50
Under 10 cwt. ..	5	—	4	11	4	4
10 and under 20 cwt.	20	4	2	6	3	2
20 ,, ,, 30 ,,	27	8	8	4	2	2
30 ,, ,, 40 ,,	4	8	4	3	2	—
40 ,, ,, 50 ,,	3	8	1	—	—	1
50 ,, ,, 60 ,,	—	9	2	—	—	1
60 ,, ,, 80 ,,	—	9	3	1	—	—
80 ,, ,, 100 ,,	—	2	—	—	—	—
100 cwt. and over ..	—	2	1	—	—	—
Total herds	60	60	60	60	60	60

But despite this the value of good hay for dairy cows is still praised by a large number of milk producers. Many have attempted to minimise some of the disadvantages of the older methods of making hay by adopting new techniques such as the quick turning of the crop after cutting, the use of specialised machinery and the timely use of the baler. Impressions gained from the 60 milk-producers in this sample suggest that these new techniques are fairly widely practised on Devon farms and this modern approach to haymaking may well be one of the main reasons why silage making is not increasing as fast as might be expected.

TABLE 10

DISTRIBUTION OF HERDS BY THE DATE THE FEEDING OF INDIVIDUAL FOODS STARTED AND THE LENGTH OF THE FEEDING PERIOD
(October to March)

	Hay	*Kale*	*Silage*	*Mangolds*	*Turnips and Swedes*	*Cabbage*
Date feeding started			*Number of Herds*			
Before October ..	4	1	—	—	—	4
October	28	13	—	—	1	4
November	22	23	8	2	4	2
December	4	7	10	3	—	—
January	—	4	3	7	2	—
February	—	2	3	5	2	—
March	1	—	1	8	2	—
Total herds	59	50	25	25	11	10
Length of feeding period in days (October-March)						
Under 30 days ..	1	—	2	10	4	—
30 and under 60 days	—	8	3	5	2	6
60 „ „ 90 „	1	10	3	5	2	2
90 „ „ 120 „	1	12	7	2	1	1
120 „ „ 150 „	13	12	7	3	1	1
150 to 182 days ..	43	8	3	—	1	—
Total herds	59	50	25	25	11	10

Variations in hay feeding between herds are shown by the distributions in Table 9. The range in quantity fed is from virtually nothing to over $2\frac{1}{2}$ tons per cow during the winter six months period. The majority of cows however, received somewhere between 10 and 30 cwt. of hay. Cows in the smaller herds tend to receive more hay but less silage than those in larger herds as the figures in Table 11 show. Where hay is used, feeding generally commences in October or early November and then continues throughout the winter and this lengthy feeding period on most farms distinguishes hay from the other bulky foods. There are suggestions that rather less hay may be fed in the future but what is fed may well be of better quality. Nevertheless, the reasons for the continued popularity of hay as the prime winter food on a large number of milk-selling farms are worthy of special study under present day farming conditions.

TABLE 11

AVERAGE QUANTITIES OF FOODS FED ACCORDING TO HERD SIZE
(October to March)

Herd Size	*Hay*	*Silage*	*Kale*	*Mangolds*	*Cabbage*	*Other Bulky*
			cwt. per cow			
Under 25 cows ..	23·7	6·6	47·9	5·0	0·5	8·9
25 and under 35 cows	22·6	11·6	38·2	11·3	4·0	5·0
35 cows and over ..	17·5	23·7	38·2	4·1	4·9	2·9

Silage

Twenty-five out of the random sample of sixty farmers fed silage to their cows. About 35 cwt. per cow was the average ration in those herds receiving silage but the range was extremely wide—from ½ ton to over 6 tons per cow. Generally speaking, silage feeding started in late November or December on the majority of farms but the length of the feeding period varied enormously to give a very different feeding pattern to that for hay.

The farmers not making silage gave a variety of reasons why silage was not made. A large number of points were put forward including (a) layout of farm not convenient, (b) buildings not suitable for erecting a convenient silo, (c) late district—not enough early grass for spring silage, (d) labour problems in making silage, (e) labour problems in feeding silage, (f) tried silage unsuccessfully, (g) haymaking methods have been mechanized and improved and (h) prefer good hay as a cow food. But in spite of these and other problems there has been a steady increase in silage making in recent years and opinion suggests there will be a gradual but continued increase in both the quantity of silage made and the number of farmers making silage in the South-West in the next decade.

Kale

One of the outstanding features in the pattern of feeding on dairy farms in the South-West during the last twenty years has been the growing popularity of kale as a winter food. The acreage of this crop has been rising since 1947 in the county of Devon and appears to be still rising at the present time. This trend is in marked contrast to the gradually diminishing acreages of the traditional globe roots (see Appendix Table 5). No less than 50 out of the sample of 60 farmers fed kale to their cows in 1958/59. Generally speaking, kale is sown to provide green fodder in the autumn as soon as grazing finishes but in recent years it has been quite common for farmers to provide a continuous supply of kale from November to March. A general standard is between one-fifth and one-third of an acre per cow and there is a tendency for relatively more kale and less silage to be used on the smaller farm.

Part of the popularity of kale as a fodder crop is due to the now almost universal method of folding the crop with an electric fence which allows control over the feeding rate and yet reduces the labour in feeding to the minimum. Another reason for the popularity of kale is the quantity of food produced per acre in response to adequate manuring. This is particularly important on the smaller farm where acreage is a limiting factor.

Discussions with farmers in the sample on feeding patterns would suggest that kale may now have reached the limit of its expansion and in future somewhat less kale may be grown. Three factors might be responsible for this trend. Firstly, many farmers are pointing to the mud problem in attempting to graze kale—particularly towards the latter part of the winter. This creates a great deal of work in washing cows before milking and in being responsible for foot ailments in cattle. Secondly, farmers are realising that kale as a green fodder crop is in its prime in the autumn and early winter and are attempting to substitute silage or other foods for kale after the end of December. Lastly, increased acreages of kale have brought problems in the crop rotation. With a significant proportion of the farm sown to kale, reseeding can become a major problem and there is the difficulty of the reduced acreage of grass available during the important early spring period—not to mention the difficulty of finding suitable fields for kale each year. In addition, kale feeding has been associated with fertility troubles in cattle breeding.

Mangolds

The acreage of this crop has been gradually declining since the war and the 1959 acreage in Devon is only half the 1944 figure. The considerations in Chapter II indicate that there was little economic justification for this crop as a food for dairy cows, so it is perhaps surprising that no less than 25 farmers out of 60 fed mangolds.

Although Table 9 shows that the quantities fed were relatively unimportant except on a few farms, a number of points associated with the future of this crop should be noted. Firstly, mangolds are often grown on mixed livestock farms where there are advantages in having these roots for sheep and young stock as well as dairy cows. Secondly, despite the heavy labour requirements some farmers argue that on farms where a large labour force is necessary, the crop absorbs surplus labour which might otherwise be wasted. Thirdly, comparisons of the relative cost of food nutrients supplied by various crops and based on average yields almost certainly undervalue this crop in areas where high yields of roots are obtained per acre.

Swedes and Turnips

These roots are less popular than mangolds as a food for dairy cows in the South-West—only one in five farmers in the sample fed them. Like mangolds, the acreage of swedes and turnips has been declining over the past fifteen years, but a substantial acreage is still grown and is probably more associated with sheep than dairy cows. Thus on dairy farms where a flock of sheep are kept, both sheep and cattle tend to receive these roots.

Cabbage

One farmer in six used cabbage and feeding generally started in October or November for a short period only (see Table 10). The advantages of this crop largely depend on its capacity to produce a considerable tonnage of high protein succulent food per acre, together with the fact that it is easier to handle than kale. Cabbage makes heavy

demands on labour but on the smaller farm this capacity to produce a great deal of food off a small acreage often makes the crop an economic proposition. The growing of cabbage tends to be localized in certain areas and the acreage grown in the South-West is probably fairly static but there is continued interest in this crop.

Fodder Beet

This has not been a popular crop in the South-West and the present acreage in Devon has fallen to nearly a third of what it was six years ago. Four out of sixty farmers fed fodder beet to dairy cows in 1958/59. On some farms these roots are grown primarily for pigs with the dairy herd tending to receive a portion of the crop.

Other Bulky Foods

Various other homegrown foods are fed to dairy cattle during the winter period. On the sixty farms under review, the cows received rape on one farm—a useful catch crop for late summer and autumn grazing—maize on one farm and some potatoes on another. In addition several farmers reckoned that their cows ate varying amounts of straw, which was intended primarily for bedding on most farms.

Combination of Bulky Foods

When the farms are grouped according to the combination of bulky foods fed during the winter period, it is found that there are no fewer than 22 different combinations in a random sample of sixty. The most popular combination according to Table 12 is that including hay, silage and kale. Comparisons of the relative merits of the different combinations from the management point of view become rather complex but from what has been said in earlier paragraphs about the individual foods, their popularity and recent trends it would seem that these three foods together could well supply all that is required from bulky foods on a large majority of dairy farms.

TABLE 12

DISTRIBUTION OF HERDS BY COMBINATION OF BULKY FOODS FED

	Random sample of 60 *Devon Herds* 1958/59	62 *Milk Costs Herds* 1956/57	*Total of* 122 *Herds*
	Number of Herds		
Hay, Silage, Kale	10	12	22
Hay only	5	11	16
Hay, Kale, Mangolds ..	8	6	14
Hay, Kale	6	5	11
Hay, Silage, Kale, Mangolds	5	5	10
Hay, Silage..	2	3	5
Hay, Kale, Swedes ..	4	—	4
Hay, Mangolds, Cabbage	3	1	4
Other Combinations ..	17	19	36
	60	62	122

(2) Concentrates

Previous studies have shown that the average dairy cow in the South-West is fed some 15—20 cwt. of concentrates annually, but feeding rates vary from nothing to over 2 tons per cow. For the winter period under review Table 13 shows the range in feeding rates. Five herds received less than 2 lb. of concentrates for every gallon of milk produced while at the other extreme eight herds were fed 5 lb. or more per gallon.

Even though there are numerous grades and types of cakes and meals, concentrates are regarded as one class of food in this study and no consideration has been given to the factors influencing the choice between the different varieties. The economic significance of the quantities of concentrates used, however, and the combinations of bulky foods and concentrates are major issues which are dealt with in the remaining sections of this report.

TABLE 13

DISTRIBUTION OF HERDS BY THE QUANTITY OF CONCENTRATES FED PER COW AND PER GALLON

(October to March)

Concs. fed per cow (cwt.)	*No. of Herds*	*Concs. fed per gallon (lb.)*	*No. of Herds*
Nil	1	Nil	1
Under 5 cwt.	4	Under 1 lb.	1
5 and under 10 cwt.	19	1 and under 2 lb.	3
10 „ „ 15 „	23	2 „ „ 3 „	13
15 „ „ 20 „	10	3 „ „ 4 „	18
20 „ „ 25 „	2	4 „ „ 5 „	16
25 cwt. and over	1	5 lb. and over	8
Total	60	Total	60
Average = 11·6 cwt. per cow in those herds receiving concentrates.		Average = 3·7 lb. per gallon in those herds receiving concentrates.	

(D) CONTRASTS IN FEEDING PRACTICES AND POLICY

Superimposed on the various combinations and levels of feeding with bulky foods are the variations in the quantities of concentrates fed per cow. These variations produce even larger differences in overall feeding patterns and highlight the relative importance of bulky foods and concentrates in different feeding systems. Discussions with farmers in the random sample indicate that, from the practical point of view, milk producers generally associate the choice of feeding patterns as between three broad groups, namely:—

(a) a *bulk-feed* or forage farming system where the herd is fed entirely or almost entirely on bulky foods receiving little or no concentrates or corn of any kind.

(b) a *moderate* system where average yields per cow are produced on moderate levels of feeding with bulky foods together with some concentrates.

(c) a *high-yield* system where the aim is for high yields per cow from considerable concentrate feeding in conjunction with bulky foods.

What are the relative merits and economics of these systems? There has always been lively discussion on the most profitable level of feeding with concentrates and currently there is a great interest in the potential of grassland and more generally in the capacity of homegrown foods to play an increasingly important role in economic milk production. This section is therefore devoted to a comparison of these three systems using the financial data for the 46 herds on which recording continued for the year ending 31st March, 1960. The case-study approach has been used in order to select small groups of farms to illustrate fairly precise feeding patterns.

(a) Bulk-Feed

Included in this group are herds where the aim is to produce milk from bulky foods with little or no concentrates fed. Many of the traditional summer milk producers fall into this category since these herds are generally expected to milk entirely off grass during the spring, summer and early autumn and are then maintained on hay with or without roots and other foods during the winter. In recent years, however, with the progress in the conservation of quality grass products and the use of green-folding crops like kale, forage systems have been developed where the cows can milk all the year round on homegrown bulky foods. With liberal diets and good quality foods it is claimed that it is possible to provide for maintenance and up to 3 gallons per cow[1] during the winter period—a similar level of production to that expected by many farmers in the flush of the grazing season. Nevertheless it is suggested here that this group may well include any herd where the cows receive up to 5 cwt. of concentrates a year. Of the 46 herds studied in 1959/60, only three producers maintained that they were following a bulk-feed policy.[2] The rate of concentrate feeding in these herds, which have been chosen to represent the system, was nil, 2·8 and 5·9 cwt. per cow.

Among the possible advantages suggested for this system is the scope for producing milk at a low unit cost. A low feed cost is the main aim but low labour costs are also possible, particularly in the larger herds and in herds where self-feeding techniques are incorporated and less attention is given in both feeding and milking operations. Another advantage is that profits are influenced little by changes in the cost of purchased feed, nor do they suffer quite so much when milk prices are reduced. This is because yields per cow are assumed to be lower than average with the bulk-feed system and therefore a cut in the price per gallon has less effect on profits per cow. In addition, there is little chance of overfeeding and wasting expensive purchased feed. It has also been suggested that this feeding pattern can be contemplated with something less than first quality cows.

On the other hand, due to the physical limits of the capacity of the cow's stomach, a ration of bulky foods may be unable to supply all the nutrients that a cow is capable of converting into milk and so have a depressing effect on yield. In other words, good quality foods are

(1) This standard is more applicable to individual cows in the herd. Herd averages will hardly ever achieve this level.

(2) An attempt was made to augment the sample with other herds which would genuinely represent this system, but such herds proved difficult to find even with assistance from District Officers of the N.A.A.S.

especially important. The provision of good quality bulky foods at all times is a considerable task, however, requiring a high standard of management. Many people would point out that purchased concentrates are a much more certain source of nutrients and have been described as a "precision tool" compared with bulky foods.

With low yielding herds all overhead costs are spread over fewer gallons so that costs must be kept to the absolute minimum if profits are to be maintained. In addition there is a danger in placing undue emphasis on low unit costs. Profit per gallon is only one of the factors which influence the performance of a herd since total profits are dependent on profit per gallon multiplied by the number of gallons produced. Hence a lower profit per gallon on more gallons may give a bigger total profit than a higher profit per gallon on a smaller yield. Again, if the acreage required to support a dairy cow is greater with the bulk-feed system, then profitability per acre may be lower than that achieved by other feeding methods. If this latter point is valid then the bulk-feed system will have few attractions for the small farm where land is a limiting factor. With these theoretical advantages and disadvantages in mind some comments are now made on the performances of the three herds chosen to represent the bulk-feed system. Results for these herds are set out in Table 14.

Farm 1

On this farm of 200 acres carrying a herd of 21—22 South-Devon cows, the deliberate aim is to produce a level output of milk throughout the year on grazing, hay, kale and mangolds with no concentrates fed—not even homegrown corn. For the year 1959/60 the average yield per cow was 439 gallons. Due to the dry season this was somewhat below normal[3] and hay was fed throughout the year except for two months in the middle of the grazing season. With the lower total return for milk at £70·3 per cow because of the decrease in yields, and the higher feed costs than in normal seasons, the results for this herd are much below the standard for the group. Table 14 shows the margin over feed and labour cost to be £10·7 per cow as against £42·8 for the group. On an acreage basis the performance of this farm compares even more unfavourably since 2·4 acres are required to support each cow compared with a standard of 1·8 acres for the group. Since beef is important in the farming system, profits are augmented by the high value of calves at birth and also by the good beef prices for culled cows. However, the lesson here is that in a dry summer and difficult grazing season this herd may well be at a greater disadvantage than other herds.

Farm 2

This is a farm of 178 acres of rather difficult wet land which carries a herd of Ayrshire cows. No concentrates are generally used but a small ration was fed in 1959/60. Some 23 cows were kept during the year in question but the normal herd size is between 30 and 40 cows. A policy of spring calving is followed on this farm so that even with a yield of 540 gallons per cow—100 gallons more than on Farm 1— the value of milk sales per cow is only £73·6 because of the relatively low milk prices in spring and summer. Table 14 shows that total feed costs per cow are similar to those on Farm 1 but labour is kept to the absolute

(3) For 1958/59 yield per cow averaged 472 gallons.

minimum to give a low-cost feed and labour system. At £30 per cow the margin over feed and labour cost is nearly three times greater but still compares unfavourably with the group. Margins per acre are also low on this farm because three acres of land are required to support each cow.

TABLE 14 **RESULTS FOR SOME BULK-FEED HERDS 1959/60**

Farm No.	1.	2.	3.	*Average of 46 Devon Herds*
Size of farm (acres)	200	178	143	179
Herd Size (cows)	21·1	23·0	30·5	35·0
Breed	S. Devons	Ayrshire	Ayrshire	—
Farm Feed Acres per cow ..	2·4	3·0	2·4	1·8
Concs. per cow (cwt.)	Nil	2·8	5·9	19·8
Yield per cow (galls.)	439	540	615	745
Percentage Winter Milk ..	50·0	22·0	36·3	48·2
Hours per cow	168	71	104	92
Concs. per gall. (lb.)	—	0·6	1·1	3·0
		£ per cow		
Returns (milk only)	70·3	73·6	90·5	110·1
Costs				
Foods				
Purchased	—	4·5	4·5	25·8
Homegrown	21·1	8·3	11·5	16·0
Grazing	8·7	17·4	5·8	8·0
Total Foods	29·8	30·2	21·8	49·8
Margin				
(over feed costs)	40·5	43·4	68·7	60·9
Labour	29·8	13·9	19·7	18·1
Margin				
(over feed and labour) ..	10·7	29·5	49·0	42·8
		pence per gallon		
Returns	38·5	32·8	35·3	35·7
Feed Costs	16·3	13·5	8·5	16·0
Margin (over feed)	22·2	19·3	26·8	19·7
		£ per acre		
Margin (over feed)	17·2	14·3	28·9	33·1

Farm 3

This is another farm of over 100 acres carrying a herd of mainly Ayrshire cows. The land is rather poor but the low grazing cost, even with 2·4 acres per cow, reflects the low rent on this farm. The accent is again on spring calving though with a more generous ration of concentrates than on Farm 2, so that the resulting yield per cow was over 600 gallons. With increased returns per cow, exceptionally low feed costs and far from excessive labour costs, this was the most profitable of the three herds in 1959/60. Table 14 indicates that margins per cow were actually higher than the group average but the relatively high acreage requirements per cow again reduced the margin per acre.

(b) Moderate System

The feed policy adopted by a considerable number of milk producers in the sample is that where average yields per cow are sought from moderate levels of feeding. Producers who support this system claim that with this method of feeding there is less risk of excessive practices developing, i.e. in wasting either concentrates or bulky foods. Secondly, that the system is less exacting than other methods of feeding and can be safely conducted with an average standard of management. But on the other hand, moderate practices are only likely to lead to moderate profits and the opportunity of additional profit may be sacrificed if some of the resources (e.g. the cows) are capable of being used more intensively.

TABLE 15 **RESULTS FOR SOME MODERATE HERDS 1959/60**

Farm No.	4	5	6	7	*Average of 46 Devon Herds*
Size of farm ..	146	94	163	202	179
Herd size	23·7	42·2	21·2	49·0	35·0
Breed	Ayrshire	Red Poll mainly	Friesian	Ayrshire	—
Farm Feed Acres per cow	1·8	1·8	2·2	1·8	1·8
Concs. per cow (cwt.)	24·9	15·4	13·6	15·3	19·8
Yield per cow (galls.)	728	721	700	750	745
Percentage Winter Milk	40·5	46·8	46·4	46·4	48·2
Hours per cow ..	103	71	86	85	92
Concs. per gall. (lb.)	3·8	2·4	2·2	2·4	3·0
			£ per cow		
Returns (Milk only)	105·2	105·9	102·8	110·7	110·1
Costs					
Foods					
Purchased ..	19·7	22·2	22·2	13·5	25·8
Homegrown ..	27·9	17·0	7·9	19·1	16·0
Grazing.. ..	6·0	12·7	11·4	8·9	8·0
Total Foods ..	53·6	51·9	41·5	41·5	49·8
Margin (over feed costs)	51·6	54·0	61·3	69·3	60·9
Labour	21·6	13·3	16·1	17·8	18·1
Margin (over feed and labour) ..	30·0	40·7	45·2	51·5	42·8
			pence per gallon		
Returns	34·7	35·3	35·3	35·5	35·7
Feed Costs ..	17·7	17·3	14·3	13·3	16·0
Margin (over feed)	17·0	18·0	21·0	22·2	19·7
			£ per acre		
Margin (over feed)	28·7	30·7	28·0	38·5	33·1

This is essentially a middle group by definition after the extremes of policy have been eliminated. A large proportion of the herds could conceivably fall into this group but four herds following a middle of the road policy have been chosen to represent the central range of this group.

Selection has been made on the basis of (a) a yield per cow between 700 and 750 gallons, (b) a stocking rate between 1·8 and 2·2 farm feed acres per cow and (c) a feeding rate of between 2 and 4lbs. of concentrates per gallon.

The results for these four herds are set out in Table 15 and there seems little need to comment on them individually. The question facing the producers on these farms is one concerning the most appropriate lines for development in the future. This subject is discussed in the general conclusions at the end of this report.

(c) High-Yield System

At the other extreme to the bulk-feed herds are those where the deliberate aim is to achieve high milk yields per cow even if this means feeding substantial quantities of concentrates. What are the likely advantages and disadvantages of such a policy?

Among the possible advantages it is clear that, if a high yielding cow makes economic use of more feed, then returns are maximised at a higher level. Overhead costs are also spread over more gallons so that both these advantages should lead to higher profits per cow. In addition, feeding for high yields is one way of expanding the size of business on a small farm. Moreover, if bulk feeds have to be curtailed, it may be argued that the acreage requirements per cow will be lower with this system. It has already been mentioned that using concentrates is regarded as a more precise way of feeding dairy cows. Lastly, high yields often enhance the value of stock.

On the other hand, due to diminishing returns, feeding at higher levels may develop into a wasteful process. In other words, if not under careful management, feeding for high yields can be uneconomic and does not necessarily lead to higher profits. Reductions in milk prices have a greater effect on the profits of high yielding cows simply because the reduction takes place on more gallons and increases in the price of concentrates have a greater adverse effect on this system than on the other two systems described.

When the 46 herds studied in 1959/60 were ranked in order of yield per cow, two herds had yields in excess of 1,000 gallons per cow and seven herds had yields of 900 gallons or over. These seven herds were classified as high-yielding herds and four of these were chosen to represent the group. This was achieved by ranking the seven herds in order of yield per cow and selecting alternate herds. The financial and other data for these herds is set out in Table 16.

Farm 8

This is a farm of nearly 300 acres carrying a herd of some 70 Friesian cows. The individual farm figures (Table 6, Appendix) show this herd has the highest yield and the highest profit per cow for all herds in the group. The farm is on good land but this performance is largely attributable to a combination of good cows and first class management. The feeding pattern is based on grazing, hay and kale—no silage is fed to the dairy cows. A fairly high proportion of winter milk is produced and it will be noted that nearly 2 tons of concentrates per cow are required to produce a yield of 1,057 gallons when the stocking rate is 1·8 farm acres for each cow.

TABLE 16

RESULTS FOR SOME HIGH-YIELD HERDS 1959/60

Farm No.	8	9	10	11	*Average of 46 Devon Herds*
Size of farm ..	285	223	109	108	179
Herd size	71·1	22·6	48·6	17·9	35·0
Breed	Friesian	Friesian	Mixed	Friesian	—
Farm Feed Acres per cow	1·8	2·0	1·3	2·6	1·8
Concs. per cow (cwt.)	38·0	26·0	22·9	29·9	19·8
Yield per cow (galls)	1057	966	913	905	745
Percentage Winter Milk	59·0	56·1	48·9	46·9	48·2
Hours per cow ..	82	105	93	120	92
Concs. per gall. (lb.)	4·0	3·0	2·8	3·7	3·0
			£ per cow		
Returns (milk only)	161·9	133·9	138·8	129·4	110·1
Costs					
Foods					
Purchased ..	45·3	43·5	39·2	48·0	25·8
Homegrown ..	20·9	14·7	9·5	10·3	16·0
Grazing.. ..	8·0	4·2	6·7	8·5	8·0
Total Foods ..	74·2	62·4	55·4	66·8	49·8
Margin (over feed costs)	87·7	71·5	83·4	62·6	60·9
Labour	14·2	18·8	20·1	25·1	18·1
Margin (over feed and labour) ..	73·5	52·7	63·3	37·5	42·8
			pence per gallon		
Returns	36·8	33·3	36·5	34·3	35·7
Feed costs ..	16·9	15·5	14·6	17·7	16·0
Margin (over feed)	19·9	17·8	21·9	16·6	19·7
			£ per acre		
Margin (over feed)	48·5	36·5	65·6	23·7	33·1

Farm 9

On this farm a herd of 22-23 Friesians averaged 966 gallons per cow. Here again the aim is intensive feeding designed to give a high milk yield and a first class result would have been achieved except for the fact that the T.T. premiums were lost for most of the year in question—hence the low returns per gallon. The pattern of feeding is also similar to that on Farm 8 in that the basis is grazing, hay and kale but a small quantity of silage is fed to the dairy cows on this farm. Table 16 shows that 26·0 cwt. of concentrates were fed to each cow and the rate of stocking was 2·0 acres per cow. This is not entirely a dairy farm since sheep are also an important enterprise. The buildings are also poor on this farm. Nevertheless, the margin over feed and labour at £52·7 a cow compares favourably with the group average of £42·8.

Farm 10

This is an all grass farm of just over 100 acres devoted entirely to milk production. The outstanding features here include an average yield of 913 gallons per cow from 22·9 cwt. of concentrates with a high stocking rate of a cow to every 1·3 acres. Even at this yield level, feed costs per gallon are well below average and this is largely a reflection of the care and good management in the feeding of this particular herd. This policy suits this size and type of farm eminently for not only are profits per cow the fourth highest in the group at £83·4 but the herd achieves the highest margin over feed costs per acre.

Farm 11

This is another farm of just over 100 acres but, unlike Farm 10, the land is not of the highest quality and in 1959/60 no less than 2·6 farm acres were used by each cow. Feeding is also virtually all hand-feeding because the land is steep and inaccessible as well as of poor quality. However, with individual attention the average yield is over 900 gallons per cow but just under 30 cwt. of concentrates are required. This reduces the margin over feed costs down to near the average level of performance. Furthermore, the extensive use of land reduces margins per acre but it is doubtful if any other feeding system would produce anywhere near average profits on this difficult farm.

(E) SUMMARY OF RESULTS

The present pattern of feeding on milk-producing farms in the South-West shows that in addition to grass as grazing, the three foods hay, kale and silage are important in the feeding of dairy cows. Hay is still the most popular winter food judged by the number of herds receiving each food and also the most important of the bulky foods (excluding grazing) from the point of S.E. contributed to the cow's ration. A ton of hay or thereabouts is still the general rule in dairy herds in the South-West. Fifty-nine out of a random sample of sixty herds received hay in 1959/60. Silage is fed on less than half the farms at present and in those herds receiving this food approximately 35 cwt. per cow was the average ration. The available evidence suggests that the quantity of silage made continues to increase and is likely to rise still further.

The increase in the acreage of kale in the South-West in the last twenty years has been remarkable and the latest figures still indicate a rising trend. Five out of every six farmers fed kale in 1959/60 and the present standard is between one-fifth and one-third of an acre per cow. Opinions suggest that for various reasons this crop may soon reach the limit of its expansion. The popularity of other bulky foods has also been examined but for the majority of farms a feeding pattern based on grazed grass, hay, silage and kale compares favourably from the management point of view.

The study has also attempted to compare the relative economics of feeding systems which differ in their use of concentrates as a supplement to the bulky foods available. Three systems were envisaged as (a) bulk-feed, (b) moderate and (c) high-yield and a small number of farms were chosen to represent each system using the case-study approach.

The true bulk-feed system, where the deliberate aim is to produce milk entirely or almost entirely off grass and other forage crops, is not well represented in the South-West. According to the random sample studied, no more than five per cent of herds fall into this category. The records for three herds chosen to represent this system show that results compare unfavourably with the group average, for profits per cow were considerably below average on two farms and profits per acre were lower on all three farms. Advocates of the bulk-feed system in search of low feed costs per gallon tend to overlook the fact that total profits are also dependent on the number of gallons produced. It would appear that when relying entirely on bulky foods the average dairy cow in the South-West is likely to yield about 500 gallons of milk taking one year with another. Thus, if margins per gallon are not substantially higher with this system then margins per cow are not likely to compare favourably. In addition, on the case-study farms some $2\frac{1}{2}$ to 3 acres are required per cow as against $1\frac{3}{4}$ acres per cow with the group average. If feed costs are to be kept low with this acreage, then rent and other costs must be minimal. Probably the most significant feature of the three farms is that they are all low rent farms with rents in the region of £1 to £2 an acre. Thus, an examination of the results from these bulk-feed herds suggests that this system is not the answer to the management problems for a high proportion of herds in the South-West. Profits are generally hard earned and below average. Reasonable profits can be achieved with extensive use of land, but this is only likely to be a possibility on some of the larger farms where rents are exceedingly low. For the majority of farms in the South-West, land is a limiting factor.

The performances of some herds following a middle of the road policy were also compared since it was the view of a number of producers in the sample that an average yielding cow fed sensibly was likely to be as profitable as any. Certainly, cows yielding say 800 gallons and fed efficiently are among the most profitable in the group, but generally speaking moderate practices only lead to average profits.

On the other hand, this study demonstrates that the high-yield system is still generally more profitable than other methods. The four herds chosen to represent this group had margins over feed costs per cow which were consistently above average and good profits were earned per acre. Contrary to popular belief these farms show that feed costs per gallon with the high-yield system are not in any way excessive when compared with average standards and therefore the system cannot be criticised as one giving rise to high cost production. Labour requirements in terms of hours per cow are also not markedly different from those in other herds.

The individual farm figures in Appendix Table 6 show that of the seven high-yield herds (over 900 gallons per cow), three are included in the five most profitable herds in the whole sample (the other two places were occupied by herds with yields of 823 and 891 gallons per cow). Moreover all seven herds show above average profits per cow. This table also shows that of the ten most profitable herds from the point of view of margins per cow, seven were fed over a ton and three between 10 and 20 cwt. of concentrates per cow. The average results for the ten most profitable herds are compared with the group average in Appendix Table 1, which again demonstrates the level of concentrate feeding in the more profitable herds.

Costings in past years have shown a distinct trend towards higher yields per cow on the smaller farm and economists have generally advocated a policy of high yields on this size of farm in order to build up the size of business. But if the high-yield system is the most profitable one on the smaller farm it must also be the most profitable system for the larger farm and larger herd—the only problem is to organise the necessary resources on a bigger scale and duplicate the pattern. In this connection it is interesting to note that recently the trend in yield per cow has been reversed and in this study yields are higher in the larger herds (see Appendix Table 2). The results also show that the high-yield system is both possible and profitable on the larger farm.

The conclusion is that a system where the economic use of productive grass and forage crops is the basis for heavy stocking with high yielding cows fed judicious quantities of concentrates is likely to prove the most profitable method of keeping dairy cows in the South-West. But the system necessarily demands a high level of management, high capacity cows which are also efficient converters of feed and many other resources which may not be available on every farm. The problems associated with the different qualities and combinations of resources on individual farms are discussed in the following section.

IV.

THE APPROACH TO FEEDING ON THE INDIVIDUAL FARM

This report has outlined the considerations the farmer must bear in mind in choosing the foods to be grown for the dairy herd. Mention has been made of season of use, quality and cost, acreage requirements, labour requirements and the bulkiness of foods as some of the more important factors involved. The choice of crops on the individual farm will depend on the prevailing circumstances on each farm. Indeed, an analysis of the feed patterns in a random sample of milk-selling farms shows a wide variation in the choice and combination of homegrown foods fed to dairy cows. Nevertheless, homegrown foods are generally a cheaper source of nutrients than purchased concentrates and it is now generally accepted that, where possible, better use of grassland and green fodder usually leads to higher farm profits.(1) Thus the primary aim of every milk-producer must be to make optimum use of the land at his disposal in the provision of food for his herd.

The question of the concentrates needed to supplement the home-grown foods available presents a more complex situation. The feed policies described in the previous section and an examination of the variety of patterns in a larger sample of farms lead one to suggest that different feed policies suit different farms. Whilst a certain policy may have advantages on one farm, other methods may be profitable on another farm. This situation tends to be confusing at times however, since it is often difficult to get a clear picture of the circumstances and conditions on individual farms which are responsible for these differences. Thus there seems to be a need for a reasoning process by which any individual farmer can arrive at the most rational feed policy for his particular farm. The framework for this method of reasoning is already in existence of course in the form of established economic principles. The need is to apply these economic principles to the feeding of dairy cows.

Before attempting to outline the factors which determine the choice of overall feed policy, it is necessary to make a distinction between the short-term or present circumstances and the longer term considerations. This is necessary because any farm can be changed significantly over the course of time by the application of capital and by better management and practices. But in the short-term many features and aspects can be assumed to be relatively fixed and it is the influence of these relatively fixed factors at any one time which largely determines the basic feeding pattern.

In practice the factors likely to operate on any farm are (a) the acreage of land and its present use, (b) the labour available, (c) the fixed equipment for dairying and (d) the capital resources both committed and immediately available for investment (including the dairy herd itself). The combination of factors will differ on nearly every farm. On larger farms for example, there may be a lot of land associated with relatively small amounts of labour or cows. This means a relatively large acreage

(1) The most recent national evidence to support this statement is given by the Report of the Committee on Grassland Utilization, 1958. Cmnd. 547, p. 19.

per cow and it is likely therefore that the quantity of homegrown feed available per cow will be much greater than average and determine the basic feed pattern. On the other hand, on many small farms there may be a considerable quantity of labour and cows associated with a relatively small amount of land. This means a strictly limited acreage per cow which in turn will influence the feeding policy. In another instance, the buildings for milking and housing the cattle may set a limit on the size of the herd that can be kept. Innumerable variations in the combinations of land, labour, livestock and buildings can be instanced, but the point is that one or more of these will be a limiting factor and set the pattern of feeding. Once the nature and level of these resources has been determined, the basic feeding pattern with homegrown foods has been established since, in the short run, the acreage per cow and hence the quantity of homegrown feed available under a given crop rotation will be fixed.

Level of Concentrate Feeding

Compared with the relatively fixed factors, the supply of concentrates can be considered as a variable or fluctuating input. Purchased concentrates are used on the majority of dairy farms to supplement the homegrown supplies of feed. The variations in the use of concentrates, however, are almost as great as the variations in the combinations or organisation of the fixed factors and there has probably been more argument about the most economic level of feeding with concentrates than there has been over any other aspect of milk production. Having outlined the basic factors which influence the supply of homegrown feeds, how can the individual farmer attempt to ascertain the most profitable use of concentrates?

The position has not been stated any better in recent years than the clear and concise statement on this subject by Morris and Jeffrey[2] who pointed out that there are two aspects of feeding, namely, the physiological aspect and the economic or business aspect. Conventional feeding is based on the widely accepted standard that 4 lb. of concentrates are sufficient, over the common range of yields, to produce a gallon of milk. But it has been shown that this arbitrary standard of physiological efficiency may conflict with the food requirements of the cow for maximum economic efficiency and that adherence to this standard may result in less than the commercial optimum output of milk being obtained. From the economic point of view, feeding for production is not a matter of how many pounds of S.E. and P.E. are theoretically required to produce a gallon of milk. The vital question is whether the extra food input over conventional standards has resulted in an increased output of milk, and if so, whether the money value of this extra output more than compensates for the additional costs incurred. Thus the application of feeding standards without reference to the profits that may result from different levels of feeding, may be more of a hindrance than a help to the milk producer attempting to achieve the most profitable level of feeding.

(2) "The Effect of Feeding and Management on the Economics of Milk Production" by S. T. Morris and R. R. Jeffrey. Journal of the British Dairy Farmers' Association No. 5, 1948.

Due to the law of diminishing returns, it is found that as the milk yield of a cow is raised by heavier feeding, the quantity of feed required to produce a given increase in milk output becomes more and more and the extent to which increasing quantities of food can exert an influence on yield is limited by the capacity of the cow. The level of optimum feeding therefore can only be determined by comparing the cost of successive units of feed input with the value of the resulting milk output. Theoretically the point of optimum feeding will occur when the money value of the extra milk just equals the cost of the extra food plus any extra labour and other costs which may arise as a result of the additional output.

But it will be readily appreciated that the basic units of many of the resources used in farming are likely to differ substantially in their character and capabilities. In the same way that one acre of land responds to more inputs of labour and capital at an economic level than another acre, so also do dairy cows differ in the capacity and efficiency to produce milk. Clearly then, the most profitable feeding level on any given farm will be achieved by studying the response of individual cows in the herd. It is essentially a task for the farmer or stockman concerned, in that he should attempt to feed each cow up to the economic limit by a process of trial and error. The optimum level of feeding will depend on the capacity and efficiency of each cow as well as other factors such as the stage of lactation and the available food supplies. The farmer or stockman should know the current costs of concentrates and the price of 10 lb. or 1 gallon of milk. After that, the guiding principle is that it is economic to feed each cow up to the level where the cost of the last scoopful of cake is just covered by the value of the extra milk produced.

It has been suggested that part of the difficulty here has been that conventional feeding standards, as set out in "Rations for Livestock"[3] for example, have been taken too literally by many people whereas they were only meant to be a guide in making up rations. In other words, that farmers should vary rations according to the individual requirements of the stock under given conditions. Arising out of this there has been some clamour for an elaboration of the feeding standards and Blaxter[4] has stated "if feeding standards in terms of energy are to be a positive tool enabling the dairy farmer to plan with maximal efficiency the feeding of his cows under the widely differing economic circumstances appertaining to his farm, then they need very considerable extension. The farmer needs precise information on the relation between input of food energy and output of milk at each lactation stage, and this information for cows of different producing ability. Given this information, rations could be planned in such a way that the most profitable production level could be realised."

Earlier paragraphs have outlined the theoretical approach to economic concentrate feeding but in practice one or two important points must be borne in mind in attempting to follow this procedure. One particular aspect is that this reasoning and procedure would be easy to follow if day to day changes in feeding were immediately reflected in the

(3) "Rations for Livestock". Bulletin No. 48. Ministry of Agriculture.
(4) "Feeding Standards for Livestock" by Dr. K. L. Blaxter of the Hannah Dairy Research Institute. Journal of the Farmers Club, Part 2, 1959.

level of milk output. Unfortunately, the results of feeding at any one time are spread over a much longer period. In other words it is necessary to think also in terms of the total lactation and the health or condition of the cow over the longer period. In this connection, the latest experimental evidence underlines how important it is to feed the dairy cow well before calving and during the first two or three months after calving. It is very probable that there is a tendency on some farms to underfeed in the early part of the lactation and to overfeed somewhat during the latter part of the lactation when yields are lower and the cow is beginning to dry off. In following the procedure outlined above experience suggests that feeding should be rather on the liberal side in the first part of the lactation but that rations should be more rigidly controlled after the first three or four months of the dairy cow's lactation.

It will be appreciated from the remarks in this section that there is a limit to how far the technical adviser or economist can help the individual farmer in ascertaining the most profitable level of feeding with concentrates under a given set-up. Probably the most the adviser can do is to acquaint those concerned with feeding dairy cows with the correct approach to feeding for maximum profits for it is impossible to know beforehand the response of individual cows to varying levels of feeding. In 1958, Foot[5] stated that "until the effect of levels of concentrate feeding on yield response has been further investigated the best practical steps would seem to be to continue to use the traditional standards for maintenance and production but to be constantly prepared to vary the plane if the occasional test departure from this plane for the individual cow appears from the yield response to the change to be justified economically." However, nutritional experiments are being undertaken and progress is being made in the statistical and economic interpretation of feeding data[6]. It may be that response curves and input-output data for cows of differing capabilities under varying conditions will provide a useful guide to farmers in feeding for maximum profit.

Other Considerations

Research work suggests that the marginal inputs of concentrates required per gallon with the higher yielding cows are very much more than the general standards in use. At the same time the individual farmer has difficulty in knowing where the optimum feed position is in any one situation and so feeding for maximum profits becomes an exacting task requiring first-class cowmanship and probably a good deal of time. There may well be a danger of overfeeding in many herds with adverse effects on profits. For these reasons alone many farmers no doubt prefer a less risky position and err on the side of underfeeding. But probably one of the more important points in practice is that in attempting to maximise returns to feed the farmer is liable to forget that feed is only one of the resources used in the productive process and his overall aim is to make the best use of all the resources under his control. Thus an

(5) Journal of the Royal Agricultural Society of England. Volume 119, 1958. Dairy Husbandry by A. S. Foot, p. 136.

(6) e.g. "Towards a Theory of Feeding Dairy Cows" by M. B. Jawetz. Paper to the Agricultural Economics Society. December, 1960.

TABLE 1

RESULTS FOR THE TEN HIGHEST AND THE TEN LOWEST MARGIN HERDS* COMPARED WITH THE GROUP AVERAGE RESULTS

	10 *Highest Margin Herds*	10 *Lowest Margin Herds*	*Average for 46 Herds*
Size of Farm (acres) ..	237·6	215·0	178·6
Herd Size (cows) ..	43·7	35·6	35·0
Farm Feed Acres per cow	1·7	2·0	1·8
Concs. per cow (cwt.)	23·6	15·1	19·8
Yield per cow (galls.)	877	572	745
Per cent. winter milk ..	51·7	45·6	48·2
Labour hours per cow	85·0	87·1	91·3
Concs. per gallon (lb.)	3·0	3·0	3·0
		£ per cow	
Returns (milk only) ..	133·0	82·8	110·7
Costs			
Foods			
Purchased ..	27·0	24·0	25·8
Homegrown ..	16·8	15·5	16·0
Grazing	6·9	7·5	8·0
Total Foods ..	50·7	47·0	49·8
Margin			
(Over feed)	82·3	35·8	60·9
Labour	16·8	17·3	18·1
Margin (over feed and labour)	65·5	18·5	42·8
		pence per gallon	
Returns	36·4	34·7	35·7
Feed Costs	13·9	19·7	16·0
Margin (over feed) ..	22·5	15·0	19·7
		£ per acre	
Margin (over feed) ..	48·3	17·9	33·1

* Highest and lowest margin per cow.

TABLE 2

RESULTS FOR THE 46 HERDS IN 1959/60 WHEN GROUPED ACCORDING TO SIZE OF HERD

	Under 25 cows	*25 and under 35 cows*	*35 and under 45 cows*	*45 cows and over*	*All Herds*
Number of Farms	12	14	10	10	46
Size of Farm (acres)	139·9	133·5	248·6	218·3	178·6
Herd Size (cows)	22·1	29·7	41·4	51·6	35·0
Farm Feed Acres per cow	1·9	1·8	2·0	1·7	1·8
Concentrates per cow (cwt.)	15·8	18·0	21·1	22·4	19·8
Yield per cow (galls.)	711	720	741	784	745
Percent. Winter Milk	47·8	47·0	47·5	49·9	48·2
Labour Hours per cow	106·8	99·4	81·8	84·6	91·3
Concentrates per gallon (lb.)	2·5	2·8	3·2	3·2	3·0
			£ per cow		
Returns:	104·1	105·8	108·8	119·6	110·7
Foods: Purchased	23·3	27·7	24·1	27·0	25·8
Homegrown	15·8	13·0	18·3	16·7	16·0
Grazing	7·2	8·1	9·5	6·9	8·0
Total	46·3	48·8	51·9	50·6	49·8
Margin (over feed)	57·8	57·0	56·9	69·0	60·9
Labour	20·0	20·1	16·1	17·2	18·1
Margin (over feed and labour)	37·8	36·9	40·8	51·8	42·8
			pence per gallon		
Returns	35·1	35·3	35·2	36·6	35·7
Feed Costs	15·6	16·3	16·8	15·5	16·0
Margin (over feed)	19·5	19·0	18·4	21·1	19·7
			£ per acre		
Margin (over feed)	30·2	31·5	28·1	41·2	33·1

TABLE 3

RESULTS FOR THE 46 HERDS IN 1959/60 WHEN GROUPED ACCORDING TO YIELD PER COW

	Under 600 *gallons*	600 *and under* 700 *gallons*	700 *and under* 800 *gallons*	800 *and under* 900 *gallons*	900 *gallons and over*	*All Herds*
Number of Herds	9	9	11	10	7	46
Size of Farm (acres)	217·6	113·5	173·2	199·7	190·5	178·6
Herd Size (cows)	31·8	32·7	38·6	34·9	36·6	35·0
Farm Feed Acres per cow	2·0	1·8	1·8	1·8	1·8	1·8
Concentrates per cow (cwt.)	10·9	14·9	21·3	22·7	29·1	19·8
Yield per cow (galls.)	522	654	736	849	970	745
Percent. Winter Milk	43·4	46·1	48·9	46·8	53·6	48·2
Labour Hours per cow	89·2	104·3	83·7	92·4	90·1	91·3
Concentrates per gallon (lb.)	2·3	2·6	3·2	3·0	3·4	3·0
			£ per cow			
Returns:	76·1	96·8	110·6	126·3	144·1	110·7
Foods: Purchased	16·0	23·8	20·8	30·3	41·2	25·8
Homegrown	15·7	13·2	18·7	14·8	16·8	16·0
Grazing	6·9	7·6	8·6	8·0	8·3	8·0
Total	38·6	44·6	48·1	53·1	66·3	49·8
Margin (over feed)	37·5	52·2	62·5	73·2	77·8	60·9
Labour	17·8	20·7	17·2	17·5	17·6	18·1
Margin (over feed and labour)	19·7	31·5	45·3	55·7	60·2	42·8
			pence per gallon			
Returns	35·0	35·5	36·1	35·7	35·7	35·7
Feed Costs	17·7	16·4	15·7	15·0	16·4	16·0
Margin (over feed)	17·3	19·1	20·4	20·7	19·3	19·7
			£ per acre			
Margin (over feed)	18·8	29·0	34·1	41·3	42·9	33·1

TABLE 4

SOME DATA FOR 'HIGH-YIELD,' 'MODERATE' AND 'LOW-CONCENTRATE' HERDS 1959/60

Feed System	*Farm No. in Table 1 (Appendix)*	*Yield per cow (galls.)*	*Herd Size (cows)*	*Breed of Cow*	*Farm Feed Acres per cow*	*Concentrates Fed*		*Labour Hours per cow*	*Margin over feed costs per cow (£)*
						per cow (cwt.)	*per gallon (lb.)*		
" High-Yield "	1*	1057	71·1	Fries.	1·8	38·0	4·0	82	87·7
	5	1004	31·6	Fries.	1·7	27·1	3·0	76	82·4
	12*	966	22·6	Fries.	2·0	26·0	3·0	105	71·5
	13	927	38·1	Fries.	2·1	26·0	3·2	78	69·7
	4*	913	48·6	Fries. & C.I.	1·3	22·9	2·8	93	83·4
	20	911	26·4	Fries.	1·9	25·7	3·2	108	62·8
	22*	905	17·9	Fries.	2·6	29·9	3·7	120	62·6
" Moderate "	14‡	750	49·0	Ayrsh.	1·8	15·3	2·3	85	69·2
	24‡	700	21·2	Fries.	2·2	13·6	2·2	86	61·2
	31‡	721	42·2	R.P.mainly	1·8	15·4	2·4	71	54·0
	33‡	728	23·7	Ayrsh.	1·8	24·9	3·8	103	51·6
" Low-concentrate " (inc. bulk-feed)	16†	615	30·5	Ayrsh.	2·4	5·9	1·1	104	68·7
	26	588	21·2	Fries.	1·8	5·4	1·0	115	58·0
	32	594	19·5	Mixed	1·4	8·6	1·6	90	53·4
	39†	540	23·0	Ayr. mainly	3·0	2·8	0·6	71	43·4
	40†	439	21·1	S. Devon	2·4	Nil	Nil	168	40·4
	44	459	43·1	Shorthorn	2·3	8·8	2·2	76	28·7
Average of 46 herds ..	—	745	35·0	—	1·8	19·8	3·0	91	60·9

* Represented high-yield herds in Chapter III.
‡ Represented moderate herds in Chapter III.
† Represented bulk-feed herds in Chapter III.

TABLE 5

ACREAGES OF CERTAIN CROPS IN DEVON 1939/59

Year	*Turnips and Swedes*	*Fodder Beet**	*Mangolds*	*Rape*	*Cabbage/ Kale/Savoys/ Kohl Rabi*
			Acres		
1939	22,331	—	14,978	7,233	4,597
1940	21,864	—	13,621	6,149	4,315
1941	25,896	—	15,067	10,919	7,744
1942	28,596	—	15,217	15,519	9,572
1943	28,472	—	15,424	16,832	10,425
1944	30,762	—	16,082	21,263	11,010
1945	33,464	—	15,465	20,405	10,286
1946	30,528	—	14,830	17,382	10,682
1947	28,843	—	14,989	14,206	8,920
1948	24,743	—	14,673	10,239	10,235
1949	23,234	—	14.090	11,796	12,090
1950	22,390	—	14,242	12,078	13,326
1951	22,696	—	13,740	11,035	14,592
1952	22,027	2,290	11,908	11,548	17,469
1953	22,653	2,510	11,256	11,004	20,419
1954	21,723	1,754	11,310	12,096	23,010
1955	21,229	1,069	10,814	9,632	24,449
1956	19,210	845	10,480	8,155	26,612
1957	17,397	755	9,138	7,818	28,276
1958	17,681	721	9,072	6,814	29,647
1959	17,415		8,231	6,066	31,783

*Acreages not available before 1952.

TABLE 6

PHYSICAL AND FINANCIAL DATA ON FEEDING PRACTICE IN 46 DEVON HERDS IN 1959/60 (IN DESCENDING ORDER OF MARGIN OVER FEED COSTS PER COW)

Code No.	Size of Farm	Size of Herd	Breed of Cow	Yield per Cow	Per cent. Winter Milk	Farm Feed Acres per Cow	Gallons per Acre	Quantities fed per cow (excluding grazing)						Concs. per Gallon	Labour Hours per Cow	PER COW						PER GALLON			Margin over Feed Costs per Acre
								Concs. and Corn		Hay	Silage	Kale	Other			Returns	FEED COSTS				Margin over Feed Costs	Returns	Feed Costs	Margin over Feed Costs	
								Purch.	H.G.								Purch.	H.G.	Grazing	Total					
	(acres)	(cows)		gall.	%	acres	gall.	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.	lb.	Hrs.	£	£	£	£	£	£	d	d	d	£
1	285	71·1	Fries.	1057	59·0	1·8	584	29·1	8·9	21·4	—	71·7	—	4·0	82	161·9	45·3	20·9	8·0	74·2	87·7	36·8	16·9	19·9	48·5
2	264	36·7	Fries.	823	45·0	2·0	422	8·2	3·6	17·4	16·4	71·9	—	1·6	116	120·3	13·9	14·8	4·3	33·0	87·3	35·1	9·6	25·5	44·7
3	315	48·2	Fries.	891	47·1	1·7	512	19·4	2·7	17·3	17·2	50·0	38·5	2·8	73	136·7	31·4	14·6	5·1	51·1	85·6	36·8	13·8	23·0	49·2
4	109	48·6	Fr.&C.I.	913	48·9	1·3	719	22·9	—	32·1	—	—	—	2·8	93	138·8	39·2	9·5	6·7	55·4	83·4	36·5	14·6	21·9	65·6
5	267	31·6	Fries.	1004	58·2	1·7	594	27·1	—	24·5	—	56·7	18·4	3·0	76	147·2	46·4	12·4	6·0	64·8	82·4	35·2	15·5	19·7	48·8
6	141	28·6	Fr.m'ly	878	52·4	2·2	399	7·6	6·3	17·0	—	46·2	0·7	1·8	70	127·3	11·9	20·2	13·5	45·6	81·7	34·8	12·5	22·3	37·1
7	496	41·3	Fries.	874	48·4	2·2	401	10·4	11·6	10·5	—	75·5	—	2·8	76	127·7	17·4	17·8	10·8	46·0	81·7	35·1	12·7	22·4	37·4
8	192	57·4	Fries.	763	52·0	1·4	537	7·9	12·4	16·3	0·9	40·1	—	2·0	73	113·9	12·8	17·1	5·6	35·5	78·4	35·8	11·2	24·6	55·2
9	177	49·0	Guern.	737	45·4	1·5	498	8·0	19·2	0·6	57·9	24·5	33·1	4·1	95	123·1	17·8	24·8	4·5	47·1	76·0	40·1	15·3	24·8	51·4
10	130	24·3	Fries.	720	57·0	1·6	453	13·1	—	5·4	—	42·8	78·4	2·0	107	111·7	21·6	9·6	6·1	37·3	74·4	37·2	12·4	24·8	46·8
11	100	46·5	Fr.m'ly	834	44·6	1·3	627	24·3	—	30·1	—	—	—	3·3	93	129·6	39·1	7·9	9·7	56·7	72·9	37·3	16·3	21·0	54·8
12	223	22·6	Fries.	966	56·1	2·0	493	26·0	—	35·1	8·0	60·2	—	3·0	105	133·9	43·5	14·7	4·2	62·4	71·5	33·3	15·5	17·8	36·5
13	240	38·1	Fries.	927	53·3	2·1	435	15·4	10·6	18·2	42·0	84·0	14·4	3·2	78	137·4	28·3	27·0	12·4	67·7	69·7	35·6	17·5	18·1	32·7
14	202	49·0	Ayrsh.	750	46·4	1·8	417	8·8	6·5	12·7	36·9	62·9	7·6	2·3	85	110·7	13·5	19·1	8·9	41·5	69·2	35·5	13·3	22·2	38·5
15	173	23·7	Fries.	851	52·3	1·5	575	18·3	7·6	13·1	11·2	54·9	—	3·4	92	112·9	30·9	14·8	8·0	53·7	69·2	34·6	15·1	19·5	46·8
16	143	30·5	Ayrsh.	615	36·3	2·4	258	2·3	3·6	27·3	6·6	36·1	17·0	1·1	104	90·5	4·5	11·5	5·8	21·8	68·7	35·3	8·5	26·8	28·9
17	174	29·9	Fries.	848	46·7	2·1	404	23·6	0·9	32·4	—	53·7	—	3·2	122	122·7	38·6	14·5	5·6	58·7	64·0	34·7	16·6	18·1	30·5
18	107	30·3	Fries.	735	47·6	1·4	518	18·8	—	17·2	—	19·8	26·1	2·9	100	109·9	28·9	10·2	7·8	46·9	62·9	35·9	15·3	20·6	44·3
19	93	31·6	Mixed	658	49·7	1·8	372	15·1	1·3	23·9	3·2	—	10·6	2·8	123	101·7	25·9	8·5	4·4	38·8	62·9	37·1	14·1	23·0	35·6
20	102	26·4	Fries.	911	42·2	1·9	492	23·0	2·7	22·2	—	37·9	32·2	3·2	108	131·2	40·1	15·7	12·6	68·4	62·8	34·5	18·0	16·5	33·9
21	199	44·4	Sh'n.Mxd	811	38·2	1·6	507	21·9	6·7	17·3	—	27·0	25·9	4·0	94	122·2	33·9	16·9	8·7	59·5	62·7	36·1	17·6	18·5	39·2
22	108	17·9	Fries.	905	46·9	2·6	343	29·9	—	18·2	—	21·5	34·9	3·7	120	129·4	48·0	10·3	8·5	66·8	62·6	34·3	17·7	16·6	23·7
23	39	25·5	Short'n	853	47·3	1·5	558	28·2	—	25·1	—	26·8	—	3·7	71	124·4	46·6	9·2	6·8	62·6	61·8	35·0	17·6	17·4	40·4
24	163	21·2	Fries.	700	46·4	2·2	320	13·6	—	23·4	15·1	—	—	2·2	86	102·8	22·2	7·9	11·5	41·6	61·2	35·3	14·3	21·0	28·0
25	204	44·5	Short'n	755	55·3	2·1	367	7·4	20·5	10·3	18·0	83·6	—	4·2	70	110·4	13·3	30·2	8·4	51·9	58·5	35·1	16·5	18·6	28·4
26	92	21·2	Fries.	588	41·5	1·8	332	5·4	—	23·7	—	88·4	—	1·0	115	84·2	7·8	12·9	5·5	26·2	58·0	34·4	10·7	23·7	32·9
27	285	41·3	Fries.	704	45·1	2·0	352	12·1	11·6	21·0	—	45·4	5·0	3·8	79	107·9	19·6	21·1	10·0	50·7	57·2	36·8	17·3	19·5	28·6
28	196	28·3	Mixed	625	40·3	2·6	243	7·4	3·5	28·7	—	10·9	4·9	2·0	99	90·0	12·2	11·4	9·3	32·9	57·1	34·6	12·6	22·0	22·2
29	76	23·2	Ayrsh.	666	51·6	1·2	541	12·2	—	19·8	—	61·2	10·4	2·1	97	99·2	24·6	13·7	4·9	43·2	56·0	35·7	15·5	20·2	45·6
30	83	31·7	Mixed	675	48·5	2·5	274	12·1	2·3	24·9	—	—	—	2·4	115	99·4	16·8	14·2	13·7	44·7	54·7	35·3	15·9	19·4	22·2
31	94	42·2	R.P.M'ly	721	46·8	1·8	410	15·4	—	7·4	114·2	31·8	—	2·4	71	105·9	22·2	17·0	12·7	51·9	54·0	35·3	17·3	18·0	30·7
32	94	19·5	Mixed	594	43·8	1·4	434	5·8	2·8	23·8	8·2	75·4	—	1·6	90	91·6	12·3	19·3	6·6	38·2	53·4	37·0	15·4	21·6	39·0
33	146	23·7	Ayrsh.	728	40·5	1·8	404	12·2	12·7	16·7	—	44·7	14·4	3·8	103	105·2	19·7	27·9	6·0	53·6	51·6	34·7	17·7	17·0	28·7
34	96	24·1	Fr.&S.D.	819	52·7	1·7	485	27·0	—	28·3	—	128·4	—	3·7	131	121·9	44·4	20·1	7·7	72·2	49·7	35·7	21·2	14·5	29·4
35	88	29·8	S. Devon	694	45·3	1·0	708	23·9	—	52·8	—	—	—	3·9	161	109·0	42·4	14·0	5·3	61·7	47·3	37·7	21·3	16·4	48·3
36	170	50·0	Mixed	594	48·8	2·1	287	11·1	—	24·8	—	—	31·2	2·1	74	87·6	17·8	11·5	11·0	40·3	47·3	35·4	16·3	19·1	22·8
37	148	50·6	Fries.	693	51·6	1·6	433	17·6	—	36·3	45·1	42·3	—	2·9	101	102·5	30·4	20·2	6·3	56·9	45·6	35·5	19·7	15·8	28·5
38	81	28·0	Fries.	609	43·2	1·8	340	11·3	—	13·4	—	47·1	—	2·1	63	86·0	18·7	8·7	13·2	40·6	45·4	33·9	16·0	17·9	25·3
39	178	23·0	Ayr.M'ly	540	22·0	3·0	178	2·8	—	26·3	—	69·6	—	0·6	71	73·6	4·5	8·4	17·3	30·2	43·4	32·8	13·5	19·3	14·3
40	200	21·1	S. Devon	439	50·0	2·4	186	—	—	90·3	—	37·9	108·0	—	168	70·3	—	21·2	8·7	29·9	40·4	38·5	16·3	22·2	17·2
41	114	40·7	Fries.	627	44·1	1·5	410	17·6	—	26·8	—	30·7	11·2	3·1	82	90·5	31·9	12·1	6·4	50·4	40·1	34·6	19·3	15·3	26·2
42	205	41·2	Mixed	742	52·3	2·8	267	27·9	0·5	18·0	—	36·4	11·9	4·3	78	105·8	45·7	12·3	13·6	71·6	34·2	34·2	23·2	11·0	12·3
43	485	45·5	Short'n	480	43·6	2·2	217	9·5	8·8	—	69·1	54·0	—	4·3	80	71·5	16·4	19·2	3·3	38·9	32·6	35·8	19·5	16·3	14·8
44	385	43·1	Short'n	459	43·7	2·3	200	8·8	—	29·6	—	70·1	—	2·2	76	64·0	14·8	13·8	6·7	35·3	28·7	33·5	18·5	15·0	12·5
45	210	30·2	S. Devon	469	44·6	1·4	340	15·3	—	24·0	5·0	72·9	30·8	3·7	75	73·4	25·6	18·6	4·6	48·8	24·6	37·6	25·0	12·6	17·8
46	145	32·7	Fries.	555	45·6	1·3	434	17·0	—	20·7	32·4	—	65·8	3·4	99	74·7	31·6	12·7	5·9	50·2	24·5	32·3	21·7	10·6	19·1
Av'ge.	179	35·0	—	745	48·2	1·8	405	15·5	4·3	21·5	6·8	42·8	12·2	3·0	91	110·7	25·8	16·0	8·0	49·8	60·9	35·7	16·0	19·7	33·1

DEFINITION OF TERMS

Size of Herd represents the average number of cows in the milking herd.

Farm Feed Acres per Cow Unit is calculated by dividing the total acreage of the farm less cash crops by the number of cow units or cow equivalents in the form of cattle, horses and sheep (an allowance has been made for any acreage used by pigs and poultry).

Milk Produced is the total gallonage produced on the farm from April to March inclusive and includes wholesale and retail sales as well as the gallonage fed to livestock and consumed in the farmhouse, etc.

Yield per Cow is the total gallonage produced divided by the average number of cows in the herd.

Gallons per Acre is calculated by dividing the annual yield per cow by the farm feed acres used per cow.

Percent Winter Milk is calculated by expressing the gallonage produced during the six months October to March inclusive as a proportion of the total milk produced in the year.

Returns are the average returns per cow and per gallon from the milk sales.

Foods.

Bulky Foods. The average quantities of hay, silage, kale and other roots consumed per cow are estimates based on the tonnages considered to have been used.

Total Concentrates includes purchased cakes and meals together with homegrown cereals fed to the dairy cow. No distinction has been made between the various grades of cakes or meals.

Food Costs are based on the actual costs of specific foods on individual farms. Homegrown foods were not costed on one or two farms for various reasons.

Margin Over Feed Costs per Acre refers to the margin over feed costs per cow divided by the farm feed acres used per cow.

Labour Hours refers to the direct hours spent on the dairy herd itself and includes the time spent on such operations as milking, washing dairy utensils, feeding, taking cows to kale and moving electric fences, cleaning parlours, shippons and general yard work connected with the dairy herd.

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